Towards a new approach to job design research within modern manufacturing:

The investigation of employee work orientations

Sharon Kaye Parker

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Summary

In this thesis it is argued that examining the work orientations' of shopfloor employees represents a new and much needed dimension to contemporary job design research. This focus arises from developments in manufacturing where, to attain a competitive advantage, organisations are increasingly introducing various new initiatives. Successful implementation of these initiatives, collectively referred to as 'Integrated Manufacturing' (IM), is deemed to require change in employee work orientations.

Two main propositions were investigated in a series of field studies. The first is that the change required in work orientations (i.e. the development of broader, more proactive, and strategic orientations) is contingent upon the introduction of autonomous forms of work design. Considerable support for this proposition was found. In an initial study, employees within a traditional company had narrow orientations and this appeared to be, at least in part, a product of their simplified jobs. In the second study, where an IM initiative was introduced without concomitant change to job control, there was no change in employees' orientations. In the third and fourth studies, cross-sectional and longitudinal evidence, respectively, was presented to suggest that introducing IM with enhanced autonomy results in the development of new and more appropriate orientations.

The second research proposition is that, within autonomous IM settings, employees with broader, more proactive orientations will be better performers. This was investigated in the final study using supervisors' ratings and skills scores as measures of performance. Orientations were shown to consistently predict scores on these indices, and change in one orientation measure predicted change in supervisors' ratings.

An exploratory aim of the thesis was to investigate the influence of non job design factors on work views. Drawing mostly on qualitative data, organisational factors (e.g. payment methods) and personal factors were found to influence the development of orientations.

Implications of the findings are discussed in relation to both job design research and issues in modern manufacturing.

Papers and publications arising

Parker, S. K. (1993). The development of measures assessing employees' orientations within manufacturing contexts. SAPU Memo No. 1417.

Parker, S. K. and Jackson, P. R. (1993). The implementation of high performance work teams. In D. Gowler, K. Legge, and C. Clegg (Eds.) Case Studies in Organisational Behaviour and Human Resource Management (2nd Edition) p. 42-56. London: Paul Chapman Publishing.

Parker, S. K. and Jackson, P. R. (1992). Product-based manufacturing: Some issues for implementation. Report for a collaborative DTI funded project with the Institute of Occupational Ergonomics, Nottingham: Human Factors and the Management of Change in Small Manufacturing Organisations. SAPU memo No. 1428.

Parker, S. K., Jackson, P. R. and Wall, T. D. (1993). Autonomous group working within integrated manufacturing: A longitudinal investigation of employee role orientations. In G. Salvendy and M. J. Smith (Eds.) Human-Computer Interaction: Application and Case Studies. p. 44-49. Amsterdam: Elsevier Publishers, B.V.

Parker, S. K., Mullarkey, S. and Jackson, P. R. (in press). Dimensions of performance effectiveness in high-involvement work organisations. Human Resource Management Journal.

Parker, S. K., Wall, T. D. and Jackson, P. R. (in press). Job design and work orientations in modern manufacturing: A comparative case study. Ergonomics for All. Proceedings of the Annual Ergonomics Conference. London: Taylor and Francis.

Jackson, P. R. and Parker, S. K. (1993). The implementation of high-performance work-teams: Teaching Guide. In D. Gowler, K. Legge, and C. Clegg (Eds.) Case Studies in Organisational Behaviour and Human Resource Management: Teaching Guide. London: Paul Chapman Publishing.

Jackson, P. R., Mullarkey, S. and Parker, S. K. (in preparation). The implementation of high-involvement work teams: A four-phase longitudinal study .

Norman, P. and Parker, S. K. (in press). The interpretation of change in verbal responses: Implications for health psychology. Psychology and Health.

Reports and advice to organisations

Parker, S. K. (1991, 1992). Evaluation of Employees' Orientations: Results From A Supplementary Survey. Electronics company, Leicester.

Parker, S. K. (1992). Improving Work Practices: Workshop Notes. Booklet designed for set-up reduction time project at an Engineering company, Dronfield.

Parker, S. K. and Wall, T. D. (1992). Evaluation of Manufacturing Initiatives: Survey Results and Recommendations. Chemical Processing company, Newport.

Parker, S. K. and Wall, T. D. (1992). Evaluation of Cellular Manufacturing: Survey Results and Recommendations. Engineering company, Dronfield.

Jackson, P. R., Mullarkey, S. and Parker, S. K. (1992, 1993). Evaluation of Product-lines and Just-in-time: Results and Recommendations from a Survey. Electronics company, Leicester.

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When I began this PhD, I had the naive view that it was just a 'means to an end'; the end being a chance for an extended holiday in another country for three years. But, like some of the shopfloor employees I discuss in this thesis, my orientation has 'developed' since then and has undergone some dramatic changes. For one thing, a PhD is definitely not a holiday!

It is also an 'end' in itself, and I would like to thank several people who have helped me to reach the (almost) end:

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Chapter 1: Overview

1.0 Introduction

This chapter contains an outline of the general research area and aims, and the content and structure of the thesis. The aim of this description is two-fold. First, it is intended to orient the reader to the text that follows by providing an overall picture of the research. This facilitates the reading of more detailed chapters. Second, the description serves to introduce the aims and propositions that drive the thesis, and thus to direct the reader's attention to key issues.

1.0.1 Research area and aims

At a broad level, this thesis is an investigation of how work is designed within manufacturing settings, and the consequences of these designs for employee well being and organisational productivity. The overarching aim is to put forward and examine a new dimension to job design research that is appropriate to recent changes occurring within manufacturing. Basically, this involves examining employees' orientations to their work as an outcome of enhanced job control, and as a predictor of individual performance.

The rationale for the focus on orientations can be tracked back to the start of the century when Frederick W. Taylor's highly influential 'Scientific Management' was developed. Along with the systematic simplification of work into small tasks, this approach required:

> a complete change in the mental attitude of the working men as well as those of the side of management, toward each other, and toward their respective duties and responsibilities (Taylor, 1911, p. 31).

This "complete mental revolution" (Taylor, 1912, p. 26-7) basically involved workers seeing it as their job to perform the narrow, manual tasks that management precisely "planned out". Management, on the other hand, had to do this planning (down to "complete written instructions, describing in detail the task which he is to accomplish, as well as the means to doing his work", Taylor, 1911, p. 28), along with the problem-solving and all other mental aspects of the work. In many cases, Taylor's intentions seem to have been realised, and workers in traditional jobs have narrow orientations. Davis and Wacker (1987) refer to this as 'job myopia' or an 'it's not my job' mentality where workers define their job in terms of a set of rigid and limited tasks. To illustrate this, consider these comments from operators within a traditional company:

> All I know is what I'm trying to achieve like, and once I've done my job then its on to the next person and I lose contact with it, you know.
>
> Well, I'm responsible for what comes off of machine. Its got to be right off of machines. Its got to be right off the miller. Well, its got to be right to finish it when I put it on't floor.

These workers' orientations focus almost entirely around producing and other strategic goals are not of concern to them. For example, consider this operator's answer to a question about ideas for improving quality:

> Well, I've never really thought about it actually, you know, until you really asked me about it. We never get involved in anything like that so.... Yeah, I suppose they could do, if they really had a good look at it like, you know what I mean, but we never get involved in that type of thing. We just do our job and that's it.

Moreover, operators seem to accept this situation and see little opportunity for change, suggesting a degree of 'learned helplessness' (Seligman, 1975):

> I say I get fed up sometimes, you know, but you just have to put with that, and I just carry on, me, just plod on, you know what I mean? I think you get into work, you get that feeling that you just keep coming everyday and you think, 'Oh, clock in, do my job, clock out, and that's it like,' you know... just come and do my job, that's what I'm paid to do anyway.

However, herein lies the problem. Such narrow and passive orientations are increasingly being recognised as inappropriate within modern manufacturing contexts. That is, it can be seen that the demands of manufacturing within a changing economic and technological environment require a new 'mental revolution' on the part of shopfloor people. It is proposed that employees now need to develop an alternative set of 'working rules' (Oliver and Davies, 1990) where they have broader and more strategic views of their roles and the wider work environment. As Wood (1989, p. 11) claims:

> We are witnessing the new flexibly specialised firm which can quickly respond to sudden changes in costs, market opportunities and/or new technologies, through adopting flexible, multi-purpose equipment and creating an flexible, re-integrated and co-operative workforce *free of the shackles of rigid job specifications, narrow job-centred orientations and excessive regulation and control* (italics added).

The process of moving away from 'narrow job-centred orientations' is investigated within this thesis. Most importantly, it is argued that enhancing the control that shopfloor employees have over their work (i.e. introducing autonomous forms of work design) enables and facilitates the development of new orientations which, in turn, are necessary for effective performance within modern manufacturing. The core aims of this thesis are thus to examine how the design of work affects people's orientations within modern manufacturing, and to examine the relationship between orientations and performance in such contexts. Addressing these questions is argued to be critical for job design research, both in extending it beyond its existing narrow framework, and in ensuring that it keeps pace with the rapidly changing nature of manufacturing.

More detail about the rationale behind these aims, and how they are explored within this thesis, is given next.

1.1 Overview of thesis content and structure

1.1.1 The domain of job design and some key terms

The starting point for any discussion of job design is usually that of work simplification (also referred to as Taylorism). Stemming from the principles of division of labour espoused by early economists (notably Smith, 1776[1974] and Babbage, 1835) and the principles of Scientific Management put forward by Frederick Taylor (1911), a 'good' and 'efficient' job from this perspective is one that is standardised, simplified, and specialised. However, partly spurned by research that showed the negative effects of such simplified jobs on workers' attitudes and behaviours, some departures from Taylorism took place in the 1950's and 1960's. These were guided by approaches to the design of work with different views of a 'good' job. Behavioural approaches, derived mostly from Herzberg's Two Factor Theory (Herzberg, 1966, 1968) and the Job Characteristics Model (Hackman and Oldham, 1976), aim to create work that "achieves high work productivity without incurring the human costs that are associated with traditional approaches" (Hackman and Oldham, 1980, p. 52). Systems approaches, notably the Socio-Technical Systems Theory (Emery, 1959; Trist, Higgins, Murray and Pollack, 1963), focus on the network of jobs that exist within larger organisational social and technical systems.

Chapter 2 contains a chronological account of these alternative ways of designing jobs. All of these approaches, albeit from different perspectives, are concerned with the structure of work within the organisation, or the work design. This generic term is used interchangeably with that of job design to refer to the focus on how jobs are structured. However, when behavioural or systems approaches are adopted, the more specific term of job redesign (or work redesign) is appropriate. The 're' describes the deliberate attempt to change jobs to make them less simplified. Davis (1966, p. 21) define this as:

> The specification of the contents, method, and relationships of jobs in order to satisfy technological and organisational requirements as well as the social and personal requirements of the job holder.

However, as will be shown in *Chapter 2*, these job redesigns (or 'departures from Taylorism') have historically been limited in scope and application. Work simplification continued to be pervasive, and can essentially be considered as the 'backcloth' against which job redesign occurs. As shall be described next, it is also the backdrop from which theory is stimulated.

1.1.2 Job design research and theory: a narrow focus

Alongside the description of job design approaches, *Chapter 2* contains a description of job design research. Broadly, this is concerned with investigating the premise that more complex jobs with greater job control improve employees' quality of working life and their productivity. Job design research has been described as "the quest to test these assumptions empirically, to examine their general validity, and determine the limits within which they operate" (Wall and Martin, 1987, p. 63). Initially, studies focused on investigating the negative effects of Taylorised jobs on people's behaviour, mental health, and perceptions. Over time, this research became more theoretical and increasingly proactive (i.e. recommendations for 'good' jobs were made). Two key models were put forward: a behavioural approach - the Job Characteristics Model of job enlargement (JCM: Hackman and Oldham, 1976, 1980); and a systems approach, the Socio-technical Systems Theory of group working (Emery, 1959; Trist *et al.* 1963). Basically, the JCM posits that jobs with certain characteristics (such as high autonomy) lead to motivated workers who put in greater effort, who are absent less often, and who are more satisfied with their work than employees in simplified jobs. The STS approach emphasises devolving control to work groups to enable the 'joint optimisation' of both the technological and social aspects of work.

The major drawback with these models is their narrowness; a problem that characterises job design research in general. This argument is made in *Chapter 2,* and it is suggested that the limited focus of job design theory is a result of its emergence from work simplification. That is, there is an interplay between theory and practice. To some degree, theories have stimulated practice; but to a greater degree, the reverse has been true and job design theory can be characterised as a reflection of, or reaction to, dominant job design practice (i.e. work simplification). As such, research has tended to focus on motivational outcomes and mechanisms, such as people's affective reactions to jobs (e.g. their satisfaction and well-being) and, in terms of productivity, their absence and turnover. Other less 'reactive' variables, such as development and learning, have received little attention either as outcome variables or as potentially important predictors of performance enhancement.

These inadequacies of job design research are highlighted by the new forms of work organisation required within modern manufacturing. That is, a change in the requirements for job design practice brings with it a need for parallel change in theory. Restricting the questions to those addressed in existing models, which derived from a particular set of practices, will no longer be sufficient.

1.1.3 New forms of work organisation in manufacturing

The last decade has seen the emergence of a 'new manufacturing paradigm' (Dean and Snell, 1991; Gunn, 1987; Hayes, Wheelwright and Clark, 1988; Schonberger, 1986). In order to provide customised and higher quality products more rapidly, and to fully utilise programmable technologies, organisations are increasingly adopting new manufacturing practices. *Chapter 3* contains a description of these initiatives, collectively referred to as 'Integrated Manufacturing' (IM), and their implications for shopfloor work design and operator roles. It is argued that IM enhances the information processing requirements of tasks, and thus requires highly skilled and knowledgeable shopfloor employees. As such, team-based jobs with operator control are argued to be the ideal form of shopfloor work organisation within IM. Not only does enhanced job control allow operators to quickly and efficiently deal with the increased information processing demands, but it also facilitates the development in skills, knowledge, and orientations needed for effective performance.

