

A FRAMEWORK FOR THE ASSESSMENT OF

MULTI-SKILLING IN WORK UNITS

by

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This thesis is presented as part of the requirements
for the degree of Master of Applied Science
of the
Curtin University of Technology

December 1986

ABSTRACT

Multi-skilling, an organisational strategy aimed at increasing the skill repertoire of the worker with the intent of facilitating role and task flexibility among organisational members, is investigated.

A literature review on the subject identified a number of factors contributing towards the development of a multi-skilled workforce. These ranged from the abolition of demarcation restrictions between jobs and skill-based pay systems, to the modification of the supervisory role. However, the literature fails to consider the role of technology in such developments. It was suggested that this was central to the development of skills.

A framework was proposed that hypothesized a relationship between technological uncertainty - the extent to which task activities are varied and difficult - and skill requirements. It was further hypothesized that technology influences the structuring of activities within organisational subsystems. It was suggested that these would act either to facilitate or inhibit multi-skilling development.

The structuring of activities within a unit consist of specialisation (the number of different tasks assigned to the unit); standardisation (the degree to which policies, rules, and procedures are formalised and used to guide action); interchangeability (the extent to which A can perform B's job at short notice, and vice versa); locus of authority (the source of decision-making authority within the unit, for example, the supervisor rather than the worker); and skill heterogeneity (the variability in skill composition among unit members).

A preliminary evaluation of the framework was carried out in an organisation engaged in the processing of mineral ore, with a largely semi-skilled workforce (N=165), where a multi-skilling programme was in progress.

Evidence was presented that suggested a relationship between the level of technological uncertainty and skill development. However, the results failed to confirm the pervasive influence of technology with regard to the structuring of activities within subsystems. Instead, technological uncertainty was significantly related to the design of jobs, and specifically to the degree of the standardisation of jobs of organisational members. Also, contrary to the anticipated direction, there was an association between perceived standardisation of activities within subsystems and job satisfaction.

ACKNOWLEDGEMENTS

I wish to thank Dr John L. Cordery from the Department of Psychology at WAIT who acted as my supervisor during the project, and offered advice and encouragement, as well as a critique of an earlier draft of this thesis. Also, appreciation is expressed to Dr Wally S. Mueller for his helpful comments on a variety of topics associated with this study.

Ethical considerations preclude the identification of the organisation in which this study was conducted. It is not possible, therefore, to name and thank a number of people from this organisation, whose cooperation I relied upon during the period of data collection. In particular, the management and staff of the Personnel Department offered much needed assistance, and this is gratefully acknowledged.

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CHAPTER ONE

INTRODUCTION

It is widely reported in the literature that in the past few decades technological changes have produced a progressive deskilling of the workforce (Braverman, 1974; Compton & Reid, 1982; Jones, 1982; Katzman, 1983; Levin & Rumberger, 1983), which is seen by some as inherent in the capitalist system (Brighton Labour Process Group, 1977). This deskilling has serious implications for the well-being, quality of working life of workers (Emery, 1963; Warr & Wall, 1975), and their job satisfaction (O'Brien, 1980). This trend, based on the principles of "scientific management", was initiated in the 1890s by Frederick Taylor (1911), and resulted in the dissociation of the labour process from the skills of the worker (Braverman, 1974), through the division and standardisation of tasks.

With the internationalisation of mass production industries, through the multinational corporations, and the influence of Henry Ford (1922) who adopted the major principles of Taylorism, these ideas were diffused and became standard practice in most parts of the

industrialised world (Littler & Salaman, 1985). The pressures towards further deskilling of the workforce can be clearly seen in traditional production sectors, such as the car industry. In such industries managerial choices, based on an engineering perspective, seek to minimise costs through specialisation and routinisation (Clegg, 1984). Robots and other forms of automation are being introduced (Edwards, 1984) that slowly replace the middle stratum of semi-skilled workers. This according to many scholars will lead to relatively few highly skilled jobs, and a preponderance of unskilled jobs (Leven, 1983; Schwartz & Neikirk, 1984) leading to an "intellectual gap" between the qualification structure and skill structure of workers (der Auwera & Mok, 1982). However, others have argued that the new technology will benefit the workers by relieving the drudgery of routine tasks, and by allowing them to be more creative (Aspen Institute for Humanistic Studies, 1982). This, of course, suggests that the new technology will be used to generate new forms of work organisation consistent with the humanisation of work movement (Work in America, 1973; Wilson, 1973).

The experience in Australia and overseas seems to indicate that technology is used "to do the same old things, only faster" (Gunzburg, 1985:149), without any serious attempt to re-design the jobs of the workers,

and give them more control over the management of their tasks (Wall, Burnes, Clegg & Kemp, 1984). The problem appears to be more acute in countries like Australia and the United Kingdom, where the rigidities of both management and unions act as a barrier to the acceptance of new ideas (Gunzburg, 1985). For example, in what has been described as "the two current technological revolutions" (Dunphy, 1985:17) - the computer integrated manufacturing and the new office technology - the existing craft union divisions and demarcations in Australia are seen as irrelevant, and act only to place a heavy cost on the use of these new technologies. A common managerial reaction is to exercise more control in the workplace to deal with the situation, but in the process the jobs of the workers are further deskilled. This, however, results in the ineffectiveness of the system. Dunphy (1985) suggests that the way to manage the new technology successfully is to redefine the jobs more broadly, and create "flexible multiskilled teams" (p.20). "Flexible work groups" are also seen as the way to manage in the continuous-process industries where technological uncertainty is high (Kelly, 1982:143). The formation of semi-autonomous, or flexible work groups, where there is fluidity between traditional job boundaries would necessitate the support of the trade unions, which may see such job re-design efforts as an opportunity by employers to erode their power in the workplace (Littler & Salaman, 1985). However,

irrespective of any adverse union reaction, at a time of rapid technological and economic changes many organisations are examining their survival potential, and are stressing the need for greater flexibility in the design of jobs and alterations in employment policies (Rothwell, 1985).

1.1 Multi-Skilling

During the seventies there were many attempts to apply principles of "good" job design, based mainly on the Quality of Working Life reports (Work in America, 1973; Wilson, 1973), the work of socio-technical theorist at the Tavistock Institute in U.K. (Trist & Bamforth, 1951; Rice, 1958), and other research writings (Hackman & Lawler, 1971; Hackman & Oldham, 1975). The conclusions reached from these writings indicated, among other things, the need to increase the number of tasks that a worker could perform, which was precisely the opposite of the Taylorist position. The new forms of work organisation that were introduced in a number of countries (including the Eastern Bloc countries) during this period incorporated a multi-skilling component in their job re-design programmes (International Labour Office, 1979).

Multi-skilling can be defined as a job design strategy

aimed at increasing the skill repertoire of workers through (i) a process of learning a series of distinct tasks that overlap with those of others within a specified work area and/or job category, and (ii) an activity of engaging in contingent or spontaneous job rotation, within this area and/or job category.

Furthermore, multi-skilling requires the modification of industrial agreements and reward systems and managerial practices, suggesting that multi-skilling leads to major alterations in the structure and structuring of activities within subsystems, and cannot be seen only as "a method of training" as some have suggested (Northage & Associates, 1982).

The results from certain experimental interventions that included multi-skilling among their objectives indicated an overall increase in the skill level of workers (Archer, 1975; Goodman, 1979). More direct benefits to the organisation were accrued in the form of reductions in the labour expenditure on production (Dovba, Shagalov, Shapiro & Zubkova, 1979). In Australia, a major re-design project undertaken in the Woodlawn mine in N.S.W. had as its main focus the development of the "multi-skilled worker" (Northage & Associates, 1982). By the early 1980s some saw multi-skilling in this country as one of the key areas for managerial initiative (Huntley, 1985). However, multi-skilling programmes in

the near future are likely to be directed only at unskilled or semi-skilled workers. There is still a reluctance to extend such programmes to include cross-trade flexibility, which is seen by senior union officials as alien to the "traditional concept of the true craftsman" (Gyoji, 1984:152). These attitudes appear to be less entrenched in some British plants where union opposition towards cross-trade flexibility has been subordinated to the realities and requirements of new technology. For example, at Mobil's refinery in Coryton tradesmen perform a range of cross-trade occupations, and supervisors are responsible for multi-trade groups across many functions (Beard, 1984; Rothwell, 1985). Also, at British Leyland's Longbridge plant technological factors were used "to subvert the existing trade-based maintenance organisation and replace it with a function more suited to management's purpose" (Scarborough, 1984:15). Economic pressures facing some industries and new wage agreements are also acting to bring about modifications and flexibility in long-established trade practices in U.K. (Holden, 1985; McCann, 1985).

1.2 The Argument for the "Multi-Skilled" Worker

Three reasons are propounded for the introduction of multi-skilling programmes in the workplace: economic,

industrial relations, and socio-psychological.

1.2.1 Economic. The argument supporting the introduction of multi-skilling in organisations for economic reasons is based on the need to broaden the skills of workers so that they can meet the demands of technical change, compete successfully in the international economic field, and afford the organisation better utilisation of the available labour. Flexibility and "multiple hybrid skills" are prescribed as essential for the future in an official British report in 1985 (I.T. Skills Shortages Committee, 1985). This prescription is not confined only to factory workers, but runs through to other occupational categories. A better qualified labour force will be suitably equipped to cope with the emerging technological developments, but this would require the upgrading of educational and training agencies, and the establishment of links with industrial firms and research institutes (Alfthan, 1985). However, these conditions are already in place in countries like Japan, where the commitment of management and unions to continual skill formation, and innovation at all levels of the organisation, is seen as providing this country with a "comparative advantage" over its competitors (Ford, 1986). Ford (1982; 1986) argues that, unlike Australia where workers are classified as skilled, semi-skilled, or unskilled, in Japanese organisations workers

are viewed as skilled or underskilled, and it is a managerial responsibility to develop their human resources to their full potential. This policy has often been cited as the reason for Japan's economic miracle (Pascale & Athos, 1982). One should contrast this attitude with that in Australia where technical and management education at all levels is considered a public responsibility.

One additional factor that hinders the development of a favourable "balance of skills" in a country is the rigid division imposed between jobs, and created by long-standing industrial relations custom and practice (Ford, 1982; 1986). For example, there exists in Australia a bewildering number of job classifications within certain awards (348 in the Metal Industry Federal Award - Part 1), resulting in issues of demarcation and reduced flexibility in the utilisation of labour. This problem has been recognised by the Committee of Review into Australian Industrial Relations Law and Systems (1985), who favours the development of industry unionism in order to rationalise bargaining and lessen the frequency of demarcation disputes. It recommends that, unless there are special circumstance, no federal registration should be granted to any new craft or occupational based unions (Report Vol.2:547). Equally, some "enlightened" unionists have proposed the amalgamation of unions,

covering workers employed in the metal trades, as a reaction to problems of inter-union competition for membership (The Australian, 18th July, 1986).

It is flexibility in labour utilisation practices that is presented as leading to the superior productivity performance of foreign owned firms in the United Kingdom. This is mainly due to the relative bargaining advantage of employers that enable them to negotiate and achieve union rationalisation and flexibility in the use of labour (Enderwick, 1983; 1984). For example, a Japanese organisation was able to have one union only representing all employees in its subsidiary in U.K., instead of six, which resulted in considerable modifications to the indigenous industrial relations system. Although quantitative evidence was not presented in this case, it was felt that flexibility in labour utilisation had added to the efficiency of the company's operations (Takamiya, 1981). This outcome would be especially true if the production system of the organisation was operating below capacity, as Kelly (1982) has argued. For a system operating close to full capacity, flexibility in the use of labour would permit labour elimination, thus contributing to an organisation's cost improvement (Kelly, 1982). From a managerial perspective multi-skilling, therefore, would be an attractive proposition.

1.2.2 Industrial Relations. Some see multi-skilling in Australia as a mechanism for the resolution of industrial conflict caused by job and union demarcation disputes (Cole, Cronbie, Davies & Davis, 1985). They argue that it would be possible to reach agreement on such issues within the confines of the Conciliation and Arbitration Act, increase worker participation, and design jobs that are less specialised and with fewer hierarchical levels, leading to a more productive and satisfied workforce (Cole et al., 1985). In the experience of these authors multi-skilling, with its concomitant changes in task allocation and supervisory practices, "have been the most prominent types of direct participation - participation by workers in the design and control of the work itself at the point of production" (Cole et al., 1985:89).

1.2.3 Socio-psychological. On examination of the relevant literature this argument for the introduction of multi-skilling in an organisation appears less powerful. There is reference in some studies supporting the view that multi-skilling had led to job satisfaction, or the enhancement of the status of the worker through skill development. However, since multi-skilling occurred in combination with other changes in the organisation, its unique contribution has not been firmly established.

Support in the organisational literature is strong regarding the need for the design of jobs that provide the worker with skill variety and opportunities for learning at work (Hackman & Oldham, 1980; Rousseau, 1977), as well as conditions favourable for the utilisation of the skill repertoire of the worker (O'Brien, 1980). These results are consistent with a recent study - conducted in a plant in Australia where multi-skilling was an important design feature - which indicated that variety of tasks (and presumably use of a wide range of skills) was the best predictor of job satisfaction (Kriegler & Wooden, 1985). A greater variety of tasks incorporated in a job that has been re-designed, however, cannot be equated with multi-skilling development. The new job, for example, may require changes in skill input, and may not tap a range of other skills, acquired over time, which may be valued by the worker. Although management and unions may classify the worker as being multi-skilled, the worker's perceptions may be exactly the opposite, as an Australian study discovered (Patrickson, 1986). Much of this misunderstanding may stem from a failure to consider carefully the various forms of skill. Cockburn (1985) has argued that "skill" consists of at least three things:

- (1) The skill which resides in the man himself, and is accumulated over time, with each new experience adding to the total pool of skills;
- (2) The skill which is demanded by the job, and may or may not match those of the worker; and
- (3) The political definition of skill which workers and unions can successfully defend against employers or other groups of workers.

The above suggest that all three forms of skill must be taken into account when designing multi-skilling programmes in an organisation. A successful design must show that the worker has developed additional skills, and the job demands are such that the worker is able to use a reasonable amount of his skill repertoire (past and the newly acquired). If the political power base of the skill has been eroded, through the weakening of the union, this should be replaced with one that relies on ability. This means that as the worker becomes more skilled, he becomes also more valuable to the organisation, and therefore, more difficult to replace. One would expect that these conditions would lead to greater job security, financial rewards, and job promotional opportunities. These in turn should encourage multi-skilling development in the organisation (Lawler, 1985).

1.3 A Need for Systematic Research

The literature on multi-skilling is characterised by lack of conceptual clarity, and "is presented in anecdotal form, with little or any systematic evidence to back up claims of success, or to clearly indentify reasons for failure" (Cordery, 1985:57). This suggests that it would be difficult to attribute direct benefits to the worker, through re-design programmes based on multi-skilling, especially when several other organisational variables have been changed concurently with such programmes. Also, research on the subject is guided by the unstated assumption, that multi-skilling is just one element, among many, necessary for the formation of effective self-managing workgroups (Cummings, 1981; Susman, 1975). Multi-skilling, therefore, has not been singled out for special attention and, as a consequence, the particular conditions within subsystems, that either hinder or facilitate multi-skilling development and practice, have not been investigated.

In this study the technological conditions favourable for the implementation of multi-skilling programes in organisations will be examined. Specifically it will be argued that the technology within a subsystem often places constraints on the type of group task that can be designed (Hackman & Oldham, 1980). It will be further

argued that the group task is central to the development of skills. For example, it would not be possible to construct a group task that is high on skill variety - which is necessary for the development of skills - when the technology within a subsystem is routine.

Furthermore, the technological system would impose additional constraints on the optimum combination of various features, which are considered desirable for the implementation and support of multi-skilling programmes (Van de Ven & Morgan, 1980). These features include: unit specialisation (the extent to which tasks assigned to the unit are the same or different); unit standardisation (the degree to which policies, rules and procedures are made formal and used to guide action); skill heterogeneity (the extent of skill variation among personnel in the unit); role interchangeability (the degree to which A can perform B's work at short notice, and vice versa); and decision-making latitude or discretion among unit personnel. Based on a framework developed by Van de Ven and Morgan (1980) for the assessment of organisations, this study will explore the following hypothesis: the optimum condition for the implementation and support of multi-skilling programmes in an organisation is a moderate level of technological uncertainty. This in turn would make possible the existence of a specific configuration of the structuring of activities within a subsystem.

1.4 Objectives of the Thesis & Plan and Summary of the Chapters

The objectives of the thesis are as follows:

- (i) Review the literature on multi-skilling and provide a number of case examples;
- (ii) Integrate the information from the review into more established areas of research into job design and organisational structure, and develop a framework based on the influence of technology on multi-skilling development;
- (iii) Test certain hypotheses that focus on the interrelationships of certain of the subunit variables, which were specified in the framework.

The plan of the chapters and their summaries are outlined below.

In Chapter 2 fourteen case studies dealing with multi-skilling practice are reported. The review is necessary for two main reasons: to highlight the disparate nature of research into multi-skilling; and to identify those critical factors that facilitate or inhibit the development of multi-skilling in organisations.

Chapter 3 deals with the results of the literature review, and the identification of some characteristics found in successful multi-skilling programmes. The results from this chapter will form the basis for the development of a framework, and the generation of hypotheses to test its validity.

In Chapter 4 the role of technology in the determination of skill acquisition, and the implications for multi-skilling development are presented. A framework is also developed, that hypothesizes a contingent relationship between technology and the structuring of activities - specialisation, standardisation, skill heterogeneity, role interchangeability, and sources of decision-making - within a subsystem. Certain hypotheses are also generated for the assessment of multi-skilling in organisations.

Chapter 5 describes the research setting where the empirical study for the evaluation of the framework took place. It contains also information on the subject population, and the description of the measuring instruments used in this study to assess multi-skilling.

Chapter 6 describes a multi-skilling programme implemented in a greenfield site, and evaluates the extent of skill development among participants. This was

assessed as being low and at a level that raised doubt on the effectiveness of the programme. A number of reasons were proposed as contributing to the problem - among them the level of technological routinisation. Evidence was presented - by comparing a group which participated in the multi-skilling programme and a group which did not - that favourable technological conditions (both groups varied in their technology measures) must exist for skill development to occur.

In Chapter 7 a preliminary evaluation of the framework is undertaken. Correlational analyses at the individual level, and the aggregate unit level (by pooling data from all work units in the organisation), and a series of multiple regressions, indicated no significant association between technology and the structuring of activities within subsystems. The framework, therefore, which argued for a contingent relationship between these variables, was not supported. There was, however, evidence to suggest that technology influences the design of jobs at the individual level. It was found that technology affects the level of technical training undertaken by personnel, thus contributing to skill development. Also, technology influences the extent to which job standardisation (i.e., the spelling out of exact job descriptions, and rules and procedures for task activities) is an option in the design of jobs. This variable affects the level of fluidity between job

boundaries and, therefore, the degree to which jobs are either specialised and assigned to individual members, or generic and assigned to groups. This, of course, has a bearing on the successful implementation of multi-skilling programmes.

Finally, in Chapter 8, a general summary of the study, and certain conclusions regarding multi-skilling are made.

CHAPTER TWO

CASE STUDIES

Fourteen case studies were selected for analysis. Of these, five were conducted in greenfield sites, while the other nine occurred in existing plants. Of the fourteen studies six took place in Western Europe, four in North America, and four in Australia.

Although a literature search identified a large number of studies on job enlargement and enrichment, these were not included in the review because they did not meet the following criteria:

- * The job design did not involve job rotation, or the learning of skills that went beyond the confines of a single job, which overlapped, fully or in part, with the jobs of others;

- * Although multi-skilling was part of the job design and rotation occurred, the author did not provide sufficient information for these two elements.

Usually, the evaluations dealt only with end result outcomes.

The present review also concentrated on industrial jobs, and did not include studies conducted in semi-professional white collar settings, although some case studies existed (for example, Frank & Hackman, 1977; Taylor, 1977).

2.1 Western Europe

2.1.1 The Aluminium Packaging Plant. Delamotte (1979) describes a programme that was introduced in the plant of a French conglomerate concerned with the fabrication of aluminium packaging. The plant employed an average of 280 workers- mostly women. Of these, 60 were skilled tradesmen, and 150 semi-skilled workers trained to perform only one or two operations. Of the semi-skilled workers, 120 were employed in three workshops that had different working and shift arrangements.

In 1971 the management of the plant, with the help of a consultant, decided to improve the position of the semi-skilled workers by embarking on a job enrichment programme encouraged by Herzberg's research results. A participative process was adopted, with management consulting with employees through committees established

for the examination of working conditions, training of personnel, job responsibilities, and remuneration. A workshop was selected for the conduct of the experiment that would serve as the basis for an organisation-wide change programme. The workshop consisted of 1 foreman, 10 skilled toolsetters, and between 25 and 27 semi-skilled workers, who were employed in the manufacture of tubes for beauty products.

Through a number of sub-committees, made up of tradesmen and operators, the workers achieved the following changes through negotiations with the management of the plant:

- * Control over the inspection of product quality, including the power to stop the line by the operator if output was defective;
- * Timely information from management concerning production scheduling, so that operators could organise work in the unit to meet the demands of the increased workload;
- * The setting up of production objectives by workers for each month;
- * A pay system consisting of a base salary, and supplemented by increments that reflected the degree

of multi-skilling training achieved by the worker. The base salary was arrived at through the evaluation of four criteria, which included job knowledge, practical skills, workload, and autonomy, and divided into five classifications ranging from 1 to 5. Four additional classifications - 6 to 9 - catered for operators who had varying degrees of multi-skilling competence;

* Working time arrangements that were flexible, and allowed the worker to make up time, if time was lost through absenteeism.

On the whole, these changes were favourably received by the workers. In particular, the relations between the supervisor and the workers improved, due to the new participative style of management. Group cohesiveness also improved, with workers indicating more solidarity among themselves. There was, however, dissatisfaction with the physical working conditions, which remained poor.

In economic terms the experiment was disappointing, and it would have ended in the first years of operation, had it not been for the staying power of the plant manager who had the support of his superiors. The manufacturing output registered a steady decline in the initial stages

of the experiment, only to reach the pre-experimental level in 1976 - almost five years after commencement. The consultant's fees also added to the deficit.

On the credit side there was a modest reduction in labour turnover and absenteeism, and an improvement in the number of returns of faulty merchandise. All-together, "the costs of the new organisation of work were twice as high as its benefits" (Delamotte, 1979:71).

When the plant management attempted to introduce the programme into the other workshops it met with resistance. For example, in the workshop consisting of older and more experienced personnel (the old girls' shop) the workers refused to consider job enrichment or multi-skilling, and would discuss only the physical constraints of work such as bad smells, noise, and dirty flooring. They rejected the possibility that they might have something to learn from the experimental workshop (the "beauty" shop, consisting of younger workers), because the "old girls" strongly believed that they were fully versed in all aspects of their work. As a results, the diffusion of the planned change in other parts of the plant never took place.

2.1.2 The Dalmine Tube Mill. The following experiment took place in the Dalmine tube mill at Apuania in Italy (Fantoli, 1979). The mill is one of six works of the Dalmine company, which engages in the manufacture of quality tubes for the boring of oil wells and the extraction of oil. At the time of the project, the mill employed 1,500 wage earners - highly unionised - 250 salaried staff including supervisors, and five senior managers.

Faced with trade union pressure, which was bringing about a general upgrading in the classification of workers (with increases in remuneration) based on length of service, and a diminution in the degree of flexibility of labour utilisation, the company reacted by promoting vocational development through gradual improvement of the workers' skills, and by introducing restructuring of work methods.

The new form of work organisation was introduced gradually in different workshops since 1973. A working party, made up of managerial personnel and workers' representatives was set up to advise on the proposed changes. The working party recommended the formation of four production groups based on homogeneity of functions, which corresponded with particular phases of the process.

Each group developed a multi-skilled workforce, and every member was available to perform any of the group's functions. This arrangement was negotiated with the trade unions culminating in a works agreement, which provided for the recognition by the company of the skill training undertaken by the worker, and his inclusion in the highest skill grade (class 5) of wage earners. A new recruit would be given 21 months to reach this classification through on-the-job training and theoretical and practical instruction given to him after working hours.

Every group was given sole responsibility for the control of the production phase under its jurisdiction, including the maintenance of equipment (maintenance workers were not included in the project from fear that their specialised background might have led to the re-establishment of a technical division of labour), and the arrangement of job rotation, rest periods and holiday scheduling. Each group was sub-divided into stable shift groups, ranging in size from 4 to 11 members per shift, according to the phase of production. The shifts were co-ordinated by a foreman who had, in addition, liaising responsibilities with the other functional departments.

An assessment of the project undertaken 18 months after commencement indicated satisfactory output and reject rates, even though new and novel equipment were installed during this period. Skills were evenly developed throughout the plant with each group developing a multi-skilled workforce rapidly. Although there was initial resistance to job rotation this was overcome as a result of group pressure, which caused individuals to expand their skill repertoire quickly through regular attendances at vocational training courses offered by the company. Group pressure was also given as an explanation for a marked drop in absenteeism, and it was this "group consciousness", according to the author, the result of multi-skilling, that led to productivity increases. However, there were also some negative outcomes from this "group consciousness" that caused the groups to become reserved in their relations with other groups, the foremen, and the various functional departments. This problem could have been remedied "only by granting the group collective co-ordination duties in relation to the shop as a whole" (Fantoli, 1979:76); but such a change was ruled out due to technological and vocational training reasons.

