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A study of user participation in information systems development

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User participation in information system development is considered to be an important factor influencing implementation success or failure. The ETHICS (Effective Technical and Human Implementation of Computer-based Systems) method was developed as a guide to user involvement in system design. A case study of successful implementation which did not use the ETHICS method explicitly is described. The case study and the ETHICS methodology are then compared and contrasted in an attempt to gain greater insight into user participation and to understand why the implementation was successful. Furthermore, techniques of software process modelling are applied to both ETHICS and the case study with the intention of more closely defining the user participation process and potentially also guiding it in future developments. The case study is used as a vehicle both to examine user participation and also to investigate the modelling of user participation.

Introduction

The involvement of users in information systems development, whether it is to design new systems or to modify existing ones, is held to be one of the most important factors influencing implementation success or failure (Mumford and Weir, 1979; Bjorn-Anderson, 1980; Mumford, 1983; Briefs *et al.*, 1985; Davis and Olson, 1985; Leonard-Barton, 1988; Tait and Vessey, 1988; Barki and Hartwick, 1989; Boehm and Ross, 1989; Rousseau, 1989). There has recently been an increase in research investigating the link between user participation and successful system implementation (Bjorn-Anderson, 1980; Mumford, 1983; Briefs *et al.*, 1985; Doll and Torkzadeh, 1988; Tait and Vessey, 1988; Rousseau, 1989; Jarvenpaa and Ives, 1991). There has also been an increase in the development of methods or strategies to help improve and measure user participation in systems development, and assess subsequent satisfaction with the working systems (Mumford and Weir, 1979; Mumford, 1983; Baroudi *et al.*, 1986; Franz and Robey, 1986; Doll and Torkzadeh, 1988; Barki and Hartwick, 1989; Janson *et al.*, 1990; Joshi, 1991; Sharma *et al.*, 1991; Wade, 1991).

The ETHICS (Effective Technical and Human Implementation of Computer-based Systems) method, developed by Enid Mumford and her colleagues, is intended as a guide to achieve a better balance between technology and people in the design of systems (Mumford and Weir, 1979). In particular, the method advocates user involvement and participation throughout the design stage to produce a 'sociotechnical system' (Mumford and Weir, 1979; Mumford, 1983) which will benefit both the business and the working environment of the users. For the purposes of this paper the ETHICS method is chosen as a typical representative of reported user participation models.

Recently software process modelling has emerged as a major new research area (Tully, 1989; Tate, 1992a, b; Tate *et al.*, 1992). Software process is the term used to designate the complex process by which software is developed, from initial conception through implementation and operation. The construction of precise and detailed models in order to define and trace the activities of software development leads to the emergence of formal approaches to software process modelling. Essentially, software process modelling views the software process in much the same way that the software process views an application: specifying, diagramming and even programming the software development process itself. A suitable software process model can be enacted in a symbiosis of computer, model (software process program) and developer. Enaction is a highly interactive computer-aided performance of the development process which involves both the developer and the programmed software process model. One of the primary aims of software process modelling is to improve software products through defining and improving the process that produces them. The techniques employed can be generalized to model and study other related processes. In particular, we show that the process of user participation can be modelled in a similar fashion to software process modelling, thus laying a foundation for further study and research. This is consistent with a shared goal of both user participation and software process modelling, namely improvement of the quality of software.

We describe a case study of the successful implementation of a system used by several administrative sections of a university. One of the authors was the chief implementor of that system. User participation and involvement was practised substantially throughout the development of the system and the intent was consistent with ETHICS though the ETHICS method as such was not used. It seems appropriate, retrospectively, to compare the procedures adopted in the case study with those of the ETHICS method. This may help us to understand more about the practical issues of user participation and how it contributed to the success of this project. In order to clarify the procedures of user participation, and the inputs and outputs involved, the ETHICS method and the case study are elaborated into data flow diagrams (DFDs), a simple form of process modelling, thus using the case study as a vehicle both to examine user participation in practice and also to investigate the modelling of user participation. Matches and mismatches of the case study and the ETHICS method are highlighted. We discuss the appropriateness of using process modelling techniques to formalise the description and application of user participation, thus making user involvement into a more tangible process which can be related more specifically to the information system development cycle. The study also highlights areas not covered by ETHICS, with a view to further research, development, and elaboration of ETHICS-like methodologies.