More specifically, it is argued that within IM contexts operators will be expected to take on a new role where they perform a range of tasks, solve problems across many domains, make decisions for themselves, and work effectively in a team. These requirements differ radically from the traditional, Taylorist system, where a 'good' worker is typically one who consistently performs his/her standard set of prescribed, narrow tasks. It is thus suggested that employees in IM contexts will need to develop an orientation to their work that is consistent with the new requirements. Some case study evidence is presented to support this claim. This then lays the groundwork for the next chapter which presents the examination of employee orientations as a much needed new dimension to job design research and theory.

1.1.4 Orientations: A new research dimension

As suggested above, examining orientations as an outcome variable and as a predictor of performance will be informative within IM contexts. This approach differs from existing job design research as it does not focus entirely on people's 'reactions' to jobs, but assumes that people can learn and develop new ways of seeing their role and the work environment. In *Chapter 4* this new dimension to job design research is outlined in more detail. Two types of work orientations are outlined as important: role and strategic orientations. The first of these, based on Ilgen and Hollenbeck's (1991) theory of 'job-role' differentiation, concerns people's views about their role and how they see their work environment in relation to this. Strategic orientations concerns employees' understanding and acceptance of the principles that underlie IM initiatives. Based on case studies and an analysis of literature, the sorts of role and strategic orientations that are most 'ideal' for effective performance within IM are outlined.

Following this, the primary arguments within the thesis are developed. In particular, it is suggested that enhanced job control, through affecting their knowledge and awareness, intrinsic motivation, and (over the long term) relevant aspects of their personality, can change employees' orientations. In relation to modern manufacturing, it is thus proposed that:

> *To the extent that the implementation of IM initiatives results in job designs with increased job control, operators will develop broader and more proactive role orientations, and more appropriate strategic orientations.*

Put another way, employees will develop new and better work orientations only when the introduction of an IM initiative is accompanied by autonomous forms of job design.

Further, it is suggested that employees will vary in the extent to which they take on board new orientations, and that this will affect how they direct their work behaviours. Within IM, it is suggested that employees do not just need to 'work harder' but to apply their effort in certain ways (e.g. thinking ahead, working co-operatively within teams). In Porter and Lawler's (1968) terms, employees require an 'appropriate role perception' to guide their behaviour. The second key proposition investigated within this thesis is thus:

> *Within modern manufacturing contexts where operators have complex jobs, those employees with broader, more pro-active role orientations and more 'appropriate' strategic orientations will be better performers.*

In addition to testing these research propositions, an exploratory aim of the thesis is to look at the potential influence of non-job design human resource factors on employees' orientations, such as organisational practices and individual difference variables.

1.1.5 The research strategy and studies

The research strategy involves a series of 'quasi-experimental case studies' with two themes developed in parallel. First, the studies are progressively more sophisticated in their research design; second, the organisations within which the studies are conducted are increasingly more integrated, thus allowing more complete investigations of the research propositions. Both quantitative and qualitative data are used. The former is mostly used to test the propositions, while qualitative accounts provide a richer investigation of the key constructs as well as information for the exploratory aim. This research strategy is outlined in more detail in *Chapter 5*, along with a description of the development of the questionnaire-based measures used to test the propositions.

The first study (described in *Chapter 6*) is located within a traditional manufacturing company, and is primarily used to validate the measures and to provide a bench-mark for subsequent investigations. The next study (described in *Chapter 7*) investigates the effect on employee orientations of the introduction of an IM initiative that does not involve changes to job control. *Chapter 8* then presents a cross-sectional study of the effects of an IM initiative on orientations that, in this case, encompassed job redesign and enhanced operator control. This is extended into a longitudinal study (reported in *Chapter 9*) that also includes an examination of the relationship between orientations and performance. The final chapter, *Chapter 10*, contains an integration of the findings from these studies and a summary in relation to the thesis aims and propositions. The implications of the results for job design theory and for broader manufacturing issues are described.

Chapter 2:

Current job design practice and research in manufacturing

2.0 Introduction

This chapter contains an historical overview of job design practice and research. The aim is to provide the background against which suggestions for job design theory made in subsequent chapters are set. It is also intended to illustrate the interplay between theory and practice, and thus these two aspects are described together.

In the first section, work simplification, its origins and its prevalence are described. This is followed by an examination of departures from Taylorism (or 'job redesigns') and the theories that have stimulated them, from simple job rotation to more complex group-based job redesign. The final section then contains a general critique and comment on job design research and theory in relation to the major issues examined in this thesis.

Given its primary function as a scene-setting chapter, salient issues are highlighted rather than repeating the results of thorough reviews presented elsewhere. The reader will be referred to these at appropriate points.

2.1 Work simplification: the 'backcloth' of job redesign

Prior to the Industrial Revolution, work design was characterised by a laissez-faire approach where jobs were allowed to "grow like Topsy" (Davis and Wacker, 1987, p. 438). Most jobs were called trades, or crafts, and were handed down through the generations. Tradition and rules of thumb, in conjunction with craft guilds, guided decisions about how tasks were allocated and performed. This artesian mode of production included a heavy reliance on individuals' skills and attitudes that were acquired largely through long 'learning by doing' apprenticeships. Management was a 'hands on' and personal style of leadership based on the know-how of master crafts people. There was a strong 'product mindedness', described by Hayes *et al.* (1988, p. 36) as "a deep understanding of the product, and a strong interest in how it was used", with a related emphasis on personalised customer service.

However, the factories and machines that came with the Industrial Revolution in the late 1700's "brought a host of technological and human relation problems never before imagined" (Aldag and Brief, 1979, p. 38). Whilst the new machinery reduced the physical toil required of workers, it also changed jobs and the way people thought about them more subtly. Not only did work have to be organised around the new technology, but a belief emerged that production systems and jobs could be designed with the same certainty as machines. For example, one of Taylor's colleagues stated in 1914 that "it is the aim of Scientific Management to induce men to act as nearly like machines as possible, so far as doing the work in the one best way that has been discovered" (Gilbreth, 1914, p. 75). This 'hard science-based industrial revolution' (Karasek and Theorell, 1990, p. 19) saw the erosion of most traditional craft workers and craft jobs, with the growth of a low skilled labour force performing simplified jobs. Thus, with the exception of a few industries (see Hayes *et al.* 1988), the artesian mode of work organisation was replaced by work simplification and a control-oriented management approach. As described next, the intellectual engine for the change was provided by the early writings of Adam Smith and Charles Babbage around 1800, and from F.W. Taylor's extensions to these principles a century or so later.

2.1.1 Work simplification: origins and a description

In The Wealth of Nations, Smith (1776[1974]) put forward a broad philosophy about industrial economics in which the cornerstone policy was the division of labour. He argued that by simplifying jobs there would be greater efficiency through increases in the worker's dexterity, saving of lost time in switching from one task to another, fewer errors, and greater opportunity for 'labour saving' inventions to be developed. Illustrating this argument, he described the potential for dramatically increasing output by sub-dividing pin-making into 18 different jobs. Babbage (1835), an engineer, further extended this principle by suggesting that because simplified jobs required less skilled labour, this meant cheaper labour and training costs. That is, rather than having to obtain a person with skill and strength to perform all the work operations, "the master manufacturer, by dividing the work to be executed into different processes, each requiring different degrees of skill and force, can purchase exactly the precise quantity of both which is necessary for each process" (Babbage, 1835, p. 26).

This approach to work was extended by F. W. Taylor (1911, 1947) in what he called 'Scientific Management' (see Kelly, 1982 for an in-depth account of the subtleties of the approach). Taylor was extremely critical of the informal 'out of date' craft work methods, and set about developing a new profession of industrial engineers to replace these. The engineers were taught to scientifically analyse and identify the basic elements of a worker's task, and then systematically apply these tasks to the new automatic machines. This activity was based on the assumption that there was 'one best way' of doing a job, and that finding this was the first step to efficient production. Underlying the whole process was a principle of separating the mental work (e.g. planning, control tasks) from the manual labour. Taylor believed that workers should only perform the physical work, while managers and engineers were to develop the processes, establish procedures, and generally control the workers. For example, Taylor described the new management responsibility as: "gathering together all of the traditional knowledge which in the past has been possessed by the workmen and then classifying, tabulating, and reducing this knowledge to rules, laws, and formulae" (Taylor, 1911, p. 9). Of course, once tasks were greatly simplified, managers and engineers were then necessary to re co-ordinate the specialised tasks. In this way, Taylor essentially filled the gap at the middle skill level in the work force (resulting from the demise of skilled crafts people) with a new 'middle elite'.

In addition to the division of labour, Scientific Management included other principles, such as matching people to tasks using systematic procedures, and a strong emphasis on supervision, reward and punishment to stop people from 'systematic soldiering' (i.e. the conscious withholding of effort). Hand in hand with these principles were the time-and-motion studies introduced by Gilbreth (1911). Each part of a task was observed and timed to find the most efficient way of doing it. Wage incentives, based on these time and motion studies, were then used to motivate a high rate of production. These principles, in combination with task specialisation, resulted in the growth of a whole management system and structure including, for example, a planning department (whose personnel issued cards to workers with their daily instructions), a rate-fixing department with engineers solely responsible for time and motion studies, separate stores where tools were issued, a separate maintenance section, particular accounting procedures, and the division of foremen into specialised positions (such as foremen for each of repairs, product quality, speed of working, etc.) (Kelly, 1982).

Work simplification became further entrenched with the development of the 'moving assembly line' for manufacturing automobiles. Introduced by Henry Ford in 1913 (Ford, 1922), this served to powerfully demonstrate that Tayloristic principles could be applied to mass production. In what become known as 'Fordism', fixed-pace conveyors and material-handling devices moved parts to the workers and tied the pace of work to machines (rather than to wage systems or supervisors). Other aspects included the design of parts to ease assembly, linear work sequencing, and the development of specialised machine tooling technology. The latter served to further sub-divide tasks between 'set-up' people who prepared the machine for operation, and semi-skilled machinists who operated the machines. Job specialisation was pushed to its limits, as illustrated in Ford's (1922, p. 108) description of a categorising system of jobs in his plants:

> We found that 670 (jobs) could be filled by legless men, 2637 by one-legged men, two by armless men, 715 by one-armed men, and ten by blind men. Therefore, out of 7882 kinds of jobs.... 4134 did not require full physical capacity.

Thus, Fordism, although encompassing Tayloristic jobs, is a more wide ranging production strategy oriented to mass production and mass marketing (Wood, 1990).

The core ideas of Taylorism and Fordism became widespread, largely as a result of the internationalisation of technology and the growth of multinational corporations that enabled the transfer of technology, machines, and experts in these production methods (Littler, 1985). By the mid-1930s, Fordism had spread to all the largest car firms and many electronic firms. Towards the second half of this century, Taylorism became prevalent across the USA, Britain, and Europe. In 1955, a national US survey of job design methods by Davis, Canter and Hoffman showed that the principles of Scientific Management dominated the way jobs were designed and there was little thought given to other possibilities. Survey respondents considered simplification as the most economical way of producing, and changing job content was not seen as a way to improve productivity and quality, nor as a way to minimise employee turnover and transfers. The latter were felt to be remedied by better working conditions, increased pay rates or improved selection techniques; while companies considered high productivity and quality as "primarily technical matters, as indicated by their approach to solving these problems through the revision of work methods, equipment, and product design... or through greater control over the employees, using additional operator training, disciplining of operators, and more inspection of production" (Davis *et al.* p. 79).

Although there is some debate about the exact spread of these production methods (Littler, 1985; Wood and Kelly, 1982), it is certainly the case that job simplification became the most prevalent method of work organisation in manufacturing (Davis, *et al.* 1955; Taylor, 1979), and it has been extensively applied in other areas of work (for example, Braverman, 1974, described the spread of Taylorism into the office). As Buchanan and McCalman (1989, p. 13) claim:

> Taylor's ideas (work simplification) have become a central feature of the taken-for-granted organisational recipe that many managers apply to the design and redesign of work, without serious question or challenge.

Not surprisingly, given its widespread application, people began to question the consequences of simplification for employee well-being and organisational productivity.

This ultimately gave rise to a new area of psychological research investigating the effects of work design.

2.1.2 The beginnings of 'job design research'

Taylor (1911, p. 31) asserted that Scientific Management would lead to "intimate, friendly co-operation" between management and workers, and ultimately, "the development of each man to his greatest efficiency and prosperity". However, he also acknowledged the possibility that simplification may not be perceived as positively by employees. He described how a worker, when first exposed to simplification, often has the impression that it will make him a "mere automaton, a wooden man" who thinks "'Why am I not allowed to think or move without someone interfering or doing it for me?'" (p. 31). Taylor's only defence against this criticism was that the same objection could be applied to all other modern subdivision of labour.

The consequences of work simplification for employees increasingly came under examination by researchers in both Britain and the United States. In Britain, the Industrial Research Fatigue Board (which evolved into the Industrial Health Research Board, IHRB) conducted some of the earliest research into the effects of simplified jobs. Not surprisingly, repetitive work was shown to be dissatisfying, tiring, and boring (IHRB, 1931; Wyatt and Ogden, 1924). Perhaps more importantly, subsequent research by the IRHB suggested that simplified jobs also affected mental health. In a sample of over 3000 blue-collar workers, Fraser (1947) found neurosis (assessed by clinicians) most frequently occurred among those who found work boring, who performed jobs that required constant monitoring and attention, or who performed assembly, bench inspection, and tool room work.

A little later, researchers from a variety of academic disciplines in the U.S. began questioning the individual and organisational costs of simplifying work. One of the key programmes of research that took place was that carried out by Walker and colleagues at Yale University (e.g. Guest, 1955; Walker, Guest and Turner, 1956). In probably the best known study, Walker and Guest (1952) studied over 1000 production employees in a car industry and found that routine, machine-paced jobs were associated with high levels of absenteeism, turnover, and dissatisfaction. Also in the car industry, Kornhauser (1965, p. 363) reported an association between mental health and simplified work design, describing the jobs as failing to allow the use of workers' abilities and thus restricting their feelings of interest, accomplishment, personal growth, and self-respect.