2.1.3 The Imperial Chemical Industries. The following programme (Wilson, 1979), which took place in Imperial Chemical Industries, a large multinational chemical company based in U.K., is regarded as the first extended attempt to put into practice new ideas of productivity bargaining in that country. The workforce in the company numbered 129,000 in 1975. The origins of the experiment could be traced back to 1964 when management, facing increased competition and economic uncertainty, decided to examine the efficiency of its plant staffing operations.

The manual workforce was divided into general (process) and craft workers (maintenance), with a high percentage of them belonging to the various trade unions. The influence of the 11 main trade unions, representing the majority of workers, had increased steadily over the years, with shop stewards exercising more power than first-line supervisors in the running of the shopfloor. In addition, the unions were able to negotiate successfully company-wide pay and working conditions. However, the system was extremely complicated and cumbersome, because of the different working combinations that applied to 22 distinct categories in the worker grading system. Also, with the introduction of new technologies, problems of demarcation between the different crafts, and between craft work and operator

work, began to emerge. Moreover, the demands of the technically-more-advanced jobs could not be reconciled with the rigid pay structure, which made it difficult to reward the worker who was facing a changing working environment.

In 1964 the directors of the company decided to appoint a six member management study group to look into the possibility of deriving a formula for an "ideal" staffing schedule based on cost effectiveness. The results of the study recommended the following changes:

- * A more efficient use of labour by allowing process workers to carry out basic plant maintenance work;
- * Flexibility between craft categories, so that each craftsman could perform the simpler jobs across all categories;
- * A reduction in supervision.

The negotiations that were carried out between management and the 11 unions concluded with an agreement, to raise manpower utilisation through the reduction of the various demarcations within and between occupational groupings. This, it was argued, would allow for the development of a multi-

skilled workforce at the same time.

The planned changes were introduced by management gradually, and provisions for the voluntary participation of units in the programme were made. By mid-1968, 5% of the company's total manual workforce was participating, and management reviewing the results of the experiment decided to continue in spite of some resistance "...if only because the new and higher pay levels established in the experiments could not be reduced and they provided precedents for other units" (Wilson, 1979:124). A new agreement was reached with the unions which included increases in pay; a no redundancy clause in the award based on retraining and re-allocation of personnel; 100% trade union membership; and control of each craft union over the allocation of its traditional work to other groups of workers. A target was set for the implementation of the agreement (within a period of 18 months), which appeared ambitious at the time (85% of the company's workforce, or 40,000 workers), but was exceeded due to the competence of the management and the lessons learnt from their attempts to introduce change in the organisation.

At the end of 1972 the company could boast specific changes that occurred in a number of areas and in accordance with predetermined objectives. Some of them were:

- * A simpler pay structure, which replaced the old and more complex system of pay rates;
- * A reduction in the number of supervisors;
- * Substantial job enrichment and job enlargement in the work of manual workers through multi-skilling;
- * More integrated work between craft workers and process workers;
- * Expertise gained by management in dealing with the workforce and the unions;
- * Changes in management style from paternalistic to participative;
- * Reduction in absenteeism and labour turnover.

There were, however, certain setbacks. With regard to demarcation, the increased control by the unions over which aspects of the work could be relinquished for common access, negotiated during the second agreement, was a retrograde step. Although the demarcations were fewer than before, "...the introduction of officially recognised lines of demarcation between work....led to

a reduction in local flexibility of manpower development" (Wilson, 1979:128).

2.1.4 The Blaupunkt Plant. This experiment (Staehle, 1979), took place in the car radio factory of Blaupunkt at Hildesheim in the Federal Republic of Germany. Blaupunkt is a large manufacturing company specialising in radio and television equipment and accessories. Before the experiment the assembly of car radios was undertaken in a loose-linked flow-line structure, with one belt (60 metres long) linking 62 work stations, at which an average of 52 workers were stationed. The assembly line required specific and different types and levels of skill to deal with four distinct operations: pre-assembly, assembly, adjustment, and testing or repairs. The work was directed by a foreman who had about 200 workers under his control.

By early 1973 the company was experiencing difficulties from the Japanese competition. However, it could not react to the changing market conditions, because of the rigidity of the production system, which did not allow for changes in quantity, type, and variations of products - requirements considered necessary to counter the threat posed by the new competitor. A further reason for the introduction of planned change was due to the employment situation facing the firm. The company was

unable to attract young nationals (nine-tenths of the workforce were aliens), because it could not meet their expectations. Although as an employer Blaupunkt offered attractive material conditions of work, it did not provide opportunities for skill and career development. It was decided that a new form of work organisation was needed, in order to provide the necessary flexibility in the production system, and create jobs that were more attractive to the locals.

In mid-1973 an internal management project group was established to examine and make plans for new job design and assembly systems. State support was also given to the programme in the form of an external consultancy. The organisational changes that followed in 1975 made improvements to the technical system, while providing scope for individual action and decision-making. Specifically, all the various assembly functions that were fragmented before the experiment were consolidated, and given to groups of 10 workers each. In this way the learning opportunities of group members were enhanced, because each member could now perform the entire assembly process. In addition, the multi-skilling requirements were met by having 30 to 40 percent overlap of job content with adjoining stations. This arrangement served several purposes: It facilitated the training of new members, since they could progress gradually from

simpler jobs to the more complex ones; it solved the problems created by absenteeism, because workers were interchangeable between stations; it created a co-operative network of groups; and facilitated communication in the plant.

The groups were also given extended responsibilities relating to the supply of materials, simple maintenance tasks, and co-ordination of work and production quantities. To avoid the possibility of negative attitudes due to the new modified working conditions, job allocations and transfers were made on voluntary basis.

The results from a survey involving some 1,500 workers indicated an increase in the skill level of workers, which forced management to provide appropriate opportunities for promotion. The economic efficiency of the plant had also improved through flexibility in the quantity of output, product type adaptation, and staffing arrangements. Supervisory and repair costs were also reduced through a decrease in the number of personnel engaged in these tasks. However, there were increases in equipment costs, and plant and wages costs. Negative reactions from supervisors, due to the pressures of the new supervisory style, which provided for more participation, and adjustments to the new work

procedures, were also noted.

2.1.5 The Durham Coal Fields. Among the earliest of the Tavistock projects that embodied the socio-technical approach was a series of studies conducted between 1950 and 1958 in the coal mines of the United Kingdom (Trist and Bamforth, 1951; Trist, Higgin, Murray and Pollock, 1963). These studies dealt with the problems of technological change in the mining of coal. Before the introduction of mechanisation the traditional system was the "single place working", in which a multi-skilled worker possessed the necessary skills to carry out all mining operations. Each miner belonged to a team, which was self-selected, shared the same rate of pay (based on the productivity of the entire team), and worked on the same coalface either on the same or on different shifts. A team consisted of various activity groups, which ranged from two to six members that worked on different shifts. Each group would complete the work allotted to it, and the next group would take up the work at whatever stage of the cycle the previous group had left it. Each team enforced its own standards of production, and had "responsible autonomy" for its operations.

In the early 50s the above traditional method of mining was replaced by the longwall method due to the introduction of the face conveyor. This technological innovation in the mining of coal was accompanied by a

re-organisation of work and job relationships that saw a great division of labour, and the allocation of single tasks to individual team members, which amounted to a serious de-skilling of the work in the mining sector. The three basic types of mining operations, i.e. (i) cutting into the coal face; (ii) loading the coal into the conveyor, and (iii) advancing the face and enlarging the gateways, were separated and subdivided further. The result was a high degree of job specialisation within these basic operations, and the establishment of different rates of pay. The changes in job fractionisation, and the disregard for the motivational forces of the primary work group were mistakes that led to difficulties in coordinating the work cycle, and problems of worker morale. The miners disliked the loss of skill utilisation, and preferred the old system where there was variety and challenge in their work.

The researchers, investigating the effects of the longwall method of mining, found that not all pits had moved to the conventional method with its high job specialisation. There were pits in the same coal seam, at the same time, under the same conditions, which adapted the new technology to fit in with the social requirements of the group. This came to be known as the "composite longwall method". The studies, therefore,

permitted a comparison of different pits where only the work organisation was different (longwall versus composite method).

The results of these comparisons showed the great superiority of the composite longwall method over the other type. Specifically, greater manpower flexibility was noted in the system, with workers rotating between several main tasks, shifts, and activity groups in response to the requirements of work. The additional skills demanded for the operation of the new machinery were quickly met, and although not all miners moved through all the specialised task required by the new machines, there was, nevertheless, greater variety in their work. Other characteristics of the composite method of work organisation were greater group cohesiveness, and the pooling of earnings. This was based on the assumption that every man in the group was multi-skilled, interchangeable with his mate according to the requirements of the unfolding task, and, therefore, entitled to the same monetary reward.

In terms of effectiveness the composite system had very little need for external co-ordination of activities. Because the system was not organised around task specialties, like the longwall method, there was natural and spontaneous co-ordination of the work cycle. This had led to a reduction in the level of supervision.

Other positive outcomes of the composite method were reduced absenteeism and increased productivity.

2.1.6 The Volvo Kalmar Plant. The experiment conducted at the Volvo's Kalmar plant, the Swedish car manufacturer (Aguren, Hanssen and Karlsson, 1976), was in response to the serious problems of labour supply and management, which was limiting Volvo's effectiveness during the late 60s and early 70s. The mechanised, machine-paced production process then in existence was responsible for high turnover, and absenteeism among assembly operators. Furthermore, the company was finding it difficult to attract Swedish workers, and was relying increasingly on foreign labour. By 1973 less than 20% of the new workers recruited were Swedish.

The Board of Directors at Volvo decided to build a new plant, which commenced operations in 1974, where new forms of work organisation could be introduced based on socio-technical principles. It was anticipated, that the planned changes would solve the manpower problems of the company without sacrificing either efficiency or results. The emphasis of the new socio-technical design was on the alteration of job content. Under the new conditions this included the manufacture of an identifiable product by workers, the exercise of substantial autonomy, and the creation of autonomous

work groups that would become multi-skilled. A collaborative approach was adopted, with unions, management, and employee groups working together in the formulation of the new objectives, rather than relying for help on external change agents.

The work task at Kalmar was the final assembly of passenger cars by 30 work teams, ranging from 15 to 20 workers each - loosely supervised. Each team had its own work station, entrance, and facilities (change rooms, sauna, etc.). A team's work was organised into two different ways: either as a "straight line assembly", where two worker operating in pairs (one for each side of the car) followed the work-flow through several positions and completed the "team" task, interchanging sides after the assembly of each car was completed; or the "dock assembly", where a car moved through different work areas, occupied by specific subgroups, whose responsibility was the completion of the subgroup task. Planned interchangeability of tasks was also carried out within these subgroups, so that each member was competent in handling the entire team task. One member of each team was assigned to act as "instructor", ensuring that new members were given the necessary training to become proficient in the team's task.

A survey carried out in 1975 showed that 89% of all workers engaged regularly in job rotation, which they

saw as contributing to their overall satisfaction with the new design. Furthermore, in combination with other aspects of the work environment (i.e. the distinct physical territory of the team, the team task, and the collective practice of decision-making) it added to the cohesion and loyalty towards the group. Job rotation outside the group, therefore, was opposed because it led to inter-personal problems, and as a results it was rarely practiced. The solution to this problem was to develop a pool of workers, made up of volunteers, who wanted to expand their skill repertoire and acted as "fill-ins" in case of absences.

Comparisons with the Torslanda Volvo factory, a facility organised along conventional lines, indicated that the Kalmar factory had less "down-time", fewer supervisors, lower absence and turnover rates, and more flexibility in handling product changes, because of technology and manpower utilisation. However, the investment in the Kalmar factory was estimated to be about 10% higher than in a conventional factory.

2.2 Australia

2.2.1 The Philips Radio Plant. Dunphy, Andreatta, and Timms (1976) describe an experiment which took place at the Philips Radio Telecommunication Division in Victoria. This plant was responsible for the manufacture of two-way radio equipment of the type used in taxicabs, and were "tailor made" to customer specifications. In collaboration with the University of N.S.W. and the Department of Employment and Industrial Relations, Philips undertook a work structuring programme, between 1972 and 1975. This was aimed at increasing the efficiency of the production system, through an update and streamline of products and production techniques, and improvement in the morale of the workforce through job re-design based on the socio-technical approach.

Prior to the commencement of the experiment in 1972, people were working in isolation, and work was organised along assembly line principles. The production process was divided into major stages with separate departments controlling each stage. Each department in turn was responsible for the production of a small part of the total process, and as a consequence work cycles within the units were short and task variety limited. This work organisation was hindering the development of a flexible manufacturing process. Operators were in need of broad-

based skills in order to handle the specialist nature of customer orders, but these skills were not allowed to develop at work. A 25% tariff reduction and increases in labour and capital costs were adding to the problems facing the company at the time. To deal with the situation the company engaged in systematic analysis of the products being manufactured, and the tasks and skills involved. From this emerged a re-design of the technical and social systems, with the objective of increasing the flexibility and adaptability of the company to meet future changes. The new system included the following:

- * The production of "fundamental pieces", or group of components, common to all radios, which were mass-produced, stored, and used at a later date to match the specific requirements of customers;
- * The development of semi-autonomous work groups (product teams) consisting of ten to twelve operators that were fully interchangeable;
- * The upgrading and extension of skills of all operators through multi-skilling training. This allowed the worker to select appropriate product components, and perform all technical operations,

ranging from the completion of circuit boards, to the final assembly of the radio. In addition to being assigned full responsibility for the manufacture of a product, groups were also given responsibility for quality control, testing, and diagnosing and correcting faults found in the finished product.

- * The elimination of one supervisory level, and the abolition of testing and quality control functions that were normally external to the unit;

- * Modification of the physical working environment, i.e. floor layout, bench and seat design, lighting, etc.

- * Improvements in the control and reporting systems.

The results of the evaluation showed an increase of 60% efficiency (dollar value of deliveries divided by the number of people employed) over the three years; improvement in product quality (10% reduction in service requirements); and overall increases in profitability, reversing the negative trend that was observed prior to the experimental intervention. In addition, the company was able to introduce new products quicker and more efficiently. The authors also found evidence that

considerable "human gains" have occurred, in the form of positive attitudes towards the programme, and decreases in accident rates.

2.2.2 The ICI Welvic Plant. The following case (Robinson and McCarroll, 1976) describes the functioning of semi-autonomous work groups at ICI Australia Ltd's Welvic chemical plant. The study was conducted in a "greenfiled" site, where two types of PVC were produced in two distinct continuous processes. At the time of the study, Welvic was a small organisation employing a total of thirty people. The objectives of the organisational design were to provide for increased productivity, better use of capital equipment and raw materials - relative to a conventional plant - while offering plant operators greater opportunity for personal development and job satisfaction. All plant operators were selected on the basis of their willingness and suitability to take responsibility, work as part of a team, and develop their skills through job rotation.

From the early stages, management adopted a collaborative approach by involving plant operators and the union in the planned change. The operators formed themselves into four shift teams, and in consultation with the Plant Superintendent made arrangements for absences, job rotation of members, and selection and training of new

employees. The position of foreman was eliminated in the new organisational structure, and operators took the responsibility of organising work and for liaising directly with management. They also made arrangements for all maintenance jobs to be done, and even attempted minor plant repairs themselves. These increases in responsibility, flexibility, and utilisation of the developed skills, were reflected in a pay system that took into account such factors as the mental requirements of the job; the physical working conditions; the expenditure of physical energy; and the acquired skills and knowledge.

Three years after the commencement of the experiment the attitudes of the plant operators were sought. Almost all of them reported that they derived great satisfaction from organising the work themselves, allocating task and controlling the pace of work. Job rotation was considered an important source of job satisfaction, because it offered the opportunity to become multi-skilled, and added greater job variety in their work. The elimination of one hierarchical level between management and operators shortened the communication lines, and made it easier for the operators to participate in decision-making. Overall, management and operators were satisfied with most aspects of the work

system, but in the absence of any meaningful hard data it was difficult to assess its impact on productivity or standards of production.

2.2.3 Philip Morris (Australia) Ltd. In mid-1974

Philip Morris (Australia) Ltd, a Victorian firm engaged in the manufacture of wine and cigarettes, initiated a "Work Satisfaction Programme" at its cigarette plant (reported in Harper and McCarroll, 1977). This was aimed at giving employees greater opportunity for autonomy, and responsibility for their own development. At the time of the implementation of the programme there were 1,000 employees in the plant - most of them female and migrant.

The idea of introducing change in the organisation was in response to an increasing incidence of absenteeism in the plant, and the belief that a job enrichment programme would go a long way towards solving the problem. With the assistance of an external consultant, the management of the company decided to opt for a participative re-design strategy involving first-line supervisors, process workers, and executives of the company and the unions. After a series of awareness-raising training meetings and seminars, about 60 people from one of the smaller departments in the plant were involved in the programme. It was hoped that this

department would act as the impetus for the diffusion of change throughout the organisation.

The programme was based on semi-autonomous work groups with the responsibility for production levels, quality of output, rotating jobs, and sharing work within the group. In addition, they were given the flexibility to determine for themselves the extent to which the current mode of working should be changed, and in what areas they wished to increase their autonomy. Following this policy, a number of employee suggestions were discussed, and some were adopted for implementation. However, groups found that they could only bring about limited changes "because of entrenched customs and union rules". This attitude affected the extent to which job rotation could be practiced within the plant, and although it remained limited within the groups, it failed to develop into a multi-skilling programme on a large scale - as was intended - due to the pressure from union representatives, and the more senior crew members in the plant. General opposition to the "Work Satisfaction Programme" slowly grew and spread throughout the organisation, particularly after the adoption of a work arrangement that allowed employees to work a 19-day month if they reached a production target (even though this was agreed jointly by management and the experimental group). By late 1976 opposition had become so great that the union voted to suspend the operation

of the programme. At the time the project ceased to operate, only an estimated 250 employees, from the entire organisation, had elected to participate in the programme.

The reasons for the unsuccessful attempts to introduce change in the organisation were many, but the most prominent, according to the authors, were:

- * Failure to involve the unions actively in the process and gain their commitment;
- * Opposition from supervisors who did not receive adequate training, and who were unsure about their new role and status, and;
- * Inadequate communication channels for maintaining an important outlet for those not involved in the programme. It became clear that distorted communication circulated through the grapevine, and acted against the acceptance of the programme.

2.2.4 The Woodlawn Mine. This is by far the best known multi-skilling project in Australia, and was undertaken in a mine situated in the south-eastern part of N.S.W. The Woodlawn mine, a "greenfield" site, was used as a

means of expanding the skills of process workers to carry out an enlarged job, rather than developing specialist skills relevant to a particular job. This, it was suggested, would promote satisfaction in the workplace through increased skill variety, and opportunities for continued learning (Northage & Associates, 1982).

Through negotiations with three unions, representing the majority of employees in the mine, the company sought to implement the following main objectives:

- * To develop a simple classification system, thus removing the traditional demarcation and productivity restrictions;
- * Arrive at a fair skill-based pay plan; and
- * Agree on a framework for Industrial Democracy.

These goals were incorporated in the "Woodlawn Industrial Agreement" in mid-1978 - the year of the commencement of the project- which contained only six award classifications, rather than sixty as is normally the case in comparable traditional mining environments.

The employment policies in the mine were aimed at young people, inexperienced in mining, who had the ability and

willingness to learn new skills. Of necessity, therefore, employee training was to become a major consideration, and a four year multi-skilling programme was developed after careful analysis of the skills required to carry out the various production tasks (Woodlawn Mines, 1983; 1984). This resulted in the identification of four operating activity areas representing equal levels of work complexity.

Each worker, through job rotation, classroom training, on-the-job training, and self-directed training programmes, was given the opportunity to train in a selection of activities within these operating areas over a four year period. By developing skills in an activity area each year, participants were able to move from Level 5 (unskilled classification) to Level 1 (fully multi-skilled classification) in four years, and achieve pay increases based on the attainment of the different skill levels. A small number of employees elected not to participate in the programme - a "right" acknowledged in the industrial agreement between the unions and the management of the mine.

Unlike most multi-skilling projects, the Woodlawn mine programme did not take place within semi-autonomous work groups, although there was an attempt to establish such groups, which proved unsuccessful (Woodlawn Mines,

1983). However, an effort was made to expand the discretionary powers of the crews (a crew consisted of a supervisor and all workers reporting to him) through the shortening of the hierarchy, and the modification of the foreman's role, which concentrated on co-ordinating and training activities rather than on direct supervision.

An evaluation of the project in 1981, carried out by outside consultants (Northage & Associates, 1982), and based on interviews conducted with 61 award employees randomly selected, reported the following results:

- * A significant lack of monitoring of skill development led to criticisms of the system which claimed to be able to assess skill levels. Employee promotion to higher skill and pay levels were seen, therefore, as haphazard and biased;
- * Poor understanding by workers and crew leaders of the rationale and objectives of the programme, and its advantages, resulted in team leaders managing the workplace by drawing on their more traditional work experiences; while workers misinterpreted and mistrusted the intentions of management for introducing multi-skilling;
- * Poor feedback on performance, due to deficient reporting systems, led to frustration and problems

with learning;

- * The attitude of most workers was that multi-skilling tended to produce a "jack-of-all trades and master of none" worker, because the worker was liable to forget all the newly developed skills, due to the considerable delay in returning back to them;
- * Most classroom training was unrelated to the elements of the job, and crew leaders, burdened by their operational responsibilities, failed to give the necessary guidance and training to the workers - a critical requirement since most workers had no prior experience in this type of work;
- * Skilled employees who joined the organisation found their prior experiences and knowledge was not taken into consideration in the programme. They were treated like unskilled employees, and this led to dissatisfaction;
- * There was uncertainty regarding the long-term career and financial prospects of employees once they had attained the highest skill level.
- * The profit objectives of the company had not been met. In fact the financial performance of the company

was poor. This was attributed to the low market prices for ore, and excessive labour costs. It was estimated originally that the total number of employees needed to operate and maintain the mine would fluctuate between 220 and 184. In reality the number of employees in the mine peaked at 517 in 1981 and was reduced to 392 in 1983 by natural attrition (Woodlawn Mines, 1983). The excessive number of workers employed in the mine during the early stages of the project, was due to loss efficiency when the operators were learning new skills. However, this efficiency loss tended to become less with time, as the operators developed their skills.

* Absenteeism and turnover rates were no better than in other comparable mining sites run along traditional lines.

In spite of the above negative results, the concensus in the mine was that "multi-skilling has had many positive effects at Woodlawn" (Woodlawn Mines, 1983:8). For example, 92% of the award employees wanted multi-skilling to continue (Northage & Associates, 1982). Some of those who reached Level 1 (fully multi-skilled) wanted to extend their skills further. For this purpose the company negotiated with the "Riverina College of Advanced Education" for the introduction of an Associate Diploma in Administration (Mining) to meet the

needs of the multi-skilled workforce (Woodlawn Mines, 1983:9). Interestingly, as more employees achieved the Level 1 classification there was "an emerging willingness and need to specialise" (Woodlawn Mines, 1983:9).

Also operators and tradesmen who developed their skills were found to be more effective and flexible. They could tackle a job from start to finish without the need to wait for additional resources. Long-term the programme also led to manpower savings due to cross-location flexibility.

The industrial relations record of the company was outstanding. This could be attributed to the involvement of the unions in the design and implementation of the programme, and the absence of demarcation disputes, due to the abolition of the various award classifications.

Finally, workers reported higher levels of job satisfaction, and work was considered more challenging than other work that they had undertaken previously. About 50% of them were financially "better off" because of the programme, by reaching the top multi-skilled classification (Level 1).

2.3 North America

2.3.1 The Aluminum Company of Canada. The following case study (Archer, 1975) describes a change that took place in a casting division of the Aluminum Company of Canada in Quebec between 1968 and 1971. Prior to the change effort, there was considerable dissatisfaction among the blue collar workers due to the fluctuating production loads. Men were dissatisfied with having to change jobs hourly to suit the constantly changing workload priorities. The main impetus for change was initiated by the superintendent of the department, in order to improve performance, and provide the workers with more satisfying jobs.

Because the change included substantial alterations to the promotion rules and pay schemes, which were based on labour agreements, and departed from established practices, it was proposed that the job re-design be confined to a casting division involving only 47 hourly paid workers. A "sheltered experiment", therefore, was proposed in which the new type of organisation could be tested without disrupting the entire workforce (consisting of 4,5000 hourly paid workers), or adversely affecting the employees participating in the programme. The recommended changes were:

- * The creation of work teams involving job rotation. The men would train one another on the jobs during regular working hours, and would receive a pay rise when they passed a theoretical and practical test. Job rotation would be decided within the group;

- * The supply of information by management to the workers about problems which directly affected them - such as work methods, mechanical repairs, pollution control, and daily production figures;

- * The modification of the foreman's job, which after the change focused on planning and co-ordinating, rather than on direct supervision.

The preparation for the change involved joint planning among the foreman, managers, and union representatives. Two internal consultants facilitated the change, but they directed the bulk of their efforts towards increasing the decision-making, planning, and problem-solving abilities of the foreman. The author reports various outcomes thirteen months after the start of the experiment. These include:

- * A productivity net gain of 7%;

- * Positive attitudes due to job rotation. Workers

broadened the definition of their jobs, and their work became more important to them. The workers looked forward to rotating on different jobs, and the more actively they rotated the more interesting they found their work to be. However, there were certain problems with the system. One or two workers could easily block rotation, thus making it difficult for the rest. Others would learn new jobs, pass tests to obtain a higher pay rate, and then return to doing their old jobs. It was suggested that only those interested in job rotation should be selected to continue working with the new system. Those with negative feelings towards their work and job rotation attributed the reason for their attitude to personal physical limitations that prevented them from doing all the jobs, or because it threatened their job status and privileges under the old system;

* Skills attained during the change increased dramatically. While 91% of the men knew only one or two jobs at the start of the experiment, only 8% fell into this category at the time of the evaluation. Also, 75% of workers knew five or six jobs, compared to none at the start of the project;

* Changes in organisational flexibility increased due to horizontal and vertical exchanges, both within and outside the casting department.

