Human Factors and Ergonomics in Manufacturing, Vol. 11 (1) 53–69 (2001)

Participation in Job Redesign: An Evaluation of the Use of a Sociotechnical Tool and Its Impact

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ABSTRACT

In this article we describe the use of a sociotechnical tool within a company manufacturing photographic products. The tool was used by shop-floor operators and managers to redesign a group of jobs and tasks prior to the introduction of new technology. The tool involved two stages: (a) generating alternative scenarios of ways to reconfigure existing and new jobs and tasks within the plant; and (b) using a set of decision criteria (e.g., control, skill variety, and opportunity for social contact) to evaluate these scenarios, drawing on established sociotechnical and job design principles. The tool proved to be successful in generating new job designs, reinforcing the value of such design techniques, and highlighting the value of shop-floor involvement in the design process. However, participation in the design process was not without its problems. We discuss these further in terms of the critical role of the workshop facilitator and the important role played by factors such as selection of participants and their background knowledge. © 2001 John Wiley & Sons, Inc.

1. INTRODUCTION

Despite the potential advantage offered by the introduction of advanced manufacturing technology (AMT) and its consequent widespread adoption, the available evidence points to poor levels of success. Majchrzak (1988), for example, reported a 50%–75% failure rate in the implementation of AMT. More recently, a survey involving 564 manufacturing organizations within the United Kingdom showed that between 50% and 60% of new manufacturing initiatives (including the use of new technology) fail to meet their original objectives (Waterson et al., 1999). Commentators agree, however, that such failures are not always due to inadequacies in the technology itself. They are often a result of problems such as technology-led management styles and poor implementation strategies (Parker & Wall, 1995; Symon & Clegg, 1991; Wall & Davids, 1992). In addition, there are many examples of inappropriate job designs that conflict as compared to complement the demands of the new technology (Buchanan & Boddy, 1985; Page, Williams, & Boyd, 1993).

From a shop-floor perspective, many authors have voiced strong concerns about the negative impact of AMT on shop-floor jobs and tasks. For example, many traditional manual jobs have been reduced to tasks that involve intermittent feeding and monitoring (Braverman, 1974; Klein, 1991). Researchers have suggested a number of job redesign strategies in order to enhance the quality of work (e.g., Hackman & Oldham, 1980). How-

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ever little attention has been given to the actual process of work redesign (Oldham, 1996), and there is a need for the development of tools to assist this process (Clegg, 1995). In what follows, we outline the sociotechnical approach to systems design and consider the possible implications of adopting the participative techniques advocated, before moving on to review the use of systematic methods and techniques to aid job design.

1.1. Sociotechnical Approaches and Participation in Job Design

Traditionally, approaches to job design and the implementation of new technology are technology centered, often failing to consider the implications on the personnel involved. The result is a suboptimal work system, not only in terms of productivity but also in terms of the psychological and physical well-being of employees. What is needed is an approach to the design of work systems that is human centered and that adequately addresses the critical dimensions of the technology, personnel, and the external environment—otherwise known as the sociotechnical system (Hendrick, 1997).

In its most fundamental form, sociotechnical systems (STS) theory advocates the joint optimization and parallel design of both social and technical subsystems (Cherns, 1976, 1987; Clegg, 1995). Both of these subsystems are mutually interdependent, thus joint design is necessary in order to develop the best possible fit between the two. STS theory also advocates strategies of high involvement and widespread participation in the design process, of all members of the organization from shop-floor workers to top management (Gerwin & Kolodny, 1992). Such involvement is needed to ensure compatibility between process and outcome such that the ownership and design of the new system is appropriated by those who will be responsible for its management, use, and support (Clegg, 1998). Thus, end users should be involved in the decision-making process, particularly where the new systems are to have a direct impact on their job (Klein, 1994). Ideally, this involvement should begin at the design stage and continue through to implementation, with users actively involved in deciding how they will run the new system (Symon, 1990). The integration of STS principles such as compatibility with the design and implementation of new work systems is one way of avoiding a preoccupation with technical issues alone and should also help to prevent any negative consequences associated with such a narrow focus.