These early studies represented the beginning of an area of psychological research examining the effects of job designs (see Aldag and Brief, 1979, for a more complete review). Most studies involved documenting the negative effects of the breaking down of jobs into narrow and repetitive tasks (i.e. the horizontal division of labour), and examining reactions such as boredom, fatigue, dissatisfaction, and, slightly later, mental health and psychological strain. This focus is not surprising as the division of labour into narrow tasks was probably the most clearly visible aspect of simplification, and these sorts of effects were likely to be the readily observable. However, little attention was given to the effects of the vertical division of labour (i.e. the removal of control and decision-making from jobs); neither were the effects of job content on productivity systematically considered (Davis and Canter, 1955). Further, most of the research was concerned with documenting the negative effects of simplification rather than making proactive recommendations for job redesign. For example, in 1955 Davis and Canter suggested that, despite all the research investigating the various aspect of jobs, there had been no principles formulated to assist industry in re-organising work.

From the 1950's onwards, some of the limitations of this early research were addressed. Industrial psychologists began to talk about 'redesigning' Tayloristic jobs, a movement that gave rise to, and became increasingly based on, theoretical models of work design. Three major types of job redesign have typically been identified in the literature (e.g. Kelly, 1982; Littler and Salaman, 1981). In reaction to the horizontal division of labour came job rotation and horizontal job enlargement. This was followed by a more theoretically-driven approach that countered the vertical division of labour - job enrichment. Both of these types of redesign are individually-based. In contrast, the third type of job restructuring focuses on group work design. These early job redesigns, their prevalence, and the theories from which they were derived are described next.

2.2 Departing from simplification: Job 'redesign' research and practice

2.2.1 Job rotation and horizontal job enlargement

The first suggested antidote to Taylorism was job rotation. This involves operators moving at regular intervals to perform different tasks. The British Industrial Fatigue Research Board was the first to systematically demonstrate the potential productivity benefits of this practice (Vernon, Wyatt and Ogden, 1924). In several industries with very short cycle times, rotating jobs every half hour increased output by 20 per cent. However, job rotation does not reduce specialisation or change the content of jobs. As such, it is probably most valuable in instances where physical fatigue from using the same muscles occurs.

Horizontal job enlargement was the next suggestion to gain attention. This refers to the horizontal loading or expansion of jobs; that is, an increase in the number and variety of activities that people perform. This typically involves combining two or more different specialist jobs together to lengthen the work cycle and increase variety. The British National Institute of Industrial Psychology played a large role in developing this concept in the 1930's where job enlargement offered a solution for a company producing wireless-sets that was experiencing problems due to repetitive work (Harding, 1931).

However, although the concept was developed much earlier, it wasn't until the 1950's that horizontal job enlargement became popular. Walker (1950) carried out the most well known early studies in the Endicott plant of the American company IBM in 1944. Enlarging the jobs of operators to include machine set-ups and quality inspection was shown to improve product quality, reduce scrap, decrease idle time for employees and machines, and result in a 95% reduction in set-up and inspection times. Many other horizontal enlargement programmes were reported in manufacturing in the 1950's (Buchanan, 1979). In particular, Phillips used such methods extensively to replace machine-paced assembly lines in their plants in Holland (Van Beck, 1964), Australia (Pauling, 1968), and Scotland (Thornley and Valentine, 1968). This typically involved creating one-man work stations where operations were grouped together to be performed by one person, and buffer stocks were introduced between the groups of operations. This meant the line was not machine-paced and operators performed more than one simple operation.

Several studies were conducted that suggested positive effects of horizontal job enlargement for workers (e.g. Davis and Canter, 1956; Guest, 1957; Walker and Guest, 1952). However, these studies frequently suffered from conceptual and methodological problems (Aldag and Brief, 1979), and not all studies report such positive effects (e.g. Nadler, 1963). One of the limitations of this type of redesign is that, whilst it may be particularly appropriate for reducing physical strain, its effects on motivation are always likely to be limited because it does not address the vertical specialisation of jobs. To paraphrase Herzberg (1966), adding one Mickey Mouse job to another does not make any more than two Mickey Mouse jobs. The next two types of redesign, job enrichment and group work design, differ from job enlargement in they explicitly aim to return some of the 'thinking and planning' aspects of work to the 'doing'. Job enrichment principles, and the theories from which these were derived, are described first.

2.2.2 Job enrichment

Job enrichment refers to vertical loading and expansion; that is, an increase in the extent to which employees' plan, organise, direct, and control their own jobs (Herzberg, 1968). This is a departure from horizontal job enlargement in that it explicitly redresses the vertical division of labour. Thus workers do not just do as they are told but participate in decisions about schedules, work methods, and even payment plans. These general principles stimulated some job enrichment experiments on both sides of the Atlantic (Buchanan, 1979). Well publicised applications include the American Telephone and Telegraph job enrichment projects that affected over 1000 employees (Ford, 1969, 1973), and, in Britain, the projects within ICI (Paul and Robertson, 1970) and the License Centre in Swansea (Asplund, 1981).

The principles for job enrichment were mostly derived from two major theories of employee motivation: Herzberg and colleagues' Two Factor theory, and Hackman and Oldham's (1976) Job Characteristics Model (JCM). These are described next.

2.2.2.1 Herzberg's Two-Factor Theory

The impetus for job enrichment came largely from Frederick Herzberg's (1966, 1968) response to the 'blue-collar blues' (Gooding, 1970) and the 'white collar woes' that occurred during the 1960's and 1970's. This period was characterised by employees reacting to their work in various 'unproductive ways' (e.g. through absenteeism, sabotage, turnover and strikes); a response that was considered to be partly a result of a general rise in people's abilities and aspirations through increased access to education (Child, 1984). The costs of these behaviours were substantial. For example, in 1913, although it cost only $38 to train a new employee at Ford, annual turnover was over 50,000 workers (i.e. 400%) thus meaning more than $2 million per year was spent on training (Meyer, 1981). Increasingly, management became concerned with motivating their employees, and Herzberg's (1968) somewhat desperate title of an article for the Harvard Business Review "One more time: How do you motivate employees?' received some attention.

As implied in this title, Herzberg and his colleagues had raised this issue much earlier. In 1959, they proposed the Two-Factor Theory of employee motivation (Herzberg, Mausner, and Snyderman, 1959). These authors suggested that the issue of motivation was becoming more important as society's affluence increased. That is, because people's basic needs had been satisfied, the 'carrot and stick' methods of motivation were no longer sufficiently powerful. This argument was related to Maslow's (1943) 'need hierarchy' theory in which humans' needs are suggested to ascend from physiological, safety, social, self-esteem, and self-actualising; and where higher level needs only begin to operate when the lower level ones have been fulfilled. Herzberg and colleagues put forward a similar theory related to the work context. Based on analysing 'critical incidents' (i.e. events that made people feel good or bad while at work) reported by over 200 accountants and engineers, they proposed that people have hygiene needs and motivator needs. The former are basic maintenance needs, and are fulfilled by extrinsic characteristics of the work environment labelled 'hygiene factors' (such as work conditions and pay). In contrast, motivator needs are higher-order growth needs that are met by intrinsic characteristics of jobs, or 'motivators' (such as recognition and working independently).

The basic tenet of the theory is that changing hygiene factors can overcome dissatisfaction but cannot increase motivation and satisfaction. The latter can only be stimulated by changing intrinsic aspects of jobs. Herzberg *et al.* (1959) suggested that functioning in a motivation-seeking state is more productive than functioning in a hygiene-seeking state, and therefore proposed making jobs more enriching by increasing the motivators present in jobs. The following principles were suggested: removing some controls on employees; increasing individual accountability; giving employees whole or natural units of work; increasing authority, freedom, and discretion; providing direct feedback to employees rather than feedback only to supervisors; introducing more difficult tasks; and assigning specialised tasks to employees so that they can become experts (Herzberg, 1966, 1968).

This approach represented an important step forward in job design research. Rather than simply documenting the negative effects of simplified jobs, a psychological theory was developed and proactive recommendations about the redesign of jobs were made. However, although it stimulated job design research and practice, the theory gained little empirical support (e.g. Dunnette, Campbell, and Hakel, 1967; King, 1970; Locke and Henne, 1986; Wall and Stephenson, 1970). For example, it has been suggested that the two-factor dichotomy may be a methodological artefact (King, 1970). Moreover, Herzberg assumes that all individuals seek motivation and self-actualisation and if they are blocked at the stage of seeking hygiene, they are 'mentally unhealthy'. This assumption clearly denies the importance of individual differences in reactions to job redesigns (Hulin and Blood, 1968). These theoretical problems were addressed in a subsequent theoretical model of job enrichment, the Job Characteristics Model (JCM; Hackman and Oldham, 1976, 1980). This model has dominated research in the area, and thus will be described in considerable detail.

2.2.2.2 The Job Characteristics Model (JCM)

The JCM approach has its origins in work by Turner and Lawrence (1965) and Hackman and Lawler (1971). Like Herzberg's findings, these studies supported claims that certain job features were likely to foster employee motivation and performance. In addition, the study by Hackman and Lawler (1971) suggested that some individuals (those with high desire for growth at work) were particularly likely to respond to these job features. From these and other studies, Hackman and Oldham (1976, 1980) put forward the JCM shown in Figure 2.1. Essentially, this model suggests that certain 'core' characteristics of jobs relate to outcomes (i.e. internal work motivation, satisfaction, and work effectiveness) through their effect on three 'critical psychological states', viz. knowledge of results, experienced responsibility and experienced meaningfulness. The core characteristics of jobs are considered to be reasonably objective, measurable and changeable properties of jobs, and include: skill variety, task identity, task significance, autonomy, and feedback from the job. Jobs high on these features are typically described as 'complex'.

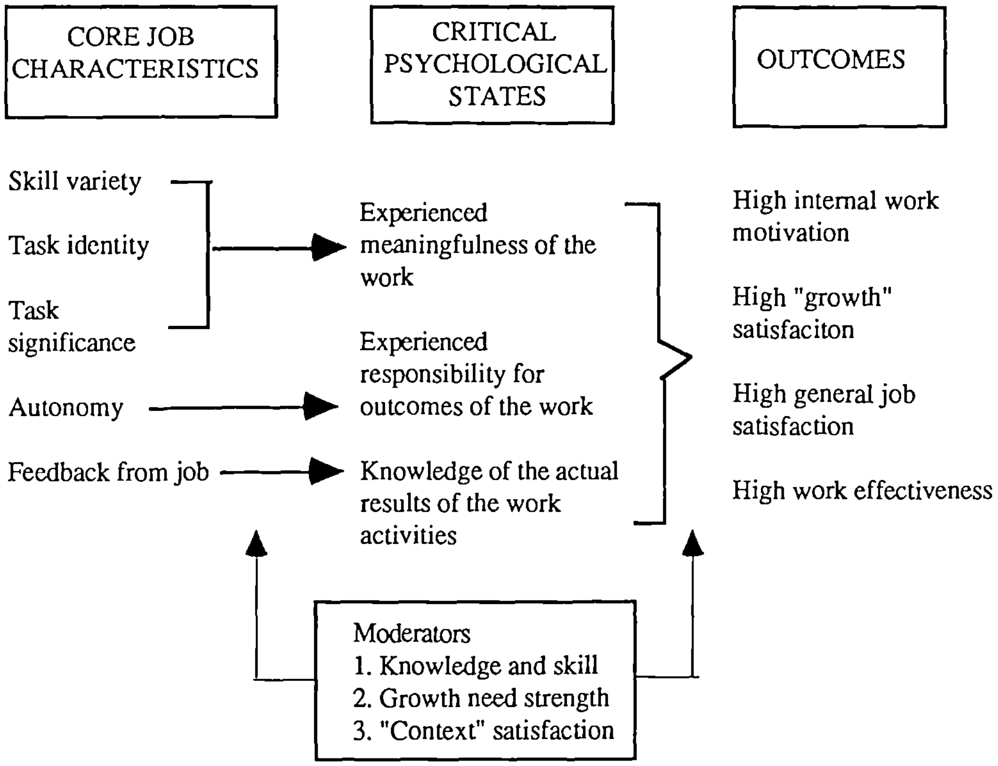

Figure 2.1: The complete JCM (taken from Hackman and Oldham, 1980, p.91).

This model thus differs from Herzberg's Two-Factor theory in that it separates features of jobs (i.e. job characteristics) from their implications for employee experiences (i.e. critical psychological states). The JCM also predicts that the relationship between the job characteristics and outcomes will be moderated by three factors: knowledge and skill, growth need strength (GNS), and satisfaction with the work context. This is a further departure from Herzberg's Two-Factor theory in that it explicitly allows for individual differences in needs rather than assuming all individuals seek growth and development.

Partly facilitated by the development of a set of measures assessing the elements of the JCM (i.e. the Job Diagnostic Survey, Hackman and Oldham, 1975; and see Dunham, Aldag and Brief, 1977), this model has been extremely popular in guiding job design research. Several of the details of the model, however, have not fared well empirically. In particular, the JCM predicts specific links between the job features and the critical psychological states (for example, feedback is suggested to be the primary determinant of 'knowledge of results'). Yet little evidence has been found for the value of the critical states as intervening variables between job content and outcomes (e.g. Hackman and Oldham, 1976; Wall, Clegg and Jackson, 1978), and they have tended to be ignored in most job design research. Further, studies typically use incumbents' perceptions of job characteristics as the independent variables (rather than gaining independent ratings of job content) and these may have inflated correlations with perceptual outcome variables. Some research has shown that, whilst the independent ratings of job content do relate to outcomes, the relationship is stronger when using the incumbent's ratings (Algera, 1983; Kiggundu, 1980).