2.3.2 The Sherwin William Plant. Poza and Marcus (1980) report a study of organisational innovation at the Sherwin-William plant in Richmond, U.S.A., a "greenfield" site of the world's largest manufacturer, distributor, and marketer of paints for industrial use.

Guided by "a desire for innovation" the management of the company set up a design group, which begun working with an external consultant in the development of a charter setting forth the overall purposes and aims for job restructuring in the new plant. The expressed need was for a well-trained, flexible, and productive workforce, and the conviction was that by arranging the work to be done by teams, and designing the socio-technical system accordingly, these objectives could be met.

Production in the new plant commenced in 1976 with a non-unionised workforce from the surrounding area. Seventy-five percent of the employees came to their jobs directly from cattle raising and tobacco farming with no industrial job history. Management philosophy and attitudes influenced heavily the physical design of the

facility. With the team approach in mind, the design of the layout followed the product flow, and kept work spaces open. This allowed a great amount of communication among workers; "floating" of workers from station to station; and shared responsibility for the entire production process. The organisational structure was flat, with major responsibilities being given to team leaders, who were responsible for co-ordinating across functions, and across the shifts of operation.

Semi-autonomous teams were formed with responsibilities for the performance of whole tasks. All team members were encouraged to learn the skills necessary to perform all aspects of the work, and they were rewarded for each skill acquired. Before an employee progressed to the next skill level his performance was subject to peer review and team leader assessment, based on criteria developed when the jobs were designed. Progression from one set of skills to the next, with commensurate pay increases, took approximately six to nine months. The objective of this skill progression was for all team members to be able to carry out all activities connected with the team's work responsibilities. In order to maintain internal and external equity on pay, and audit progression decisions, a salary committee was formed which met once weekly. Some of the positive results of the programme were:

- * A reduction in workforce;
- * A lower than average absenteeism and turnover rate;
- * No lost time due to accidents (in 1,108 days of operation);
- * Positive Quality of Work Life measures, including workers' enthusiasm for the new skills acquired.

There were also certain lessons to be learnt from the experiment:

- * Boundary management, involving the division and headquarters, or distribution and sales, could only be performed effectively by the facility manager - not the team leader;
- * Publicity regarding the programme could have helped morale;
- * Salary levels must be acceptable to the workers;
- * Management leadership at the commencement of operations must be strong and positive, especially if the workforce is unskilled;

- * Some supervisory personnel may find it difficult to adjust to new management practices;
- * A career path, that takes into account the growth needs of certain workers must be charted;
- * Workers in addition to technical skills need training in decision-making and problem-solving.

2.3.3 The Rushton Mining Company. The quality of work experiment at the Rushton Mining Company (Blumberg, 1980; Goodman, 1979; Trist, Susman and Brown, 1977), an underground coal mine in Pennsylvania, U.S.A. employing about 180 people, was aimed at improving employee skills, safety, and job satisfaction, while raising the level of performance and productivity at the same time. Long-term there was also a need to attract younger workers to the site. In 1970, the chief executive of the mine, and the president of the United Mine Workers of America signed a letter of agreement to collaborate on the project. With the help of an external research team a work re-structuring programme was planned, which resulted in considerable changes being made to the communications, decision-making, and reward systems in the mine.

Basic to the programme was the development of autonomous work groups, and a job-switching arrangement that allowed workers within a section to learn all the jobs, and become multi-skilled. This, it was argued, would provide for greater flexibility to react to environmental changes, and offer maximum manpower utilisation. From the miner's point of view it would enhance opportunities for task variety, and would contribute towards the development of a professional coal miner - one who was able to apply multiple job skills in his job. In agreement with this approach, all rates of pay were adjusted so that each worker received the same rate (the highest rate paid in the mine), and this reflected conditions of equal responsibility for production and maintenance of equipment.

There were also changes in the role of supervision. Since the responsibility for daily production was delegated to the crew, the foreman was no longer responsible for this aspect of work. Instead, his role included the monitoring of safety regulations, and the development of new activities, such as training new miners, planning, as well as integrating work in the section with operations occurring in other parts of the mine. To supervise the activities of the experiment, a joint management-labour committee was established with equal representations from the two sides.

The experiment was introduced in one of the two parts of the mine - the other section served as the control group for comparison purposes - and was staffed with volunteers. The experimental section employed 24 miners (8 X 3 shifts), plus 3 mechanics (one per shift) who reported to the head of maintenance, and 3 foremen (one per crew). Following a series of training sessions and "section conferences" the experimental section was declared officially autonomous early in 1974. Later the same year a new section was opened in the mine, and it too was designated as an experimental section.

The evaluation of the experimental section - one of the most thoroughly conducted in the literature - which occurred early in 1975, indicated the following:

- * No significant increases in productivity was recorded (extensive econometric analyses were conducted);
- * Significant reductions in the number of safety violations occurred; while safety practices and attitudes showed a marked improvement;
- * Miners reported that the programme had substantially increased their skills. Most of them earned more money as a result;

* Group working had contributed to the development of positive attitudes towards other team members, and interest in one's work also increased;

* Improved communication, both vertically and horizontally occurred, and co-ordination between crews increased.

Some negative outcomes were also reported. For example, supervisory and managerial stress levels increased in the experimental sections, as was conflict within the union because of pay differentials between the experimental sections and the others.

Subsequent to the evaluation of the first experimental section, a series of management-labour planning meetings were conducted, in order to draw up a suitable agreement for the extension of the experiment to cover the entire mine. However, in a close vote, and with all the miners voting, the quality of work programme for the entire mine was rejected. Only the two autonomous sections voted to remain in the programme.

2.3.4 The General Foods Plant at Topeka. The following study was conducted in a "greenfield" division of General Foods at Topeka in the U.S.A. (Schrank, 1974;

Walton, 1972; 1977). The plant which was opened in 1971 was designed to provide a high quality of work life, enlist human involvement, and result in high productivity, although it appears that economic effectiveness was the main justification for the new plant.

The design features of the Topeka experiment involved self-managing work teams with collective responsibility for large segments of the production process. The teams (7 to 14 members) were large enough to encompass a set of interrelated tasks, and small enough to allow effective face-to-face meetings for decision-making and co-ordination. All activities normally allocated to separate functions - such as maintenance, quality control, caretaking, industrial engineering, and personnel - were built into the operating team's responsibilities. All individuals in the team were cross-trained so that they could perform most of the production jobs in the plant. An average worker took about three years to become fully multi-skilled. Every effort was made to design challenging tasks by including to all sets of tasks higher human abilities and responsibilities. However, each set comprised unique skill demands. Consistent with this aim was a single job classification with incremental pay adjustments that reflected the mastery of additional skills. Individuals

were paid for the number of jobs they could do, rather than for the particular job they occupied at the time. Since there was no limit to the number of workers who could qualify for the top rate of pay, workers were encouraged to learn as many skills as they desired.

A position of "team leader" was created to replace that of the foreman, but this also was eliminated after a period of time, because it became redundant due to the self-managing capacities of teams. All plant rules evolved over time from collective experience, rather than from managerial initiative alone. Also, the technology and architecture were designed to facilitate team member interaction, while hierarchical status symbols were minimised.

By 1974 some impressive results had been achieved in cost savings (\$600,000 annually), quality improvements (92% fewer quality rejects than the industry norm), and lower absenteeism and turnover (both about 3%). Also employees praised the variety, dignity, and influence that they enjoyed, the team spirit, open communication, and mastery of new skills with commensurate pay - all contributing to high levels of job satisfaction.

There were, however, certain difficulties. The matter of compensation, for example, had been a source of conflict among workers. Evaluation criteria for assessing job

mastery had been questioned openly by the workers and found to be deficient. There was also a feeling among workers that the pay plan did not adequately reward one for the level of involvement demanded by the Topeka system. Other problems were:

- * Some team leaders had difficulty in adjusting to the new way of non-directive management; while some workers demanded from their leaders more direction, and found the unstructured way of doing things hard to accept;
- * On occasions, there was excessive peer group pressure applied to the group member to conform. Scapegoating was also evident;
- * The increased involvement of workers, into affairs that were once considered the province of management, posed a threat to this group. A consequence of this was the lack of support, especially from influential staff groups at corporate headquarters.

However, six years after the implementation there were still positive attitudes and commitment among workers, along with favourable absence and turnover figures.

CHAPTER THREE

CHARACTERISTICS OF MULTI-SKILLING PROGRAMMES

The cases reported in Chapter 2 vary markedly from one another as to the purpose and the stimulus for change. For example, only one study - the Woodlawn mine case - had as its central focus multi-skilling as a change strategy. Differences also appear in the way the interventions were carried out, and the manner in which the various problems were defined. There is also a lack of agreement among evaluators regarding the selection of criteria for the measurement of success. All these reasons contribute to the problem of reaching conclusions regarding the effectiveness of multi-skilling. Added to this is the difficulty of identifying "the point at which science ends and advocacy begins" in case reporting (Yorks & Whitsett, 1985:25).

Notwithstanding these comments, it is possible to identify certain elements, common to most studies, that may be critical for the success of multi-skilling programmes in organisations.

In this chapter some characteristics of multi-skilling programmes will be identified. The information is primarily based on the studies reviewed, but in some

instances the conclusions reached have been reinforced with additional evidence from the job design and organisational change literature.

3.1 The Impetus for Change

In the majority of cases the impetus for change came from a desire to improve the human aspects of work, while enhancing, at the same time, the economic performance of the organisation. Only four studies emphasised one of the above two aspects - one on the socio-psychological aspects of work, and three on economic performance. Some authors have suggested that in successful innovations managers behave as if both economic and human values count. The reasons are pragmatic. "When changes in the work structure do not improve the work environment from a human perspective, they will not increase employees' contribution to the business; likewise, changes in work structure that require managers to relate differently to workers but do not also benefit the business are not likely to be sustained by those managers over time." (Walton, 1979: 94-95). However, the evidence seems to suggest that work innovations are still viewed as a device for production flexibility, or to avoid revolutionary protests and trade union pressure, or to attract labour - all with economic and /or development reasons in mind

(Bartolke & Gohl, 1982; Lupton, Tanner, & Schnelle, 1979). It is not surprising, therefore, that worker and union suspicion towards such programmes is continuing. In the Woodlawn mine (Northage & Associates, 1982) the workers mistrusted the reasons for multi-skilling, while in two of the cases reported the workers voted to terminate the programme (Goodman, 1979; Harper & McCarroll, 1977). Poza and Marcus (1980) noted that publicity regarding the programme at the Sherwin-William plant would have helped its acceptance, and added to employee morale. These attitudes, of course, are the results of poor communication regarding the aims of the programme.

3.2 Participation

The last comment suggests a need for worker participation in the design of work. This may be necessary for the development of feelings of ownership and commitment towards such changes among all those involved (Hackman & Oldham, 1980). This was attempted in all studies reported with varying degrees of success. Also, Cummings (1981) cautions against the tendency to provide complete specifications for the formation and operation of groups by decision-makers, recommending instead the specification of only a few critical features. Although the possibility of decay is great

with the adoption of such an approach, an evolutionary development with inputs from workers is seen as the most realistic. Walton's (1972) example of plant rules and procedures evolving over time conforms with the above suggestion.

Stjernberg (1982) feels that the anxieties and worries of employees about changes should be allowed to surface. He believes that neither elected representatives of workers, nor researchers and consultants can be successful in bringing these problems to the attention of decision-makers. Instead, he advocates the establishment of a new role - that of "resistance agent". One, or a few employees, sceptical to the changes should be encouraged to bring up their own reservations about the changes, discuss it with others, and negotiate solutions. This, of course, implies that there should be considerable flexibility in organisations to accommodate the various needs of the individuals. Stjernberg proposes the "multi-principle" organisation, where each employee has good opportunities to choose among groups and tasks organised according to several different principles. He claims that "a multi-principle organisation will facilitate the learning at one's own speed. When someone feels ready for a new or enlarged task it would be possible to either change the organisation of his or her task or to change group" (Stjerberg, 1982:113). This requirement seems pertinent

in the case of the Woodlawn mine (Northage & Associates, 1982) where some workers found the job rotation changes too rapid. Similar problems are reported elsewhere (Durand, 1982).

Active involvement in the formulation of objectives, and support from the top management group is common to all the studies. Also, the participation of supervisory personnel was seen as important to the success of the programme. When the workforce was unionised, the support of the trade unions regarding multi-skilling was considered critical. This was especially true in the case of those plants which were located in countries where the industrial relations system was adhering to rigid demarcation divisions for the performance of work.

3.3 The New Role Requirements

In the studies reviewed the role of the first-line supervisor had undergone considerable change. With a flatter organisational structure the position assumed greater importance with regard to planning and co-ordinating (Archer, 1975; Fantoli, 1979; Goodman, 1979; Poza & Marcus, 1980). In some instances the new role requirements caused serious problems, such as higher

stress levels (Goodman, 1979); difficulty in adjusting to the new role expectations (Poza & Marcus, 1890); and open rejection of the new role (Harper & McCarroll, 1977). In plants where the supervisors had line and staff responsibilities (i.e., production quotas and training) there was considerable conflict for competing objectives, and usually the staff responsibilities suffered (Northage & Associates, 1980). Where the new role was applied successfully, the position of supervisor became redundant in time (Walton, 1972).

The new participative way of managing teams, and the resultant loss of status and control by the supervisors is potentially the most difficult to solve, because of the resistance that such programmes generate (Klein, 1984), and the new demands that they impose on the participants (Bittel & Ramsey, 1982). One such demand is the changing role requirements at different stages of the development of groups. Walton (1979) argues that it is a mistake to assume at the beginning of the change programme that the idealised state of advanced development exists. Since workers at that time lack the technical, human, and problem-solving skills to perform effectively a more directive approach is necessary. Poza and Marcus (1980) concur. However, in time, when the groups develop important skills, a participatory approach is warranted (Hersey & Blanchard, 1977). Others

have expressed similar views (Lawler, 1985; O'Toole, 1977). They have argued that as the characteristics of the work force change, notably in the area of education and skill, so is the effectiveness of particular management styles.

In some cases the flatter organisational structure led to some adverse reactions, especially from the members of the parent company, due to the changed roles of staff groups. The reduced influence of these groups, which caused an alteration in the established power relationships in the system, poses a great threat to the existence of such programmes (Osbaldeston & Hepworth, 1982). To solve this problem, Walton (1975) proposes boundary-spanning roles linking managers of innovative plants with managers of traditional plants. The consensus is that top management should act as a buffer between semi-autonomous groups and staff from the parent company, especially if similar innovations did not occur there. This emphasises the need to integrate the programme with the rest of the organisation. However, integration and diffusion to other parts of the organisation is not a characteristic of innovative design experiments (Walton, 1975). The point is made that in greenfield sites the opportunity exists for the introduction of innovative work structures, unconstrained to a large extent by custom, practice, and vested interests (Bailey, 1983). This, however, is not

the case in existing plants. It is, therefore, inappropriate to treat such plants as "inspirational and instructive examples" (Walton, 1979:98) for others to follow. What is successful in a greenfield site, may be inappropriate in an established one. Still others see the problems associated with organisation design activities, and diffusion as a consequence of the failure to learn new roles. They argue that "as long as 'organizational design' is defined in terms of static organizational attributes (e.g. structure), rather than the process by which key members of the organization learn to perform new organizational roles, we will never understand why and how organizations can be diffused." (Hall & Fukami, 1979:162).

3.4 Individual Versus Group Designs

From the studies reviewed the issue of individual versus group design for multi-skilling weighs in favour of the group design. The organisation of work at the group level with regard to multi-skilling is to be expected, for the simple reason that a longer and complete piece of work is more possible for a group than for an individual, adding to skill variety and to the motivating potential of the job (Hackman, 1978). Also, the group design approach transfers the control of the work being done downwards in the organisation

(Hackman, 1978) - a key characteristic of multi-skilling programmes. With a reduction in the influence of the first-level supervisor increases in workgroup autonomy may be necessary, in order to cope with the variances encountered during task performance. These variances need to be dealt with by the group members at the source, rather than by an agent external to the subsystem.

From the studies reviewed only the Woodlawn mine (Northage & Associates, 1982) designed work at the individual level, and is, therefore, the only study which did not adopt a socio-technical systems approach. However, as Alber and Blumberg (1981) suggest the tendency of adopting a team approach as a natural adjunct to job innovations is no more likely to produce positive results than the individual approach. Also, Hackman and Oldham (1980) recommend that if both individual and group designs are feasible, to opt for the group design only if it is substantially more attractive. The problem with group designs are that "designing, implementing and managing work teams requires a good deal of behavioral science sophistication and managerial talent." (p.224). Susman (1975), on the other hand, argues that the selection of a team approach, and the delegation of decision-making to groups is dependent on the technology. He presented

evidence to support such delegation when group members had to perform their tasks under conditions of reciprocal interdependence. Under this situation, decisions regarding conversion activities require frequent exchange of information of varied content between group members and a decision-maker. In conditions of uncertainty, decision-making is enhanced when decisions concerning conversion activities are made by members of the work group rather than by a decision center external to the group.

Susman (1975) specifies an appropriate group structure to complement autonomous decision-making groups:

- * A network in which each member can communicate with other members;
- * Members who are multi-skilled; and
- * Low status differences among members. This can be achieved through the leveling of skill and wage differences.

Susman, therefore, does not consider multi-skilling for its own sake, but as a pre-condition for the development of autonomous decision-making groups.

The lowering of status differentials among members is

essential for equal task allocation within the group (Susman, 1970). When this cannot be achieved, and the primary job classification remains, job changes within the group are low (Blumberg, 1980). However, status differences are not only the result of formal assignment, but can also establish themselves informally through other mechanisms. Carnall (1982), for example, discovered that with service and seniority employees develop "rights in a job", and value stability. In existing plants job re-design involving multi-skilling could pose a potential problem for these people, and would threaten the success of the programme. Employees who served long apprenticeships to qualify for jobs would oppose any moves by newcomers to learn their jobs. An example comes from the Woodlawn mine, where tradesmen imposed demarcation barriers to some duties carried out by Trades Assistants, which they previously condoned. This change in attitude occurred as a result of certain representations that were made to management by Trades Assistants, to extend the multi-skilling programme in the organisation to include their classification. Tradesmen saw this as an attempt to undermine the apprenticeship system by legitimising alternative routes to trade skill acquisition (Woodlawn Mines, 1983). Also, Archer (1975), Northage and Associates (1982), and Durand (1982) report instances where employees blocked the job rotation path of others for various reasons.

Cummings (1981) has offered guidelines for the design of effective self-regulating groups. Among his recommendations are that such groups should: gain legitimacy from stakeholders so that the necessary resources can be secured; delineate their task and physical boundaries; develop consensus goals; create performance measures; and have the freedom to choose their primary design method. Although these activities can make a team self-directing, it may be that, as was suggested earlier, a leader is needed, particularly at the early stages, to help members develop their skills and knowledge through experimentation, and to maintain the group's boundaries. This development needs to take place in an environment where the team can learn without any interference from other groups. Conflicting values may endanger the progress of the group. At the Topeka plant (Glaser, 1977), for example, a great source of difficulty stemmed from the reluctance and general uneasiness on the part of middle management, which displayed a traditional resistance to innovation. This problem is potentially threatening for the development of multi-skilling, and as Heller (1976:53) points out "it is important to realise that attitudes can inhibit the use of skills as effectively as technical or structural barriers".

3.5 Individual Differences and Selection

There is a great deal of controversy surrounding the general applicability of job design efforts aimed at creating more meaningful jobs. The individual differences hypothesis has been supported by a large body of research (Brief & Aldag, 1975; Dubin & Champoux, 1977; Hulin & Blood, 1968; Robey, 1974; Wanous, 1974). This research indicates that some workers do not desire opportunities for growth and personal development in their work. For example, in one Australian study O'Brien (1980) found that 13 percent of those surveyed wanted less skill-utilisation and influence in their work. To account for this phenomenon Nystrom (1981) has suggested that employees respond to their own perceptions of jobs, not just to other people's perceptions, nor solely to jobs' physical characteristics. Some jobs that managers believe should be enriched may not be so intolerable to the job occupants themselves. Support for this comes from Dubin, Stone and Champoux (1974), who have found that some job occupants tend to perceive autonomy and variety as being higher than do other observers.

Consistent with the above view is Lawler's (1976) proposal that workers should be given all relevant information about the kind of job situation that exist in an organisation and allowed to make up their minds,

whether to participate or not, without coercion. In existing plants this appears to be the most sensible approach to adopt regarding multi-skilling job re-designs. Evidence that this self-selection procedure was applied successfully comes from the Richmond Sherwin-William plant (Poza & Marcus, 1980). However, others have indicated that this policy may be difficult to maintain in practice even though the "rights" of individuals were made explicit in industrial agreements, as was the case in the Woodlawn mine (Woodlawn Mines, 1983). Peer pressure to conform with the majority decision to support multi-skilling may be so strong, that the options are either to join the programme, or to leave the organisation. At the end of a five-year period since the introduction of multi-skilling no dissenting voice was being heard at Woodlawn. All the workers who originally elected not to participate in the programme had either left the organisation, or joined with the rest (Woodlawn Mines, 1983:13).

From the studies reviewed the screening of applicants for the new plants has been often intensive. At the Topeka plant, for example, Glaser (1977) reports that of 625 people who applied for jobs in response to newspaper advertisements all but 98 were eliminated by various screening methods. The team leaders, subsequently, arranged for a selection week-end in which 35 of the 98 short-listed applicants were rejected, leaving only 63

who were offered jobs. Those selected expressed a willingness to accept responsibility, willingness to work rotating shifts, and a desire to learn multiple jobs and new skills. Clarification of the requirements of the new working environment may be necessary at the screening stage of the selection process. Acceptance by the new employees of the new conditions of work was of critical importance to the success of the Saab Scania project, for example (Norstedt & Aguren, 1973). In this organisation differences in attitudes towards skill development between new and old employees was attributable to the selection of a new workforce, which expressed commitment towards learning multiple tasks - more difficult and with greater responsibility than was customary.

Northage and Associates (1982) recommend the recruitment of a young workforce with minimal experience in large firms or unionism. The findings by Blumberg (1980) support this view. In his study of the Rushton coal miners, job rotation was engaged primarily by the younger men, and the movement was from simple towards more complex jobs. In the same study status was found to be an important variable, also influencing job rotation frequency. These findings suggest that skilled tradesmen may resent job rotation even though demarcation restrictions are eliminated, due to their

identification with their primary job classification. This problem may be more serious in organisations where formal job classifications cannot be eliminated because of industrial award agreements.

The implications of Blumberg's (1980) findings, with reference to age and status, need to be addressed in the design of multi-skilling programmes. It seems necessary to provide a clear path for job interchangeability for those who can and are willing to participate. Also, since multi-skilling depends, to a large extent, on the willingness of group members to interchange tasks, the relationship among them is of critical importance. Self-selection, and selection by fellow team members has been proposed as promoting the design of effective work groups (Cummings, 1981).

3.6 Pay Schemes and Promotion

Multi-skilling programmes necessitate increases in pay. The development of job competencies by the worker raises the expectation of equitable payment (Jaques, 1961), especially if the job re-design has also increased the workers' span of discretion (Ford, 1973). In one Australian study the members of an autonomous work group threatened the dissolution of the group, unless there

was recognition by management - in the form of higher wage rates - of the increased work value in terms of skills and responsibility of its members (Dunham, Wallace & Davies, 1976).

In the majority of the studies reviewed, increases in pay were granted on the basis of skills acquired, and not on work performed. This, according to Lawler (1985), is a characteristic of high involvement systems, and therefore, consistent with the goals of multi-skilling programmes. In a few studies pay equalisation for all group members was established at the beginning of the project. However, this practice was blamed for the poor results in the frequency of job rotation in the study reported by Goodman (1979). According to this researcher there was no incentive for the workers to switch and exchange jobs in order to receive a higher rate of pay, and job rotation in the organisation never became institutionalised. Also, there were feelings of inequity expressed by older miners, because "green" employees were receiving top rates of pay, while experienced workers had to earn it before the system was introduced. The method of linking pay increases to skill acquisition resulted in disputes over the accuracy of the evaluation process for the assessment of the skill level of the worker. For example, in the Topeka plant (Schrank, 1974) and the Woodlawn mine (Northage & Associates, 1982), the

majority of employees felt that subjective measures were being used. The best approach, which proved acceptable to most of its employees, was developed at the Richmond Sherwin-William plant (Poza & Marcus, 1980), where performances were subject to peer reviews, team leader assessments, and scrutiny from a salary committee. This committee was also responsible for the maintenance of external equity on pay.

In most of the studies reported where pay was based on skill acquisition, there was also a grading system which allowed a worker to progress to higher levels of job responsibility on the mastery of groups of skills.