The ETHICS method and user participation

A number of researchers, primarily Enid Mumford and her colleagues (Mumford and Weir, 1979; Mumford, 1983) have developed a sociotechnical approach to systems design. This approach views the interaction between technology and people as important for producing systems which are both technically efficient and lead to high job satisfaction; it emphasizes user as well as expert participation. The sociotechnical design process is shown in Figure 1.

ETHICS is a method to help a design group (made up of management, users and technical experts) diagnose and formulate the problem, set objectives and develop alternatives, and take other appropriate actions right through to implementing and evaluating the new system. Throughout development, emphasis is placed on both the human or social and the technical aspects of the system. Users develop social alternatives to improve job satisfaction, and experts develop technical alternatives to increase business efficiency. These are matched with a view to finding the best sociotechnical fit under the usual cost, resource and other environmental constraints. There have been more recent publications and research on user participation based on the ETHICS method and the sociotechnical design process (Herbst, 1972; Kelly, 1978; Janson *et al.*, 1990; Eason, 1991; Sharma *et al.*, 1991; Wade, 1991). Furthermore, there are other information system development models, such as the traditional system development life cycle (Davis and Olson, 1985), the system theoretical approach (Bansler, 1989), the multi-view approach (Avison, 1990), and the critical approach (Bansler, 1989). For our purposes we have chosen to use the original ETHICS model mainly because this model is the basic foundation on which others have built their work. It is appropriate that we should briefly examine the concepts and ideas in this basic ETHICS model in order to broaden our own understanding of the user participation process.

ETHICS consists of the following systematic steps (Mumford, 1983):

(1) Diagnosing business and social needs and problems.
(2) Setting efficiency and social objectives.
(3) Developing a number of alternative solutions.
(4) Choosing the most satisfying solution.
(5) Designing this solution in detail.
(6) Implementing the new system.
(7) Evaluating the results.

The method and the associated diagram in Figure 1 show the systematic steps that a design group should follow in order to produce a 'best sociotechnical solution'. Figure 1 depicts steps (1) to (4) listed above. It does not specifically include steps (5) to (7). Furthermore, the ETHICS description and diagram specify only activities. It is not clear from Figure 1 when, for example, the design group should input particular ideas and effort. The outputs are also not explicitly depicted. For the purposes of clarification and understanding, we have elaborated the ETHICS steps as shown in Figure 1 by a DFD as shown in Figure 2.

The importance of user participation has been stressed and supported by many researchers and practitioners (Bjorn-Anderson, 1980; Tornatzky *et al.*, 1980; Mumford, 1983; Briefs *et al.*, 1985; Davis and Olson, 1985; Doll and Torkzadeh, 1988; Leonard-Barton, 1988; Boehm and Ross, 1989; Lindner, 1989; Rousseau, 1989; Jarvenpaa and Ives, 1991). It is used as a technique to overcome resistance to change (Carnall, 1986). It increases user commitment to system success. By maximizing user design input, it increases both system quality and user satisfaction. However, there are problems and difficulties associated with user participation. Ives and Olson (1984) pointed out that there are theoretical, methodological

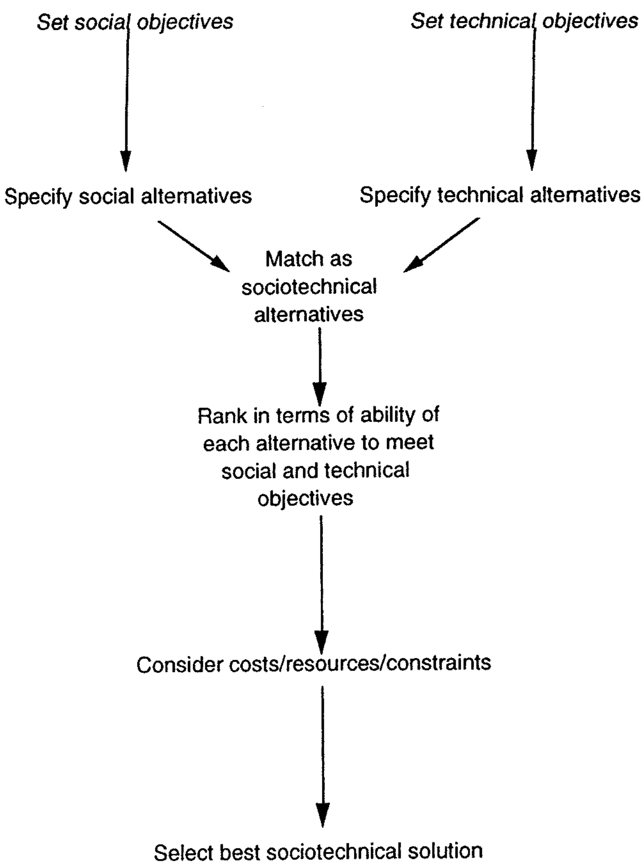

Figure 1 Sociotechnical systems design (source: Mumford and Weir, 1979)