Although the participation of end users is widely encouraged from a sociotechnical perspective, there does exist some conflicting evidence regarding its overall effectiveness. Seeborg (1978), for example, found participation to have a positive effect, providing the opportunity for people to work together on a meaningful problem. This opportunity provided a growth experience not usually encountered by the participants. Likewise, Davis and Wacker (1988) argued that job design should not be delegated to specialists, suggesting it is only by involving those affected by the changes (usually shop-floor workers) that greater ownership will be encouraged and new job designs more readily accepted.

Others, however, have warned of some of the potential negative aspects of participation, especially if the process is not managed appropriately. For example, expectations may be raised, which creates problems if ideas suggested by the participants are for some reason not implemented. This may result in the emergence of resistance to the proposed changes, especially if participants come to realize for the first time that their jobs may be at risk (Blatti, 1996; Parker & Wall, 1998). This research highlights the need to be sensitive to historical and contextual factors in order to determine the appropriateness of participation in the job design process as a whole, and, more specifically, the precise form that participation will take. A key aim of the current research is to explore the impact of a number of contextual factors, including worker participation and management support, on the process of job redesign. We review some of the techniques available to aid job design, focusing on participative tools recently developed within a sociotechnical framework.

1.2. The Use of Systematic Methods and Techniques to Aid Job Redesign

Various techniques and methods exist for the purpose of designing new jobs as well as developing existing roles (Davis & Wacker, 1988; Parker & Wall, 1998). However, on the whole very few tools explicitly address the psychological and organizational consequences of design decisions, and often have a strong functional and technical focus (Clegg et al., 1996; Eason, 1982). As Eason (1982) argued, there needs to be a shift in focus so that job design decisions take into account organizational factors at a number of levels (e.g., viewing the organization as a production system and a group of individuals). In short, new methods and tools that explicitly support psychological and organizational criteria during job design are needed.

Recent developments within a sociotechnical framework have attempted to overcome these technical biases. These include methods developed for use within system design (e.g., Hutt & McCauley, 1987; Taylor, 1990) as well as techniques designed to carry out specific activities such as task allocation (Older, Waterson, & Clegg, 1996). All of these attempt to structure information into a format that ensures coverage of critical issues and are designed to be compatible with mainstream technical approaches to system design (Hornby et al., 1992).

A recent development is techniques that are based on the idea of a scenario-based representation of design. These techniques have a number of objectives, including improving the usability of computing systems (e.g., Carroll, 1995) as well as the associated changes that a system may bring about to the work activities of operators (e.g., Kuutti, 1995). Clegg et al. (1996) described a scenarios-based tool that aims to generate alternatives for the way an organization, or part of it, carries out its basic day-to-day work. Each scenario is described using a set of standard headings that includes: the scope (and boundaries) of the scenario; the vision of how the system works; the organization structure that supports this way of working; the roles that exist within that structure; and the scenario's anticipated benefits as well as its costs, disadvantages, or both. Although the usefulness of this tool has been demonstrated at management level, further research is needed to explore its effectiveness with shop-floor staff. This is a key aim of the current research.

Consistent with the principles of sociotechnical design, the Scenarios tool is designed to be highly participative, allowing the involvement of all stakeholders, including managers, technical specialists, and end users. Tool effectiveness will be assessed, and the impact of participation in the job design process will be considered.

1.3. The Present Study

In the present study, we describe the use and modification of the "scenarios tool," a sociotechnical tool based on the work of Clegg et al. (1996). The tool was used to redesign a set of operator tasks and jobs within the production department of a photographic manufacturing company. The key objectives of the study are:

1. To describe the outcomes from the use of the tool when used with a cross-section of employees and to evaluate these against a set of requirements derived from previous research and outlined in Table 1 (Older, Waterson, & Clegg, 1997), and
2. To consider the impact of factors associated with participation in the job design process.

2. METHODS OF STUDY

2.1. Background and Context

This case study took place within a photographic manufacturing company in the North of England that has been operating in the region for the last 15 years. The company is organized on a functional basis and employs approximately 1,000 people.