3.7 Training

In all studies the main training method for multi-skilling was job rotation, supplemented in some cases with formal, theoretical, and practical instruction on company time (Northage & Associates, 1982), or on workers' time (Fantoli, 1979). Goodman (1979) has argued that the introduction of job rotation is unlikely to be a smooth operation, and that at least two implementation activities are important: (i) a good feedback system to monitor the frequency of job rotation; and (ii) a

facilitator to manage job rotation opportunities within and between jobs.

In most studies there was an absence of training criteria for the measurement of learning, with considerable reliance being placed on participants' and supervisors' perceptions as to the degree of skill acquisition resulting from the programme. There were, however, a few exceptions. In some organisations - for example, the Sherwin-William plant - an attempt was made to assess the time needed for a worker to progress from one skill level to the next; or, as in the case of the Topeka plant, to become fully multi-skilled. In one study (Archer, 1975) the skill level of all participants was assessed by comparing the range of jobs that a worker could perform before and after the introduction of multi-skilling. This type of information, of course, is essential for the evaluation of multi-skilling programmes in organisations; however it has not been systematically gathered by the evaluators.

From the review certain problems emerge associated with the design and administration of training and individual differences that could endanger the progress of multi-skilling. The following are some examples:

- * Centralisation of training which led to lack of relevance between classroom training and on-the-job requirements;
- * Lack of planned training paths;
- * Unsystematic on-the-job coaching by supervisors;
- * Lack of feedback on performance (from others, and through information reporting systems);
- * Physical barriers that separated workers and made job rotation difficult to occur;
- * Failure to take into account individual learning patterns; and
- * An unwillingness to interchange tasks;

The above show certain deficiencies in the management of multi-skilling programmes, but do not present unsurmountable problems. Training effectiveness could have been enhanced through better programme management, selection procedures, and incentives for job rotation. There are, however, certain other conditions that may render the training of new employees problematic -at least until the employee settles in the new job. These are due to initial unmet expectations, and surprise in

entering an unfamiliar organisational setting (Louis, 1980). Katz (1980) also has suggested that, for those employees, many aspects of the job that have undergone enrichment usually have a minimal impact on job satisfaction and may even impose great demands on the new employee. Feldman and Brett (1983) claim that people want to be able to establish routines that are predictable, regain their confidence about performing well in their new job, and reaffirm their sense of personal control in the work setting. If this is denied to them, and there is little hope of reducing uncertainty, or reasserting control - for example by moving constantly around - they are more likely to develop feelings of helplessness and depression (Wortman & Dintzen, 1978).

3.8 Patterns of Multi-Skilling Practice

There are two distinct ways of engaging in multi-skilling - and a third that combines both approaches - that are reported in the literature. The first is to exchange jobs, for example, when worker A interchanges jobs with worker B. This type of multi-skilling, based on job rotation, is practiced in semi-autonomous work groups where the task is designed at the group level, group members have been trained to handle a related

series of tasks that add up to a natural "whole" unit of work, and interdependence among team members is high. Multi-skilling is practiced frequently, and is spontaneous due to production contingencies. As a consequence, skill utilisation is high.

The second is when a worker fills a position that has become vacant temporarily due to absenteeism, vacation scheduling, or when the pressure of work makes it mandatory to shift underemployed human resources from one work station to another where they are needed. In this case, the job has not been designed at the group level, tasks are individual and separated from each other, and interchangeability of tasks, within a work station is not occurring spontaneously. Moreover, group functioning among the members of the work station usually is severely constrained due to technological and geographical factors. Multi-skilling in this instance is based on a managerial objective to minimize slack resources, and increase manpower flexibility by moving workers around to meet production needs. The worker, after an initial period of skill acquisition, while he trains in the task requirements of various jobs in different work stations - usually adjacent to his own - returns to his permanent work station and is available to put his new skills into practice when the opportunity presents itself. This, as was mentioned earlier, occurs

when there are changing production circumstances, turnover, or absenteeism; so that the higher these indices in an organisation, the greater the incidence of multi-skilling. Also, it should be noted that the decision when or where to engage in multi-skilling is outside the control of the worker. In addition, skill utilisation in this example can be low, necessitating frequent re-training in order to maintain an acceptable level of skill competence in various work areas.

Although the combination of these two ways of engaging in multi-skilling would seem to be "ideal" - because they offer a base of skills that can be practiced frequently in one's own work station, combined with opportunities to utilise, on occasions, additional skills learned in a different station(s) - empirical evidence suggests that, in general, one or the other occurs in practice. It was found, for example, that employees of semi-autonomous work groups become so cohesive that they resent changing work stations, and inter-group conflict often occurs as in the case of Volvo's Kalmar plant (Aguren, Hanssen & Karlson, 1976).

Although both approaches, as described above, have been found to be successful (Swedish Employers Confederation, 1975:60-61), an evaluation of the two methods of multi-skilling would indicate that the first is superior because:

- * It is designed to occur regularly, and, therefore, skill utilisation is high;
- * More personnel are involved each time it occurs (for example, two people participate every time job switching takes place, instead of one as in the second case of job rotation);
- * The task has been designed at the group level, aimed at expanding the skill repertoire of the workers (technical and decision-making), and add to the motivating potential of the job, by providing opportunities for the completion of a "whole" piece of work;
- * It occurs in an environment where considerable autonomy has been granted to the group.

The above elements do not necessarily occur in the second case.

There is, however, another type of multi-skilling - through planned job rotation - reported in the literature, that is used as a method of job enlargement and enrichment, while claiming success in the development of skills in the workforce. The following

example is typical of many such interventions:

"Job rotation allows a merger of a number of functions any one of which on its own would not be sufficiently rewarding for the worker in terms of personal fulfilment. Changes of work station must be sufficiently frequent to reduce the monotony of the various tasks, but not so frequent as to reduce performance", and, "Finally it needs to be pointed out that the great advantage of this system is that it enables the workers to become multi-skilled." (Hanspach & Schafer, 1979:14-15).

However, critics of this approach have registered their concern (Fein, 1974), and cast doubt on the effectiveness of such methods, as the following quote indicates:

"That short-cycle routine work is seen as monotonous and uninteresting is understandable. But that it should become more interesting and challenging if employees switch at regular intervals, every hour or so, from one boring job to another - that is not so easy to understand! (Swedish Employers' Confederation, 1975:58).

It is not surprising, therefore, that this type of job rotation has been characterised by a "history of failure" (Swedish Employers' Confederation, 1975:58). The above comments suggest that the routinisation of work must be taken into account when designing changes based on multi-skilling development in organisations. However, little attention has been paid to this important element in the literature on multi-skilling.

3.9 Outcomes

A number of positive outcomes have been reported, which range from productivity gains to increases in job satisfaction; but since multi-skilling took place in conjunction with other systemic changes, it is impossible to identify its unique contribution. However, there are certain economic outcomes that stem from the organisation of work along multi-skilling lines:

- * A rationalisation of industrial awards, and a tendency for a reduction in problems and disputes associated with demarcation issues;
- * Increases in workforce flexibility; and
- * Reduction in the labour force. This has often been substantial - for example, a 25% reduction in the plant's workforce was reported by Poza and Marcus, 1980. This is a major factor in productivity gains achieved by organisations (Kelly, 1982).

From a managerial perspective these are positive advantages that lead to higher effectiveness (through

cost reduction), and make the introduction of multi-skilling in organisations an attractive proposition.

3.10 Summary

After reviewing the case studies presented in Chapter 2, the following conclusions can be reached:

Multi-skilling is a job design strategy which occurs within the context of a collaborative and participative approach to management and industrial relations. It involves extensive consultation and negotiations with unions and employee representatives regarding the implementation of change; alterations in the structure and structuring of activities within groups; the rationalisation of industrial awards; pay schemes based on the acquisition of additional skills; and job progression that reflect the mastery of groups of skills.

Multi-skilling leads to labour flexibility due to greater manpower utilisation, through the development of broad categories of homogeneous skills in the workplace, and the elimination of demarcation restrictions.

CHAPTER FOUR

A FRAMEWORK FOR ASSESSING MULTI-SKILLING

4.1 Constraints on the Development of Skills

In Chapter 3 certain procedural and structural changes were identified that appear to be critical for the successful implementation of multi-skilling projects. These include among others, employee and union participation in the design and management of the programme; the establishment of semi-autonomous workgroups; job rotation; modification of the supervisory role; and alterations in the pay system. However, one important dimension that seems to determine the potential for skill development in an organisation has not been made explicit in the literature on multi-skilling. This is the level of task routinisation - a technological dimension - and has been defined as the "absence of substantial demands made upon the worker in terms of knowledge, experience and responsibility, as well as to his concurrent feelings of boredom and under-utilization." (der Auwera & Mok, 1982:148).

Technology has been suggested as constraining "the

feasibility of work redesign by limiting the number of ways that jobs within the technology can be designed" (Hackman & Oldham, 1980:121-122). Hulin and Roznowski (1985), noting that "tasks are technology's most direct consequences" (p.71), adopt a much stronger position. They have argued that "technological characteristics of a subsystem play the most important role in the creation of tasks and other job factors within a work center that have an impact upon individuals" (p.73). However, research on job design has by-passed the investigation of technologies existing in the various organisational subsystems, and concentrated instead on the study of task characteristics at the micro-level. This is a serious omission and one that "ordains the task characteristics area to studying symptoms rather than underlying constructs" (Hulin & Roznowski, 1985:81). Since tasks and configuration of tasks are hypothesized to be technologically determined, it is reasonable to expect that designers of change programmes would attempt to modify the technologies in the subsystems, in order to create conditions favourable to their change objectives. The modification of the technical system, however, has seldom been tampered with in such changes, as the job design literature indicates. What is seen instead are efforts towards the redesign of work roles surrounding the tasks - roles and tasks can be designed independently according to Clegg (1984) - without any

alteration in the technological arrangements within subunits. This practice has led Clegg (1984) to conclude that "joint optimisation" of the technical and social systems in most interventions "is a myth". If this is the case then existing routine technologies within organisational subsystems would impose considerable constraint on the development of technical skills in the workforce. This is because the complexity of tasks and the skill level required of workers are reduced, as work becomes more routinised (Grimes & Klein, 1973).

Furthermore, what decision-making responsibilities are given to workers, associated with role requirements, may be "token" and of limited value if the tasks themselves are programmable in advance.

The above observations would suggest that a high degree of routinisation in a unit, and its limiting effects on tasks, and multi-skilling development, which relies on the expansion of the skill repertoire of workers, are incompatible.

4.2 Technology

A number of researchers have suggested that the first consideration in addressing the issue of effective unit design is the choice of technology (Randolph, 1981; Randolph & Dess, 1984; Van de Ven & Morgan, 1980). This

is because of the pervasive effects of technology, which influences directly and indirectly organisational subsystems and their members (Hulin and Roznowski, 1985).

There are a number of approaches to the measurement and definition of technology in the literature (Fry, 1982; Gerwin, 1981; Hulin & Roznowski, 1985; Rousseau, 1983). For example, Perrow (1967:195) defined technology as "the actions that an individual performs on an object, with or without the aid of tools or mechanical devices, in order to make some changes in that object". Other definitions commonly used (Rousseau, 1983:243) include "technical complexity" or "the transformation of inputs into outputs". However, there are three dimensions basic to all typologies which help clarify the construct of technology. These are task predictability, problem analysability, and task interdependence (Randolph, 1981). Task predictability is the number of "exceptions" (Perrow, 1967; 1970), "variability" (Van de Ven & Delbecq, 1974), or "technological variety" (Gerwin, 1981), encountered during the performance of a task. "Analysability" (Perrow, 1967; 1970), "task difficulty" (Van de Ven & Delbecq, 1974), or "technological explicitness" (Gerwin, 1981) is characterised by search behaviour necessary for the solution of problems faced during the execution of a task. Perrow (1970) has argued that these two dimensions are independent of each other,

and there is empirical evidence to support this view (Withey, Daft & Cooper, 1983). However, some researchers have combined the two dimensions into a single measure of technological routineness (for example, Lynch, 1974), while others selected only one dimension to operationalise the concept (for example, Hage & Aiken, 1969). Task interdependence (Thompson, 1967), the third technological dimension, is the degree to which individuals are dependent on and support others during task performance, and ranges from low to high.

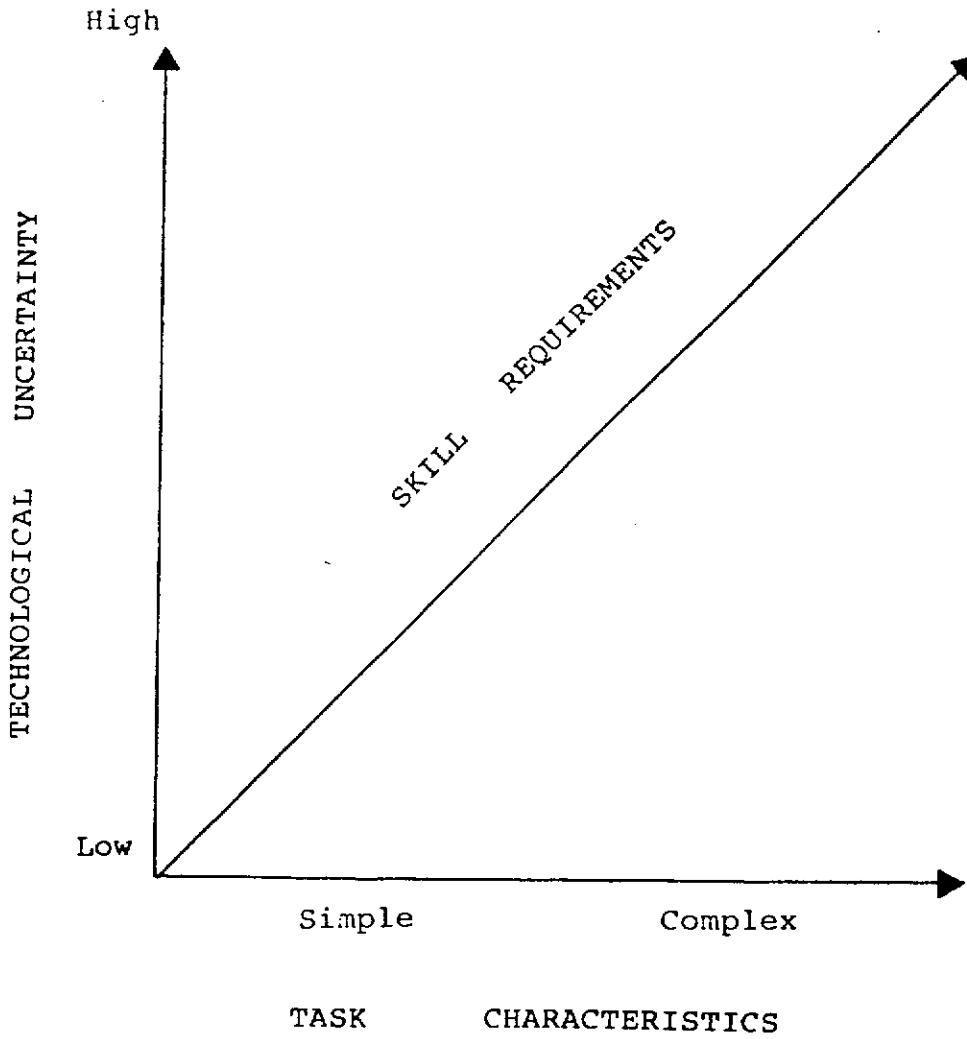
4.3 Uncertainty

To explain the relationship between technology and job design, Slocum and Sims (1980) have suggested that "uncertainty" is a key concept to consider. Uncertainty is defined as "the difference between the amount of information required to perform the task and the amount of information already possessed by the organization" (Galbraith, 1973:5). Combining their technology model, consisting of various configurations of three elements (workflow uncertainty, task uncertainty, and job interdependence), with Hackman and Oldham's (1975) model of job redesign, Slocum and Sims (1980) reached the following conclusion: In order to effect a change in job characteristics associated with a work system, the unavoidable injection of uncertainty into that system

is necessary. This is because technological uncertainty affects the information processing requirements of job holders (Galbraith, 1973; 1977). According to this explanation, when technological uncertainty is low and work is predictable, the information processing needs of workers are low, since standards, rules, and procedures could be specified well in advance to guide task execution. However, as the uncertainty increases employees are likely to face relatively high levels of variability in their work, because the combinations of possible events, and the rules to apply in dealing with them, cannot be predicted accurately. In this instance, any attempt to apply rules and standardised procedures, would render a system ineffective. This framework suggests that the less controllable the technology, the more complex and less structured the design of jobs, and, therefore, the level of skills and abilities required of workers. These conclusions are consistent also with Perrow's hypothesis. A number of empirical studies (Billings, Klimoski & Breaugh, 1977; Hage & Aiken, 1969; Mohr, 1971; Pierce, 1984; Rousseau, 1977; Trist & Bamforth, 1951) have pointed to such relationships, which are illustrated in Figure 4.1.

FIGURE 4.1

Hypothesized Relationships Between Skill Requirements
& Technological Uncertainty and Task Characteristics



4.4 Matching Technology and Unit Design

The work of Van de Ven and his associates (Van de Ven, & Delbecq, 1974; Van de Ven, 1976b; Van de Ven & Ferry, 1980) is based on a contingency theory of organisation, work unit, and job design. The basic premise in the theory is that "the structure of an organisation unit is a rational response to the difficulty and variability of the work it performs" (Van de Ven, 1976b:155). Units high in effectiveness, undertaking work at varying levels of task difficulty (analysability) and variability (exceptions), will exhibit patterns of structure and processes matched to the level of task uncertainty they are facing.

Structural elements are defined in terms of (1) specialisation, the number of different tasks assigned to the unit; (2) standardisation, the operating procedures, rules and policies that are to be followed in the execution of the task; (3) discretion, the degree to which supervisors and unit personnel are able to make work-related decisions; and (4) personnel expertise, the degree of knowledge or skills of unit personnel required to operate the programme (Van de Ven, 1976a).

Briefly, three kinds of performance programmes are possible for the structuring of work activities: systematised, discretionary, and developmental (Van de Ven, 1976a).

Systematised. In the systematised mode, effectiveness will be increased when the tasks assigned to a unit have a low level of exceptions, and are low to medium in analysability. A systematised mode is a capital-intensive programme which specifies: (i) a limited number of repetitive tasks that are generally well understood by employees; (ii) detailed standards and operating procedures to be followed at each step in terms of quantity and quality; and (iii) built-in monitoring devices to detect departures from standards so that corrections can be made. Structural elements appropriate for this type of programme are high levels of unit standardisation, supervisory discretion, and specialisation; low to medium levels of personnel expertise; and low levels of employee discretion.

Discretionary. A discretionary mode is appropriate if the tasks delegated to a unit have a medium level of exceptions, and range from low to high in analysability. The discretionary mode is a labour-intensive programme for managing tasks that recur periodically, and exhibit moderate variations, so that different adjustments are necessary in order to deal with them. A discretionary

mode consists of: (i) low to high levels of personnel expertise; (ii) a repertoire of alternative methods for handling problems and issues related to task accomplishment; (iii) guidelines for choosing these methods and exercising discretion; and (iv) the specification of expected outputs in terms of quality and quantity. The structural elements associated with the discretionary mode are medium levels of unit specialisation, standardisation, employee and supervisory discretion, and personnel expertise.

Developmental. The developmental mode is a programme for handling tasks delegated to a unit, which are novel (high in the number of exceptions), and range from medium to high levels in analysability. The developmental mode is a team-intensive programme requiring judgement, extensive search for solutions, and evaluation of actions, from all participants. It consists of: (i) medium to high levels of personnel expertise; (ii) general goals to be achieved, without specifying in advance either the means, or role activities necessary for their accomplishment; (iii) broad guidelines for problem solving (in the absence of a repertoire of strategies); and (iv) a set of norms and expectations to guide interpersonal behaviour within the group. The structural elements characteristic of the developmental mode are high personnel expertise and

employee discretion, and low unit specialisation, standardisation, and supervisory discretion.

The theory argues that deviations from these hypothesized modes and underlying dimensions will lead to reduced effectiveness. For example, in conditions favourable to the application of the systematised mode, allowing for greater employee discretion, less standardisation, or greater interchangeability than is prescribed, are expected to cause unnecessary repetition of tasks, lead to inefficiency, and increase the frustration and dissatisfaction of the participants (Drazin & Van de Ven, 1985). Equally, application of the systematised mode, in a work situation that requires discretion and flexibility to adequately accommodate task variations, would be inappropriate and ineffective.

4.5 Implications for Multi-Skilling Development

An examination of the task-contingent theory of work-unit design (Van de Ven & Morgan, 1980) would lead to certain conclusions regarding the potential development of multi-skilling in organisations. Table 4.1 presents certain patterns of relationships expected among technological uncertainty and design dimensions for highly effective organisational units.

TABLE 4.1

Expected Relationships Among Technological Uncertainty,
And Design Dimensions For Highly Effective
Organisational Units

	1	2	3	4	5	6
Technological Uncertainty (1)	*					
Unit Speciali- sation (2)	Cx	*				
Skill Hetero- geneity (3)	Cx	Cx	*			
Role Interchan- geability (4)	Cv	Cv	-	*		
Unit Standardi- sation (5)	-	Cv	-	+	*	
Centralisation of Decision-Making (6)	-	Cv	-	-	+	*

Legend. Relationships: (+) = Positive ; (-) = Negative ;
(Cx) = Curvilinear Convex ; (Cv) = Curvilinear Concave.

Adapted from: Van de Ven, A.H. & Morgan, M.A. (1980).

From the relationships listed in Table 4.1 one can see that technological uncertainty (number of exceptions and level of analysability) has the following associations with other variables:

- * A negative relationship with standardisation, and centralisation of decision-making;
- * A curvilinear convex relationship with specialisation, and skill heterogeneity; and
- * A curvilinear concave relationship with role interchangeability.

This suggests, for example, that unit specialisation is high at both low and high levels of technological uncertainty. At low levels of technological uncertainty work can be subdivided to a high degree - because of its predictability, and in order to take advantage of economies of scale - and assigned to a great number of workers. Unit standardisation, with explicit rules and procedures for task execution would be high, while discretion would be low, and decision-making would concentrate at the supervisory level. This is consistent with the systematised mode.

At the other extreme - when technological uncertainty is

high - work would be allocated to heterogeneous groups of experts, with in-depth training in specific occupational areas. Because workers at this level of uncertainty would face a great number of exceptions, and situations requiring high levels of analysability, the standardisation of work procedures would be difficult to establish. Task uncertainty would also need to be dealt with at the source, as it occurs, and, therefore, the discretion for decision-making would need to be decentralised so as to allow personnel to use their judgement, abilities, and team effort (developmental mode).

In both instances - at low and high levels of technological uncertainty - skill heterogeneity would be high, due to the differences in task requirements, and job classifications within the unit, while interchangeability of tasks would be low. For low levels of technological uncertainty interchangeability of tasks would be counter-productive for three reasons:

A). Although it would be easy to train people in a variety of jobs, which have been narrowly defined, there would be little possibility of workers improving their skill repertoire (Slocum & Sims, 1980).

B). The production system would be less efficient if workers would have to break the rhythm of their work, change work stations, and adjust to new tasks every once in while (the intervals for switching jobs often depends on how boring the task is) (Swedish Employers' Confederation, 1975).

C). The practice of rotating amongst equally boring or narrowly defined jobs is likely to lead to frustration and job dissatisfaction among participants (Drazin & Van de Ven, 1985; Swedish Employers' Confederation, 1975).

At high levels of technological uncertainty, the in-depth specialised knowledge of workers would seem to potentially act as a barrier to task interchangeability between various occupational groups. Since skill utilisation would be high for workers facing an environment high in technological uncertainty, task interchangeability as a means of multi-skilling development would seem, therefore, unnecessary. The various skills necessary for the accomplishment of a group task are brought together through high levels of interdependence.