Even with a simplified model, focusing on the basic tenet that certain job characteristics predict job attitudes and behaviour, evidence has been mixed (for reviews of studies, see Cummings, Molloy and Glen, 1977; Cummings and Molloy, 1977; Kelly, 1992; Pierce and Dunham, 1976; Roberts and Glick, 1981; Stone, 1986; Wall and Martin, 1987; and for meta- analyses, see Fried and Ferris, 1987 and Loher, Noe, Moeller, Fitzgerald, 1985). First, looking at the relationship between job content and job satisfaction, Stone (1986) reported this as high in the field (r = +.63) and in the laboratory (r = +.53), although others have claimed lower correlations (e.g. Glick, Jenkins and Gupta, 1986; Loher, *et al.* 1985; Roberts and Glick, 1981). Second, in terms of relating job content to performance outcomes, Stone (1986) reported that job complexity was positively related to job performance in 11 field studies (r = +.30), but also found a negative correlation in three lab studies. Based mostly on laboratory studies, Fried and Ferris (1987) and Berlinger, Glick and Rogers (1988) also obtained low correlations (0.23, and .21, respectively) between job complexity and performance.

The reviews reported above have been criticised by Kelly (1992) in that the studies: tend to have cross-sectional designs (which look at naturally occurring variations in jobs rather than change) or be carried out in laboratories; focus on average correlations or average effect sizes (which disguises information about the range of effects, and causes for this range); and rarely consider the relationship between job content and performance. Kelly (1992) thus performed a meta-analysis (using non-parametric statistics) of 31 studies that did not have these problems. Whilst there was a clear relationship between improvement in job content and job satisfaction, there was not a consistent relationship between improved job content and job performance. This supports Wall and Martin's (1987) conclusions in their earlier review of job design research, and is consistent with findings in the participation literature that participation usually affects satisfaction but not performance (e.g. Miller and Monge, 1986).

The inconsistent associations between job content and outcomes, particularly that of performance, might be accounted for by considering the moderator variables (e.g. Oldham, 1976; Stone, 1976). However, the extent to which these actually function as moderators is not well established. The moderating effects of knowledge and skill and contextual variables have rarely been examined empirically, and the extensive research on GNS as a moderator has had mixed results (Hackman and Oldham, 1980; Wall and Martin, 1987). Two recent meta-analytic studies found that this variable did function as a moderator of the relationship between job content and job satisfaction (Loher *et al.* 1985; Spector, 1985), while other reviews have reported inconclusive results (Graen, Scandura and Graen, 1986; Kelly, 1992). In terms of GNS moderating the relationship between performance and job complexity, again there is some support for this (Fried and Ferris, 1987; Graen *et al.* 1986; Spector, 1985) but other evidence that it does not function as a moderator (Kelly, 1992). Thus, it seems likely that the failure to take into account moderators does not, on its own, account for all cases where relationships were not found between job content and outcomes.

While the JCM has been a useful integrative model and has stimulated research, increasingly researchers are finding it conceptually inadequate. The restricted focus on only five job characteristics variables has been hailed as particularly problematic (e.g. Robert and Glick, 1981; Wall and Martin, 1987). Some researchers have expanded the range of variables to incorporate other features of jobs (e.g. Martin and Wall, 1989, examined cognitive demand and cost responsibility), but such variables are not yet widely in use. Attention has also been given to other potential moderating variables (e.g. self-esteem) although, as with GNS, there have been inconsistent findings (Wall and Martin, 1987). The latter authors echo Kemp and Cook's (1983, p. 896) call to stop the quest to find which moderators are replicable across situations, and instead attempt to specify "the conditions under which moderators are important". Finally, there has been a restricted focus on the types of outcome variables assessed, and a lack of attention to mechanisms explaining the outcomes of job redesign, particularly performance (Clegg, 1984, Kelly, 1992; Wall and Martin, 1987). These latter arguments are key to this thesis and are developed in more depth later.

2.2.3 Group work design

Job enlargement and enrichment both focus on change to individual jobs. However, an alternative approach is to redesign a group of jobs that contribute to a common goal. This strategy can makes more sense as production units often require the integration of separate activities to make a product. The design recommendations for these 'autonomous work groups' (also called self-managing work teams, self-regulating work teams, and semi-autonomous work groups) are similar to the job enrichment principles, albeit applied at the group level of analysis. Thus, groups are usually formed around a set of tasks that form a self-completing whole, and members are given the necessary autonomy, skills and information to perform the whole task (Cummings, 1978). As well as control over the scheduling of their tasks and work methods, group members can help determine the production goals, carry out personnel tasks (e.g. recruitment of new members) and perform support functions (Gulowsen, 1972).

2.2.3.1 Socio Technical Systems (STS) approach

Autonomous group working is a direct outgrowth of the 'Socio Technical Systems' approach developed by consultants at the Tavistock Institute of Human Relations in Great Britain (Emery, 1959; Rice, 1958; Trist and Bamforth, 1951; Trist, *et al.* 1963). This approach represents a mixture between human relations theorists concerned with social and personal features (e.g. Herzberg, 1966) and classic theorists concerned with organisational techno-structural characteristics. Thus, it does not advocate an exclusive focus on social issues (i.e. the people and their relationships), nor does it take a deterministic view of technology. Rather, the approach emphasises the need to 'jointly optimise' both these systems when designing jobs (Emery and Trist, 1960; Cummings, 1978; Susman, 1976). These ideas stemmed from studies of self-managing multiskilled teams in Indian textile mills (Rice, 1958) and British coal mines (Trist *et al.* 1963) where, after an initial focus on changing the work design within the existing technology, the advantages of redesigning both the technology and the social organisation became clear. In a well known application of these principles, Volkswagen removed long machine-paced assembly lines and re-organised the technology so that small teams (de-coupled from the lines) built a set number of engines per day (Jenkins, 1978).

Not only are self-regulating work groups an attempt to design effective relationships between the social and technical aspects of the work system, but they are also concerned with the relationships between the systems and their wider environments. The aim is to structure work systems so that group members can meet environmental demands without being too much affected by external disruptions. Typically, employees who perform interdependent tasks are grouped into a team that is relatively differentiated from other groups. Supervisors then manage the boundary between this group and the environment, while group members are responsible for activities within it. Increasing the control of operators allows them to manage variances (or unprogrammed deviations from standards or procedures) close to the source (Cherns, 1976; Cummings, 1978; Pasmore *et al.* 1982). By controlling these variances at source disturbances in other parts of the system can be avoided, often saving money, time, and energy.

The impact of the STS approach on job design practice, like job enrichment, has generally been limited. The major exceptions to this include the relative popularity of group working in North America (Pasmore, *et al.* 1982) and in Scandinavian countries. Regarding the latter, group work experiments initially took place in Norwegian companies such as Norsk-Hydro (Emery and Thorsrud, 1969), and subsequently in Sweden (Jenkins, 1978; Buchanan, 1979). Successful plants (albeit with higher set-up costs) were built by companies such as Saab and Volvo, where the layout and technology were designed with semi-autonomous groups in mind. However, in the rest of Europe, the application of autonomous group working has been limited to a few well-publicised companies such as Phillips and Fiat. The difficult theoretical 'package' of academic language in which the STS principles are embedded is often put forward as a factor inhibiting its spread.

From a research perspective, several strands of inquiry into autonomous work groups can be identified (Wall and Martin, 1987). First, there is a considerable body of research that investigates the effects of autonomous work groups on people and productivity (see Beekun, 1989; Cummings *et al.* 1977; Pasmore *et al.* 1982; Pearce and Ravlin, 1987; Srivasta *et al.* 1975; Taylor, 1977; Walton, 1979 for reviews). This began with some well-documented case studies and action research programmes (e.g. Rice, 1958; Trist and Bamforth, 1951). From the 1960's on, a somewhat disparate literature emerged, characterised by non-systematic studies with research designs that did not allow strong causal inference. Some of the outcomes of this research included findings that autonomous group working can: enhance employee satisfaction (e.g. Pasmore, 1978; Trist, Susman and Brown, 1977); reduce productivity costs through group members' innovations (e.g. Walton, 1977); improve performance (Pasmore, 1978); decrease absenteeism, turnover and accident rates (e.g. Walton, 1977); enhance organisational commitment (Emery, 1959); and improve mental health (Herbst, 1974). However, most reviewers and researchers lament the quality and quantity of research into group work design (e.g. Cummings, 1978; Manz and Sims, 1987; Pasmore, *et al.* 1982), particularly the lack of field studies using strong research designs (e.g. Wall and Martin, 1987).

In an attempt to rectify this, Wall and colleagues in Sheffield carried out a series of comparative (e.g. Kemp, Wall, Clegg and Cordery, 1983) and longitudinal studies (Wall and Clegg, 1981; Wall, Kemp, Jackson and Clegg, 1986; see also Cordery, Smith and Mueller, 1991). These have generally confirmed the positive effects of autonomous groups on job satisfaction. However, whilst an improvement in productivity has sometimes been found (e.g. through the elimination of supervisory position), these studies have not provided any consistent evidence that performance is enhanced with group work design. In the most recent study, Wall *et al.* (1986) claimed that work group autonomy had "specific rather than wide-ranging effects on employee attitudes and behaviour" and did not seem to positively affect job motivation, work performance, and turnover. It is clear that more well-designed studies of autonomous work groups are needed, including investigations of the contingencies that determine their effectiveness. More investigation is also needed into the processes that occur within groups, such as the work carried out by Manz and Sims (1982) on 'group think'.

A further wave of academic interest has been to extend and make explicit earlier thinking (e.g. Cummings, 1978; Susman, 1976), and to develop the application of STS ideas in contexts adopting advanced manufacturing technology (Cummings and Blumberg, 1987; Susman and Chase, 1986). Part of this has involved developing the argument that autonomous work groups are most successful in situations of high technical interdependence and uncertainty and situations where the task environment is dynamic.

There have also been suggestions and attempts to integrate the JCM with group work design (Cummings, 1982; Denison, 1982; Hackman, 1977; Rousseau, 1977). In particular, Hackman (1983, 1989) revised the JCM to make it applicable at the group level. This has very similar predictions for motivation, satisfaction, performance and labour turnover as the individual model. For example, the three most important features of self-managing groups for predicting performance include: the design of the group task (i.e. containing the motivational properties already described as desirable for individual tasks); the composition of the group (e.g. the right number of people, and a balance between the heterogeneity and homogeneity of group members); and the appropriateness of the group norms about performance.

In summary, whilst there has been considerable research into the effects of group work design, its quality has been limited and there are many more questions that need to be addressed. This is particularly important in light of evidence that the popularity of group working is beginning to increase in the 1980's and 1990's (Cummings, 1986; Lawler, 1992; Manz, 1992), and that its application is extending into service sectors and automated plants (Cummings, 1986). It has also recently been argued that applications in these modern contexts may require ‘self-leading teams’ that have even greater self-determination than autonomous work groups (Mans and Sims, 1987; Manz, 1990, 1992). These trends are discussed further in the next chapter.

2.2.4 Summary of departures from simplification

To date, the chapter has provided a general chronology of job design research and theory, from the origin and principles of work simplification to departures from Taylorism that have largely been stimulated by job design theory. These job redesigns have progressed from techniques that consider only the horizontal division of labour (e.g. job rotation) and that focus on the redesign of individual jobs, to theory-based initiatives that consider the vertical division of labour and that are also concerned with groups of jobs.

The general principles of job redesign received some government interest in the late 1960's and early 1970’s when concerns about work design were expressed in a wider movement known as the Quality of Working Life (QWL) Movement (Seashore, 1981). This got some encouragement from Government (e.g. the Work Research Unit of the Department of Employment) and from unions. Reports such as Work In America (1973) and, in Britain, On the Quality of Working Life (commissioned by the Department of Employment; Wilson, 1973) were influential. Such reports contained 'good' work design principles; typically that jobs should have variety, include all tasks needed to complete a product or process, incorporate control and monitoring tasks, allow self-regulation, and permit social interaction.

However, on the whole, the QWL movement did not take off (Child, 1984; Kelly and Clegg, 1982; Littler, 1985). In the late 1970’s, unemployment was rising steeply and management attention was directed to the industrial democracy debate. Work simplification spread into the office (Braverman, 1974) and continued to dominate in manufacturing (e.g. Taylor, 1979), even with the introduction of new flexible technology (Clegg, 1984). In 1985, Littler observed that there were only a few isolated examples of new job designs and that the QWL principles “were the gospel of a few avant guarde consultants" (p. 21). Similarly, Child (1984, p. 43) observed that, whilst there were many programmes with superficial changes in jobs, “there are possibly no more than 100 or so European schemes that really enrich jobs significantly". Overall, it can be seen that job design theory did not substantially affect job design practice.

There are several explanations for the dominance of work simplification. At a practical level, the process of redesigning jobs can be difficult. Attempts sometimes fail to get off the ground, change may be limited in spread to one small section, or new work practices may eventually erode (Child, 1984). This is partly because job redesign can be costly (such as the capital costs in changing technology and training), but also because the changes are hard to implement. Hackman (1975) lists common problems, such as not diagnosing existing jobs or people properly, supervisory resistance, and a lack of education for staff who are responsible for the changes. Successful job redesign often also requires consideration of broader organisational systems (e.g. payment systems) as well as various climate and culture factors (e.g. trust in management) (Oldham and Hackman, 1980). These issues are even harder to deal with, particularly during times of high unemployment when aspects of work such as job security and payment are high priorities and may be seen as threatened by the restructure of jobs (Kelly, 1982).

Job redesign can also be hard to implement because of its effect on the existing power distribution in the organisation. Delegating control to operators can upset vertical power relations such as the role of supervisors (Cummings, 1978), relations with groups such as engineers (Clegg, 1984), and may also have ripple effects further up the organisation (Child, 1984). Taylorism, on the other hand, can be seen as perpetuating the higher status of management, meaning they can take home higher financial and symbolic rewards than shopfloor employees (Buchanan and McCalman, 1989). Job redesign can also be threatening to unions. For example, when Volkswagen formed semi-autonomous work groups at Salzgitter in 1975, employers saw the groups as an opportunity to reduce union strength, and the unions saw informally elected work group leaders as potentially threatening their power (Littler and Salaman, 1985).