The focus of this study is on new developments within one of the production departments, which is primarily concerned with a high-precision process of chemical manufacturing known as melting. Production is carried out on a 24-hour basis and operated by three shifts employing approximately 70 people. Due to changes in health and safety regulations, dramatic changes in the manufacturing processes were needed at the time the study took place. New production equipment was planned, one outcome being that many traditionally manual tasks were being automated using a new computer-based process control system. The problem facing the company was how to redesign the existing jobs of “melters” within the department and, in particular, how to manage the interface between the melters and their main internal supplier, the solutions department.

The company itself was keen to see a shift toward increased multiskilling and enhanced operator control to attain the flexibility and increased efficiency the new technology could potentially provide. Management was very much aware of the need to limit the potentially negative impact of the new technology, such as deskilling and loss of control, and was keen that the researchers should play a key role in helping to manage the overall process of change.

2.2. Overview of the Research Process

The research was conducted between April and September 1996 and was organized into three phases.

TABLE 1. Requirements for a Job Design Tool (adapted from Older et al., 1997)

The tool should:
1. have a structured and systematic format;
2. consider trade-offs;
3. examine the content and quality of the human’s job;
4. enable its users to make informed choices;
5. encourage participative use by end users;
6. require minimal training and support;
7. be adaptable and tailorable to different situations;
8. be easy to learn and usable.

Phase 1 of the study involved information gathering and task analysis. This was necessary in order to understand the tasks, processes, and people involved. More specifically, phase 1 involved attendance at project management meetings, a series of 12 semistructured interviews with shop-floor operators, tours of the existing and new production plants, and consultation of company documents.

The outcome from the task analysis was an overall representation of the production process in the form of a flowchart. The validity of this representation was cross-checked using feedback from employees and provided a “reality check” of the analysis.

Phase 2 of the study involved tool selection and modification. This was complicated by the fact that the new technology being implemented was of a unique design, and many details of how the plant would operate were unknown at the time the study took place. This meant ensuring that the tool that was selected, and any adaptations made to it, were at the appropriate level of generality given the spread of knowledge among workshop participants.

The tool used in the present study represents a combination of a scenarios-based tool that has been used for change management (Clegg et al., 1996) and a tool that has previously been used for task allocation (Older et al., 1997).

In its original format, the Scenarios tool used eight headings to structure information. The first five are for generation of the scenario and the remaining three are used for evaluation (see Table 2).

Although the headings for the generation of alternative scenarios were considered appropriate and useful, the evaluation criteria of benefits, costs, and implications were considered too general. A greater level of detail was required in order to identify and explore specific job-related issues, thus a more detailed and specific level of evaluation was sought. This was developed using a set of decision criteria derived from the Task Allocation Tool (Older et al., 1995), which was selected due to the high level of specificity of the criteria, which assess both people-centered (e.g., motivation and job satisfaction) and organizational factors (e.g., resources and feasibility). Feedback was obtained in interviews with 5 employees as to the relevance of the criteria, which suggested that some of the criteria would be too specific given the general level of knowledge about the developments planned. Concerns were also raised about the language used, suggesting it should be modified to make it more comprehensible to users. Taking these suggestions

TABLE 2. Headings Included in the Scenarios Tool

Criteria for scenario generation
1. the scope of the scenario;
2. the vision of how the system works;
3. the logic underlying this choice of scenario;
4. the organizational structure to support this way of working;
5. the roles that exist within that structure.
Criteria used to evaluate scenarios
1. the anticipated benefits associated with that scenario;
2. the anticipated costs or disadvantages;
3. the implications of making that choice.

into account, the decision criteria considered most appropriate were grouped together under common headings, which in turn complemented many of the criteria in Warr's (1987) Vitamin Model of job-related mental health. The result was an evaluation tool consisting of 12 criteria, which covered issues related to job and work design (e.g., control, autonomy) as well as more organizational and operational issues such as efficiency and training implications. Feedback was obtained from employees confirming the relevance of the criteria and the appropriateness of the language used to describe them. The criteria included are shown in Table 3.

Phase 3 of the study involved running three job design workshops with managers and shop-floor operators. Each workshop lasted one day. The morning was allocated to the generation of different scenarios, and the afternoon to their evaluation. The outcomes from these workshops were summarized in a report to the company, which included a set of recommendations for change as well as priority areas for future investigation.