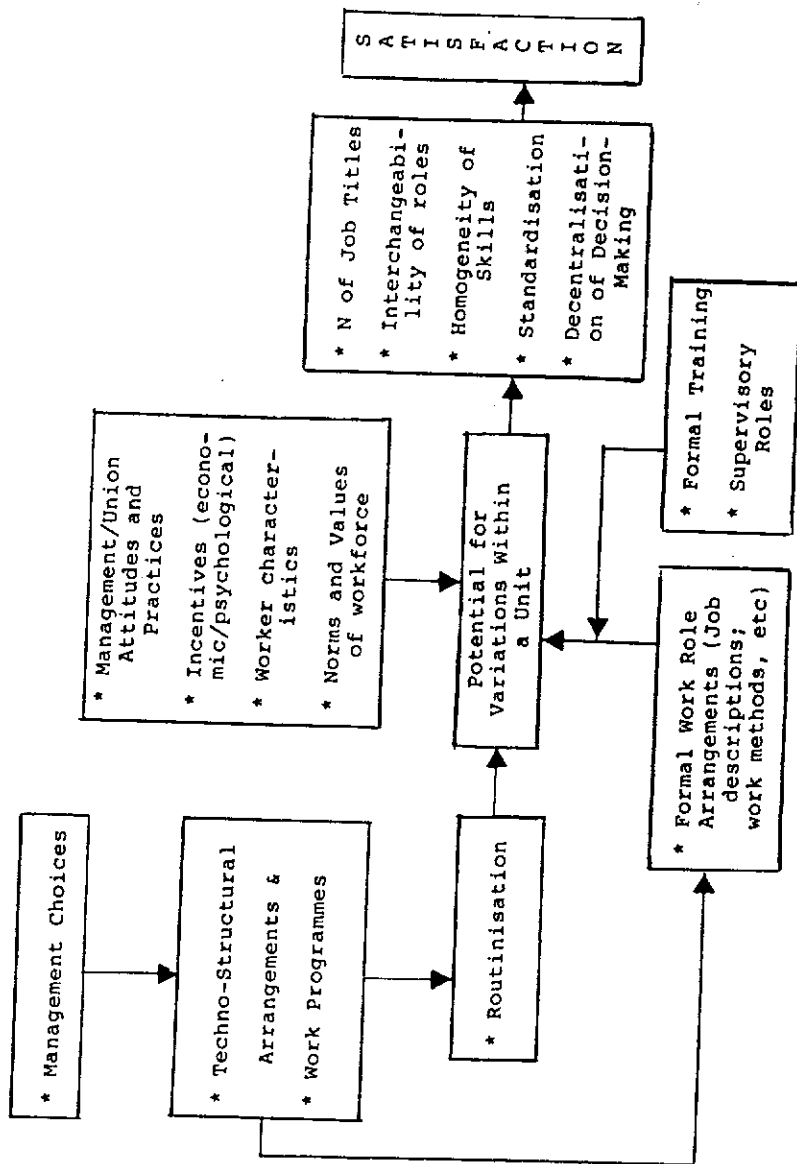
At moderate levels of technological uncertainty, on the other hand, it would be possible to have low levels of specialisation; low levels of skill heterogeneity; and

high levels of task interchangeability (Table 4.1). In addition, the standardisation of rules and procedures would be at the medium levels, while workers would be afforded moderate degrees of decision-making latitude (discretionary mode). This suggests that multi-skilling development would be possible in a unit facing moderate levels of technological uncertainty. In such a unit a relatively low division of labour could optimally occur, with a small number of different job classifications or job titles, and with skills which would be "sufficiently homogeneous to be highly interchangeable" (Van de Ven & Morgan, 1980:34). These conditions, of course, are present in successful multi-skilling programmes.

Central to the argument presented above is the premise that the potential skill development of personnel varies according to the technological uncertainty, or extent of routinisation present in the subsystem. This, together with the configuration of the various structural unit dimensions (Table 4.1.) would determine, to a large extent, multi-skilling practice. However, other factors, which were presented in the literature review (i.e., management and union attitudes, demarcation restrictions, status, etc.) would interact to modify the implementation of multi-skilling programmes. These relationships are illustrated in Figure 4.2.

FIGURE 4.2

A Framework for Assessing Multi-Skilling



The framework presented in Figure 4.2 depicts sequential relationships among variables based on the work by Van de Ven and Morgan (1980), and from the literature review on multi-skilling. The information from these two sources are integrated into a unified approach.

Consistent with a systems perspective, the framework suggests that the primary input is from key decision-makers (Clegg, 1984), who are making strategic choices for the functioning of the organisation. These organisational choices are in relation to the type of technology, structure, and work programmes, to be adopted by units for the accomplishment of organisational objectives. The level of technological uncertainty existing in the unit, and experienced by unit personnel, is regulated through the extent of work routinisation. This could range from high routinisation, where work activities are pre-programmed and predictable, to low routinisation, where tasks are novel, and cannot be specified in advance. Also, as a consequence of the technological choices (routine-nonroutine), the prescription of work role arrangements (either narrow or broad) are established for unit personnel.

Routinisation in the framework contains two elements, exceptions and analysability (not shown in the model in

the interest of parsimony), that are conceptually distinct although empirically related (Withey, Daft & Cooper, 1983). The routinisation of technology in turn is associated with the structuring of activities within the units, as indicated by Van de Ven and Morgan (1980). The structuring of activities consist of: the degree of specialisation of unit personnel, and is operationalised in terms of the number of job titles in the unit; the frequency of role interchangeability among team members; the extent of skill heterogeneity, standardisation of procedures, and decentralisation of decision making. As was mentioned earlier in this chapter, the effectiveness of the unit is dependent on the choice of an appropriate performance programme for the unit (systematised, discretionary, or developmental) that best matches the level of routinisation of work (number of exceptions and degree of analysability) within a unit. The level of job satisfaction among unit members is hypothesized to be contingent upon the fit between the degree of routinisation, and the appropriate configuration of the structuring of activities existing in the unit.

Figure 4.2 suggests that there are additional sources of influence that can potentially provide a number of variations within a unit, and limit the extent of multi-skilling practice among members of a workgroup. These sources have been identified in the literature review,

and since the concern in the present study is with only a part of the framework (routinisation -> structuring of activities -> job satisfaction), they will not be discussed further.

4.6 Variables for Assessing Multi-Skilling

In the preceding discussion a number of variables were identified, which appear relevant for the evaluation of multi-skilling within work units. It is suggested that the assessment of multi-skilling at the individual level would be inappropriate, because this would indicate only skill levels of individual workers, but not multi-skilling practice, which depends on systemic changes occurring within a workgroup. Therefore, the extent of multi-skilling could be assessed at the unit level through the following variables:

1. Number of exceptions, or task variety, which is the "frequency of unexpected and novel events that occur in the conversion process" (Withey, Daft & Cooper, 1983).
2. Analysability, or the degree to which there are objective, computational procedures to follow in solving a problem. Job complexity is characterised by unanalysable situations (Withey, Daft & Cooper, 1983).

3. Number of job titles in a unit, which is an indicator of unit specialisation (Van de Ven, 1976a).
4. Role interchangeability in the unit. This is the degree to which A can perform B's job at short notice, and B can perform A's job under similar circumstances (Van de Ven & Ferry, 1980).
5. Skill heterogeneity in the unit. This is the extent to which the skills of personnel within a unit are different or homogeneous (Van de Ven & Ferry, 1980).
6. Standardisation or formalisation. This is the extent to which rules, procedures, and performance objectives are made explicit in order to coordinate, control, and evaluate a unit's activities (Van de Ven & Ferry, 1980); and
7. Decentralisation of decision-making, which is the extent to which decision-making has been delegated by staff and line management to operators (Van de Ven & Ferry, 1980).

The selection of the above seven variables is consistent with the recommendations of job design reforms aimed at

developing autonomous and multi-skilled workgroups. For example, the Swedish Employers' Confederation Technical Report (1975), after reviewing the results from 500 experiments, suggested the following modifications in work methods and practices:

- * Extension of the work cycle and integration of production and auxiliary tasks. This recommendation affects the routinisation of work, and adds to the number of exceptions, and degree of analysability encountered in the execution of the task.
(Variables # 1, and # 2).

- * The grouping of personnel and machines around homogeneous tasks covering "whole" products. This recommendation would lead to homogeneous skill development (Variable # 5) and, as a result, would affect the number of job categories, or titles within a unit (Variable # 3).

- * Extensive and spontaneous job rotation within the production group due to the requirements of work
(Variable # 4).

- * Assignment of work problems to workers, rather than presenting them with ready-made solutions
(Variable # 6).

- * Decentralisation of authority and responsibility
(Variable # 7).

4.7 Research Hypotheses

The model, outlined in Figure 4.2 gives rise to a number of distinct research hypotheses. These are as follows:

Hypothesis #1: The acquisition of skills within a unit - reflected in the amount of "technical" training undertaken by the employee - will be positively related to the level of technological uncertainty (number of exceptions and level of analysability) encountered in the unit.

This follows from the work of Roznowski and Hulin (1985) who found that skill development was related to technical complexity.

Hypothesis #2: The number of exceptions, and level of analysability in a unit will be significantly related to the structuring of activities within that unit.

This is based on the work of Van de Ven and his associates (Van de Ven & Ferry, 1980; Van de Ven & Morgan, 1980), and can be tested using a homogeneous

population from one organisation.

Hypothesis #3: Multi-skilling development in an organisation will tend to be successful (i.e., there will be a greater number of skilled workers utilising a greater variety of skills) in work units where there are the following conditions:

- * Moderate levels of task uncertainty (exceptions and analysability);


which in turn permit

- * Low levels of specialisation (number of titles);
- * Low level of skill heterogeneity;
- * High interchangeability of roles;
- * Moderate levels of standardisation; and
- * Moderate levels of decision-making latitude.

Using Van de Ven and Morgan's (1980) framework, it was argued that the above pattern of relationships are consistent with the "discretionary mode", and multi-skilling development.

Hypothesis #4: Job satisfaction will be positively related to task uncertainty (exceptions and analysability).

Implicit in multi-skilling programmes is the belief that



skill development will lead to increases in job satisfaction. However, if skill development also leads to greater task complexity, because of greater skill utilisation, the evidence appears conflicting regarding the outcome (job satisfaction). For example, Brass (1985) found a negative relationship between technological complexity and job satisfaction; while Roznowski and Hulin (1985) reported a positive relationship between the two variables.

CHAPTER FIVE

METHODS

5.1 Research Setting and Background

The study was conducted in a greenfield site situated at the South-West corner of Australia. The new plant - a minerals processing plant owned and operated by a multinational company - was designed and built to take advantage of new technological developments in the processing of mineral ore. Operations commenced early in 1984 with a largely semi-skilled workforce (see Table 5.1) recruited from the surrounding area, and generally without any prior experience in the minerals processing field. There were however a small number of employees who were transferred from two other company plants not very far from the new site. Selection of employees was on the basis of whether the recruits would "fit in" with the new form of organisation promoted by the company, which relied on team work for the execution of work assignments, and the expansion of tasks that went beyond traditional job boundaries (multi-skilling). It was argued that this work arrangement would provide the organisation with greater flexibility in operations,

TABLE 5.1

Skill Level of Workers on Commencement of Employment.
Percentage in Each Category.

<u>Category</u>	<u>N</u>	<u>Unskilled</u>	<u>Semi-Skilled</u>	<u>Skilled</u>
Tradesmen	45	-	-	100%
Powerhouse Operators	13	-	44%	56%
Shift Process Workers	85	5%	77%	18%
Day Process Workers	22	9%	64%	27%

Examples of Classification:

Skilled: Electrical Fitter; Instrument maker; Fitter and Welder, etc.

Semi-Skilled: Machine Operator; Driller; Assembler; Storekeeper; Engine Driver, etc.

Unskilled: Labourer; Cleaner, etc.

thus contributing to its effectiveness, at the same time fulfilling the needs of individuals for greater task variety, challenge, and job scope.

Union involvement was established during the planning stages of the project. In particular, the union representing all process workers was central to a programme dealing with the development of a multi-skilled workforce in the plant. The results of negotiations between the company management, and representatives of this union were ratified in early 1984 by the Western Australian Industrial Commission, which determined that seven process worker classifications would reflect degrees of skill acquisition by a worker. A document was drawn up which, in addition to the normal industrial provisions of an award, included detailed information on the operation of the additional skill system (multi-skilling). Specifically, it dealt with the various gradings of process workers, and the proficiency points awarded, based on the successful completion of training modules, that were specially designed for this purpose; job rotation through various plant areas; and demonstration of on-the-job operating proficiency of the worker. It also allowed for different individual requirements and learning needs, by introducing flexibility in the system in the form of frequency and freedom to participate or not in either area or task rotation. Although management

action regarding multi-skilling was initially directed at the process worker group, it was hoped that all functional groups, including tradesmen, would participate gradually in the programme, as negotiations with the various unions were successfully completed and worker acceptance towards the scheme secured.

In order to assess the effectiveness of the programme of multi-skilling in the plant, the management of the company employed the services of two academics from the Western Australian Institute of Technology (WAIT) to act as external evaluation consultants for a period of three years, and report on the results of evaluations carried out annually. Also, it was argued that an important component of the evaluation would be the extent to which its direction and content was guided and monitored by a representative body of people. For this reason, an Evaluation Taskforce was set up consisting of plant management, union officials, shop stewards, and operating personnel from various functional areas. A key responsibility of this group was the dissemination of information to all organisational levels regarding the progress and effectiveness of the programme. The survey conducted for the present study coincided with the second round of data collection of the Evaluation Taskforce.

5.2 Sample and Procedure

On hundred and sixty-five (165) male employees of the company participated in the survey. Of these, 85 were Shift Workers, 22 Day Workers, 13 Powerhouse Operators, and 45 Tradesmen. These groups were surveyed through a questionnaire which was modified to reflect the particular work arrangements of various groups. Specifically, two different questionnaires were distributed - one for the Shift Workers, and the other for the rest of the employees. The response rate was 75%. Five non-useable and non-classifiable questionnaires were also returned. Table 5.2 presents an analysis of response rates by category. Questionnaires were administered to employees in late July and early August 1985 during working hours by a member of the Evaluation Taskforce responsible for the longitudinal assessment of the project. The questionnaires were completed in worktime, in groups of 10-12. All questionnaires were placed in a sealed envelope addressed to the Western Australian Institute of Technology (WAIT) research team and handed to the evaluation consultants. Each questionnaire had an

TABLE 5.2

ANALYSIS OF RESPONSE RATE BY FUNCTION

<u>Group</u>	<u>N of Respondents</u>	<u>% of Total</u> <u>From Each Cat.</u>
Tradesmen	45	70
Powerhouse Op.	13	81
Shift Workers	85	74
Day Workers	21	84

introduction that gave instructions on how to register the responses on the item scales, and explained that the purpose of the study was to investigate employee attitudes towards their jobs and work that would help management take appropriate action to improve the quality of working life in the plant. Participation in the study was entirely voluntary, and employees were assured that their responses would be held in the strictest confidence by the research team. Employees were asked to indicate their name on the questionnaire for purposes of collecting data for comparing responses over time. The vast majority of employees voluntarily complied with this request (i.e., only eight workers failed to indicate their name). A copy of the questionnaire is given in Appendix I. Additional data were collected at the same time by examining the personnel and training records of the company. In particular, the training history of each person since commencement at the plant was compiled, and his level of education and work history was assessed. The job classification of each employee was also identified, his job responsibilities, and his prior formal training, work experience, and union affiliation served as a guide for designating the employee as unskilled, semi-skilled, or skilled.

Twenty-three co-ordinators also reported on the frequency of job rotation of all Shift Workers and

provided data on subunit technology. In addition, they rated the workflow interdependence of their teams using Thompson's (1967) classification, and the scales suggested by Van de Ven and Ferry (1980: 166-168). This questionnaire is presented in Appendix II.

5.3 Measures

5.3.1 Technology Measures

Routinisation of Work. As was mentioned in Chapter 4 Rousseau (1983) pointed out that there exists no universally acceptable measure of technology, and that research in the field is characterised by lack of conceptual and operational comparability. Disagreement exist in terms of the level of analysis at which a unit's technology is to be assessed, and the operational measures used to define technology. In this study the technology of the unit or its degree of routinisation is operationalised in terms of the number of "exceptions" and the degree of "analysability" encountered in the transformation of inputs into outputs (Perrow, 1967; 1970).

The first dimension, number of exceptions, refers to the frequency of unanticipated events that occur during the

conversion process. When there is great task variability, with a number of novel events occurring during the execution of the task, participants cannot predict problems in advance, and the tasks could be classified as unique. On the other hand, when the exceptions encountered are few, tasks are predictable and repetitious.

The second dimension, analysability, makes a distinction between work that can be reduced to a set of mechanical steps - making minimal demands on the participants' analytical skills in search for alternative actions - and work that requires an active search for solutions that go beyond pre-programmed actions (Withey, Daft & Cooper, 1983). The exceptions and analysability constructs parallel the classification made by Van de Ven and his associates (Van de Ven & Delbecq, 1974; Van de Ven & Ferry, 1980). For these researchers exceptions and analysability refer to task variability and task difficulty respectively. To measure these two dimensions an instrument developed by Withey, Daft, and Cooper (1983) was used in the present study (see Appendix I). Preference for this instrument was based on an evaluation by Withey, Daft, and Cooper (1983) on the discriminant ability of six-previously-used instruments of unit technology. As a result of their study a new instrument was produced that was

found on application to be superior to the other instruments. Although the new instrument can be used to measure a single technology dimension (routinisation), Withey, Daft, and Cooper (1983) argue against it. Empirical results suggest that the two dimensions possess distinct relationships with other unit structural characteristics. Because the testing of the research hypotheses in this study is based to a large extent on the ability of the technology measures to differentiate among units, further analysis of the scale was conducted to determine its psychometric properties.

In order to test the construct validity of the scales and their reliabilities, twenty-three co-ordinators rated the extent of routinisation within their units using the instrument developed by Withey, Daft, and Cooper (1983). The results of a factorial analysis, on the subunit scores, using oblique rotation, confirmed the results reported by the researchers mentioned above. Two distinct dimensions were found, and the five items in each dimension corresponded exactly with those found in the above study (see Table 5.3). The reliabilities (Cronbach, 1951) of the scales were also high (Exceptions Alpha = .92; Analysability Alpha = .87). However, before the scales were administered to the entire subject population, it was decided to exclude one item from the analysability scale. Two items appeared to be asking the same question, and respondents, in

general, object to answering questions that they perceive to be similar. The question: " To what extent is there an understandable sequence of steps that can be followed in carrying out your work?" was retained in preference to the item that substituted "..carrying out your work" for "..doing your work". The item included in the scale was found to be more reliable than any of the other items included in the analysability scale (i.e., Alpha would have been reduced to .80 if this item was deleted from the scale).

To test whether the technology scales were able to discriminate among units, the scales were administered to all subjects. A one-way analysis of variance across different functional areas with distinct technologies, and considered a priori of having different measurement values (see Figure 5.1), found significant differences on the technology dimensions (Table 5.4 & Table 5.5), thus confirming their discriminatory power. However, the analysability scale was less able to discriminate among the various groups. This was also the case in the Withey, Daft, and Cooper (1983) study.

The ability to discriminate between various functional groupings in the plant was taken as an indication that the instrument possessed construct validity

TABLE 5.3

FACTOR STRUCTURE OF ROUTINISATION
OBLIQUE ROTATION
N = 23

<u>Item #</u> ^a	<u>FACTOR 1</u>	<u>FACTOR 2</u>
1	.91 (.67)	.12 (.47)
2	.31 (.44)	.59 (.79)
3	.72 (.86)	.15 (.40)
4	-.11 (.21)	.65 (.60)
5	.14 (.59)	.95 (.73)
6	.74 (.75)	.01 (.53)
7	.22 (.53)	.90 (.57)
8	.84 (.81)	.49 (.44)
9	.98 (.76)	.18 (.32)
10	.18 (.48)	.74 (.62)
<u>Alpha</u>	.92 (.81)	.87 (.85)

Note: Loadings in parentheses are from the Whitney et al. (1983) study. Factor 1 = Exceptions;

Factor 2 = Analysability.

a: See Appendix II for details of items.

FIGURE 5.1

Main Tasks of Groups	
Shift Process Workers (Group A)	Routine lube and pump changes; area checks; hosing down presses; flushing tanks; acid washes; chemical washes; chemical unloading; loading of ore into trains; monitoring TDC control production panels.
Day Process Workers (Group B)	Tradesman's assistant. Maintenance work (e.g. pump overhaul and lubes). Mobile within maintenance section, and on loan to various tradesmen. Some crane driving and welding. Housekeeping tasks.
Powerhouse Operators (Group C)	Watchkeeping. Monitoring of control panels. Taking readings. Equipment and alarm checks.
Tradesmen (Group D)	Breakdown maintenance (electrical, etc.) Planned maintenance and overhalls of equipment. Inspection of buildings. Modification of existing installations. Carrying out the placement of new installations.

TABLE 5.4

MEANS, STANDARD DEVIATIONS, AND POST HOC
SIGNIFICANCE TESTS ON EXCEPTIONS

Tukey's Multiple Comparisons: 95% Confidence Intervals^a
Pair-Wise Comparisons Between Group Cells

GROUPS	MEANS	SD	DIFFERENCES			
			BETWEEN GROUP MEANS			
			A	B	C	D
A	2.0259	.5796	-			
B	2.7818	.7950	.7559*	-		
C	2.1385	.5679	.1126	.6433*	-	
D	2.7289	.8281	.7030*	.0529	.5904*	-

a:

Group A = Shift Workers (n=85);

Group B = Day Workers (n=22);

Group C = Powerhouse Operators (n=13);

Group D = Tradesmen (n=45).

*: P<.01

TABLE 5.5

MEANS, STANDARD DEVIATIONS AND POST HOC
SIGNIFICANCE TEST ON ANALYSABILITY

Tukey's Multiple Comparisons: 95% Confidence Intervals^a
Pair-Wise Comparisons Between Group Cells

GROUPS	MEANS	SD	DIFFERENCES			
			BETWEEN GROUP MEANS			
			A	B	C	D
A	2.4706	.8086	-			
B	2.7159	.6739	.2453	-		
C	2.1538	.8450	.3168	.5621	-	
D	2.7444	.6112	.2738*	.0285	.5906*	-

a:

Group A = Shift Workers (n=85);

Group B = Day Workers (n=22);

Group C = Powerhouse Operators (n=13);

Group D = Tradesmen (n=45).

*: $P < .05$

(Cronbach & Meehl, 1955), which made its use in research at the organisational subunit level acceptable. Also, the results of the F test across different functional areas indicated that aggregation of data is a proper procedure for deriving subunit technology scores from individual level data (Fry, 1982). Two scales comprising 5 items for "exceptions", and 4 items for "analysability" assessed subunit technology. Composite scores on these two factors were calculated, equalling the sum of subunit responses to all items that had high loadings on that factor. With this method two scores - one for "exceptions" and the other for "analysability" - were obtained (Alwin, 1973).

5.3.2 Unit Structuring of Activities Measures

Number of Job Titles in the Unit. According to Van den Ven and Ferry (1980) the number of job titles in the unit is an indication of the degree of unit specialisation and it is measured by counting the number of distinct job titles or functions of unit personnel. Dewar and Hage (1978) have suggested that job titles can represent either task or person specialisation. They have argued that job titles are not the same as occupational specialties which have distinct and

separate kinds of knowledge attached to them, as opposed to job titles that on the whole do not. In this study the job titles in the "maintenance" units represent occupational complexity. The "Process Worker" titles, however, do not represent occupational complexity to the same degree. They go a long way, though, from the traditional industrial setting in classifying workers on the basis of expertise gained through on-the-job, and classroom training. A new employee joining the organisation receives a classification of "Process Worker 6", indicating a low level of job complexity. As the worker gains more experience, and expands his knowledge of refinery operations, he is re-classified until he receives the job title "Process Worker 1", indicating a high level of job expertise.

Role Interchangeability in the Unit. This is measured by considering the degree to which two workers can interchange their tasks at short notice, even though they have different job titles or functional assignments (Van de Ven & Ferry, 1980). Role interchangeability was measured through four items (Van den Ven & Ferry, 1980). An index of role interchangeability was arrived at by averaging the responses, on a five-point scale. All four items were used in the Shift Process Worker Questionnaire (see Appendix I, questions 28-31 inclusive). However, when

analyses were conducted for the entire sample, only two items were included (questions 29 and 30), since job rotation for other functional areas was not institutionalised and, therefore, not practised. In this instance the measure, consisting of the two above items, indicated the potential for job-switching within a unit, and assessed the extent to which members of a unit possessed skills that were interchangeable. Reliability coefficients for all scales are shown in Table 5.6

Unit Skill Heterogeneity. This is defined as the range of skills and competencies possessed by personnel within a unit (Van de Ven & Ferry, 1980). The assessment of unit skill heterogeneity was based on a number of variables (suggested by Van de Ven & Ferry, 1980) that were contributing to skill differentiation within a unit. The following information was extracted from the personnel and training records of the company:

1. Years of education beyond "Year 10".
2. Total number of hours spent on induction training.
3. Total number of hours spent on health and safety training.
4. Total number of hours spent on technical training.
5. Type of educational programmes received at work since commencement.

To arrive at an index of skill heterogeneity for units, the standard deviations of responses to the first four items presented above (items 1 to 4) were obtained for each unit. The units were then rank-ordered in terms of the degree of variability (as assessed by the standard deviation) within each unit - from most homogeneous (ranking 1) to least homogeneous - and the rank score assigned to the unit. For item 5 a qualitative content analysis was necessary. The range of educational programmes undertaken by unit personnel were identified (there were 42 different programmes being offered to plant personnel), and the degree of concensus in programme selection was ascertained. Again, units were rank-ordered in terms of degree of variability. Where full agreement was reached by all unit personnel, in terms of educational programmes offered and attended, ranking 1 was given. Higher rankings were given to units with degrees of variability in programme selection among unit personnel. The score from this ranking, and the scores from the other four items were combined to form an index of unit skill heterogeneity.

Unit Standardisation. Van de Ven and Ferry (1980) define this variable as the extent to which rules and procedures are formalised and followed in order to coordinate unit activities. An index of unit

standardisation was obtained by averaging the responses of unit personnel over four items (Source: Van de Ven & Ferry, 1980) on a five-point scale (see Appendix I, questions 24-27 inclusive).

Decentralisation of Decision-Making. This measures the distribution of authority in the unit, or the locus of decision-making authority within an organisation (Source: Van de Ven & Ferry, 1980). Twelve items, using a five-point response format, reflect the existence of multiple sources of authority for decision-making. These are split into four 3-item sub-scales, tapping supervisory authority; member authority; group authority; and external authority over decisions in the following areas: The amount of influence in deciding the kinds of work or tasks for the unit; the establishment of standards of performance for the unit; and decisions affecting the drawing up of rules, policies, and procedures for the unit (see Appendix I, questions 20-22 inclusive). Four indices of loci of decision-making are thus calculated, by averaging three items for each area of decision-making authority (Van de Ven & Ferry, 1980).