and measurement problems associated with involvement research which prevented definite conclusions concerning user involvement from being reached. Markus (1983) noted that user participation is not advisable where powerful authorities have decided that a particular system, although unpopular with users, will be implemented. User involvement in information system development work should be avoided if secrecy is important (Pfeffer, 1981). Besides, when implementation complexity is high, user involvement can have 'the effect of intensifying and highlighting the potential conflict and disruption associated with an innovation' (Tornatzky *et al.*, 1980).

Management in general have a low appreciation of the need for user involvement, leading to symbolic rather than substantive support for user participation (Davis and Olson, 1985; Bansler, 1989). The composition of the work or design group often reflects this aspect vividly. Users prefer elected rather than selected representatives (Davis and Olson, 1985; Leonard-Barton, 1988), while the opposite is true for management. Mutual trust between users from various departments of the same organization often does not exist, and cannot be established overnight. Also, working together often brings conflicts of interest to the surface which have to be dealt with explicitly (Carnall, 1986; Boehm and Ross, 1989). Communication skills within the design group have to be learnt since users with little technical expertise cannot understand the jargon used by expert designers. Only through communication and consultation can conflicts of interest and problems of stress be avoided. A coordinator, or facilitator, who is usually the project manager (Carnall, 1986; Boehm and Ross, 1989), also referred to as the 'change agent' (Leonard-Barton, 1988), needs to be present in the work group to keep the project on schedule, to help resolve conflicts and to monitor morale. As suggested by Boehm and Ross (1989), the primary role of this coordinator is 'to be a negotiator between his various constituencies, making winners of each of the parties involved in the software process'.

The case study

The setting of the case study was a UK university which was established in the 1960s. At that time, a central Data Processing (DP) department was set up to handle all data entry and processing functions for administrative needs. The DP department designed, implemented and operated all the required systems on a mainframe computer. Subsequently a number of microcomputers were added to the system. The user departments used forms to record their data, which were passed to the DP department for entry and processing. Reports were then produced for the user departments. This type of working arrangement led to a situation where users did not know how their reports were generated. Some did not understand why particular reports were generated, thus some reports were never used. In addition, staff in the DP department did not really understand the data they were handling. As the university expanded, the inefficiency and ineffectiveness of this arrangement became more apparent. When a new Registrar (Head of all administrative sections) took over a few years ago, he initiated some quite dramatic changes. The DP department was dissolved; a new minicomputer was purchased and a small Management Information Systems (MIS) section was established solely to provide computer support. The user departments were made to handle their own data entry and processing functions. This meant that staff in MIS had to understand what the user departments did in order to support their activities with computer resources. Furthermore, staff in the user departments had to learn to use the computer and to operate their own systems. These changes were still rippling through the administrative sections when the events described in the case study took place.

The following account of the case study was based on minutes taken in meetings and the experience of one of the