From another perspective, job redesign can be seen as having no effect on the distribution of power at all, being seen as part of a capitalist plot to extract co-operation from workers whilst maintaining control over them. This view stems from Braverman's (1974) thesis that there can be no end to Taylorism without an end to capitalism, and that management will always seek to control workers. From a detailed analysis, Kelly (1982) suggests there is some truth in this suggestion as job redesigns have usually provided net benefits to management rather than workers. Some unions hold views that restructuring will involve labour intensification; although, on the whole, the British trade Unions have sceptical and inconsistent views about job redesign (Buchanan and McCalman, 1989), and this may be an additional factor that has inhibited its spread (Osbaldeston and Hepworth, 1975).

A less extreme view is that simplification principles have become part of a "taken-for-granted organisational recipe" (Buchanan and McCalman, 1989, p 13), and that the dominant attitudes and values of management do not encourage change. Littler (1985) argues that Taylorism and Fordism have subtly fostered a 'technocratic' attitude that technological considerations far surpass job design considerations in organisational performance. Clegg (1984) suggests that the ready acceptance of these technocratic principles comes partly from the dominance of engineering involvement in work design, as well as a general fit with widely-held psychological values that people do not want increased responsibilities. Buchanan and McCalman (1989) similarly argue that management prefer ‘common sense’ ideas about organising work that have ‘hard’ short term gains, rather than more complex and ‘soft’ social-science ideas that have less certain and less quantifiable long term gains. Indeed, evidence suggests that managers are not keen to improve working practices for reasons of health, safety, or QWL unless they are convinced there will be an adequate return on the investment or they are forced to do so through legislation (Asplund, 1981). With job redesign, neither motivation existed. Compared to the 'safe bet' of the simplification approach, there was no clear documented evidence that changing work organisation would result in cost benefits. Descriptions in the popular literature of alternatives to Taylorism were often too insubstantial to serve as credible examples, and academic accounts were typically phrased in complicated and obscure language (Buchanan and McCalman , 1989). As Clegg (1984, p. 142) claimed: “new designs which attempt to increase complexity can be seen as historically, economically, psychologically, and managerially risky”.

On the whole, against the backdrop of a well-established approach to organising work that fits comfortably with managerial values, the potential gains of job redesign had to be seen to outweigh the possible risks and costs. This simply was not the case, and improving the quality of working life of employees was not - by itself - considered a sufficient reason to make changes. Consistent with this, the most dominant movement away from simplification was group technology, a form of layout change based on production engineers’ concern with flexibility and performance. Further, as will be described in the next chapter, current changes taking place in manufacturing often go against principles of simplification, to the extent that they have been hailed as the ‘end of Taylorism’. These changes, however, are not a result of psychological theories but a direct reflection of changing market, economic and technological conditions that demand a more flexible response for competitive advantage.

The next section contains a general critique of job design research from a scientific perspective. In so doing, I extract general issues from the material already presented as part of the historical overview and add further information. The aim is to make some general conclusions about the current status of job design theory and research in relation to the issues of concern in this thesis.

2.3 General synopsis of job design research and theory

The major models governing job design research have been described in the course of the historical overview, the most influential approaches being the Job Characteristics Model and Socio Technical Systems theory. However, other perspectives have recently emerged. These are not fully-fledged job design models, but rather approaches or perspectives with implications for research in this area. They include: organisational context approaches (e.g. Clegg, 1984), the Social Information Processing approach (Salancik and Pfeffer, 1978), Action Theory (e.g. Hacker, 1985, 1986) and occupational socialisation (Frese, 1982). In general, these perspectives have had little effect on job design research or practice. However, they are described for reasons of completeness and, as will be suggested later, because of their potential for greater impact.

2.3.1 Further approaches to job design research

The organisational context approach has become increasingly prominent since the 1980's. This has arisen in a variety of different forms, and includes looking at the effects of various organisational structures and practices on jobs, as well as determining how adjustments can be made in these to make job redesign more successful (Oldham and Hackman, 1980). For example, researchers have examined how job design is affected by leadership practices (Cordery and Wall, 1985), goal setting, (Umstot, Bell and Mitchell, 1976), organisational structure (e.g. Aldag and Brief, 1979), and a range of other variables. Another area, somewhat neglected, involves investigating the process of implementing job redesign. For example, considering whether employee participation has beneficial effects on the acceptance or outcomes of new work designs (e.g. Seeborg, 1978). Finally, a particularly important contribution within the organisational context approach, discussed further in the next chapter, is research that examines how technology and the uncertainty it creates can influence job content and its consequences (e.g. Brass, 1985; Clegg, 1984; Slocum and Sims, 1980). Put another way, context is set as a contingency, where the effectiveness of a particular form of job design depends on the degree of uncertainty within the environment.

Probably the most well-known alternative approach within job design research is the Social Information Processing Approach. Put forward by Salancik and Pfeffer (1978), this suggests that job attitudes and needs are personal constructs resulting from information processing. In particular, information from the social environment is suggested to affect people's perceptions of, and satisfaction with, their environment. This suggestion was often seen as potentially invalidating the job characteristics approach by implying that job perceptions were caused more by social influences than by the objective features of jobs. Most research subsequent to the original article focused on how the constructions of jobs are influenced by the social context, both in the laboratory (e.g. O'Reilly and Caldwell, 1979) and in the field (e.g. Griffin, 1983). Overall, conclusions from reviews in the area suggest that social factors do affect people's perceptions and attitudes, although not to the exclusion of job characteristics (e.g. Blau and Katerberg, 1982; Thomas and Griffin, 1983).

The SIP approach is best known for its premise that job perceptions are affected by social influence. However, the SIP approach derives from "the fundamental premise that individuals, as adaptive organisms, adapt attitudes, behaviour, and beliefs to their social context and to the reality of their past and present behaviour and situation" (Salancik and Pfeffer, 1978, p. 226). That is, as well as social context, this approach emphasises the influence of past experience in people's constructions about jobs and generally acknowledges that people actively restructure and re-interpret their existing work environment. In probably the only study that takes this perspective, O'Reilly, Parlette and Bloom (1980) showed how people's 'frame of reference' (defined by variables such as age, tenure, and father's education) affected their job perceptions and attitudes. This sort of research is important as goes beyond just assessing attitudes to considering the mechanisms and processes that cause the attitude. To date, however, the research has been very indirect and has not explicitly examined the nature of people's constructions about their work.

The third approach to be considered because of its potential implications for job design research is Action Theory. The basic tenant of this 'grand theory' (based primarily on German research) is that work is about actions: "without action there is no change in the work object" (Frese and Zapf, 1993, p. 27). An action is defined as the smallest unit of behaviour that is related to a conscious goal (Hacker, 1986, p. 73). Two important features of actions are posited. First, an action process is where action proceeds to a goal, to a plan, to execution, and to getting feedback. Essentially, the goal 'pulls' the action and is in this sense motivational. Second, an action is regulated by cognitions. This regulation of action is deemed to take place at four levels: the sensorimotor level (i.e. largely unconscious processing), the level of flexible action patterns (i.e. ready made action programmes, or 'schemata'), the intellectual level (i.e. conscious problem-solving), and the heuristic or metacognitive level. With practice, consciously regulated actions can become routinized and are thus able to be performed at lower levels. Long term knowledge of these processes, accumulated through acting on the world, is said to be stored in the 'operative image system' (Hacker, 1986).

Based on this theory, Frese and Zapf (1993) provide a specific list of action-based suggestions for designing jobs. Many of these are similar to existing recommendations, albeit from a different theoretical base. For example, they advocate jobs that allow people to complete all the steps in the action process from goal-setting to feedback, and that use all the levels of regulation. To facilitate the design of such jobs, researchers adopting this perspective have developed a series of job analysis instruments which, for example, assess the regulation requirements of work (see Frese and Zapf, 1993, for a detailed description in English).

From a theoretical perspective, an important contribution of Action Theory lies in its emphasis on non-motivational processes in explaining behaviour and performance. In addition to the increased intensity of effort caused by motivation, Frese and Zapf (1993, p. 43) describe a process of 'intellectual penetration', or a deep intellectual understanding of the task and its requirements that differentiates 'super workers' from average workers. Extending this cognitive emphasis to the concept of control, they argue that "people who have control can do better because they can choose adequate strategies to deal with the situation". Similarly, Volpert (1975) described how jobs with partialised actions cause problems such as a reduced level of competence, and a reduced ability to deal with problems from more than one perspective. Thus, job redesign is not only recommended for motivational or humanistic reasons, but to allow the development of appropriate cognitive strategies.

Finally, derived in part from Action Theory, an important perspective for job design research is that of occupational socialisation. This research is concerned with changes in the person that take place in, and because of, the work situation (Volpert, 1975, 1989; see also Brousseau, 1978; Karasek and Theorell, 1990). It is suggested that a person develops their personality through action and therefore work affects its development (i.e. personality is seen as an outcome variable rather than an individual difference variable). This represents an interactionist perspective where it is considered that personality and the environment interact to bring about actions and personality change, personality characteristics are relatively stable but can change from one situation to another, and where people are active in the environment through their cognitive interpretations and actual changes to the environment (Cox, 1978; Endler and Magnusson, 1976). The occupational socialisation perspective also relates to the view in which human development is seen as a continuous process extending throughout the life-span (e.g. Baltes, Reese and Lipsitt, 1980), and to the literature that examines the socialisation process that newcomers to organisations undergo (e.g. Schein, 1980; Van Maanen, 1976; Van Maanen and Schein, 1979).

Taking a broad view of personality, Frese (1982) summarised research looking at the effect of work on people. Evidence is presented that work can have four types of effects: effects on activity, cognitive effects, role taking and the development of values, and emotional effects. Regarding the first of these, there is evidence to suggest that simplified job designs lead to resignation and apathy (e.g. Kornhauser, 1965) and a reduced level of aspiration (e.g. Fellmann, 1980, reported in Frese, 1982); effects that might be reversed with more complex jobs (see, for example, Frese, Stewart and Hanover, 1987). There is also some evidence that cognitive abilities do not just reflect selection processes, but can be changed by job designs. In the most well-known study of this kind, Kohn and Schooler (1978) found that job complexity had a small but consistent effect on intellectual flexibility (Schleicher, 1973, also reported increases in a traditional IQ measure due to job complexity). Related to this, Wall and colleagues have shown that increased control led to operators learning skills to prevent faults, possibly through acquiring a better understanding of causal pathways (Jackson and Wall, 1991; Wall, Jackson and Davids, 1992). Finally, there is research that looks at the role taking process when people enter a new job (e.g. Louis, 1980; Mortimer and Lawrence, 1979a,b; Van Maanen, 1976) or a particular profession (e.g. medical students; Becker and Geer, 1958), although no such research has looked at these processes with job redesign.

2.3.2 General evaluation of job design research

These additional perspectives have generally had a limited impact on research (or, indeed, on practice); the JCM and related approaches have continued to be the most influential in stimulating job redesign experiments and in integrating research. However, job design research suffers from several problems, not the least of which is its scarcity. In 1985, Schneider asserted that job characteristics research was "very prominent during the mid to late 1970's, but by 1983 essentially no new work was being published" (p. 577). Wall and Martin (1987) similarly noted a lower rate of publications in this area during the 1980's than during the 1970's. Moreover, the job design research that is carried out is often methodologically and conceptually limited (e.g. Roberts and Glick, 1981). The latter stems in large part from the dominance of the JCM and related approaches that, as suggested earlier, suffer from problems such as a narrow focus and loose descriptions of mechanisms. There has also been a lack of interest in such issues as the effects of organisational contingencies, the process and dynamics of redesigning jobs, and technological change and design issues.

In relation to this thesis, there are two major interrelated problems with job design research: a focus on a limited range of outcome variables, and inadequate attention to mechanisms of performance. I shall draw on some of the recent perspectives described above to make this point. Regarding the first, a 'successful' job redesign is typically considered to be one where, as a result of job content changes, people report an improvement on some affective reaction variable (e.g. greater job satisfaction, more job commitment, less psychological strain). Occasionally, improved absenteeism and turnover are included as outcomes (and even more rarely, performance). However, this approach tends to regard people as passive 'reactors' to job redesigns. In contrast, the final three perspectives described above (i.e. SIP, Action Theory, and occupational socialisation) have in common an assumption that people are not 'static', but that they change in response to and actively construct the work environment. The SIP perspective suggests that people construct different meanings about their work based on experience and the social context. Action Theory suggests that people develop new perspectives and cognitive strategies if they have sufficient control over their work. The occupational socialisation perspective also acknowledges the potential effect of work on cognitions, and further suggests that more complex jobs may change people's level of activity, their role values, and other aspects of their personalities.

Thus, as a result of job redesign, changes may occur that are more dynamic, developmental and learning-oriented than changes in affective reactions. For example, people may take on new values and orientations to their work, learn more about the work environment, develop new problem-solving strategies, and enhance their aspirations. Given that the stated aims of job design research often encompass learning and development, it seems particularly pertinent to include these as outcomes. For example, Hackman and Oldham (1980, p. 85) stated that more complex jobs "create opportunities for considerable self-direction, learning, and personal accomplishment at work". Such changes may also be important in explaining performance benefits; a particularly neglected aspect of job design research.