Team Responsibility. This measurement consisting of 19 items (see Appendix I, question 23), on a five-point scale, assesses the extent to which team members are given responsibility to make decisions on specific tasks

such as the ordering of stores and supplies, the scheduling of job rotation through different work areas, etc. This scale is based on criteria offered by Gulowsen (1972) for the existence of semi-autonomous workgroups. It was specifically developed for this study, although a similar scale has been used by Kemp, Wall, Clegg and Cordery (1983); and Wall, Kemp, Jackson, and Clegg (1986). Only Shift Workers scores are included in the analyses.

5.3.3 Job Design Measures

Job Standardisation. This job design variable (see Appendix I, questions 13-18 inclusive) measures the degree to which the task assignments and job responsibilities that make up a job are documented in a job description. Job standardisation is measured on a five-point scale, as the average of six items (Source: Van de Ven & Ferry, 1980).

Job Authority. This measure at the job design level assesses the degree to which the job incumbent exercises discretion in making certain job related decisions. The average of four items (see Appendix I, question 19) on a five-point scale, gives an index of job authority (Source: Van de Ven & Ferry, 1980).

5.3.4 Affective Measures

Job Satisfaction. This measurement (see Appendix I, question 33, items a-o inclusive) is based on the work of Warr, Cook, and Wall (1979) and consists of 15 items rated on a 7 point scale. High Alpha reliability was found for this scale (Alpha = .94), consistent with the results obtained by Warr et al. (1979) and Clegg & Wall (1981). Validities for this measure, and the other measures described above, are reported in the original studies.

5.3.5 Individual Level Job Proficiency Measures

Multi-Skilling Points. This is simply the aggregate of points attained by Shift Workers. This information was obtained from training records, and was verified by inspecting the personnel file of each worker, and noting his permanent job classification and rate of pay. This measurement applies only to Shift Workers.

Job Experience. This is the number of different work areas that a Shift Worker has worked in since commencing employment with the organisation. However, it is not an indication of the extent of his competency in handling work assignment in these areas. Often rotation was

practised in the plant without formal skill training being given to workers. It is, therefore, only a rough guide in assessing the mobility of subunit members within their operations centre. This measurement was obtained by asking all Shift Workers to indicate, from a list of work areas, where they have worked in (Appendix I, question 2). This information was also used to detect any mobility patterns within and between subunits and operations centres.

Time with the Company. This is the time (in months) since the employee commenced employment with the organisation.

Time in the Job. This is the time (in months) since the employee was assigned to his current job.

Technical Training. This measurement was obtained by totalling all the hours spent on formal training of a technical nature by the employee since commencing employment with the organisation. Examples of technical training programmes are: familiarisation with plant services; welding; pumps; plant lubrication; scaffolding; forklift driving; keyboard training (for operating the various monitors controlling the plant processes); operation of mobile platforms, etc.

Health and Safety Training. This is the total number of hours spent by a worker, since commencement of employment, on programmes dealing with health and safety aspects in the workplace. Programmes consisted of modules on occupational safety and health, fire training, and first aid instruction.

Induction Training. This is the total number of hours spent on induction training. A comprehensive induction programme was offered to all new employees. The orientation period was spread over five days and totaled 22 hours of instruction for the full programme. It dealt with company history and background; the way the ore is processed; organisational objectives; lines of communication; organisational planning; union membership; and certain basic information dealing with technical aspects of the work environment. A tour of the mining and processing area was also included.

All information regarding the hours spent on all types of training programmes by a worker were extracted from the computerised training records of the company. These records were properly maintained by a personnel clerk, whose responsibility was to ensure that the records were kept up-to-date monthly.

TABLE 5.6

SCALE RELIABILITIES
CRONBACH'S ALPHA
N = 165

<u>Scale</u>	<u>N of Items</u>	<u>Alpha</u>
Exceptions	5	.80
Analysability	4	.76
Job Standard- sation	6	.71
Job Authority	4	.85
Supervisory Authority	3	.78
Member Authority	3	.76
Group Authority	3	.89
External Authority	3	.77
Unit Stand- ardisation	4	.71
Role Inter- changeability	2	.77
Role Inter- changeability	4	.70 ^a
Team Respon- sibility	19	.94a
Job Satisfaction	15	.94

a: Scale for Shift Workers only.

TABLE 5.7

a

COMPARISON OF MEAN SCORES BY FUNCTION

JOB DESIGN, STRUCTURING OF ACTIVITIES,

AND JOB SATISFACTION

SDs in Parentheses

<u>Variable</u>	<u>Grp:A</u> (N=85)	<u>Grp:B</u> (N=22)	<u>Grp:C</u> (N=13)	<u>Grp:D</u> (N=45)	<u>F</u>
Role Inter- changeability	2.83 (.87)	3.07 (.98)	4.73 (.56)	2.61 (1.57)	F=13.1**
Job Stand- ardization	3.33 (.82)	2.92 (.62)	3.73 (.69)	2.65 (.71)	F=11.3**
Unit Stand- ardization	3.23 (1.01)	3.65 (1.74)	3.40 (.80)	2.97 (.99)	F=1.95
Job Satis- faction	67.27 (16.51)	74.09 (14.09)	65.46 (17.03)	63.87 (17.43)	F=1.93
External Authority	3.89 (1.14)	3.36 (1.55)	3.26 (1.31)	3.70 (1.09)	F=1.89
Group Authority	3.57 (1.05)	3.74 (1.89)	3.38 (.90)	3.21 (.88)	F=1.45
Supervisory Authority	3.78 (1.00)	3.91 (1.26)	3.56 (.86)	3.98 (.69)	F=.69
Job Authority	3.31 (.96)	3.06 (1.72)	3.00 (.96)	3.27 (1.16)	F=.51
Member Authority	3.06 (1.10)	3.02 (1.30)	2.87 (.78)	2.87 (.81)	F=.41

a: F ratios were calculated using One-Way Analysis of Variance. * P<.05; ** P<.001

Group A = Shift Workers; Group B = Day Workers;
Group C = PowerHouse Op.; Group D = Tradesmen

5.4 Research Design

The research design adopted for this study was cross-sectional, and quasi-experimental. In order to assess the degree of multi-skilling practice in the plant, data were collected at a single point in time from Shift Workers belonging to ten different subunits (a subunit corresponds with a particular workgroup). These 10 subunits were located within two operational centres (five subunits each), with each subunit consisting of 13 and 10 workers each for Centres A and B respectively. Within each centre, members from all subunits belonging to that centre were exposed to the same working environment. Comparisons were then made across all units to detect any significant differences between units.

It was hypothesized previously (Chapter 4) that a fully multi-skilled workgroup would be more likely to face a moderate level of technological uncertainty (exceptions and analysability), and a specific configuration of structuring of activities within a unit (i.e., low specialisation, low level of skill heterogeneity among workers, high role interchangeability, and moderate levels of decision-making latitude).

To test the above hypothesis the following assumption was made: it was expected that it would be highly unlikely for all workgroups in the plant to have

progressed to the fully multi-skilled stage of their development at the same time. Since wide variations in unit skill development was expected at the time of data collection, it was argued that a multigroup posttest-only design (pretest measures were not available for the majority of the variables under examination) would be the most suitable means of testing the hypothesis. For example, it would be possible to compare (i) multi-skilled groups with other multi-skilled groups; (ii) and multi-skilled groups with groups that did not reach that level of development; and observe whether the anticipated pattern of relationships were consistent with the hypothesis. Of course it was not possible to assign workers randomly to the various work units and, therefore, this condition represented a major violation of the posttest-only design (Campbell & Stanley, 1963). However, this design was supplemented with one that made comparisons between the experimental group A (Shift Workers), and three nonequivalent control groups B, C, and D, from the same organisation (Day Workers, Powerhouse Operators, and Tradesmen respectively). On the technology variables the groups exhibited the following relationships: $B, D > A, C$. It was, therefore, possible, to test for differences in the structuring of activities of these groups, and observe whether they were in accordance with the anticipated configurations.

Also, in order to test for the extent of skill acquisition among Shift Workers - the result of the multi-skilling programme - a nonequivalent control group was used. The Day Worker group (B) was selected because of similar background in terms of prior job experiences and training (see Table 5.1). A comparison of skill acquisition between these two groups (Shift and Day Workers, group A and B respectively), since commencement of plant operations, would indicate whether the multi-skilling programme had a significant effect on skill development (i.e., $A > B$), or whether factors other than the programme contributed towards such development. It was suggested in Chapter 4 that increases in skill requirements were more likely to be associated with increases in technological uncertainty. One potential problem with this type of comparison group, apart from selection (for example, in the non-equivalent control group one can never be certain that the two groups are similar, since the subjects were not assigned randomly) is that of mortality. Loss of subjects from the groups would pose an additional threat to the internal validity of the design.

All statistical analyses for these comparisons, and for subsequent analyses conducted with the entire sample, were performed using the Statistical Package for the Social Sciences (SPSS) programmes (Nie, Hull, Jenkins, Steinbrenner & Bent, 1975; Hull & Nie, 1981).

CHAPTER SIX

MULTI-SKILLING IN A GREENFIELD SITE

6.1 Design Considerations

The design of the multi-skilling programme in the organisation surveyed was based on the following stated objectives:

- * Jobs consisting of a variety of tasks, broad in scope and challenging in work content;
- * Clear organisational objectives, responsibility for decision-making, and accountability for outcomes;
- * Opportunity for social contact through the design of semi-autonomous work teams;
- * Work tasks extending beyond traditional job boundaries ;
- * Career paths carefully mapped out, and based on the needs and aspirations of individual members;
- * A reward system based on skill acquisition and knowledge;

- * A technology that was based not only on the requirements of production, but took into account also the needs of people;
- * Flexibility in the administration of the programme that recognised and made allowances for individual differences;
- * Direct and open two-way communication;
- * Working conditions conducive to productivity and efficiency, without sacrificing the safety and well-being of the individual.

6.1.1 Definition of a Multi-Skilled Worker. In the agreement between the relevant union and the plant management, a multi-skilled worker was defined as one who:

- i) Completed and understood the general operating and servicing modules, and safety procedures relevant to the operating area for which credit was sought;
- ii) Worked in the operating area for a sufficient period to acquire the necessary on-the-job experience; and

iii) Passed the required theoretical and practical tests for the operating area.

6.1.2 Point Allocation and Grading. The plant was divided into two operational areas Centre A and Centre B, each consisting of 14 and 8 distinct sub-areas respectively. Each sub-area was allocated a specific number of proficiency points, ranging from 20 to 180 points, which reflected varying degrees of operational complexity. The total possible number of proficiency points, within each operating centre, was 900 points. A worker who had attained the maximum 900 proficiency points was graded "Process Worker 1", while a worker classified as "Process Worker 2" had accumulated 400 proficiency points. Employees with lesser aggregates were classified as "Process Workers 3". The same classification (Process Worker 3) was also given to employees who had not received any proficiency points, but were participating in the multi-skilling programme through area and task rotation. Lower gradings were reserved for new and inexperienced workers who were not involved in area rotation as yet.

6.2 Assessment of Multi-Skilling

The major goal of management at the plant was to develop a worker with extended knowledge of plant operations, and job skills. The role of the multi-skilled worker, it was argued, would provide the organisation with flexibility in meeting production schedules, while at the same time enhancing the quality of working life in the plant through a work environment that offered skill variety, continued opportunities for learning, and long-term career advancement. In this section the basic hypothesis that the experimental intervention led to an increase in job skills is investigated.

6.2.1 Components of the System. The programme for the development of a multi-skilled workforce in the plant consisted of:

- * Formal training programmes conducted by the Personnel and Training department;
- * On-the-job experience based on job rotation through various areas, which were clearly defined and assessed as to the level of work complexity involved in carrying out the various tasks;

- * Careful assessment of the theoretical and practical competence of the worker before his re-classification into a higher grade, which attracted pay increases;
- * Semi-autonomous work groups ranging in size from 10 to 13 members;
- * Formal team meetings (once every three weeks) for the discussion and consideration of team issues; and
- * Modification of the traditional supervisory role, which included a teaching component for the development of team members, and a co-ordinating function - as opposed to a control function - for facilitating team activities. This change was reflected in the new title given to the supervisor, who was now called Co-ordinator.

Twelve months into the project, the machinery for meeting the objectives of multi-skilling was in place according to an independent evaluation task force's preliminary report. It was reasonable, therefore, to expect that at the eighteen month of operation a substantial number of process workers would have become multi-skilled.

6.3 Results and Discussion

6.3.1 Skill Acquisition. The results of Table 6.1 (based on Personnel and Training records) indicate that 40% of all Shift Process Workers (SPW) - not only those who participated in the study - had undergone the type of training, on-the-job-experience, and formal assesment for the awarding of proficiency points. However, only about 16% of all SPW had aggregated sufficient points (equal to, or greater than 400 points, but lesser than 900 points) to be classified as "Process Worker 2". No worker had achieved the total maximum of 900 points necessary to be classified as "Process Worker 1" - although some SPWs had received this classification due to previous job experience and ability. The above results, therefore, suggest that the programme has been slow in developing the desired level of skill expertise in the plant. If one takes into account the relative stability of the SPW group (see Table 6.2) the reasons for the slow development of skills within the SPW teams must be due to other factors than simply lead-time for such development to occur.

TABLE 6.1

Multi-Skilling Points Achieved
 Entire Shift Process Worker Group (N=115)

<u>Points</u>	<u>Frequency</u>
0	69
20	2
30	3
40	2
80	2
100	1
120	4
140	3
150	1
180	4
240	1
280	2
300	2
380	1
400	5
460	2
480	2
500	3
520	1
560	2
580	1
690	1
700	1

TABLE 6.2

One-Way Analysis of Variance.

Length of Service and Training Since Commencement.

Comparison Across Different Functional Groups.

VARIABLE	Group A Shift Process Workers (N=85) X (S.D)	Group B Day Process Workers (N=22) X (S.D)	Group C Powerhouse Operators (N=13) X (S.D)	Group D Trades Personnel (N=45) X (S.D)	F	TUKEY (.05)
Time with Company	16.52 (6.25)	7.73 (7.42)	15.69 (3.88)	16.96 (6.24)	12.78*	D, C, A, B
Induction Training	4.15 (6.34)	10.94 (12.97)	1.85 (3.51)	3.00 (7.40)	5.54*	B, A, D, C
Technical Training	26.96 (24.38)	56.33 (28.81)	.46 (1.13)	36.40 (23.47)	15.51*	B, A, C, D
Health & Safety Training	16.86 (10.47)	7.22 (14.78)	9.31 (7.97)	13.60 (8.87)	5.37*	A, B

* Significant at the .001 level.

It was suggested in Chapter 4 that the development of skills among group members is dependent on the level of technological uncertainty experienced by the group. Support for this view is provided in Table 6.2. A one-way analysis of variance, performed across the four main functional groupings in the plant (Shift Process Workers, Day Process Workers, Powerhouse Operators, and Trades Personnel), and comparing their level of training activity, indicated the following: the Day Process Worker group, which on commencement of employment was comparable to the Shift Process Worker group, in terms of prior job experience and skill classification (see Table 5.1), achieved a higher level of "technical training" and "induction training" than the Shift group. Equally, the Shift group achieved a higher degree of "health and safety training" than the Day group. This suggests that the two groups had different training needs. The Day group, with a moderate level of technological uncertainty encountered during task performance (Exceptions Mean = 2.78; Analysability Mean = 2.72) required a lengthier orientation on commencement of employment, and training in a variety of technical areas in order to provide support to the trades personnel. The Shift group, on the other hand, faced with a higher level of routinisation (Exceptions Mean = 2.03; Analysability Mean = 2.47), and a hazardous

working environment (see Figure 5.1) required more instruction on the health and safety aspects of their work.

One potential problem in comparing the two groups is the difference in their length of service with the plant (Table 6.2). However, this difference only serves to reinforce the extent of the need for "technical training" among the members of the Day group. Added to this was the custom of transferring workers from Day work to Shift work; so that a number of Shift workers had obtained "technical training" whilst on Day work. Again, this only gives weight to the argument that, the Day worker group had achieved an accelerated level of skill development, compared to the Shift worker group. One concern amongst some workers, who transferred from the Day to the Shift group, was that on joining the Shift Process Worker group some "technical training" ceased to be offered to them. After multiple requests to train, or obtain added skills, i.e. crane driving, these have been met with a refusal. "These opportunities only apply to 'Day' workers"; or "once on 'Shift', training programmes are non-existent", were typical comments expressed by some Shift Process Workers, when they volunteered information on the quality of their training in the questionnaire. This lack of opportunity for training was a source of dissatisfaction among Shift workers. When comparing both groups (Day and Shift), 43%

of Shift workers expressed dissatisfaction with aspects of their "technical training" as opposed to 9.5% of Day workers.

6.3.2 Frequency of Job Rotation. Figure 6.1 indicates that the overwhelming majority of SPWs did not engage in frequent job rotation. Sixty-one per cent of those participating in the study reported that they did not engage in any job rotation during the past three months. Furthermore, a great number seemed satisfied with this arrangement. Nine Shift Worker Co-ordinators also (representing nine out of ten shift teams) agreed with these results. They felt that their team members, in general, did not wish to rotate frequently. Various reasons were given for the slowness of job rotation, but the most prominent was lack of trained personnel capable of carrying out a variety of tasks for job rotation to operate effectively. Yet without frequent job rotation the possibility of more people being trained in various areas appears remote.

There was some reluctance on the part of co-ordinators to allow job rotation to occur before the worker was fully trained in one area. Even SPWs expressed the view that it was counter-productive to rotate team members before they were ready as "inexperienced personnel had

FIGURE 6.1

Frequency of Job Rotation
Shift Process Workers

To the question:

"During the past three months how often did you rotate to other jobs within your operating centre?"

Responses (n=84) were as follows:

Not once	About once every month	About once every week	About every day	About every hour
61%	29%	5%	4%	1%

When asked whether they were happy with the frequency of job rotation 59% answered "Yes", and 41% "No".

Of those answering "Yes" (N =48) the frequency of job rotation was:

Not once	About once every month	About once every week	About every day	About every hour
60%	25%	6%	6%	2%

Those who answered "No" (N=33) responded as follows:

Not once	About once every month	About once every week	About every day	About every hour
61%	36%	3%	0	0

cost this company a lot of money". The problem was exacerbated by frequent low staffing levels due to separations, sick leave, annual leave, etc., that made the loss of a trained team member to another area even more critical. Pressure of work was also experienced by workers through frequent bottlenecks in specific work areas, making job rotation prohibitive for all those involved, while indicating a need for improved work-flow management and "down-time".

Questionnaire data indicated that some dissatisfaction towards the slowness of job rotation was felt by those who learnt quickly and were keen to upgrade their skills; however, others seemed quite happy to remain in one area indefinitely. A number of reasons were suggested by co-ordinators as contributing to slow mobility: lack of interest in the programme; failure to progress to the assessment stage of their training quickly, due to poor ability; and reluctance to transfer to another area, because of the anxiety that such change would entail, thus effectively blocking the job rotation opportunities of other team members.

A noticeable absence of leadership in the management of the multi-skilling programme from staff specialist groups was evident. In particular, the Personnel and Training departments had adopted a "hands off" approach, relying on line management, and to a large extent, on

the co-ordinators, to deliver the goods. Yet, this group was ill-equipped in terms of experience and expertise to deal with the problems of organisational innovation. It was left up to plant management to proceed with the skills development of workers. This was often subordinated to the requirements of production. For example, certain plant management stepped in and imposed certain restrictions for job rotation, in order to stabilise the performance within their teams at a higher level than was being experienced. In one operation centre, it became policy not to transfer a member to another area until he had learnt the previous area thoroughly, and gained his proficiency points. Overall, the data indicate that movement of personnel from one work area to another usually took an average of six months.

There were also certain administrative problems associated with the management of the programme that made job rotation difficult. For example, there was a shortage of qualified assessors to administer the various tests during the working time of SPWs. Some workers had been waiting for three months or more to sit for the appropriate tests, and workers from some areas were prevented, as was mentioned above, from moving to another area before they had completed all the training requirements.

The influence of these constraints on the ease of job rotation could be seen on examination of questionnaire data. Information was provided on the various work areas and the movement of SPWs within them, which indicated that:

- (i) There was no exchange of workers between operation centres. Only two workers - out of a total of 85 who participated in the study - had any experience in another centre;
- (ii) No worker had rotated through all areas within his operation centre even for short periods;
- (iii) Only half of the personnel within each operating centre had any direct experience, however brief, in any one designated work area.

One other contributing factor hindering the smooth operation of job rotation, even within specific work areas, was the organisation of work activities at the individual level, rather than the group level. An examination of the three most important tasks of SPWs revealed that each worker had his own area of responsibility and specified tasks to perform. Also, the

SPW co-ordinators, rating the interdependence of their team members, indicated that at least 50% of the task activities in the groups were conducted by individual members working independently. This was the lowest level of interdependence of any occupational group surveyed within the plant. Furthermore, the idea of the team-work encompassing the entire shift group could not be applied in practice, because of the physical dispersion of workers at designated work stations attending to their various tasks. The grouping of tasks, therefore, was not on the basis of a "true production group" (Swedish Employers' Confederation, 1975:63), where the movement of team members between different jobs occurred spontaneously without outside direction, and in order to facilitate the efficient functioning of the production process. Rather the groups were, what Hackman and Oldham (1980:164) refer to as, "coacting groups". In such groups tasks are individually defined, and members are separated physically, even though group members meet occasionally to discuss problems associated with production and the management of the group.

The above points suggest that considerable time and effort must be expended before the problems outlined above are rectified, and workers in each operation centre become fully interchangeable.

6.3.3 The Structuring of Activities. Tables 6.3, and 6.4 present information on a series of one-way analyses of variance across ten Shift Process Worker groups (five for each operation centre). The results indicate that the groups were homogeneous in almost all the variables under examination. No significant differences were found between the various groups except in one area: amount of "on-the-job experience" in the plant ($F=2.94$; $P<.01$). "On-the-job experience" (Table 6.4) was significantly different between one group in Centre A (Shift 3, Mean=10.60), and two groups in Centre B (Shift 9, Mean=4.89 & Shift 10, Mean=4.43). These differences could be attributed to the supervisory practices of co-ordinators in the various groups, although this idea was not explored fully.

The technological variables, Exceptions and Analysability, and the degree of multi-skilling in the groups did not show any variation across the groups. Also, an analysis of multi-skilling points by group revealed that only a few individuals within each group had undergone training up to the proficiency point allocation stage. No one-group, therefore, could be said to be fully multi-skilled. As a consequence, the hypothesis that a multi-skilled group would show increases in the number of exceptions and analysability encountered in the work, which would in turn allow

TABLE 6.3

One-Way Analysis of Variance
 Comparison of Shift Refinery Worker Units
 Design Variables
 N = 10

Variable	F Ratio	Probability
Team Responsibility	2.01	n/s
Group Authority	1.97	n/s
Job Standardisation	1.73	n/s
Member Authority	1.67	n/s
Role Interchangeability	1.33	n/s
Analysability	1.27	n/s
External Authority	1.17	n/s
Exceptions	1.11	n/s
Job Authority	.95	n/s
Unit Standardisation	.92	n/s
Supervisory Authority	.88	n/s
Job Satisfaction	.48	n/s

TABLE 6.4

One-Way Analysis of Variance
 Comparison of Shift Refinery Worker Units
 Education, Training, and Job Experience Variables
 N = 10

Variable	F Ratio	Probability
On-the-job Training Experience	2.94	P<.01
Multi-skilled Points	1.82	n/s
Education	1.68	n/s
Time with Company	.93	n/s
Technical Training	.92	n/s
Induction Training	.84	n/s
Health & Safety Training	.35	n/s

modifications in the structuring of activities to occur, could not be tested (Hypothesis #3). Applying Van de Ven and Morgan's (1980) framework, as outlined on Chapter 4, the Shift Process Worker group is not equipped for multi-skilling development. The technological variables of "exceptions" and "analysability" are in the low ranges. It was previously argued that a moderate level of the above two variables is necessary for the creation of a favourable environment for multi-skilling to occur.

6.3.4 Job Satisfaction. The task force's preliminary evaluation report on the project contained information regarding satisfaction with several facets of the work environment. Table 6.5 presents a trend on the movement of attitudes -either positive, neutral, or negative - over a period of time. Each item was originally measured on a 7-point scale, but in order to condense and highlight the information the scale was collapsed into a 3-point interval. The direction of satisfaction with several aspects of work appears to be mainly in the negative direction, although statistical analyses (t tests) revealed that the differences between the means were not significant except from one item - "amount of variety in your work". In this case, the difference between Time 1 (N=88, Mean=5.17, S.D=1.30) and Time 2

TABLE 6.5

Direction of Affective Responses at T1 And T2
(T1 in Parentheses)
Shift Refinery Workersa
Percentage in Each Category

Item	Negative %	Neutral %	Positive %
<u>Satisfaction with:</u>			
1. Physical work surroundings.	24.4 (20.7)	24.4 (19.5)	51.2 (59.8)
2. Freedom to choose own methods of working	17.4 (12.5)	15.1 (10.2)	67.5 (77.3)
3. Fellow workers.	12.8 (5.7)	10.5 (11.3)	76.7 (83.0)
4. Recognition you get for good work.	58.8 (38.7)	18.8 (23.8)	22.4 (37.5)
5. Supervision you get from coordinator.	12.8 (20.4)	20.9 (19.4)	66.3 (60.2)
6. Amount of responsibility you are given.	13.0 (22.7)	24.7 (12.5)	62.3 (64.8)
7. Opportunity to use your abilities.	25.9 (19.3)	25.9 (14.8)	48.2 (65.9)
8. Chance for promotion.	34.1 (30.7)	29.4 (31.8)	36.5 (37.5)
9. Way the refinery is managed.	38.4 (36.4)	31.4 (30.7)	30.2 (32.9)

Table 6.5 continued on next page.