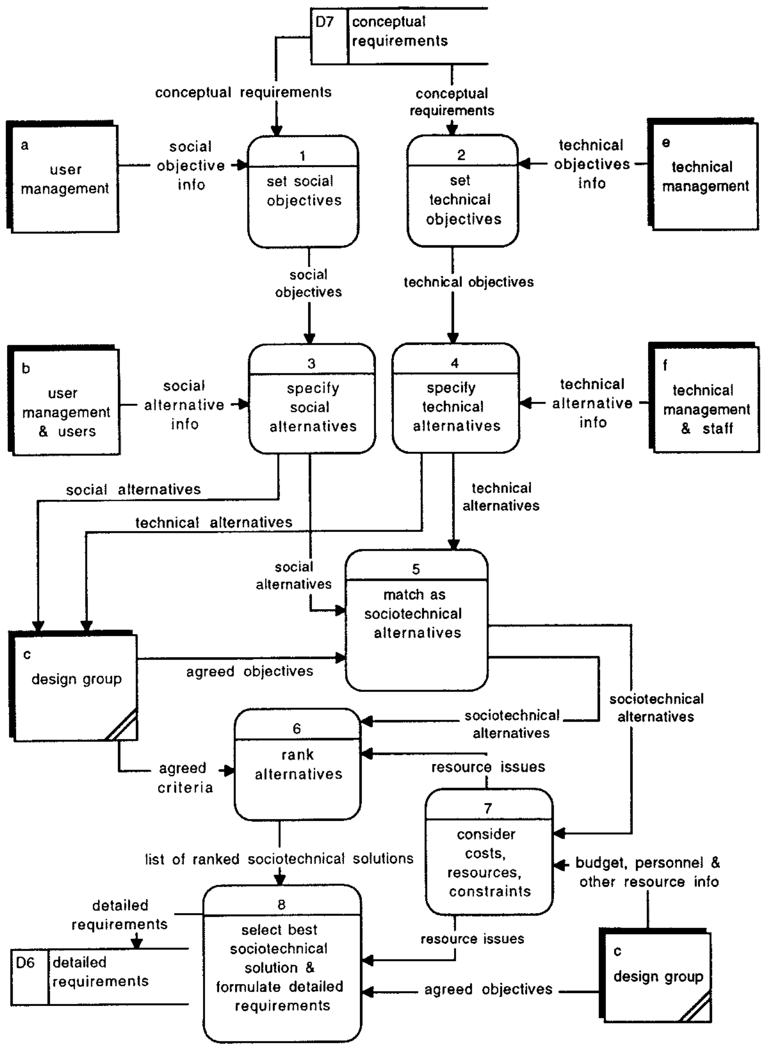

Figure 2 DFD of the ETHICS method

authors who was involved in the project at the time. The key players in this case study were staff in five administrative sections of the university, namely Accommodation, Finance, Admissions, Student Records and MIS. MIS was the section in charge of providing appropriate computer facilities and services for administrative sections. It operated the computer facilities and provided system design, implementation and training support to the other sections. The other four sections were in different stages of growth in terms of their IS usage (Davis and Olson, 1985). The Finance section consumed just under half of the computer resources using a software package for accounting and finance. Within this section, there were various levels of users ranging from those having quite expert knowledge of the accounting and finance software, to data entry clerks, to those who did not even know how to switch on a terminal. The Student Records Office relied on an in-house package written in a 4GL for its routine operations. There was one expert user in this office with detailed knowledge of the underlying database management system, but other users were mostly experienced clerks. The Admissions Office had just completed a system migration. Their former system had operated on microcomputers. This had been replaced by a purchased package written in COBOL obtained from another university. Users in this office resented the fact that they were no longer insulated from everybody else, and that they had to compete for resources on the same minicomputer with all the other administrative sections. They had been very proficient with their micros, but were rather slow in their progress with the minicomputer. The Accommodation Office was the last section of the four to become computerized. A custom-made programe written in a 4GL had been installed recently, and users in this section were still in their learning phase.

Although the programs used by the sections were installed in the same minicomputer, they were operated as separated packages with very little interaction between them. In practice, however, the work of the four sections interrelated very closely. The following is an account of the events that took place every August. As the A-level examination results were published, the Admissions Office sent out hundreds of confirmation letters to candidates who had satisfied the university's entrance requirements. The personal data of these candidates were then sent to the Finance Office and the Accommodation Office as hardcopy reports. The Finance Office, which had to send fees details to the candidates, would re-enter the data into its accounting package, employing an army of data entry clerks. Staff in the Accommodation Office, who had to send housing information to the candidates, would also manually enter these data into their record system. As the candidates confirmed that they would come to the university in October, their records were put onto diskettes. These were delivered to the Student Records Office where the records were uploaded into the minicomputer. The Student Records Office then liaised with the Finance and Accommodation offices to prepare documents for student registration. Before a student could register, housing had to be arranged – a responsibility of Accommodation Office. The student must also pay the first terms' fees for tuition and quarters – a responsibility of Finance Office. Then he/she was allowed to register and collect his/her student card.