The most frequent explanation of performance benefits, posited by the JCM, is that increasing the motivating potential of the job makes people want to put in more effort and produce higher quality work (Hackman and Oldham, 1980). These authors acknowledge that this might also work the other way; that is, when people in enriched jobs perform well, they feel satisfied and motivated. Other motivational explanations are less frequently employed. For example, an explanation based on instrumentality theory is that, after job redesign, workers may perceive closer links between effort, performance, and valued rewards (Kelly, 1992). Another possibility is that the goal-setting elements of job redesign may be responsible for directing behaviour (Kelly, 1992; Wall and Martin, 1987). Some non-motivational explanations have also been put forward. The JCM suggests that an increased quantity of output is said to result from indirect factors associated with job redesign, such as reduced dysfunctional behaviours (e.g. day-dreaming) and a more efficient work system (see also Cummings and Srivastva, 1977; Kelly, 1992; Locke, Sirota and Wolfson, 1976). Another argument, based on STS theory, is that employees in enriched jobs, specifically in autonomous work groups, can respond more rapidly and flexibly to circumstances than if supervisors are directing them (Wall and Martin, 1987). Finally, Kelly (1992) suggests that productivity benefits occur because employers negotiate changes such that fewer employees perform a similar amount of work for more money. On the whole, however, the most common mechanism put forward is that described initially (i.e. more complex jobs motivate people to put in effort) and very little job design research has attempted to systematically investigate alternatives to this.

Job design research has also neglected mechanisms suggested by more general models of performance. For example, according to Blumberg and Pringle's (1982) model, individual performance is determined by opportunity, capacity (e.g. cognitive abilities and strategies), willingness, and the interaction of these variables. Similarly, Porter and Lawler's (1968) instrumentality model of motivation and performance is a more cognitive-based approach, and has an important distinction between effort and performance. Effort refers to how hard an individual works, while performance refers to the effectiveness of the effort. An individual's abilities and traits (i.e. capacity) set the upper limits for performance, while a person's role perception (i.e. their definition of successful performance of the job) determines whether the effort is turned into good performance. An inappropriate perception - such as a police officer who sees his/her job as filling jail cells - results in inappropriate performance (e.g. many false arrests).

Thus, if job design theories are to adequately explain performance changes, they will need to specify the effects of job designs on variables such as capacity and role perceptions. This may mean considering some of the developmental and learning-based changes described above. For example, it was suggested that increased control may allow people to develop a better operative image system (Frese and Zapf, 1993), to learn fault prevention skills (Wall *et al.* 1992), and to increase their intellectual flexibility (e.g. Kohn and Schooler, 1978, 1982). These changes to 'capacity' will undoubtedly affect performance. Similarly, changes in the role socialisation process may affect role perceptions which, in turn, affect the appropriateness of the effort a person puts in. As Frese (1982, p. 219) suggests, these learning-based and developmental changes are likely to be particularly important for performance over time: "Long-term productivity means that an individual or a work group has developed its full potential and is showing an active approach to work, raising the level of aspiration in this process and readjusting the work accordingly".

In summary, job design research suffers from a narrow range of outcome variables and restricted attention to performance. However, these deficiencies can be seen as reflecting where job design research came from. Job design theories were a reaction against narrow, mostly manual jobs with simple technology. The typical goals of redesign were to improve the quality of people's work experience, and thus reduce behaviours such as absenteeism and turnover. Not surprisingly then, theory mostly focused on people's emotional reactions to their enlarged jobs, and how this affected motivation-based behaviours. There was little need to go beyond this to look at how people might develop or grow as a result of job redesign, or how such changes might affect their performance.

However, the goals of work design are changing in modern manufacturing. Tayloristic jobs are increasingly being recognised as too rigid for companies that require more flexible responses to markets, and there is a movement towards more autonomous and complex forms of work design. This accentuates the inadequacies of existing job design theory and suggests an urgent need for extensions that keep pace with current developments. These arguments are made more thoroughly in the following two chapters. *Chapter 3* contains a description of the new manufacturing paradigm and its implications for work design, and this is followed by, in *Chapter 4*, the presentation of an extension to job design research that makes it more appropriate to modern manufacturing.

Chapter 3

Emerging job design practice in manufacturing

3.0 Introduction

In the previous chapter simplification was described as the dominant paradigm for work organisation; as part of a 'taken for granted organisational recipe'. Departures from Taylorised jobs were shown to be infrequent, despite research documenting the negative effects of simplification on people and the availability of theory-based principles for 'good' jobs. However, it is now clear that the recipe for organisational success in manufacturing is changing to meet new goals, and that this demands new, more flexible forms of work organisation. These changes in the requirements for practice, in turn, bring a need for development in job design research and theory. Restricting the questions to those addressed in existing models, which derived from a particular set of practices, will no longer be sufficient.

This argument will be developed and extended in this chapter. First, the inadequacies of existing production methods against a changing economic, technological and social background are examined. These inadequacies have seen the emergence of a new manufacturing paradigm (referred to here as 'Integrated Manufacturing', IM) that is focused on flexibly and rapidly producing high quality goods whilst maintaining low costs. The initiatives which characterise IM are described, followed by an account of their potential implications for work design. It is argued that team-based jobs with high levels of operator control will be the most successful form of shopfloor work organisation to provide the flexibility needed within IM. In such cases, operators will need to take on a new role with higher-level performance requirements. The new operator requirements are the focus of the final part of the chapter; in particular, the need for employees to develop a fundamentally new orientation to their role and the work environment. This lays the groundwork for the next chapter in which I present the examination of employee orientations as a much needed new dimension to job design research and theory.

3.1 Inadequacies of the existing production paradigm

Some of the negative human implications of Taylorism and Fordism have been described already. However, organisational problems with these methods of productions have also been widely documented (see Child, 1984; Littler, 1985 for more details). For example, the fragmentation of tasks (particularly the division of mental tasks from manual tasks) results in high co-ordination and control costs, such as those associated with supervision, monitoring, inspection, planning, and complex clerical systems. Most importantly from the current perspective, Taylorism and Fordism are best suited to markets requiring large volumes of standardised products. In particular, whilst the flow-line production style seen in Fordist plants is effective while demand for a given product remains, it is extremely inflexible to changes in product design. For example, early this century, it was observed that even a small change to the appearance of the car, requiring a change in assembly methods, halved production in the first month and slowed it for 2 months after that (Porter, 1917). Tayloristic production methods are also usually only suitable for markets that are price oriented rather than focused on quality or reliability. The latter place a much heavier emphasis on employees' commitment and use of initiative, qualities not fostered within traditional factories.

Historically, most companies adopting Taylorism and Fordism have not been particularly concerned with flexible production or high quality. For example, in Davis, *et al's.* (1955) survey of industrial companies, by far the most important consideration in the way jobs were designed was minimising the time and cost required to perform the operations. The need to design jobs to provide 'maximum production flexibility' was barely a consideration. However, in today's market, this is no longer the case. Karasek and Theorell (1990, p. 28) suggest that Taylorism has been so successful that it has led to a huge over capacity in most goods, and thus "the previously hungry-for-products mass of consumers has now been replaced with a population that needs to be persuaded to buy something". It is no longer sufficient for most manufacturing companies to compete purely on the basis of cost (Dean and Snell, 1991; Lawler, 1992). They also need to produce high quality products, to be flexible to customer demands (e.g. able to provide customised, innovate and a diverse range of products) and, most importantly, according to Alasoini (1993), they need to compete on the basis of time (e.g. being quick to build products, and to develop new ones). Achieving a sustainable 'competitive advantage' in terms of these goals requires a new approach to production and work organisation.

This realisation of the need for change has occurred in light of increased industrial competition, particularly from Japan and, to a lesser extent, from what was previously known as West Germany. These countries substantially increased their export base at a time when manufacturing in the US and the rest of Europe was in decline (Hayes *et al.* 1988; Okumara, 1989). They began to provide goods to markets once dominated by US firms, including the high-technology and 'strategic' markets considered particularly important (Abernathy, Clark and Kantrow, 1981; Hayes *et al.* 1988). For example, largely due to the successes of Toyota, the Japanese share of the world motor vehicle production increased from about 1% in 1955 to about 28% in 1988 (Womack, Jones and Rood, 1990). At first the failure of US manufacturing firms to compete was blamed on fiscal, monetary and trade policies (such as Japan's lower wages and protectionism policies). However, when foreign companies began to manufacture effectively away from home, explanations of their success swung away from macro-economic factors and focused on their approach to manufacturing (Hayes, *et al.* 1988). At the same time, it was observed that many difficulties experienced in US companies (such as slow lead times, poor quality, much work-in-progress, and poor use of technology), but not in Japanese companies, were problems that did not relate to macro-economic factors but could only be attributed to different organisational practices (Hayes *et al.* 1988; Womack *et al.* 1990).

Thus, it has become increasingly clear that traditional ways of manufacturing are inadequate. As described above, Taylorised factories are not sufficiently flexible to allow adequate responsiveness to customers, they do not facilitate the level of employee commitment needed for high quality, and the 'one best way' principle does not align with the constant need for continuous improvement. Further: the traditional separation of employees from the end-products and customers is problematic at a time when the importance of service is growing in comparison to physical products (Karasek and Theorell, 1990); the high levels of inventory and stock associated with traditional production methods are of more concern because of higher interest rates and energy costs; and, from a social perspective, the narrow jobs with low control are inconsistent with rising education levels and the increasing importance attached to skill use and development (Child, 1984; Karasek and Theorell, 1990). The inadequacy of existing methods is summarised by Hayes *et al's*. (1988, p. 59) analogy with the gradual ineffectiveness of the Roman army 1500 years ago:

> The Roman army lost its effectiveness as it became more hierarchical, as its leaders were increasingly drawn from the elite on the basis of political favour rather than fighting experience, as decision making became more standardised and centralised, and as its supervisory style evolved from 'follow me' motivation to close, brutal control... so did American manufacturing lose its effectiveness after World War II.

These authors urged radical changes in traditional manufacturing management: "breaking down old barriers, creating new values, and encouraging new ways of thinking" (p. 19).

This call seems to have been heeded. Increasingly, manufacturing organisations are introducing organisation-wide changes in order to remain competitive (e.g. Dean and Snell, 1991; Drucker, 1990; Gunn, 1987; Hayes and Wheelwright, 1984; Majchrzak, 1988; Schonberger, 1986; Susman and Dean, 1989; Wickens, 1987). This originally focused on the adoption of new programmable technology that enabled companies to make customised products at close to mass production cost. However, attention has swung to new management practices, particularly those associated with the visibly-successful Japanese companies. This includes changes in manufacturing strategy (Hayes and Jaikumar, 1988; Kanter, 1985; Peters and Waterman, 1982), inventory control (e.g. Hay, 1988; Hall, 1983; Klein, 1976, 1991), quality assurance (e.g. Deming, 1982, 1986; Garvin, 1987; Hannah, 1987), human resource practices (Delbridge and Turnbull, 1992; Snell and Dean, 1992), and job design (Buchanan, 1992; Dean and Snell, 1991). Many commentators see these changes not in terms of a new set of 'tools', but as "a paradigm shift in manufacturing culture and practice" (Webster, 1993, p. 53); that is, a new manufacturing paradigm based on fundamentally different philosophies that extends to organisation-wide transformation (Gunn, 1987; Schonberger, 1986, 1987). These changes are described in more detail.

3.2 Integrated Manufacturing: A description

With the diverse array of new manufacturing strategies and philosophies, it can be difficult to see conceptual commonalities. There are also numerous terms to describe the changes, such as Japanisation (e.g. Turnbull, 1988), High Performance Work Systems (Buchanan and McCalman, 1989; Perry, 1984), Lean Manufacturing (e.g. Womack *et al.* 1990), and Time-based Flexible Manufacturing (Alasoini, 1993). However, commentators in the area agree that the new production methods coalesce around the notion of integration. Dean and Snell (1991, p. 778) use the term 'Integrated Manufacturing' to describe a paradigm "whose core concept is the elimination of barriers between different facets of a manufacturing organisation". Susman and Chase (1986) also refer to the Integrated Factory - a factory of the future where new technology and new methods link up nearly all aspects of manufacturing. In a European Commission report, the term Computer-Integrated Manufacturing (CIM) is used to describe a business strategy that "creates the possibility of co-ordinating and integrating all company functions, of contracting the lines of communications, and of increasing access and autonomy for all workers" (Eurotecnet, 1991, p. 5). Thus, despite an array of different terminology, the new paradigm can be characterised by its focus on integration. For simplicity, the term 'Integrated Manufacturing' (IM) will be used throughout this thesis. This term is descriptive, and does not come with the same loaded assumptions as terms such as Lean Production and Japanisation.

Dean and Snell (1991) differentiate between two types of integration within manufacturing: stage integration and functional integration. The first of these refers to the integration of the traditional stages of manufacturing in time, space, and information (for example, removing re-work, test and inspection as separate stages of production). Functional integration refers to the integration of manufacturing functions such as quality control, production planning, and accounting (e.g. Susman and Chase, 1986, suggest that design and manufacturing may eventually merge into one function). Closer links between the stages and functions of manufacturing are necessary to achieve a third type of integration, described by Dean and Snell (1991) as goal integration. This involves the 'synergy', or the simultaneous attainment, of three strategic goals: cost, quality, and lead time.

Four major initiatives can be seen to underlie Integrated Manufacturing: Advanced Manufacturing Technology (AMT), Cellular Manufacturing, Total Quality Management (TQM), and Just-in-time (JIT)[3]. Whilst there is recognition of technology as an integrating vehicle, the other practices can be used without AMT, or can be seen as prerequisites to achieving the full benefits of the new technologies (Susman and Chase, 1986). The four initiatives, their prevalence, and their integrating potential are described in greater detail. Although they will be described separately, it is unusual for these methods to exist in isolation from each other, and it is often recommended that they should occur together.

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[3] Dean and Snell, 1992 suggest the first three of these are key practices in IM. Similarly, Susman and Chase (1986) describe the integrated factory as including AMT and the new methods of planning and managing the manufacturing process: group technology, just-in-time delivery, OPT/ SLAM (which attempt to reduce bottlenecks and maximise machine availability), and producability (reducing set-up times). Others have noted the importance of cellular manufacturing (e.g. Parnaby, 1988; Drucker, 1990).

3.2.1 Advanced Manufacturing Technology (AMT)

AMT refers to a family of technologies used in various stages of manufacturing (e.g. design, fabrication, assembly, planning, and control) across a range of industries. The technologies have in common the use of computers to store and manipulate data, and can be broadly defined as "an automated production system of people, machines, and tools for the planning and control of the production process, including the procurement of raw materials, parts, and components, and the shipment and service of finished products" (Pennings, 1987, p. 198).