TABLE 6.5 Continued

Item	Negative %	Neutral %	Positive %
<u>Satisfaction with:</u>			
10. Attention paid to suggestions you make.	52.4 (45.9)	19.0 (19.6)	28.6 (34.5)
11. Hours of work.	17.4 (18.5)	20.9 (19.5)	61.7 (62.0)
12. Relations between management and unions.	34.1 (36.4)	21.2 (28.4)	44.7 (35.1)
13. Job security.	5.8 (5.6)	16.3 (3.5)	77.9 (90.9)
14. Amount of variety in your work.	27.9 (9.1)	25.6 (17.1)	46.5 (73.8)
15. Rate of pay.	23.5 (32.9)	15.3 (11.4)	61.2 (55.7)
16. Recreational and social facilities.	57.7 (63.2)	23.5 (23.1)	18.8 (13.7)
17. Shift working arrangements.	21.2 (19.4)	30.6 (20.8)	48.2 (59.8)
18. Technical training you receive.	43.0 (40.9)	18.6 (23.9)	38.4 (35.2)
19. Team development training you receive.	43.0 (36.4)	30.2 (26.2)	26.8 (37.4)
20. Opportunity to broaden your range of skills.	40.0 (33.0)	23.5 (12.5)	36.5 (54.5)

a: T₁ N=88; T₂ N=85.

(N=85, Mean=4.16, S.D.=1.49) was significant ($t=4.73$; $P < .001$), with 28% of workers expressing dissatisfaction at Time 2 as opposed to 9% at Time 1. This may be due to a shift of adaptation level often occurring in change programmes of this kind (Goodman, Bazerman & Conlon, 1980). However, almost half the Shift Process Worker population were satisfied with the amount of variety in their work. Overall, when the job satisfaction of SPWs was compared with the job satisfaction of Day Process Workers, Powerhouse Operators, and Trades Personnel in the plant, it was found to be at a comparable level (see Table 5.7)

6.4 Differences Between Multi-skilled and Other Shift Workers.

In order to examine whether there were any significant differences between Shift workers who had undergone multi-skilling training (N=29), and those who had not (N=52) a discriminant analysis was performed on the data. Four cases - from a total of 85 subjects - were excluded from the analysis due to missing information. The following variables were included:

- * the technological variables (exceptions and analysability;

- * the structuring of activities variables (supervisory authority, group authority, member authority, external authority, team responsibility; unit standardisation, and role interchangeability);
- * the job design variables (job authority, and job standardisation); and
- * an outcome variable (job satisfaction).

Using stepwise analysis, a discriminant function was produced to show how the independent variables combined to discriminate between multi-skilled and other workers. Tables 6.6, 6.7, and 6.8, show the results of the discriminant analysis, which correctly classified 65.43% of the subjects. The mean (group centroid) for the multi-skilled group was (-.57811), while for the non-skilled group the mean was (.32241). As can be seen from the summary in Table 6.7, four variables were found to discriminate between the two groups. The multi-skilled group perceived a greater degree of unit standardisation, and less freedom in decision-making regarding general and specific aspects of group functioning. However, at the job design level, the multi-skilled worker perceived a greater degree of authority in making job-related decisions. The relatively greater freedom to act given to the worker by his supervisor, when his job expertise is high, is

consistent with the view proposed by Hersey and Blanchard (1977) that effective leadership depends on the identification of the "task-relevant maturity", or competence, of the worker, and the degree of external control imposed on him. In the same vein, the multi-skilled worker (in the minority amongst team members) may have perceived the structure imposed on the group, and consistent with the task-relevant expertise of members, as inappropriate or excessive.

Neither "exceptions" nor "analysability" contributed towards the separation of the two groups. An examination of the two sets of means (Exceptions = 2.01; 2.00; $P > .05$, and Analysability = 2.32; 2.52; $P > .05$) indicate that the jobs of the multi-skilled workers did not change. This observation is supported by the results of a qualitative analysis on the tasks of all SPWs, which showed that the multi-skilled workers were not assigned more complex tasks to perform. Furthermore, the multi-skilled worker found it difficult to utilise his repertoire of skills. This was due to the design of tasks at the individual level, rather than the group level, and the slow frequency of job rotation within the units (only 19% of the multi-skilled workers felt that they were able to use to some extent the skills acquired in the plant). However, this situation appears not to have influenced the level of job satisfaction of the

TABLE 6.6

Discriminant Analysis.
Multi-Skilled Versus Not Skilled.
Group Means and Standard Deviations.

Variable	Classification Group			
	Multi-skilled (N =29)		Not Skilled (N = 52)	
	Mean	SD	Mean	SD
Exceptions	2.01	(.47)	2.00	(.64)
Analysability	2.32	(.50)	2.52	(.95)
Supervisory Authority	3.71	(.82)	3.90	(1.07)
Member Authority	2.91	(.80)	3.23	(1.20)
External Authority	3.90	(1.13)	3.88	(1.15)
Group Authority	3.23	(.92)	3.81	(1.09)
Unit Standardisation	3.35	(.93)	3.19	(1.07)
Role Interchangeability	2.58	(.52)	2.64	(1.11)
Job Authority	3.46	(1.07)	3.25	(.92)
Job Standardisation	3.29	(.76)	3.38	(.87)
Team Responsibility	44.20	(10.78)	53.02	(22.21)

TABLE 6.7

Results of Discriminant Analysis Summary Table					
Function	Eigenvalue	x2	df	Cannonical Correlation	P
1	.19110	13.45	4	.40	<.01

Step	Variable Entered	Wilk's Lambda	Probability
1	Group Authority	.929590	<.05
2	Unit Standardi- sation	.874772	<.01
3	Job Authority	.851931	<.01
4	Team Responsibi- lity	.839557	<.01

TABLE 6.8

Results of Discriminant Analysis Classification of Groups			
Actual Group	# of Cases	Predicted Group Membership	
		1	2
Multi-Skilled (1)	29	16 (55.2%)	13 (44.8%)
Not Skilled (2)	52	15 (28.8%)	37 (71.2%)

Overall "hit" rate = 65.43%

multi-skilled group, which was not significantly different from that of the other group (Multi-Skilled Group Mean =64.69; Not Skilled Group Mean = 68.94; $P > .05$).

6.5 Summary of Results

Eighteen months after the commencement of the multi-skilling programme in the plant, the following results were obtained:

- * Only a small proportion of SPWs (16%) had achieved multi-skilling training at an intermediate level of proficiency;
- * The frequency of job rotation was unsatisfactory due to a (i) shortage of trained personnel that would allow the interchange of tasks; (ii) pressure of work-flow management, and administrative problems associated with the assessment of trainees; (iii) interference from plant management; and (iv) unwillingness from some workers to participate in the project.

Another contributing factor was the way the jobs were designed, which did not allow for spontaneous job rotation to occur, in order to meet the demands of production, but relied mainly on planned transfers from one work area to another.

- * No technological change had resulted in the work of the multi-skilled worker, which remained to a large extent routine. However, the multi-skilled worker perceived greater freedom concerning the planning and execution of his tasks.

- * Some disillusionment with the programme, regarding the use of skills acquired in the plant, and the amount of work variety encountered by the worker, were also noted.

CHAPTER SEVEN

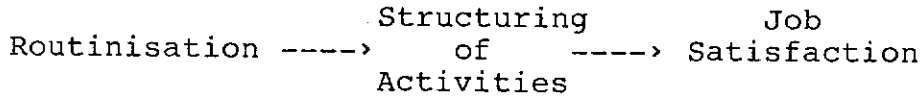
A PRELIMINARY ASSESSMENT OF THE FRAMEWORK

In Chapter 6 the results of the multi-skilling development in the organisation surveyed made it impossible to test the validity of the framework presented in Chapter 4. However, it was possible to test certain relationships among a number of variables, by pooling the data from all functional areas, and performing a number of statistical analyses.

7.1 Analyses

Correlational analyses were performed on the data. Two comparisons were made: (i) data were analysed at the subunit level (comprising 22 subunits from four different functional groupings); and (ii) at the individual level (N = 165). Also, using a series of multiple regressions, all measures were analysed at the individual level - including those that assessed unit characteristics, i.e. unit standardisation - in order to

identify the most powerful explanatory variables.
Specifically, the following associations were explored:



Consistent with the above framework it was Hypothesized (Hypothesis # 2) that the number of exceptions, and level of analysability in a unit are the best predictors for explaining the structuring of activities within a unit.

Also, it was suggested (Hypothesis # 4) that job satisfaction will be positively related to number of exceptions and level of analysability encountered during task performance.

Finally, it was hypothesized (Hypothesis # 1) that the acquisition of skills within a unit would be positively related to the level of exceptions and analysability encountered in the unit. Some results were presented previously (Chapter 6) that suggested such a relationship. This hypothesis will be tested further by using the entire sample.

Although Van de Ven and Morgan (1980) argued that some of the structuring of activities variables exhibit curvelinear relationships with the technological

variables, it was not possible to test this in this case. The number of exceptions, and level of analysability ranged from low to medium in the organisation surveyed. It was, therefore, appropriate to test for linear relationships.

7.2 Results

7.2.1 Zero-Order Correlations at the Unit Level. Table 7.1 shows the zero-order correlations between variables at the unit level of analysis. Subunit composite scores were computed for each variable by calculating the mean responses within each subunit. Of the 22 subunits identified in the plant, 19 were included in the analysis. The remaining 3 were excluded due to the small size of the subunit, and unsatisfactory response rate from the members of these subunits.

On examination, the correlations do not support the hypothesis that exceptions and analysability influence the structuring of activities within organisational units, and Hypothesis #2, therefore, is rejected. Exceptions is positively related to technical training

TABLE 7.1

ZERO-ORDER CORRELATIONS AMONG ALL VARIABLES
AGGREGATION OF DATA AT UNIT LEVEL

N = 19

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Exceptions (1)	-												
Analysability (2)	.64**	-											
Job Titles (3)	.16	.29	-										
Supervisory Auth.(4)	-.25	-.03	-.04	-									
Member Auth. (5)	-.31	-.17	-.03	.42	-								
External Auth. (6)	-.32	-.22	.09	.58**	.38	-							
Group Auth. (7)	-.31	-.15	-.06	.38	.86***	.49*	-						
Standardisation (8)	.06	-.01	.30	-.03	.10	.18	.24	-					
Role Interchang. (9)	-.12	-.21	-.63**	-.04	-.17	-.12	.07	.45	-				
Skill Heterogen. (10)	.13	.25	.69**	.02	.03	.21	-.01	-.44	-.70***	-			
Induction Train. (11)	.28	.05	.06	-.20	.17	-.06	.20	.60**	-.13	.31	-		
Technical Train. (12)	.49*	.17	.55**	-.37	-.16	-.20	-.21	-.03	-.60**	.66**	.47	-	
H & S Training (13)	-.51*	-.20	00	.22	.21	.53*	.28	.10	-.14	-.07	.67**	-.22	-
Satisfaction (14)	.14	-.26	.05	.17	.34	.30	.33	.25	-.07	.10	.69**	.31	-.36

* P<.05; ** P<.01; *** P<.001.

($r=.49$, $P<.05$), reflecting the degree of task variety, and the amount of training necessary in order to cope with it. Exceptions is also related negatively ($r= -.51$, $P<.05$) to health and safety training. The other technological variable, analysability, shows no significant associations with any of the other variables.

Variables dealing with the distribution of authority in the unit - i.e., supervisory authority, member authority, group authority, and external authority - show some strong association amongst themselves, but do not reach significant levels either with exceptions, or analysability, as was hypothesized, or with any of the other variables.

Three variables show strong positive associations amongst themselves: Number of job titles in the unit; skill heterogeneity; and technical training. Also, role interchangeability is negatively related to all three of the above variables (skill heterogeneity $r = -.70$, $P<.001$; technical training $r = -.60$, $P<.01$; and number of job titles in the unit $r = -.63$, $P<.01$). The above associations are as expected. For example, greater job specialisation, reflected in the number of titles in the unit, would be associated with greater variability in

skills, which would make role interchangeability more difficult to achieve.

Because of the strong intercorrelations among the three variables mentioned above, the relationships between sets of variables are spuriously high. When partial correlations were performed to control for the separate influence of the other two variables, the correlations between technical training and role interchangeability, and job titles and role interchangeability reached non-significant levels. However, skill heterogeneity was still significantly related to role interchangeability after controlling for technical training and job titles ($r = -.50, P < .05$; and $r = -.48, P < .05$ respectively). This result is consistent with the expected relationship between these two variables shown in Table 4.1.

An interesting result is the strong association ($r = .69, P < .01$) between job satisfaction and amount of induction training given to unit members on commencement of employment. Job satisfaction, however, is not related to any of the other variables as was hypothesized.

7.2.2 Zero-Order Correlations at the Individual Level.

Table 7.2 shows the intercorrelations among the technological variables of exceptions and analysability; the job design variables of job authority and job

standardisation; technical training; and job satisfaction, performed at the individual level (N = 165).

Both technological variables are significantly related to job standardisation, although the association between exceptions and job standardisation appears to be spurious given the high correlation between the two technological variables ($r = .46, P < .001$). Exceptions, however, is strongly related to technical training ($r = .28, P < .001$) - a result consistent with the analysis at the unit level - and Hypothesis # 1, therefore, that the intensity of technical training is related to the level of technological uncertainty is thus confirmed. Technical training, however, is not significantly related to analysability - the other technology variable - as was hypothesized.

The relationship between the technology variables (exceptions and analysability) and job satisfaction is not significant, and, therefore, hypothesis #4, that job satisfaction will show a positive relation with the number of exceptions and degree of analysability encountered during task performance, is rejected.

TABLE 7.2

Intercorrelations Among Selected Variables

At The Individual Level

N = 165

	(1)	(2)	(3)	(4)	(5)
Exceptions (1)	-				
Analysability (2)	.46***	-			
Job Authority (3)	.04	-.22**	-		
Job Standard. (4)	-.19*	-.50***	.17*	-	
Technical Tr. (5)	.28***	.11	-.07	-.14	-
Job Sat. (6)	.15	-.11	.27***	.28***	.00

Two-tailed test.

* P<.05; ** P<.01; *** P<.001

The results indicate that analysability is negatively related to job standardisation ($r = -.50, P < .001$), and job authority ($r = -.22, P < .01$), which in turn show a positive association with job satisfaction ($r = .27, P < .001$; and $r = .28, P < .001$, respectively). The strong association between job authority and job satisfaction ($r = .27, P < .001$) is consistent with the job design literature (Hackam & Oldham, 1975). However, the negative relationship between job authority and level of analysability ($r = -.22, P < .01$) is not as expected. Equally, the positive association between job standardisation and job satisfaction ($r = .28, P < .001$) is contrary to expectations. However, the negative relationship between analysability and job standardisation ($r = -.50, P < .001$) is consistent with the literature (Van de Ven & Morgan, 1980).

7.2.3 Multiple Regression. In order to determine accurately the relative contribution of the variables included in the analyses, a series of multiple regressions were performed with dependent variables exceptions and analysability (combined and separate), and job satisfaction.

The results of regression analyses (Table 7.3), at the individual level, with routinisation as the dependent variable, showed that job standardisation was a better predictor of the routinisation of work, than any of the other variables which were entered in the analysis, and accounted for 15% of the variance. When routinisation was broken down into the dimensions of exceptions and analysability, and separate stepwise multiple regressions performed, it was found that job standardisation accounted for 6% of the variance in exceptions and 25% of the variance in analysability. Further multiple regression analyses were performed, with various combinations of variables simultaneously entered in the analyses, in order to test the suitability of different models in predicting routinisation. The job design model, comprising job standardisation and job authority, was a better predictor ($F=21.49$, $P<.001$) than the combination of the structuring of activities variables (i.e. role interchangeability, unit standardisation and distribution of unit authority variables). This result is contrary to the suggestion illustrated in Figure 4.2 that shows the influence of technology to be primarily at the organisational unit level.

TABLE 7.3

STEPWISE REGRESSION ANALYSES					
<u>Variable</u> <u>Order</u>	<u>Beta</u>	<u>R</u>	<u>R</u> ²	<u>R</u> <u>Change</u>	<u>F</u>
<u>Routinisation</u>					
1.Job Standard.	-46582	38312	14678	14678	28.21**
2.Unit standard.	30904	45685	20871	06193	21.50**
3.External Auth.	-17757	48741	23757	02886	16.83**
<u>Exceptions</u>					
1.Unit Standard.	35756	22493	05059	05059	8.74*
2.Job Standard.	-28809	33851	11459	06400	10.55**
3.External Auth.	-23506	40641	16517	05058	10.68**
<u>Analysability</u>					
1.Job Standard.	-49568	49568	24570	24570	53.42**
<u>Job Satisfaction</u>					
1.Unit Standard.	30547	48877	23890	23890	51.48**
2.Member Auth.	24842	55793	31128	07238	36.84**
3.Role Interch.	21671	58385	34088	02960	27.93**
4.Job Auth.	18470	60892	37078	02990	23.72**

Notes: * P < .01; ** P < .001.

Underlined variables are dependent variables.

Decimals were omitted in the first four columns.

When a stepwise multiple regression was performed with job satisfaction as the dependent variable (Table 7.3), unit standardisation was found to be positively associated with job satisfaction, and explained 24% of the variance in that variable. The total amount of variance contributed by all the variables accounted for 37% of the variance, with member authority contributing 7%, and 3% apiece for role interchangeability and job authority. When different models were tested, by combining various groups of variables together with simultaneous entry, the results showed that the structuring of activities variables better explained job satisfaction ($F=14.34$, $P<.001$) than either the job design variables or the technology variables. This result is consistent with the framework illustrated in Figure 4.2.

In summary the following results were obtained:

- (i) The technology variables do not explain to a great degree the structuring of activities within units;
- (ii) Job satisfaction is not positively related to technological uncertainty, but to the perceived level of unit standardisation; and
- (iii) The acquisition of skills is positively related to technological uncertainty.

7.3 Discussion

In reviewing the findings from this study two methodological issues warrant consideration. The first concerns the problem of cross-level inferences where the same data yield widely varying statistics at different levels of aggregation. This is not simply an aggregation problem in which the association between two variables systematically varies at different levels, but an issue of homogeneous grouping which results in larger correlations for subunits than for individuals (Hammond, 1973). To minimise the possibility of drawing the wrong conclusions from results based on aggregate data, it is suggested that only those results that are consistent with individual level results should be considered. Notwithstanding these comments, it should be borne in mind that groups are qualitatively different from their individual members because of interactions among members, and differences between individual level measures and unit level measures should be expected.

The second issue relates to the simultaneous use of micro- and macro-level scales from perceptually based data that may be operationalising the same construct. Pierce and Dunham (1978) have suggested that measures of various constructs, such as structure and job design,

may be confounded by common measurement techniques, and they argue for independent and objective measures as verification that the constructs are conceptually different. Since perceptual measures were obtained for the majority of the various constructs in this study, caution should be exercised in interpreting the results of macro-level constructs.

The data from the correlational analysis (Table 7.1), and stepwise multiple regressions (Table 7.3), do not support the hypothesis (Hypothesis #2) that the number of exceptions and analysability of a unit's work are the "most important predictors for explaining the design of an organizational unit" (Van de Ven & Ferry, 1980:181). These two variables were not found to influence to any great degree the structuring of activities within the units. There were, however, important associations between these two contextual variables, and two variables at the job design level, that have implications for the development of a multi-skilled workforce in a unit.

The first variable, number of "exceptions", or degree of task variety encountered in the job, was found to be strongly related to technical training both at the unit level ($r=.49$, $P<.05$), and at the individual level of analysis ($r=.28$, $P<.001$). "Technical Training" at the plant represented a distinct kind of knowledge involving

special tools and techniques for dealing with various tasks, and requiring formal instruction. This type of training led to the acquisition of skills (usually marketable skills such as scaffolding), and was accomplished at an accelerated pace when the requirements of the job made it mandatory. The Day Process worker group, for example, a comparable group to the Shift Process group on commencement of employment, achieved an unanticipated high level of technical training. This had occurred even though the Day worker group was not involved in a formal multi-skilling programme at the time. If one were to identify the multi-skilled worker on the basis of the acquisition of technical skills, then the Day worker group would be the more skilled of the two. This type and level of training, as was mentioned earlier, did not occur on the basis of successful formal multi-skilling programme management, but due to the demands of work.

The second contextual variable, "analysability", however, was not related significantly to technical training. This may be due to the possibility that "technical training", as was operationalised in the present case, tapped the variety of tasks in the job, but not their level of difficulty to the same extent. This last characteristic would have been necessary for the emergence of a significant association between

technical training and analysability.

Analysability showed a strong relationship with "job standardisation" at the individual level of analysis ($r=-.50$, $P<.001$). Job standardisation affects the degree to which roles and tasks are spelled out in a job description, and rules and procedures are made precise (Van de Ven & Ferry, 1980). These constraints of course limit the potential for multi-skilling acquisition in a unit. The reverse is also true. Susman (1970:576) found, for example, that "work groups that are not restricted by exact job descriptions develop in an autonomous fashion with each member becoming multi-skilled".

Another set of variables that can potentially influence the extent of multi-skilling development in a unit are: Number of job titles in the unit; the degree of skill heterogeneity among team members and; amount of technical training given to team members. These variables were not related to the two technological dimensions. However, it may be that these variables are related indirectly to the technological variables through size, which affects the degree of specialisation, and the division of labour within a unit (Child & Kieser, 1981). This possibility, however, was not investigated further.

It was suggested that these three variables (job titles,

skill heterogeneity, and technical training) act to differentiate among members of the workgroup, and constrain the ease of role interchangeability in the unit. There is the possibility that a high level of differentiation and specialisation would impair group functioning, because of insufficient common ground among members, and lead to problems of communication, and those emanating from status differences (Hackman, 1978). On the other hand, too great homogeneity of skills, technical training, and job titles in a unit, could limit the learning opportunities of participants, because team members would not learn from one another, as the skill repertoire of each member overlapped. This is a potential problem for all multi-skilling programmes.

The distribution of unit authority variables - another group of variables that influence the extent of multi-skilling development in a unit (supervisory authority, external authority, member authority, and group authority) - were found to be highly intercorrelated. However, all the correlations were in the positive direction, pointing to some inconsistency in responses on first examination. For example, it would be reasonable to expect that decreases in supervisory authority would be reflected in increases in group

authority and vice versa; but according to Tannenbaum (1968) the amount of control in an organisation is not fixed, and that it can be decreased or increased so that all groups at the same time can gain or lose control. The exercise of power in organisations, therefore, cannot be seen as a "zero-sum game" always (Katz and Kahn, 1978:322). The argument is that when there is consensus regarding the pursuit of common goals we are dealing with a persuasive process, rather than a power struggle, so that all the participants gain an advantage. However, when groups are involved in a power struggle, because of conflicting interests, some groups gain power while others lose it. The distribution of unit authority variables were not found to be related to the two technological variables; but as Ovalle (1984:1057) points out the conceptual links between technology and control "have not been subjected to a systematic and empirical assessment." No clear evidence exists to justify the explanation that supervisory style varies predictably as a function of technology. Hage and Aiken (1969), for example, found no relationship between routinisation and discretion, suggesting that structure was dependent on supervisory style rather than on technological complexity. Similar results were obtained by Hrebiniak (1974). Also, Wall, Burnes, Clegg and Kemp (1984) have suggested that in terms of "autonomy and control social choice remains the critical factor" (p.17).

The relationship between job satisfaction and induction training at the unit level of analysis is interesting, although this association fails to reach significance at the individual level of analysis. The possibility that the result at the unit level may be spurious cannot be discounted. The strong association may be due to error in ecological correlations through homogeneous grouping of subjects. However, there is some theoretical basis for supporting the results, and the personnel management literature is rich with examples of dysfunctional consequences when proper induction procedures are denied to the new employee. Inadequate orientation is blamed for low morale (Holland and Curtis, 1972); anxieties about the new work environment (Mondy and Noe, 1984); high turnover (Flippo, 1976; Sloane, 1983); and failure to understand and support organisational change (Robinson and McCarroll, 1976).

The study population in the plant received a comprehensive induction programme, where the plant philosophy and objectives of the multi-skilling design effort were made clear. It is possible that the initial job expectations of the new recruits were raised, and this led to favourable attitudes towards their jobs (James & Jones, 1980; James & Tetrick, 1986). Co-worker socialisation may have acted also to reinforce these

impressions (O'Reilly and Caldwell, 1979; Weiss and Shaw, 1979; White and Mitchell, 1979). Also, the view that induction training can influence the perceptions of the trainees favourably is consistent with the growing literature dealing with the importance of beliefs and myths in the management of organisational change (Boje, Fedor and Rowland, 1982; Eden, 1986; King, 1974; Nystrom and Starbuck, 1984; Sproull, 1981).

The relationship between analysability and the two job design variables (job authority and job standardisation) warrants a few comments. The strong negative association between analysability and job standardisation ($r = -.50$, $P < .001$) is as expected. This is because rules governing the execution of the tasks cannot be specified in advance, as the task become increasingly difficult. Also, one would anticipate that under similar conditions a positive relationship between analysability and job authority would prevail. That is, as the task becomes more difficult the locus of authority would be delegated to the worker. However, the results show that in the organisation surveyed this was not the case ($r = -.22$, $P < .01$). Job authority is concerned with the latitude vested in the worker for determining what work to perform and in what order, as well as the establishment of rules and procedures for the execution of these tasks. A possible explanation for the inconsistent

results may be that, as Figure 5.1 indicates, a great percentage of employees (Tradesmen and Day Workers) were engaged in "breakdown" maintenance duties. These crisis situations may have acted to reduce the perceived control of the worker over the management of his tasks.