The sequencing of the above events was very important, since most operations depended on the completion of previous steps. As the systems for all of the four sections resided on the same minicomputer, the unnecessary duplication of records and data entry effort was cumbersome as well as expensive. Yet users in individual sections were so involved with their own systems that they did not see the need for integration. The first author was working as the MIS Officer of the university at the time. She and her staff in the MIS section designed and implemented most of the systems used by the administrative sections. They were accustomed to working with the users and knew the systems well. They realized the importance of integrating the systems. The MIS Officer convinced the Registrar that these four independent systems should be integrated in order to streamline the processes from student admissions to student registration. The Registrar, after considering organizational and resource issues, approved a project to accomplish the task. The project was initiated in May of that year, with the intention of 'going live' the following August.

The MIS section was appointed as the coordinating section, and it was also to provide programming support for the project. At the time, no formal information system development methodology had been adopted. However, user participation and involvement was viewed as a valuable tool in the design of successful systems by the MIS section, and staff in that section practised it substantially in system development. The MIS Officer called a meeting with heads of the four sections to explain the task in hand and to set up a user participation mechanism. Each section was to nominate (or elect) two representatives, a senior member who understood the procedures and a junior member who operated the existing system. These people together with staff from MIS formed the design or working group. The first problem was to make personnel in the four sections work together. At the outset people in each of the four sections simply did not have faith in the others. They were dedicated to their own jobs, sceptical of others, and very protective of their own systems. Each section perceived that its system was the best. Each system seemingly gave its section authority, position and an image of being technologically advanced. People in each section did not want to know how the other systems functioned and they certainly discouraged others from even trying to understand theirs. The idea of the four sections integrating their systems together was very difficult for them to accept because this meant revealing their systems for all to see, learn, and criticise. They were worried that this might lead to changes of systems, alterations of working practices, or different job definitions.

The MIS Section had to coordinate negotiations in such a way that staff in the four sections involved would put aside their pride, prejudices and fears of communicating with each other. Most important of all, they must learn to trust one another so that they could work together to deal with the problem in hand. After consultation with individual sections, an open meeting approach was adopted. The working group would meet regularly to discuss problems and exchange ideas. Minutes were taken at each meeting which served as official records and milestones.

At the first meeting of this working group, the importance of the project was stressed and organizational objectives and constraints were clearly explained. Three alternative strategies were considered. The first alternative was to develop a manual system to link the four existing systems. The second alternative was to write a completely new system covering the admission-registration work of the four sections. The third alternative was to write a linking system connecting the four existing systems and automating most of the interfaces involved. The first alternative was rejected because it would not improve the situation very much, and the second alternative was also rejected because it would take too long to develop. The working group agreed that the major objectives were that existing system knowledge should be harnessed rather than ignored, and that the new system should link the existing four systems together, rather than replacing them. Hence the third option was adopted by the working group.

Each section had been accustomed to working relatively independently of each other, thus they only knew their own work and responsibilities, and had little idea of how the functions of the administrative sections fit together. It was decided that each section should prepare detailed accounts of their working procedures both in order to clarify requirements and for the other sections to understand them. These details were then integrated together into a set of overall requirements and working procedures for the new system. Staff from each section were given the opportunity to learn and understand the workings of other sections and to query their system functions. Furthermore, staff in MIS explained how time and effort could be saved if data from one system could be automatically fed into another system.

The design group was concerned that if records of the system were made available to all four sections, adequate segregation security should be provided so that data belonging to a particular section could only be modified by its staff, but be made available for reference by all staff concerned. It was also agreed that although MIS provided programming support, the system belonged to the users. Since the other four sections were responsible for its operation, they must agree on the transition procedures and clearly define their responsibilities. For ease of understanding of the activities, the inputs and outputs involved in choosing a solution, and for subsequent comparison with the ETHICS method, a DFD modelling the above events has been developed and is shown in Figure 3.

When the new linking system was completed, the creation of an initial record in the Admissions system automatically set up corresponding records in the Finance and Accommodation systems if the candidates satisfied the entrance requirements of the university. When financial and housing details became available, these data were automatically passed to the Student Records system to facilitate registration. Admissions could spend their efforts dealing with admissions queries instead of printing reports and preparing diskettes to be distributed to other sections. Finance and Accommodation saved a lot of expense and time because there was no need to employ extra data entry staff. Experienced staff in their individual sections managed and operated the system more effectively and efficiently. Student Records were happy because the students' financial and housing details accessible to them were complete and up-to-date. Each section was in full control of their part of the system because sufficient segregation security had been installed to distinguish between users from different sections. All in all, the new linking system was considered a complete success by users in the four sections. In addition, the system was delivered ahead of schedule, which meant that sufficient trials were conducted to iron out possible sources of error. Formal measurement of user involvement and user satisfaction (Doll and Torkzadeh, 1988; Baroudi *et al.*, 1986; Franz and Robey, 1986) was not carried out at the time. However, the fact that the system facilitated the provision of accurate and up-to-date records across sections; that it helped to save time and money by avoiding duplicate data entry; that it was delivered on time; and that it was used by the users and is still in operation (with only minor changes) today suggested that the system does have a certain degree of success.