There are three major types of technology, each of which can help to integrate manufacturing: Computer-Aided Design (CAD), Computer-Aided Production Management (CAPM), and Computer-Aided Manufacturing (CAM). CAD assists engineers with the design of new products and allows closer links between production and design. CAPM involves systems concerned with the planning and control of production resources (see Webster, 1993 for a complete discussion). For example, one system (MRP II) integrates raw materials and store management procedures with production, thus turning demands for products into material requirements that can be readily ordered from suppliers. MRP II is also used to schedule production so that operating time is maximised and production can be more closely linked with planning and inventory control. Finally, CAM refers to the technology for controlling material handling and machine operation. Most often it refers to stand-alone Computerised Numerically Controlled (CNC) based equipment that store computer programs to control machine operations, such as cutting, shaping or drilling metal. A further generation of CAM, not yet widely adopted in industry (Bessant and Haywood, 1985; Edquist and Jacobsson, 1988), is the Flexible Manufacturing System (FMS). This typically has a central computer and CNC or other machine technologies that are linked together to allow materials to be automatically transferred between them. Recent developments have also seen the integration of all four types of technology into one system (Sharit, Chang and Salvendy, 1987), although this level of automation is still at the development stage and as yet presents too many design and cost issues to be widely adopted (Clegg and Wall, 1987).

Even in less dramatic forms, however, AMT has the potential to radically change manufacturing. For example, with CAM, in addition to the usual benefits of automation (i.e. reduced labour costs, consistent product quality, enhanced output levels), the programmability of the machines allows greater flexibility in changing to different, or new, product designs. Because the change from one product to another takes place by loading different software, rather than physically re-setting machines, there is also greater machine utilisation (Majchrazak, 1988; Sharit, Chang, and Salvendy, 1987). This programmability creates economies of *scope* (i.e. being able to efficiently produce a range of parts or products) and economies *of scale* (i.e. being able to produce a large volume quickly); features that enable the production of customised goods at mass production cost (Jelinek and Goldhar, 1984) as well as more flexible responses to customer demands (Majchrzak, 1988). Many commentators predict the increasing adoption of complex and integrated forms of AMT due to technical advances and the increasing need for market responsiveness (e.g. Northcott, Fogarty and Trevor, 1985). As Cummings and Blumberg (1987, p. 38) stated; "If manufacturing organisations are to compete successfully in today's world economy, the important question is not whether to adopt new technology, but how to accelerate its implementation".

3.2.2 Cellular Manufacturing

Cellular Manufacturing is a broad term referring to the layout of machines, processes, or people into product-based groups, or cells. It stemmed from the engineering principles of 'group technology' that in turn originated in the USSR (Burbidge, 1979; Mitrovanoff, 1961). Rather than grouping machines according to their function (e.g. all lathes in one section, all grinding machines in another), they are grouped in terms of their contribution to similar products (e.g. a lathe, grinding machine, and drilling machine are grouped together to make families of similar parts). This means each grouping (or 'cell') has a low variety of jobs to cope with, thus simplifying the work flow and scheduling, reducing setting time, and decreasing the amount of in-process and finished inventory (Hyer and Wemmerlov, 1984). Further, as this change in layout is also often associated with people operating more than one machine (such as in single-manned cells), worker flexibility is increased and labour costs are lowered. The creation of group technology cells was one of the most popular forms of work reorganisation, although its spread was nevertheless limited to "about 10% of batch engineering firms in the early and mid-1970s" (Littler and Salaman, 1985, p. 98).

Whilst group technology was initially an engineering-based grouping of machines, it has evolved to a more widely-applicable method of organising production (Littler and Salaman, 1985) and it is now often associated with autonomous group working. Whereas early group-technology cells were limited in the number of people working in a cell (usually one operator) and in the scope of product made, there has recently been a movement towards ‘product-based cells’ that include most of the processes, machines, and people required to build a complete product. The most extreme form of cell, not yet prevalent, is a 'factory-within-a-factory' or 'mini-business' group that includes all support functions and is completely accountable for its performance (Ingersoll Engineers, 1990).

The implementation of group technology and product-based cells has rapidly accelerated in the late 1980s and early 1990s, and has been hailed as the 'quiet revolution' occurring in British manufacturing industry (Ingersoll Engineers, 1990). Survey evidence in the report from Ingersoll Engineers suggests that Cellular Manufacturing has been implemented to some extent in over half of the UK's engineering companies with a quarter of the remainder planning to do so. In particular, product-based cells that contain all resources to build an entire product are becoming more common and represent a fundamental - often assumed - feature of IM (Bratton, 1993). For example, in conjunction with autonomous group working, cells are a key component of Drucker's (1990) 'new theory of manufacturing', Parnaby's (1988) ‘modern manufacturing’, and Lawler's (1986) 'new design' plants.

3.2.3 Total Quality Management

The importance of quality as a strategic goal has recently been recognised in Britain, albeit “after years of neglect” (Wilkinson, Marchington, Goodman, and Ackers, 1992, p. 2). This change reflects a general recognition that poor quality can be more costly than good quality (e.g. Crosby, 1979, 1984), thus quashing the common belief that there has to be a trade-off between these two goals. In line with this, there has been a movement away from seeing quality control as a policeman function to viewing it as a management strategy. The latter is usually being referred to as ‘Total Quality Management’ (TQM) (see Ishikawa, 1985; Feigenbaum, 1983 for details of this movement), and stems from arguments that quality should be integrated into management control systems (Deming, 1982,1986).

Two key philosophies feature in TQM (Wilkinson, *et al.* 1992). The first is the idea that prevention rather than detection of faults is the way to proceed (i.e. the principle of ‘right first time’ advocated by Crosby, 1979), and that this is facilitated by continually improving production processes (Juran, 1989; Juran and Gryna, 1988). Secondly, the responsibility for quality is clearly laid at management's door. Ishikawa (1985), for example, blamed 85% of quality problems on inadequate management systems. These philosophies and general concepts of TQM have recently become more widely used by British writers and practitioners (e.g. Hill, 1991a,b; Oakland, 1989).

One of the problems in discussing TQM is the elusiveness of the term. According to Dean and Snell (1991, p. 778), quality control "involves a few relatively simple concepts and an amorphous array of peripheral associated practices". The British Quality Association has put forward two extreme definitions, ranging from an emphasis on qualitative or 'soft' characteristics (such as customer orientation, employee participation and training) to 'hard' views from production/operations management (e.g. Crosby, 1979; Juran, 1976, 1989, Juran and Gryna, 1988). The latter focuses on aspects such as systematic measurement, setting standards of performance, and using statistical procedures to monitor quality (e.g. Statistical Process Control). Somewhere between these extremes is a mixed view that emphasises the need for scientific methodology combined with a team-based approach (Deming, 1986; Feigenbaum, 1983; Wilkinson, *et al.* 1992). Most UK proponents of quality adopt either the 'hard' view or the mixed view. Oakland (1989), for example, sees TQM as a triangle with the three points as 'management commitment', 'statistical process control', and 'team-working'.

Because of this range of definitions, the extent and manner in which TQM serves to integrate manufacturing varies across organisations. Minimally, it emphasises the responsibility of direct employees for quality, thus integrating quality with production. A participative approach may involve more than this, such as an education process encouraging all employees to be more customer-oriented and establishing teams of people to solve quality problems. The importance of the latter is emphasised by Hill (1991a,b) and Oakland (1989), and involves policy deployment teams (e.g. to clarify the organisational purpose and how quality fits in) and task teams (i.e. quality circles, quality improvement teams). According to Oakland (1989, p. 236), the value of teams lies in changing an organisation's culture from one of independence to one of interdependence through a process of knowledge sharing: "knowledge is very much like organic manure, if it is spread around, it will fertilise and encourage growth, if it is kept covered, it will eventually fester and rot". Using employees' local knowledge to solve quality problems usually represents a key feature of TQM.

3.2.4 Just-in-time

Since Toyota Motor Corporation pioneered Just-in-time (JIT; Monden, 1983), this strategy has been hailed as a key contributor towards enhanced competitiveness; that is, as a low-investment and 'back to basics' approach to manufacturing with consequent radical transformations. The organisational benefits of JIT have been loudly proclaimed (e.g. Parnaby, 1987; Schonberger, 1982, 1986; Voss, 1987; Womack, *et al.* 1990) and include, for example, lower inventory costs, quicker responses to customers, higher quality, and lower scrap. Not surprisingly, many Western companies are introducing JIT. Voss and Robinson (1987) reported that 57% of 132 UK companies they surveyed were implementing or planning to implement JIT, and Oliver and Wilkinson (1988, p. 79) reported that JIT exists or is planned in about two-thirds of the companies listed in the Times 1000 index.

The basic aim of JIT is to enhance productivity by increasing the rate of throughput in the plant, thereby increasing the turnover ratio of capital (total sales/total assets) and the total productivity of the plant. In its simplest form, this is achieved by producing and delivering the exact quantity of defect-free raw materials, parts, and sub-assemblies, just-in-time for the next stage of the production process until, ultimately, the finished goods are produced just-in-time to be sold (Schonberger, 1982). This process shall be referred to as 'JIT Production'. (Indeed, although not of central interest here, this principle can be extended back to the supplier so that supplies are not stocked but provided as needed, thus resulting in ‘JIT purchasing’). This system of production is known as a demand-pull system because production is ‘pulled’ by the demands of the next stage rather than 'pushed' according to a predetermined plan. A system of material control is needed to pull parts through the system (e.g. boxes with ‘kanban cards’ stating how much is to be produced), and the sizes of batches are ultimately reduced to the size of one. In this way, the output from manufacturing matches with the needs of the market and there is minimal inventory. This contrasts with traditional factories where inventory accumulates because of operating and supplier constraints and uncertainties, such as a variable quality of supplies, unreliable machines, variations in operator skill levels, and slow set-up times. An essential tenet of JIT is that these causes of excess inventory are not fixed and should be attacked.

Precisely what is meant by JIT is a major source of confusion. For example, in the Voss and Robinson (1987) survey, ‘JIT’ involved a varied and often narrow set of practices. Indeed, it is often seen as a 'tool-box of techniques' from which companies can selectively implement those that suit them. Some of the initiatives already discussed can be seen as part of the JIT tool-kit. For example, programmable technology reduces the set-up time involved in changing over to new product designs, thus enabling small batches to be produced more cost-effectively. TQM means that quality is controlled at the source thereby eliminating the need for buffer stocks to guard against quality problems, reducing the 'unproductive' time that is spent reworking, and ensuring that reworked parts do not disrupt the smooth flow. Switching to product-based cells is also often a precursor to JIT as it simplifies the work-flow and minimises the movement of materials (Oliver, 1991). Other techniques associated with JIT include preventative maintenance, housekeeping so that one can see and measure inventory, simplifying product-designs, reducing machine set-up times to allow swift changeovers of product, and the principle of continuous improvement (or 'Kaizen') to ensure the constant accumulation of small gains in efficiency (e.g. Booth, 1987; Hanna, 1987; Howell and Lorraine, 1987; Hutchins, 1989; Voss, 1987; Gryna, 1988). JIT also sometimes involves changes to job design and attempts to enhance employees' skills and motivation (this is discussed in detail later); and Graham (1988) suggests that JIT often occurs in conjunction with techniques to reduce the possibility of industrial action because the lack of buffer stocks means industrial disputes can upset the whole production process.

As well as involving a varying array of tools (which Graham, 1988, suggests are not as purely 'Japanese' as they are often assumed to be[6]), there is a broader debate about what JIT means. Some commentators argue that it represents a fundamentally different philosophy of manufacturing (e.g. Graham, 1988, Hall, 1987; Heiko, 1989; Im, 1989). For example, according to Graham (1988), management's role within JIT is to minimise and eliminate those factors that cause excess inventory and capacity (such as long set-up times, machine breakdowns, unreliable supplies); whereas the Taylorist approach is to accommodate these factors through the use of inventory, excess capacity, close supervision, deskilled jobs, and complex computer systems. Other commentators,

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[6] For example, Graham argues that flexibility has arisen from increased recognition of inefficiency of task specialisation; and decreased work-in-progress has become important due to increasing unit values, high interest rates, make-to-order markets, and the need to quote shorter lead times to remain competitive. These, in turn, lead to a need to reduce batch sizes and hence set-up times. According to Graham, 1988 "only JIT purchasing (long term purchaser-supplier relationships with frequent deliveries), 'zero defects', and 'kanban' production control are indisputably innovative to Western manufacturing management practice, and these are seen low down on the list of techniques being implemented as part of JIT programmes" (p. 71). Indeed, Zipkin (1991) cites assertions that even kanban is not new in principle and that the idea was sparked by U.S supermarkets.

however, have a more pragmatic view of JIT as simply "a practical insight into the practical problems of factory management" (Zipkin, 1991, p. 41). Similarly, while some people see JIT as capable of reversing the deskilling process inherent in the Fordist model (e.g. Tolliday and Zeitlin, 1986), others see JIT as a way to combine product diversity and mass production without any significant re-skilling (e.g. Turnbull, 1988). Thus, even at a broad level, there is considerable diversity in what JIT means. Research such as that recently conducted by Davy, White, Merrit and Gritzmacher (1992) is needed to more clarify exactly what this initiative involves. Based on a survey of professionals' perception of what features make up JIT, they reported three underlying constructs: operating control and structure (e.g. decentralisation of control, simplification), product scheduling, and quality implementation (e.g. holding employees responsible for quality).