The results of the stepwise multiple regression with job satisfaction as the dependent variable, and the structuring of activities and technological variables as independent, found that unit standardisation explained 24% of the variance in job satisfaction. This result is in disagreement with job redesign efforts that assume a negative association between workers' perceived degree of structure and overall job satisfaction (see Snizek & Bullard, 1983 for review). However, there is evidence from some studies which suggests a positive relationship between formalisation of work procedures and job satisfaction (Green and Organ, 1973; Hickson, 1966). More recently, Snizek and Bullard (1983) reported the results of a longitudinal study which showed that employees' perceptions of increases in the standardisation of work procedures correlated positively with increases in job satisfaction. The theoretical justification for these results is based on the belief that lower role definition can bring anxiety because the individual is not able to rely on detailed direction from his superiors (Rizzo, House and Lirtzman, 1970). In the absence of written rules and procedures guiding work

activities, employees may experience role ambiguity, which was found to be associated negatively with job satisfaction (Jackson and Schuler, 1985).

Standardisation of procedures has the tendency to reduce role ambiguity, and in this way provide the employee with clarity and guidance about what is expected. These findings have implications for the successful management of multi-skilling, which relies, as in the present case, on frequent job transfers between different groups.

Although no significant association is reported in the literature between task variety - the result of multi-skilled training - and ambiguity (Jackson and Schuller, 1985), the practice of job rotation may heighten role ambiguity if this is involuntary and participative decision-making is minimal. Negative outcomes, such as increases in absenteeism and accidents, may result, as Gannon, Poole and Prangley (1972) found in an organisation where job rotation was carried out without consultation with the employee.

CHAPTER EIGHT

SUMMARY AND GENERAL CONCLUSIONS

Research on multi-skilling appears to have concentrated on describing the political aspects of its introduction (i.e, management-union negotiations, etc.), the new role requirements of management (and in particular the role of the supervisor), and the amount of discretion given to team members. However, the mechanisms necessary for the development of skills have been largely ignored. In this study an attempt was made to explore some of the subsystem and job design considerations that need to be taken into account in programmes of this kind. A framework was proposed that hypothesized a relationship between technological uncertainty and skill requirements. It was further hypothesized that technological uncertainty influences the structuring of activities within units (specialisation, role interchangeability, skill heterogeneity, and degree of centralisation of decision-making). These activities in

turn would either facilitate or restrict multi-skilling development, depending on the configuration of the relationships among these variables.

A preliminary test of the framework did not indicate that there was a pervasive technological influence to account for the structuring of activities within subsystems. Perhaps the most plausible conclusion that can be reached is that a combination of factors explain the structuring of activities in organisations, and that technology only indirectly affects them. For example, it was suggested that size may affect the degree of unit specialisation and, therefore, the division of labour (as can be inferred from the number of different job titles), and level of skill heterogeneity in the unit. This emphasises the need to look beyond the existing structure-contingency models, and to consider, in addition, size, the choices of stakeholders, and the influence of ongoing processes occurring within organisations that shape the structural properties of units (Bobbit and Ford, 1980; Hall, 1977).

Technology, however, was found to influence variables at the job design level. Job standardisation was negatively related to the level of task routinisation and in particular to "analysability"; while technical training showed a strong association with the other technological

dimension "exceptions". This result suggests a link between the degree of task routinisation and one pre-condition for the successful development of multi-skilling: decreases in job standardisation, which would create fluidity between different job boundaries, and accelerated technical training due to the demands of the task. On the basis of these results, therefore, this study emphasised the need to consider changes in the technological variables of exceptions and analysability, when planning for the introduction of multi-skilling programmes. This would obviate the problem of designing ineffective programmes that present the worker with a range of routine jobs to choose from, in the belief that the collective learning experiences from these jobs would constitute multi-skilling. The evidence that was presented here seems to suggest that skill development will progress at an accelerated pace, when the technological requirements are favourable.

However, other factors beyond the individual job level must be considered for the successful implementation of multi-skilling. Previous research (Van de Ven & Ferry, 1980) has suggested that a moderate level of technological uncertainty would also contribute to the desired configuration of structuring of activities, which would facilitate multi-skilling development. These include: (a) moderate levels of centralisation of

decision making; (b) low levels of skill heterogeneity; (c) high levels of role interchangeability; and (d) low levels of unit specialisation. However, it was not possible to establish the validity of the argument that the technological uncertainty being faced by the workers must be at a moderate level for multi-skilling development to occur, in this study.

When comparing groups where multi-skilling was formally introduced in the organisation surveyed, the following were also suggested as influencing the effectiveness of the programme:

- * The design of tasks at the group level, and the task-required interdependence necessary for the development of a multi-skilled workgroup;
- * A supportive administrative system, which would provide the mechanism for the assessment of skills, and offer guidance to line management;
- * Supervisors who "believe" in the programme; and
- * Workers who are willing to participate in multi-skilling training.

In addition changes in the work situation must include a "package of activities" that were found to facilitate the development of a multi-skilled workforce in the organisation. Some of these practices were outlined in the literature review, and include, among others, the abolition of demarcation restrictions, skill-based pay systems, and decentralisation of training.

Evidence was also presented which indicated that multi-skilling led to increases in the amount of discretion exercised by the worker. When multi-skilled workers were compared with workers who did not undertake such training, it was found that the multi-skilled workers had more discretion in their job. This flexibility is necessary in order to cope with the changes in the expanded task and, increase the control of the worker over the transformation process. This, of course, is consistent with the objectives of a multi-skilled programme, which aims at enhancing the motivational potential of the job (Oldham and Hackman, 1976).

However, no association was found between increased technological complexity - an outcome anticipated from multi-skilled programmes - and job satisfaction.

Instead, two practices were found that correlated with greater job satisfaction in the plant: (i) a comprehensive induction training programme offered to team members, and (ii) higher levels of unit

standardisation of policies and procedures. The first practice may be seen as raising the initial expectations of the workers, while the second establishes role clarity. Both are relevant for the successful management of change programmes and should be taken into account when implementing multi-skilling programmes.

Finally, a consideration emanating from this study was the need to apply more stringent evaluation criteria for multi-skilling acquisition. So far the literature reported results from the majority of multi-skilling evaluations that relied on perceptual data for drawing conclusions on the effects of multi-skilling programmes. Had the present study relied on data from interviews and observations, instead of objective data, it would have probably reached the conclusion - there was considerable consensus among the various stakeholders that the project was progressing smoothly - that multi-skilling development in the plant was at an advanced stage. However, the use of objective data from training records conclusively demonstrated that multi-skilling development was lagging behind 18 months after its introduction. Precise training criteria and learning objectives, procedures for assessing skill acquisition, and an administrative feedback system based on up-to-date information, therefore, are essential for the accurate assessment of multi-skilling in organisations.

There are certain limitations regarding this study. One is the reliance on cross-sectional data to study the effects of technology on the structuring of activities, which need to be examined developmentally for the derivation of cause-effect relationships (Child and Kieser, 1981). Another is the subject population which was taken from the same organisation. It is likely that the characteristics of the containing organisation had influenced the characteristics of its subjects, especially since a change programme was under way at the time. The results may be peculiar to the organisation studied, and therefore not able to be generalised. There was also the problem of obtaining measurement results on most variables that tended to be in the low to middle ranges. This of course precluded any thorough evaluation of the framework, which makes predictions that are curvilinear with regard to certain relationships. This would have necessitated measurement results that ranged from low to high on the scale.

Considerable interest has been shown in recent years in Australia and overseas regarding the implementation and management of multi-skilling programmes. There is a need, therefore, to make precise the conditions under which multi-skilling development takes place. It was suggested in this study that multi-skilling represents a special case of job redesign. It also involves specific

changes being made to a subsystem with regard to the structuring of activities. However, as was mentioned earlier, research in the area of multi-skilling has concentrated on certain contextual and procedural factors that were found to facilitate multi-skilling development. This was done to the exclusion of technology, job design issues, and those concerned with modifications to the structuring of activities within a subsystem. Future research on multi-skilling needs to address these central issues, and provide practitioners with clear guidelines in these areas for the design of effective multi-skilling programmes.

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APPENDIX I

GENERAL INSTRUCTIONS FOR ANSWERING THE QUESTIONNAIRE

Most of the questions ask you to circle one of several numbers that appear on a scale below the item. Corresponding with each number on a scale is a brief description of what the number represents. You are to circle the one number that most accurately reflects your answer to each question. For example, if your answer to the following question is "Very Much", circle the number "5" on the answer scale.

Q. Did you feel like coming to work today?

Not At All	Just A Little	Not Sure Sure	Quite A Bit	Very Much
1	2	3	4	5

SECTION A

THIS FIRST SECTION ASKS YOU SOME BACKGROUND DETAILS ABOUT YOURSELF. PLEASE REMEMBER THAT ALL THIS IS TREATED CONFIDENTIALLY. YOUR NAME IS NECESSARY FOR US TO BE ABLE TO COMPARE YOUR VIEWS TODAY WITH HOW YOU SAW THINGS WHEN YOU FILLED OUT THE LAST QUESTIONNAIRE.

Q.1 PERSONAL DATA

- a) Name:
- b) Age:
- c) Sex (m/f):
- d) Job Category:
- e) Centre (A or B):
- f) Shift or Days?
- g) Shift Number:
- h) When did you start work at [this company]?
(Give month and year).
- i) How long have you been in your current job?
- j) Have you ever worked at another [this company] plant? No:___ Yes:___
- k) If "Yes" please specify.

Q.4 How many of the tasks in your current job are the same from day to day?

Very Few	A Few	About half Of Them	Quite A Few	Most Of Them
1	2	3	4	5

Q.5 To what extent is there a clearly known way to do the major types of work you normally encounter?

To No Extent	Little Extent	Some Extent	Great Extent	Very Great Extent
1	2	3	4	5

Q.6 To what extent would you say your work is routine?

To No Extent	Little Extent	Some Extent	Great Extent	Very Great Extent
1	2	3	4	5

Q.7 To what extent is there a clearly defined body of knowledge which can guide you in doing your job?

To No Extent	Little Extent	Some Extent	Great Extent	Very Great Extent
1	2	3	4	5

Q.8 People in this team do about the same job in the same way most of the time.

Very Seldom	Some- times	About Half The Time	Quite Often	All The Time
1	2	3	4	5

Q.9 To do your work, to what extent can you actually
rely on established procedures and practices?

To No Extent	Little Extent	Some Extent	Great Extent	Very Great Extent
1	2	3	4	5

Q.10 Basically, team members perform repetitive
activities in doing their jobs.

To No Extent	Little Extent	Some Extent	Great Extent	Very Great Extent
1	2	3	4	5

Q.11 To what extent is there an understandable sequence
of steps that can be followed in doing your
work?

To No Extent	Little Extent	Some Extent	Great Extent	Very Great Extent
1	2	3	4	5

Q.12 How repetitious are your duties?

Very Seldom	Some- times	About Half The Time	Quite Often	All The Time
1	2	3	4	5

Note: Exceptions = Items 4,6,8,10,12. } Reverse
Analysability = Items 5,7,9,11. } Scale

SECTION C

THIS SECTION IS CONCERNED WITH THE WAY THE JOB THAT YOU CURRENTLY DO IS STRUCTURED.

Q.13 How many written rules and procedures exist for doing your major tasks in your current job?

Very Few If Any	A Small Number	A Moderate Number	A Large Number	A Great Number
1	2	3	4	5

Q.14 How precisely do these rules and procedures specify how your major tasks are to be done?

Very General	Mostly General	Somewhat Specific	Quite Specific	Very Specific
1	2	3	4	5

Q.15 When considering the various situations that arise in performing your current job, what percent of time do you have written or unwritten procedures for dealing with them?

PER CENT OF TIME

0-20%	21-40%	41-60%	61-80%	81-100%
1	2	3	4	5

Q.16 To what extent did you follow standard operating procedures or practices to do your major tasks the past three months?

To No Extent	Little Extent	Some Extent	Great Extent	Very Great Extent
1	2	3	4	5

Q.17 How clearly do you know what level of work performance is expected from you (in terms of amount, quality, and when it is required)?

Never	Seldom	Occasi- onally	Often	Always
1	2	3	4	5

Q.18 How clearly does your job description specify the standards on which your performance is evaluated?

No Job Description	Does Not State	Very General	Quite Clear	Very Clear & Precise
1	2	3	4	5

Q.19 Listed below are four common decisions about your work. How much authority do you have in making each of the following decisions about your work?

AMOUNT OF AUTHORITY I HAVE
IN EACH DECISIONS

None Little Some Quite A Bit Very Much

- | | | | | | | |
|----|--|---|---|---|---|---|
| a) | Determining what tasks I will perform from day to day? | 1 | 2 | 3 | 4 | 5 |
| b) | Setting quotas of how much work I have to complete? | 1 | 2 | 3 | 4 | 5 |
| c) | Establishing rules and procedures about how my work is to be done? | 1 | 2 | 3 | 4 | 5 |
| d) | Determining how out-of-the-ordinary work situations are to be handled? | 1 | 2 | 3 | 4 | 5 |

Note: In questions 20-22 (inclusive) items (a) represent Member Authority; (b) Supervisory Authority; (c) Group Authority; and (d) External Authority.

SECTION D

THIS SECTION IS CONCERNED WITH THE WORK TEAM TO WHICH YOU BELONG, THE AMOUNT OF INFLUENCE THE TEAM HAS, AND THE WAY YOU SEE THE TEAM CONCEPT OPERATING IN PRACTICE.

Q.20 How much say or influence do each of the following have in deciding what kinds of work or tasks are to be performed in your team?

		<u>AMOUNT OF SAY IN DECIDING TEAM'S WORK</u>				
		None	Little	Some	Quite A Bit	Very Much
a)	Team members individually?	1	2	3	4	5
b)	Your coordinator?	1	2	3	4	5
c)	Your coordinator and members as a group in team meetings?	1	2	3	4	5
d)	People in line management or staff positions outside of your immediate work team? (e.g. managers or engineers).	1	2	3	4	5

Q.23 To what extent is your team given responsibility for performing the following tasks?
(All items reverse scale).

RESPONSIBILITY GIVEN

	Sole Responsi- bility	A Good Deal	Moderate Amount	Just A Little	None
a) Deciding who does what job each day.	1	2	3	4	5
b) Counselling individual team members (e.g. over absence).	1	2	3	4	5
c) Ordering stores and supplies.	1	2	3	4	5
d) Disciplining individual team members.	1	2	3	4	5
e) Arranging cover for absence within the team.	1	2	3	4	5
f) Scheduling rotation through the work areas.	1	2	3	4	5
g) Deciding whether overtime is needed.	1	2	3	4	5
h) Planning and scheduling team development activities.	1	2	3	4	5
i) Recruiting and selecting new team members.	1	2	3	4	5

(QUESTION CONTINUED NEXT PAGE)

(QUESTION 23 CONTINUED)

RESPONSIBILITY GIVEN

	Sole Responsi- bility	A Good Deal	Moderate Amount	Just A Little	None
j) Deciding which team members need technical training.	1	2	3	4	5
k) Arranging technical training for team members.	1	2	3	4	5
l) Organising and conducting team meetings.	1	2	3	4	5
m) Setting targets, and standards for work performance.	1	2	3	4	5
n) Solving local production problems.	1	2	3	4	5
o) Evaluating skills gained by team members through training.	1	2	3	4	5
p) Monitoring safety and dealing with safety issues.	1	2	3	4	5
q) Organising times for breaks.	1	2	3	4	5
r) Deciding who stays back to do overtime.	1	2	3	4	5
s) Arranging cover for leave.	1	2	3	4	5

SECTION E

THIS SECTION IS CONCERNED WITH THE WAY YOUR TEAM AS A WHOLE IS ORGANISED TO DO ITS WORK AND ACHIEVE ITS PERFORMANCE GOALS.

Q.24 Overall, how clearly have specific performance targets been set for your team?

No Targets Were Set	Targets Are Very Unclear	Targets Are Some- what Clear	Targets Are Quite Clear	Targets Are Very Clear
1	2	3	4	5

Q.25 How specific or general are the rules, policies, and procedures in your team for coordinating and controlling the work activities of all team personnel?

There Are No Set Rules, Policies, Or Procedures	Very General	Somewhat Specific	Quite Specific	Very Specific
1	2	3	4	5

Q.26 How often do you think you and your fellow team members have tended to ignore these rules, policies or procedures during the past three months?

Not Once	Very Seldom	About Half The Time	Quite Often	All The Time
1	2	3	4	5

(Reverse Scale)

Q.27 How strictly are these operating rules, policies, or procedures enforced in your team?

Not At All Enforced	Very Loosely Enforced	Somewhat Strictly Enforced	Quite Strictly Enforced	Very Strictly Enforced
1	2	3	4	5

Q.28 During the past three months, how many other people in your team have worked in the same job that you are currently working in?

None	Only One	A Few Others	Most Others	All Others
1	2	3	4	5

Q.29 How many other people in your team are qualified to do the same job that you are currently doing?

None	Only One	A Few Others	Most Others	All Others
1	2	3	4	5

Q.30 How easy would it be to rotate the jobs between your team members, so that each could do a good job performing anyone else in the team's tasks?

Very Diff- icult. Most Members Would Need Extensive Retraining	Quite Diff- icult. Some Members Would Need Extensive Retraining	Somewhat Difficult. A Few Members Would Need Retraining	Quite Easy Some Members Would Need Minor Retraining	Very Easy. No Members Would Need Re- training
1	2	3	4	5

Q.31 During the past three months, how often did you rotate to other jobs within your operating centre?

Not Once	About Once Every Month	About Once Every Week	About Every Day	About Every Hour
1	2	3	4	5

Q.32 a) Have you been able to rotate through the different jobs in your operating centre as often as you would have liked?

(Tick One) Yes: __ No: __

b) If not, why not?

SECTION F

Q.33 The following set of questions ask you how satisfied or dissatisfied you are with [the organisation surveyed] as a whole. Circle the number beside each question which best expresses your view.

The following scale will help you express the strenght of your attitude.

-
- 1= I'm extremely dissatisfied
2= I'm very dissatisfied
3= I'm moderately dissatisfied
4= Neither satisfied nor dissatisfied
5= I'm moderately satisfied
6= I'm very satisfied
7= I'm extremely satisfied
-

DEGREE OF
DISSATISFACTION.....SATISFACTION

HOW SATISFIED ARE YOU WITH:

Circle one number beside each question.

- | | | | | | | | |
|---|---|---|---|---|---|---|---|
| a) Physical work surroundings? | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| b) The freedom you get to choose your own methods of working? | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| c) Your fellow workers? | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| d) The recognition you get for good work? | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| e) The supervision you receive from your coordinator? | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| f) The amount of responsibility you are given? | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| g) The opportunity to use your abilities? | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

(QUESTION CONTINUED NEXT PAGE)

(QUESTION 33 CONTINUED)

-
- 1= I'm extremely dissatisfied
 - 2= I'm very dissatisfied
 - 3= I'm moderately dissatisfied
 - 4= Neither satisfied nor dissatisfied
 - 5= I'm moderately satisfied
 - 6= I'm very satisfied
 - 7= I'm extremely satisfied
-

DEGREE OF
DISSATISFACTION.....SATISFACTION

HOW SATISFIED ARE YOU WITH:

h) Your chance of promotion?	1	2	3	4	5	6	7
i) The way the plant is managed?	1	2	3	4	5	6	7
j) The attention paid to suggestions you make?	1	2	3	4	5	6	7
k) Your hours of work?	1	2	3	4	5	6	7
l) Relations between management and unions at this plant?	1	2	3	4	5	6	7
m) Your job security?	1	2	3	4	5	6	7
n) The amount of variety in your work?	1	2	3	4	5	6	7
o) Your rate of pay?	1	2	3	4	5	6	7
p) Recreational and social facilities?	1	2	3	4	5	6	7
q) Shift working arrangements?	1	2	3	4	5	6	7
r) The technical training you receive?	1	2	3	4	5	6	7
s) The team-development training you receive?	1	2	3	4	5	6	7
t) The opportunity you have to broaden your range of skills?	1	2	3	4	5	6	7

APPENDIX II

COORDINATORS' QUESTIONNAIRE

THE FOLLOWING TEN QUESTIONS DEAL WITH THE EXTENT OF ROUTINISATION OF WORK WITHIN YOUR WORK UNIT.

Q.1 How many of the tasks in the team under your control are the same from day to day?

Very Few	A Few	About half Of Them	Quite A Few	Most Of Them
1	2	3	4	5

Q.2 To what extent is there a clearly known way for your team members to do the major types of work they normally encounter?

To No Extent	Little Extent	Some Extent	Great Extent	Very Great Extent
1	2	3	4	5

Q.3 To what extent would you say the work of your team members is routine?

To No Extent	Little Extent	Some Extent	Great Extent	Very Great Extent
1	2	3	4	5

Q.4 To what extent is there a clearly defined body of knowledge which can guide your team members in doing their job?

To No Extent	Little Extent	Some Extent	Great Extent	Very Great Extent
1	2	3	4	5

Q.5 To what extent is there an understandable sequence of steps that can be followed by your team members in carrying out their work?

To No Extent	Little Extent	Some Extent	Great Extent	Very Great Extent
1	2	3	4	5

Q.6 People in the team under my control do more or less the same job in the same way most of the time.

Very Seldom	Some- times	About Half The Time	Quite Often	All The Time
1	2	3	4	5

Q.7 To do their work, to what extent can your team members actually rely on established procedures and practices?

To No Extent	Little Extent	Some Extent	Great Extent	Very Great Extent
1	2	3	4	5

Q.8 Basically, team members in my unit perform repetitive activities in doing their jobs.

To No Extent	Little Extent	Some Extent	Great Extent	Very Great Extent
1	2	3	4	5

Q.9 To what extent is there an understandable sequence of steps that can be followed by your team members in doing their work?

To No Extent	Little Extent	Some Extent	Great Extent	Very Great Extent
1	2	3	4	5

Q.10 How repetitious are the duties of your subordinates?

Very Seldom	Some-times	About Half The Time	Quite Often	All The Time
1	2	3	4	5

THIS QUESTION DEALS WITH THE INTERNAL FLOW OF WORK BETWEEN YOUR IMMEDIATE SUBORDINATES. LISTED AND DIAGRAMMED BELOW ARE FOUR COMMON WAYS THAT THE WORK PERFORMED IN YOUR SECTION CAN FLOW BETWEEN YOUR IMMEDIATE SUBORDINATES. (YOU, AS THE COORDINATOR, SHOULD CONSIDER YOURSELF OUTSIDE THE BOXES BELOW).

Q.11 Please indicate how much of the normal work in your section flows between your immediate subordinates in a manner as described by each of the following cases:

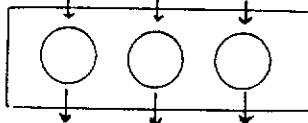
HOW MUCH WORK NORMALLY FLOWS BETWEEN MY IMMEDIATE SUBORDINATES IN THIS MANNER

ALMOST NONE OF THE WORK	LITTLE	ABOUT 50% OF ALL THE WORK	A LOT	ALMOST ALL OF THE WORK
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a) Independent Work flow case, where work activities are performed by your immediate subordinates separately and do not flow between them?

1	2	3	4	5
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Work Enters Section



Work Leaves Section

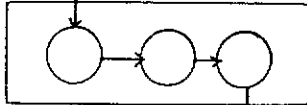
HOW MUCH WORK NORMALLY
 FLOWS BETWEEN MY IMMEDIATE
 SUBORDINATES IN THIS MANNER

ALMOST NONE OF THE WORK	LITTLE	ABOUT 50% OF ALL THE WORK	A LOT	ALMOST ALL OF THE WORK
-------------------------------	--------	---------------------------------	-------	------------------------------

b) Sequential work flow case, where work and activities flow between your immediate subordinates, but mostly in only one direction?

1	2	3	4	5
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Work Enters



Work Leaves

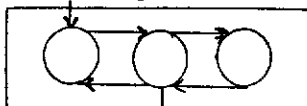
HOW MUCH WORK NORMALLY
 FLOWS BETWEEN MY IMMEDIATE
 SUBORDINATES IN THIS MANNER

ALMOST NONE OF THE WORK	LITTLE	ABOUT 50% OF ALL THE WORK	A LOT	ALMOST ALL OF THE WORK
-------------------------------	--------	---------------------------------	-------	------------------------------

c) Reciprocal work flow case, where work activities flow between your immediate subordinates in a back-and-forth manner over a period of time?

1	2	3	4	5
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Work Enters



Work Leaves

THE FOLLOWING TWO QUESTIONS DEAL WITH THE FREQUENCY AND ABILITY OF YOUR SUBORDINATES TO ROTATE THEIR JOBS.

Q.12 During the past three months, how often did your immediate subordinates rotate their jobs within your operating centre?

Not Once	About Once Every Month	About Once Every Week	About Every Day	About Every Hour
1	2	3	4	5

Q.13 a) Have your immediate subordinates been able to rotate through the different jobs in your operating centre as often as they would have liked?

(Tick One) Yes:___ No:___

b) If not, please explain the reasons why this is not happening.