Software process modelling techniques applied to user participation

From the above discussion, it can be seen that user participation was beneficial for system design and implementation and, indeed, essential to success. Although there have been suggestions to define and measure user participation as a set of operations or activities performed by individuals, or as a subjective psychological state (Barki and Hartwick, 1989), there seems to be little in the way of a formal process which describes user participation from its initiation, follows it through and measures any results or consequences for feedback. This lack leads to the idea of applying software process modelling techniques to user participation. Just as software process models are used to formalize, represent and enact the software process (Tully, 1989), modelling the process of user participation in a similar manner can form a basis and mechanism for further studies and research. In addition, software process modelling is typically concerned with improving the quality of software products (Tate *et al.*, 1992; Tully, 1989), and user involvement in system design typically improves some aspects of system quality, thus improving software. Hence there already exist common ground where software process modelling and user participation can usefully interact. Furthermore, since process modelling can be applied to more general processes (Tate *et al.*, 1992), the description and application of the procedures of user participation can, in principle, be studied in this format. The DFDs of Figures 2 and 3 represent a first cut at the modelling of particular user participation processes. Another perspective is to use social process modelling (Newman and Robey, 1992) to explore the steps in ETHICS in further details. This approach, however, has not been adopted in this paper, as the authors' intention was to try to model the procedures of user participation within the software development process.

Matches and mismatches

As mentioned earlier, though the ETHICS methodology was not explicitly followed, the general principles of user

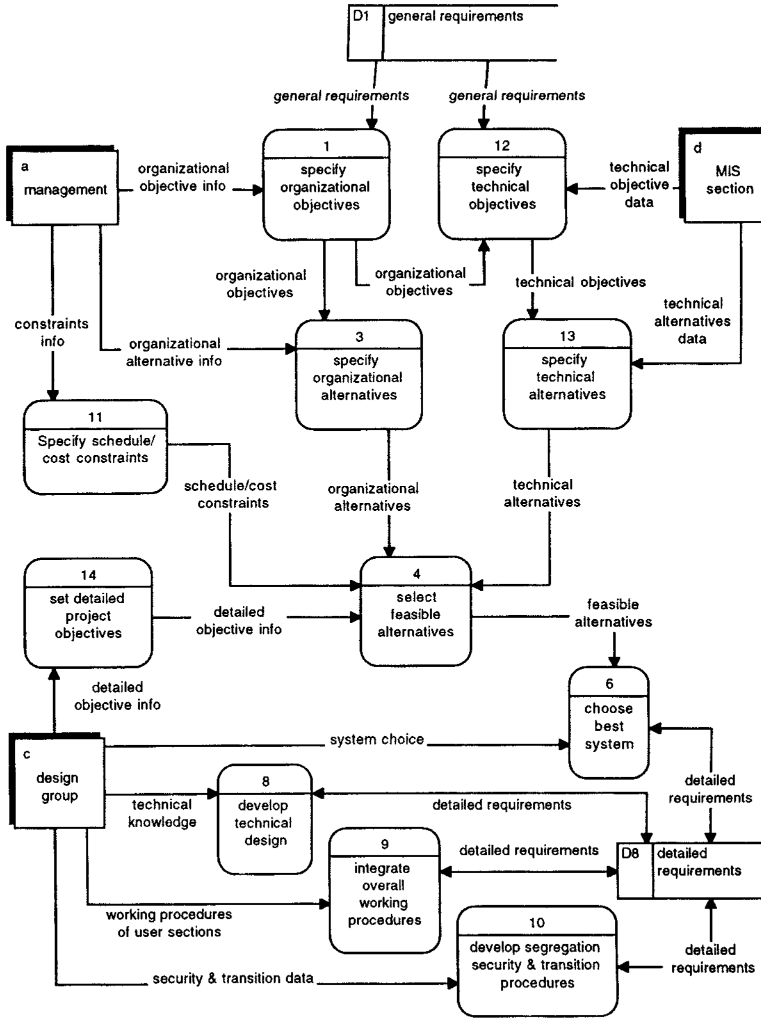

Figure 3 DFD of the case study

participation in information systems development were well understood and practised in the case study. Hence it seems advantageous and appropriate to identify the matches and mismatches of the case study and the ETHICS methodology to see what conclusions can be drawn. Further matches and mismatches are examined in the section on the data flow diagrams.