2.3. Workshop Participants

Consistent with STS theory, researchers sought a representative cross section of employees for each workshop. Following consultation with managers and operators most likely to be affected by the changes, a group of individuals was selected to take part in the workshops. The group included: two operators from the melting department; one operator from the solutions department; one technical/design specialist; the project "start up" manager; and two project facilitators (who had general responsibility for keeping the workforce informed of the new changes).

Following an initial open invitation to attend, more direct encouragement was given in order to obtain sufficient numbers. Actual attendance varied between workshops, which had a significant impact on the outcomes from each workshop. The number of researchers present varied from one to three. Table 4 summarizes attendance at the three workshops.

3. WORKSHOP OUTCOMES

During workshop 1 it became apparent that some of the categories used to generate alternative configurations of operator roles and tasks were proving to be difficult to use by participants. In particular, many of those at workshop 1 found the category labels "Vision" and "Logic" to be confusing and inappropriate within the context of the changes that were going on within the department. One of the main problems was that these categories were seen as being very similar to others such as "Scope" and "Structure," and participants found it difficult to generate discrete examples for each category without

TABLE 3. The 12 Criteria Used for Evaluation of Scenarios

1. control & ownership	7. efficiency
2. skill variety	8. cost
3. task load	9. quality
4. physical security	10. flexibility
5. social contact	11. communication
6. training	12. overall impact

TABLE 4. Workshop Attendees

Role	Workshop 1	Workshop 2	Workshop 3
Production dept. 1 ops.	2	2	2
Production dept. 2 ops.	0	1	1
Technical specialist	1	1	1
Startup manager	1	1	1
Project facilitators	2	2	0
Researchers	2	3	1

repeating similar overlapping information. In order to clear up this confusion, the categories of "Vision" and "Logic" were dropped in subsequent workshops, and participants concentrated on generating scenarios using the remaining categories within the tool (i.e., Scope, Structure, and Roles). Table 5 below is a summary of the scenarios generated across the three workshops.

Scenario 1 in Table 5 outlines the form of existing roles and tasks within the department where a high degree of job specialization and separation of tasks was in operation. Scenarios 2 and 3 represent alternative designs where tasks are partially (scenario 2) and completely (scenario 3) shared. Both scenarios 2 and 3 involve increasing degrees of multiskilling respectively, and redistribution of role and responsibilities. Scenario 2 outlines a situation where both types of operators (melters and solutions personnel) carry out the same tasks (e.g., CV tasks) but decide who does what, and when, on the basis of process demands and workload. Scenario 3 was less specifically defined and involved complete merging of roles across departmental boundaries.

The second stage in the use of the scenarios tool involved evaluating the three scenarios that had been generated earlier. Table 6 is a summary of the outcomes from this stage in the use of the tool across the three workshops. Each of the three scenarios was evaluated using the 12 job design criteria (control, skill variety, task load, etc.), and summary

TABLE 5. A Summary of the Scenarios Generated Using the Tool in the Workshops

	Scenario 1	Scenario 2	Scenario 3
Scope	Existing structure	Partial multiskilling	Complete multiskilling
Structure	Maintain present boundaries: Solutions personnel work upstairs, melting personnel work downstairs.	Maintain boundaries but melters share some tasks with solutions personnel (e.g., CV activities—changing and cleaning lines and vessels).	No boundaries. Abandon distinction between solutions and melting personnel. Work as one crew and rotate tasks.
Roles	Specialized and separated	Overlap of tasks, melters to become partly multiskilled, solutions to carry out existing tasks	Single role for all crew members combining all tasks

TABLE 6. A Summary of the Evaluation of the Scenarios Using Job Design Criteria from the Workshops