Matches

There were a number of distinct matches. ETHICS advocates that members of the work or design group should be representatives elected (as opposed to selected) from various participating departments. This approach was adopted in the case study. These representatives thus had the backing of their departments. Convincing them to work for the success of the project meant that they, in turn, would try to convince their respective departments. Thus user involvement was pitched at the right level, including representation by key perspectives, but not too many people (Leonard-Barton, 1988). In the case study, the design group met in open meetings to discuss problems and issues, and to exchange ideas and information. In the beginning, members of the work group did not trust each other and conflicts of interest surfaced. However, through meeting and working together over a period of time to achieve the same goal, reasonable expectations, mutual trust and understanding were established within the work group (Carnall, 1986; Boehm and Ross, 1989). This was probably the most important factor influencing the success of the project. An important step of ETHICS is the setting of efficiency and social objectives. Although the case study showed other different kinds of objectives as well as technical and social ones, it was notable that objectives were set at the start of the project, and that everyone in the design group understood them. Thus the goals of the project were established at the outset. Finally, the MIS section, in particular the MIS Officer, acted as the coordinator or facilitator. She was the person trusted by everyone and was seen as the neutral party. Resolving conflicts of interest, solving problems of stress, checking that the project was on schedule and keeping the group's morale high were her responsibilities. The new system would not benefit staff in the MIS section since they did not use it at all themselves.

Mismatches

There also existed a number of differences between the procedures adopted in the case study and those advocated by the ETHICS method. The first step in ETHICS is to diagnose business and social needs and problems with respect to the system to be developed by the design group. The suggestion is that a considerable amount of time and effort should be expended in this step focussing on both short and long term efficiency and job satisfaction. The method also encourages development of alternatives such that the one best fitting both the business and social criteria can be chosen. In the case study, however, diagnosis and development of alternative strategies was largely done by the MIS section in conjunction with management. The business and social issues having been identified, these together with alternative solution strategies and constraints were then presented to the design group. The design group worked to produce one solution, a satisfying one, then adopted it and worked to produce the system. A catalyst for this approach was the specific deadline. The project was initiated in May and must 'go live' by August to coincide with the admissions-registration round, otherwise the system would have to wait a whole year for the cycle to begin again. The reasons for the mismatches may be that one problem with the use of ETHICS is that it can be time-consuming (Davis and Olson, 1985). The case study offered an example of a practical solution. It has been noted that multiple alternatives originating from multiple parties could become sources of conflicts, with different users opting for different strategies (Tornatzky *et al.*, 1980). This situation was avoided. Furthermore, the ETHICS methodology tends to be an idealized model, ignoring organizational constraints, inter-departmental conflicts, and (to some extent) human characteristics. In most cases of information systems development, these issues exist and must be dealt with explicitly and effectively.

The data flow diagrams

In the elaboration of the ETHICS steps shown in Figure 1 into the DFD shown in Figure 2, it is assumed that a project with conceptual requirements is in hand before the method is adopted, and that these conceptual requirements are the initial information used in setting both the social and technical objectives. It should also be noted that the resulting best sociotechnical solution chosen only leads to the formation of detailed requirements for the system to be implemented. The solution itself is not the implemented system, as steps 5 to 7 of the ETHICS method are not depicted in Figure 1. In the DFD developed for the case study (Figure 3), general requirements which existed before the initiation of the project are explicitly depicted. These general requirements guided the formulation of the organizational objectives. Also in the case study, the chosen solution was the implemented system, hence events did not halt after detailed requirements of the system had been drawn up. Further prototyping and implementing activities continued. The DFD in Figure 3 only goes as far as the design stage, however. The steps following that stage are less interesting from a user participation point of view and are therefore omitted here.