	Scenario 1	Scenario 2	Scenario 3
A: Control & Ownership	Solutions—no change. Melters—manual and some other tasks automated.	Solutions—lose some control and ownership of work area, but gain more freedom as less tied to process. Melters—gain control and shared ownership over some tasks.	Potentially less control for everyone as difficult to predict proposed human–machine allocations. Potential for less ownership in the department as a whole.
B: Skill Variety	Solutions—gain some new skills (e.g., Change Vessell [CV] tasks) but tied to process. Melters—gain new skills (e.g., keyboard skills).	Solutions—share CV tasks. Melters—gain new skills (e.g., CV tasks).	Skills distributed around department. Solutions may lose some skills as less time for demanding tasks.
C: Task Load	Solutions—some skepticism, may lead to more tasks (e.g., supervising process) or no change. Melters—decrease in workload.	Solutions—less potential for overload especially during peaks. Melters—reduction in workload but potential for increase if CV tasks have to be done in parallel with others.	Wide range of tasks may cause overload and potential for confusion in roles. New technology may increase workload irrespective of merged roles.
D: Physical Security	Solutions—increase in hazards due to CV tasks. Melters—bigger batches mean potential for physical strain.	Increase in people in solutions area could lead to increases in hazards. Less specialized ownership means less commitment to health and safety isues.	Potentially dangerous as more people in hazardous areas.
E: Social Contact	Less social contact overall as information on process available on screens.	More contact between solutions and melters.	More contact and shared concern with work issues. Skepticism that it would have any impact. Role of supervisor critical.
F: Training	Solutions—training for CCV tasks and background knowledge of process. Melters—computer skills.	Solutions—training for CV tasks and background knowledge of process. Melters—training for CV tasks and computer skills.	Enormous demand on training, would require new training program.

continued

TABLE 6. *Continued*

	Scenario 1	Scenario 2	Scenario 3
G: Efficiency	Potential for overload could lead to inefficiencies, but this could be planned for in the new system. Existing structure ensures accountability and quick response to process.	Need to provide cover to deal with potential overload. Less familiarity with tasks may mean more errors.	Need to provide cover to deal with potential overload but responsibility for cover might be difficult to work out. Lack of ownership and responsibility will have negative impact.
H: Cost	Costs may potentially increase because of risk of overload. Minimal training costs.	Cost effective in the long run despite initial training costs.	Expensive training costs, breakdowns in process due to errors, increase waste. Could be cost effective if manpower could be reduced.
I: Quality	Present system of specialization results in high levels of quality. Current system could be improved (e.g., weighing and mixing tasks).	Partial merging may lead to individual variations in quality. Need for regular rotation of some tasks in order to prevent errors.	Increased potential for error and therefore a reduction in quality. Lack of ownership and movement of personnel mean lower quality. Could lead to quality improvements in the long run if it leads to greater knowledge of the process.
J: Flexibility	Solutions—currently depends on 24-hour production. Less flexibility due to cover being limited. Melters—may be freed up to perform other tasks.	More flexibility for all as melters can provide partial cover for solutions.	Need to have flexible cover widely available. Product change may be more efficient if it could be shown to work. Greater flexibility may impact on quality.
K: Communication	Accurate and precise information available to everyone from the computer system. Less face-to-face contact, concern about “invisible” nature of process. Need for greater communication across people.	High level of communication required between melting and solutions (greater than scenario 1). Face-to-face contact reduced.	Good communication essential, possibly difficult for process controllers. Negotiation skills needed to cover who does what. Solutions—may lose information, therefore need for tight coordination.

continued

TABLE 6. *Continued*

	Scenario 1	Scenario 2	Scenario 3
L: Overall Impact	Widespread fear that system will lead to job losses. Solutions—satisfaction remains the same but could decrease if more tied to the process, increases if they have more responsibility. Requires solutions being manned by two people at a time. Melters—lower satisfaction due to task load, skill reduction, and loss of control. Less identification with product, less pride and opportunity for feedback.	Solutions—reduction in satisfaction due to loss of control. Melters—better satisfaction than scenario 1 and may compensate for other losses in terms of control. Potential for conflict between solutions and melters.	Solutions—lose all satisfaction and pride in the job. Would end up as "reactors" rather than "initiators." Uncertainty on a day-to-day basis about the job would consist of high variation in terms of skill variety and workload. Fear of making mistakes may lead to lower satisfaction. Grading scale will have to be changed in order to encourage people to train.

notes were made for each of the scenarios against the criteria. Table 6 is a summary of the outcomes from this stage in the use of the tool across the three workshops.

As can be seen from Table 6, a great deal of information covering a wide range of issues was generated using the tool. The evaluation of the scenarios tended to be structured around the various roles within the department, and, in some cases, this led to conflict. In the case of scenario 2, for example, the consideration of criteria relating to control (box 2A in Table 6) raised some concern about the potential loss of control by solutions operators. By contrast the same scenario was seen as likely to increase feelings of control and ownership among melting personnel. This highlights the need to manage the use of the tool very carefully, as discussed later in the article. In addition, other concerns were raised about the impact of the new system in terms of increasing the tasks of solutions operators and decreasing the tasks of melting operators (box 1C in Table 6). In other cases there was broad agreement among participants in terms of the impact of the scenarios. For example, in the case of scenario 1, there was agreement that the new technology would lead to less opportunity for social contact (box 1E in Table 6) and that scenarios 2 and 3 were more preferable (boxes 2E and 3E).

The final part in the evaluation of the scenarios involved considering the overall impact of the design scenarios. The main outcome from the workshops was that each of the scenarios had some advantages and disadvantages in terms of psychological (e.g., control, opportunity for social contact) and operational (e.g., cost and quality) criteria. None of the scenarios was seen as being the outright choice of participants at the workshops. However, scenario 2 was seen as potentially the most advantageous because it would lead on the whole to more satisfying jobs across roles within the department and at the same time would be cost effective to implement. Participants also noted that there were some disadvantages to scenario 2. For example, it could lead to loss of control by solutions personnel over their tasks and responsibilities. However this was seen as a minor disadvantage that could be overcome by further consideration of the allocation of tasks between the two groups of operators as well as by identifying further opportunities for training.

4. FINDINGS AND DISCUSSION

In this section we first consider the strengths and weaknesses of the tool in terms of the requirements set out earlier in Table 1, as well as potential areas for future development (section 4.1). Second, we consider the implications of the study in terms of the impact of participation on job redesign initiatives in similar manufacturing contexts, as well as other lessons learned (section 4.2).

4.1. Evaluation of the Tool

In order to evaluate the tool, we adapted a set of user requirements for an effective tool derived from previous research in the area of task allocation and job design (Older et al., 1997). These requirements are shown in Table 1 and were selected from the original list largely on the basis of their applicability to manufacturing contexts and their coverage of issues related to job design.

Looking first at the first requirement in Table 1 (a structured and systematic format), our experiences in using the tool led us to believe that overall this was one of its main strengths. The tool helped participants at the workshops to methodically work through each of the scenarios, and, at the same time, to consider each of these against the set of 12 job design criteria (criteria 3 and 4 in Table 1). In addition, the tool facilitated debate of other issues related to the overall operational impact of each scenario (e.g., quality and production flexibility) and provided a means by which these could be recorded and later consulted (i.e., the tool maintains a record over time of design rationale; Moran & Carroll, 1996). Overall, the tool generated a wide-ranging set of discussions (Table 5 and Table 6) and, together with our background knowledge of the company, led us to believe that these would not have been so thoroughly addressed had the tool not been deployed within the company.

The tool also supported participation in the workshops (criterion 5 in Table 1), although this was not without its own difficulties and problems (see section 4.2). A key feature of the tool that seemed to promote participation was the fact that the tool supported a “common language” with which all parties (solutions and melting operators, managers) could discuss changes to work and job design. For example, some of the terms that were used (e.g., “ownership”) were unfamiliar to participants and opened up debates such as “who owns this process?” and “who has the right to change the distribution of skills and responsibilities?” These debates, to some extent, allowed participants to ask questions that were not necessarily tied to job design per se and had not been previously given adequate coverage or time for consultation (e.g., fears about the impact of the technology on job security). At other times, the language and terms used in both the first and second stages in the use of the tool provided a focus for discussion for more specific issues (e.g., the overall scope of a scenario and its impact on skill variety). Overall, the tool supported discussion of macro and micro aspects of the change process while encouraging participants to grasp the “wider picture” and to think of the overall “systemic” impact that was likely to be brought about.