It is interesting that although ETHICS advocates separation of the objectives into social and technical, in practice, as shown in the case study, the overriding objectives are organizational and managerial ones which influence the formation of other kinds of objectives. As mentioned earlier in the case study, MIS assumed the role of the neutral coordinator, as well as providing technical support. MIS helped to resolve conflicts of interest and problems of stress between the four user sections and in general guided the project on course. A lack of trust and understanding seemed to exist between the four user sections, rather than between MIS and the users. This is different from the scenario described in ETHICS where there are only two groups of people, non-technical and technical staff, and problems may exist between these two groups. This difference may account for the different handling and sequencing of some of the activities shown in the two DFDs. Furthermore, in theory it is feasible to consider cost and resource constraints after socio-technical alternatives are formed. In practice, however, constraints, whether they are costs, resources or schedules, are usually considered at the outset by management, and laid down as firm guidelines to the design group for subsequent system development and implementation.

Discussion and conclusions

One of the virtues of process modelling is that it defines or delineates the procedures that are to be followed for a particular process. Although user participation in information system development has been emphasized and advocated by researchers and practitioners, the process has only been described very informally. In the DFDs of Figures 2 and 3, we have shown an initial attempt at modelling the user participation process in greater detail. If software process modelling techniques are further employed to form an initial prototype for user involvement, this prototype can then be enacted by participating users. If this prototype has corresponding data collection, measurement and feedback mechanisms built in, it can be enhanced iteratively in line with actual experience. User participation can also form part of the more general picture of the whole software process. The advantage of such models is that user participation or involvement could then become a matter of course. It could, where appropriate, be built into the system development cycle as application data flow diagramming, documentation and programming are because the process model includes and specifies it. It has been said that process modelling can have many different goals, and that it is more usually employed to precisely define, characterize or direct the software process than to non-intrusively observe a relatively unconstrained development (Tate, 1992a). The process of user participation is undoubtedly relatively unconstrained, though it may benefit by being more precisely structured. Due to the nature and variety of software process modelling techniques, however, a model can be as intrusive or unassuming, as procedural or informal as a design group or a developer would desire (Tate, 1992a).

The elaboration of the outline of the ETHICS method of Figure 1 into the more systematic DFD of Figure 2 starts the construction of an initial generic ETHICS process model. The subsequent DFD of the case study shown in Figure 3 can be considered as an attempt to model the description and application of the procedures of user participation in a particular situation. Even though the actions or activities depicted in the DFDs are ones that have to be carried out by humans, the process can be computer-assisted. For example, the contents of the data flows can be specified; simple actions can be guided with a statement like 'Please list technical objectives'. For more detailed guidance, structured questions and sequences of help messages can be invoked for particular activities. All of which can employ the computer for assistance in enacting a user participation process model in order to enhance and structure participation. Although we are still some way from an enactable model, the combined effects of the two DFDs could be interpreted as an embryonic stage of process models for user involvement. From another point of view, the ETHICS method could be regarded as a generic process model of user participation and the case study as a specific model instance tailored and adapted to a specific situation.

As far as the case study is concerned, there are a number of factors contributing to the success of the project. Firstly, the project was backed by the Registrar, Head of all administrative sections. His role was that of figurehead, leader and 'champion' (Leonard-Barton, 1988; Lindner, 1989). Users saw completing the project successfully as a direct means of pleasing the leader. Following the leader is a culture which exists in many organizations, and the influence of strong leadership and top management support on the success of projects is well known to be significant (Davis and Olson, 1985; Rousseau, 1989; Jarvenpaa and Ives, 1991). Secondly, the deadline was a very real constraint (Lindner, 1989). The old system was creaking at the seams. Every user realized the implications if the project were to fail. Finally, and probably most importantly, the new system was to be the users' system right from the start, thus all parties involved had a common agreed direction (Lindner, 1989). The users had to make it work because their reputations were at stake. The last two factors significantly motivated the users. Motivation and readiness to acquire new skills are known to link with individual needs and perceptions, and also with organizational culture and reward systems (Mumford, 1983; Rousseau, 1989; Geriach and Kuo, 1991; Joshi, 1991). The fact that the system was delivered ahead of schedule allowing for trials, tests and training probably helped to reduce the resistance to change (Geriach and Kuo, 1991; Joshi, 1991). It should be noted that although Enid Mumford's ETHICS method is not very specific about input, output, activities and results, the elaboration into DFDs helps towards understanding the steps in greater detail. It has been shown in this paper that simple process modelling can be applied to user participation to help clarify and better define the entire process and potentially to help guide and monitor it through computer assistance.

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