The tool was also helped to consider some of the trade-offs between different groups and job design choices (criterion 2 in Table 1). The manner in which this was done was often implicit, rather than explicitly negotiated by participants at the workshops. For example, participants tended to work through each scenario and then make reference to their earlier discussions when evaluating a particular criterion against one of the scenarios. Many of the choices and evaluations that were made had “knock on” effects such as raising training needs (e.g., increases in skill variety such as CV and keyboard tasks) or reducing/increasing opportunity for social contact (e.g., scenarios 1 and 3). The trade-offs between these choices and the interdependencies that existed both within and between scenarios and criteria were recognized by participants and were fully taken into account. In addition, the final criterion (overall impact) encouraged discussion of trade-offs in a much more explicit manner and ensured that this aspect of the design process was systematically and thoroughly addressed.

Although the tool proved to be on the whole successful in meeting the criteria in Table 1, there are one or two areas that represent areas for improvement and future development. First, although our experience in using the tool led us to believe that it was easy to modify and adapt (criterion 7) to a particular situation, it was also clear that without the guidance of the researchers this would have proved to be difficult. Similarly, with regard to training requirements and the overall usability of the tool (criteria 6 and 8), it proved difficult to assess these factors because “hands on” use of the tool was largely limited to the researchers. Our experiences led us to believe that the tool requires some supporting guidance in the form of documentation and other training materials. For example, the tool would have benefited from some information regarding the selection of participants, conduct of the workshops, tailorability of materials, and guidance as to how the role of the workshop facilitator should be managed (see also section 4.2.5). In addition, the tool needs to provide more information regarding when and where they should be used within the larger context of an overall job redesign initiative.

Also needed is a way of further assessing the validity of the tool. Although the researchers’ judgments of how well the tool meets the requirements in Table 1 go some way toward achieving this, the tool would benefit from more independent assessment, possibly by those employees involved in tool use or by independent observers. One possible option is to conduct a postjob design task analysis, comparing the outcomes with the preparatory task analysis done prior to use of the tool. These issues are being addressed in the ongoing development and evaluation of the tool (e.g., Axtell, Pepper, Clegg, & Wall, 1999; Hesse, 1998). We plan to collate information across these studies and provide guidelines for using and adapting the tool in future versions.

4.2. Issues Related to Participation at the Workshops

There was great variation between the three workshops, which served to highlight a number of important issues. These include the background knowledge of participants, resistance and the sensitive nature of discussion in the workshops, and the cross-section of participants. Other important factors common to the participative process include the wider organizational context and the role of the workshop facilitator.

4.2.1. Knowledge of Participants. The fact that the new technology had already been designed created inconsistencies within and between workshops in terms of the background knowledge participants had about the new system. Similarly, the fact that the technology had been designed constrained the range of potential job designs that could be meaningfully generated during the workshops. This meant that certain participants felt unable to contribute and also necessitated time being spent explaining how the new plant would work rather than discussing the actual job design issues. This highlighted the need for more effective communication about the new developments and the need to provide participants with appropriate knowledge so they can make an active contribution. Moreover, this suggested the need to build in an earlier preparatory step in the process of tool use, one which would equip participants with the appropriate level of relevant knowledge to enable effective participation.

4.2.2. Coverage of Sensitive Issues. As mentioned earlier in section 4.1., the structure of the tool enabled participants to determine the focus of the discussions. Although this worked to positive effect in workshop 1, in workshops 2 and 3 this resulted in the avoidance of scenarios that could potentially result in an increase in responsibilities and changes in the demarcation of different roles. This avoidance may have been motivated by a number of factors, including: the desire to avoid potential conflict with colleagues, skepticism about any impact their involvement would have, and an underlying fear of job losses and resistance to “collaborate” in any process that may actually result in job loss. The debates that emerged in workshops 2 and 3 necessitated skillful handling on behalf of the workshop facilitator to minimize conflict and its potentially negative impact while also seeking to optimize the workshop outcomes. This highlighted clearly that the tool alone will not produce the desired results and that it is essential for the process to be skillfully and sensitively managed.

4.2.3. Cross-Section of Participants Across all three workshops, the participants occupying the various roles differed in terms of the evaluation criteria they regarded as important. Operators from production department 1 were generally in favor of increasing their level of multiskilling, concentrating mainly on the criteria of skill variety, task load and control, and ownership. The biggest concern for operators in production department 2 was the issue of control and ownership. They were very negative about any ideas of multiskilling and merging departments, seeing this as clearly eroding the level of control and ownership that they currently enjoyed. They also questioned levels of physical security, efficiency, quality, and training demand of any scenarios based on merging the two departments. For those in management, the focus was on the potential benefits afforded by multiskilling across a variety of factors including flexibility, efficiency, cost, skill variety, and task load.

Although attempts were made to ensure that the appropriate cross-section of participants took part, there were a number of absences in workshops 1 and 3. This had the effect of skewing the discussion such that in workshop 1 there was little resistance and much support for scenarios based on multiskilling through the merging of the two departments. By contrast, in workshop 3, the presence of one very assertive operator who voiced strong resistance to any changes proposed, had the effect of creating a coalition among all of the operators, thus masking any expression of conflicting interests between the two groups of operators. This effectively turned the workshop into a “workers versus management” situation.

4.2.4. Organizational Context. One factor that limited the impact of participation in the present study was the fact that much of the technology had already been designed, with the exception of certain peripheral functions. As such, the design options were largely predetermined, and it was more a matter of evaluating the available alternatives rather than coming up with unique job design solutions.

Several issues that emerged from the workshops raise questions about the appropriateness of end user participation. The most obvious here were concerns about downsizing. Would operators willingly engage in activities in which they could effectively be designing themselves out of a job, and would resistance to any changes ultimately be driven by the desire to maintain the status quo? Influences such as these are beyond the control of the particular participatory method employed (Blatti, 1996). Management staff have a crucial role to play in being prepared for such issues and in having the skills to handle such situations effectively.

4.2.5. Role of Workshop Facilitator. One important practical issue that came about during this study was recognizing the potentially political role of the facilitator. For example, it soon became obvious that skill was needed in managing the discussion in the workshop so as to avoid the premature evaluation of suggestions. Background knowledge of the tools and of the change project are essential for ensuring the accurate interpretation and recording of appropriate information. The facilitator must effectively and sensitively deal with the dynamics of political issues such as reductions in staffing levels in a manner that does not hinder or restrict the objectives of the workshop. In the present study, the workshops were presented as the appropriate place to voice such concerns, and the facilitator provided an independent and objective role with which to raise such concerns. This overt recognition of issues meant that the concerns were acknowledged and documented, enabling progression onto the consideration of other evaluative criteria. When dealing with issues of such sensitivity, managers and change agents must be careful about giving assurances that may not be upheld. There is a danger of raising expectations, which, when not forthcoming, may result in disenchantment and resistance (Eason, 1992).

A similar point can be made in terms of the politically sensitive role of the change agent (in this case the researcher). Badham (1996) argued that the political role of the change agent must be explicitly recognized, as change itself is an inherently political process. Change agents may be perceived as a tool of the management. This emphasizes the importance of assuring all participants of the independence of the change agent/facilitator throughout the participatory process, as often change agents (e.g., consultants) are not independent. Complicating this issue in the present study was the fact that the proposals recommended by the researchers were consistent with what management wanted, thus potentially casting doubt on the impartiality of the researcher, irrespective of the merit of the recommendations. One possible way of overcoming political barriers to the change process is to involve participants in the actual design of the change activities they will later use. This is consistent with suggestions by Axtell et al. (1996), who advocate participatory design and management of the process itself. Measures to increase awareness of the need to change may also help.

The “process” issues outlined above bring attention to the tension within sociotechnical tool development; that is, the extent to which the development of precise techniques actually contradicts the nontechnocratic, humanitarian, and participative nature of the STS tradition. Badham and McLoughlin (1997) suggested an approach to STS tool development that accepts the importance of developing new tools and techniques to assist STS design and implementation, which also stresses the central significance of managing the application of these tools. This is consistent with previous research reviewing examples of the successful use of participative approaches, acknowledging that successful use is contingent on a variety of factors including the management of the design process (Wilson & Haines, 1997). The present research adds further support to this position and highlights some ways to manage the application of participative tools.

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