3.2.5 Summary of IM initiatives

To recap, this section contained a description of four increasingly prevalent initiatives that characterise Integrated Manufacturing: Advanced Manufacturing Technology, Cellular Manufacturing, Total Quality Management, and Just-in-time. It is clear from the discussion that there is no one set of practices that make up each of these. There are variations in the 'tools' companies adopt, in the extent to which organisations go beyond adopting specific techniques to include broader cultural changes and, as will become evident later, in the way the initiatives are implemented. Nevertheless, the differences among these techniques and the variations in what they involve should not mask what they have in common. As Dean and Snell (1991, p. 799) state, the value of the IM construct is "that it enables researchers to transcend superfluous differences among these practices and instead examine their theoretical similarities". What links these initiatives is their potential to integrate traditionally separate aspects of the stages and functions of manufacturing, thus allowing fast and flexible responses to market demands as well as high quality products at an acceptable cost. Essentially, it can be seen that the objectives of IM are the same across different contexts, although these are manifested in different ways.

On the basis of this common denominator of integration, it is clear that IM initiatives will have implications for work design. First, the introduction of initiatives is likely to affect the structure of work. Some commentators have argued that IM will perpetuate simplification and intensify work (e.g. Turnbull, 1988), whilst others argue with equal conviction that it has the potential for reversing simplification (e.g. Hirschhorn, 1984; Kern and Schumann, 1989; Zuboff, 1988). In the latter vein, Dean and Snell (1991, p.

781) suggest that the traditional Tayloristic features of jobs (i.e. the division of labour, specialisation and standardisation) are based on the separation of stages and functions, and if integration takes place then, minimally, these "artefacts of separation" will diminish. As will be argued in more depth later, it is likely that the specific effects of IM initiatives on job design will depend on the uncertainty of the production environment and the choices that organisations make. A second implication of IM initiatives for work design is that particular types of job design may be most effective. More specifically, designs where operators have complex work and high job control may better align with the objectives of IM for flexible responses and high quality products.

The next section examines the implication of IM initiatives for work design, both in terms of possible changes to the content of shopfloor jobs with their introduction, and in terms of the design strategy most likely to maximise their effectiveness.

3.3 IM and its implications for work design

Interest in work design usually involves examining the consequences or effects of the form of work organisation on job attitudes or behaviour. As suggested in the previous chapter, some authors have turned this question around to look at how technological and structural characteristics influence the design of jobs (Brass, 1985; Clegg, 1984; Fry and Slocum, 1984; and Slocum and Sims, 1980). The approach put forward by Clegg (1984) is adopted here to examine the implications of IM for work design. In this framework, it is suggested that the objective complexity of a job arises from both the physical tasks and the work roles undertaken by the job holder. The difficulty of the tasks comes from the techno-structural arrangements and the uncertainty these give rise to; while the complexity of the work role is largely determined by the patterns of local control and decision-making rights. The effects of IM on task difficulty and work role are discussed in turn. Based on this analysis, an 'ideal' work design strategy for IM is put forward.

3.3.1 Task difficulty

The difficulty of the task is determined by techno-structural arrangements that can be represented on the dimensions of technical difficulty, intra-group task interdependence, inter-group interdependence and environmental uncertainty (Clegg, 1984). Based on Gailbraith's (1973, 1977) view that organisations are information processing systems that adapt to cope with uncertainties, it is suggested that these techno-structural arrangements create a decision-making and information processing environment. The first three dimensions directly cause local uncertainties, and the environmental dimension indirectly causes local uncertainties through one of the other dimensions. The more uncertainty created by the technology and the structural arrangements, the more information processing required by the job holder and the more complex the demands of the job. For example, a maintenance engineer will have high information processing requirements because the task itself is difficult, the work-flow is unpredictable, and group members may need to pool together skills to solve complex problems. On the other hand, a traditional assembly line operator has a simpler task and a predictable work flow, and therefore has few information processing requirements (Clegg, 1984). The major techno-structural dimensions, and the likely effect of IM on them, are discussed in turn.

3.3.1.1 Technical difficulty

The technical difficulty of tasks can be considered in terms of two dimensions: operational technology and knowledge technology (Hikson, Pugh, and Pheysey, 1969). Operational technology refers to the equipping and sequencing of activities in the work place, and includes elements such as the extent of automation, work flow rigidity, equipment uniformity, cycle time, and the number of operations. Uncertainty from these can increase with IM initiatives. For example, Cellular Manufacturing and Just-in-time result in changes in the sequencing of activities that make tasks more difficult (e.g. shorter run times, less rigid work sequences). IM initiatives also usually involve workers performing more work operations using a greater range of equipment (e.g. at Toyota, operators tend up to 16 machines at once, Slaughter, 1987), as well as carrying out tasks typically allocated to separate functions (Bratton, 1993; Dean and Snell, 1991). For example, operators working in flexible cells within a JIT system may be expected to set-up their own equipment, maintain their machines on a day-to-day basis, check the quality of products themselves, and keep their work area clean. Several writers have observed that automated plants have led to an increased task variety (e.g. Butera and Thurman, 1984; Clegg, Kemp and Wall, 1984; Schonberger, 1986).

Knowledge technology refers to the number of exceptions that must be handled, and the degree to which a problem is analysable (Perrow, 1967). Both of these can potentially be affected by the introduction of IM initiatives. Several authors have argued that operators require higher-level cognitive skills to cope with AMT (e.g. Adler and Borys, 1989; Buchanan and Bessant, 1985; Helfgott, 1988; Perrow, 1983; Sharit *et al.* 1987; Schonberger, 1986; Walton and Susman, 1987; Wall, Corbett, Clegg, Jackson, Martin, 1991). This is largely because the new technologies absorb the routine information processing and decision-making requirements of a job, whilst increasing the need for "employees to manage the unforeseen and non-routine variances that cannot readily be controlled by computers" (Cummings and Blumberg, 1987, p. 47). Also adding to the difficulty of problem-solving, AMT increases the cost of errors (e.g. Zicklin, 1987) particularly when machines are combined into cells or FMSs (Abernathy, *et al.* 1983).

More generally, it has been argued that advanced cognitive skills are needed to deal with the greater discretion and flexibility inherent in IM (Bratton, 1993; Buchanan and McCalman, 1989; Hirschhorn, 1984), as well as with the pressures of interdependent processes that do not have buffers between them (Dean and Snell, 1991). For example, JIT requires quick responses to problems in order to keep the work flowing, thus resulting in "a greater need to use initiative, solve problems and keep production going to keep subsequent processes being starved of parts" (Tailby and Turnbull, 1987, p. 17). Bratton (1993, p. 391) described how Cellular Manufacturing required operators with new diagnostic skills who "had to learn to conceptualise all the functions and perform all the operations in the most cost-effective way". Finally, Dean and Snell (1991) suggest that the pursuit of multiple goals within IMmeans more complex problem-solving is required.

One apparent contradiction to the suggestion than IM enhances the knowledge technology of the tasks may arise from the earlier description of JIT. It was suggested that an important feature of JIT is removing or reducing factors that cause excess inventory, rather than accommodating these constraints. This can occur through simplifying work procedures (e.g. quicker and easier set-ups), the production process (e.g. a simplified layout), and product designs (i.e. designs that are easier to manufacture, Bessant and Lamming, 1989). For example, Schonberger (1982) described how the set-up of a punch press machine was reduced from at least three hours per set-up to under nine minutes, and Turnbull (1988) described the introduction of machines in a JIT factory that an unskilled worker could operate proficiently within a few days. However, simplification does not necessarily mean less difficult tasks for operators. Indeed, simplified procedures and processes might allow operators to perform tasks that had previously been performed by more skilled operators or by other technical specialists (Jackson and Martin, 1993). Further, as will be suggested later, the relationship between JIT and simplification is not determined, and management can choose alternative strategies to deal with production constraints and uncertainties

3.3.1.2 Interdependence

There are at least two types of interdependence that cause uncertainties: intra-group interdependence (or technically required co-operation) and inter-group interdependence (or level of boundary transactions). Because of the explicit focus of IM initiatives on merging traditionally distinct aspects of manufacturing, both of these are expected to increase in modern manufacturing contexts (Dean and Snell, 1991; Ettlie, 1986, 1988). In terms of intra-group interdependence, flexible automation has been shown to increase the interdependencies between direct labour jobs (Argote and Goodman, 1986; Majchrzak, 1988; Shaiken, 1984). Initiatives such as product-based cells also increase the extent to which team members are required to co-operate to complete their work (Dean and Snell, 1991; Ettlie, 1988; Susman and Chase, 1986). The removal of stock between interdependent work units with JIT increases this interdependence further, as the lack of buffers to absorb variability in production means the actions of employees must be even more tightly co-ordinated.

IM can also increase inter-group interdependence, or the extent of boundary transactions between different groups. The integration of organisational goals means that groups are required to co-operate with other functional groups to a greater extent than is traditionally required in manufacturing organisations (Buchanan and Boddy, 1982; Dean and Snell, 1991; Hayes *et al.* 1988). Susman and Chase (1986, p. 262) describe this as an increase in 'vertical interdependence'; that is, a greater dependency between hierarchical levels for planning and controlling the production process. For example, if the marketing strategy is 'a reduced lead time from order to production for a greater variety of products', then this requires co-operation between design, purchasing, production and marketing. Even within functions, there will be tighter interdependence between groups. Within production, for example, product-based groups may need to co-ordinate their activities with other groups more closely. This differs from early autonomous work-groups where boundaries were intentionally created so that the team was self-contained and buffered from other activities.

3.3.1.3 Environmental uncertainty

The difficulty of people's jobs is likely to be indirectly affected by uncertainties arising from the environment (Clegg, 1984). Modern manufacturing exists in a more uncertain environment for at least two reasons. First, a more dynamic environment results from being more tightly coupled to processes within the organisation. That is, uncertainty is increased by a customer-driven marketing strategy that does not have the buffering of market forecasts or stocks of finished goods (Susman and Chase, 1986). For example, if raw material supplies are not delivered, then there are no stocks of supplies available to draw on. Uncertainty is further increased by the adoption of the IM initiatives. For example, having flexible AMT allows greater responsiveness to market demands which, in turn, leads to the manufacture of more complex products with more frequent design changes (Piore and Sabel, 1984; Sorge *et al.* 1983).

Second, uncertainty is increased because of what is going on outside the organisation. In the DTI's major policy document on good manufacturing practice, *Manufacturing in the Late 1990's*, it is argued that companies need to be able to cope with excess uncertainty arising from features such as volatile financial circumstances, slower growth in the world economy, increasingly sophisticated technology, shorter product-life cycles, and environmental considerations. Organisations also need to be able to handle increased product and market complexity, including multi-technology products, multi-niche products, more knowledge-based products, greater service content, more choice and greater customisation. On the whole, manufacturing organisations need to be able to "tackle and beat customers who are increasingly likely to be part of a large financially strong, global businesses, capable of introducing new products fast" (Department of Trade and Industry, 1989, p. 58).

In summary, IM is likely to enhance the information processing requirements, and thus the difficulty, of people's tasks. Local uncertainties are directly increased by the knowledge technology of the tasks and the need for more intra-group and inter-group co-operation, as well as being indirectly increased as a result of greater environmental uncertainty.

3.3.2 Patterns of local control

The other major determinant of the objective complexity of jobs described by Clegg (1984) is the work role. This is largely determined by the patterns of local control and decision-making rights. These are, in turn, influenced by the information processing requirements of the job. When information processing requirements are low, local control can be achieved through rule or procedure specification (i.e. routinisation), target setting and direct supervision (Ouchi and Maguire, 1975; Van de Ven and Morgan, 1980). Jobs will be more Tayloristic with this type of control as employees have less opportunity to make decisions. However, if information processing requirements increase, output control is preferable as jobs cannot readily be pre-specified and routinised. That is, it is hard to have rules and procedures for all the uncertainties, and it is difficult for a supervisor to make all the decisions or the best decisions. Instead, decision-making rights should be devolved to operators. Control can then be achieved through the monitoring and evaluation of outputs (such as through setting and monitoring goals) in conjunction with establishing norms or expectations of appropriate behaviours for the operators (Ouchi, 1977). Others writers examining the relationship between uncertainty and job design also concur that operator control is the best strategy when uncertainty is high (e.g. Slocum and Sims, 1980). More broadly, it has been suggested that as uncertainty increases, there is a need for more flexible, decentralised, and less bureaucratic organisational structures (e.g. Gailbraith, 1977; Lawrence and Lorsch, 1969; Perrow, 1967, Thompson, 1967).

Because of the greater information processing requirements arising from the uncertainties inherent in IM jobs, it follows that the most effective work design within IM will be the devolution of control to operators. This theoretically-derived premise is consistent with much of the existing literature looking at job design within IM. Many writers have advocated the devolution of control and upgrading of skills when IM initiatives are introduced (e.g. Bratton, 1993; Buchanan, 1987; Buchanan and Bessant, 1985; Cummings and Blumberg, 1987; Dean and Snell, 1991; Hirschhorn, 1984; Lawler, 1986, 1992; Perrow, 1984; Schonberger, 1986; Walton and Susman, 1987). These arguments are most developed in relation to AMT and have arisen out of observations that, whilst some organisations have successfully implemented AMT and gained productivity benefits (see for reviews Ingersoll Engineers, 1982; Bessant and Haywood, 1985; Ettlie, 1988) many organisations have not obtained the flexibility gains they hoped or have reported few benefits (see Jaikumar, 1986; Zammuto and O'Connor, 1992). Difficulties with implementing AMT and failures to use it to its potential have often been shown to come from neglecting the job design and broader human aspects of AMT (e.g. Blackler and Brown, 1986; Blumberg and Gerwin, 1984; Butera and Thurman, 1984; Clegg and Kemp, 1986; Clegg and Corbett, 1987). Various writers have argued for the early consideration of work design issues, (e.g. Clegg and Wall, 1987; Cummings and Blumberg, 1987; Susman and Chase, 1986) and have advocated more complex job designs.

More specifically, several authors have recommended a ‘flexibly oriented’ or ‘operator control’ approach to AMT where multiskilled operators are responsible for most aspects of the machine, including maintenance and programming. This contrasts to a ‘control-oriented' or 'specialist control' approach where operators perform the mundane operating tasks (e.g. loading, unloading, monitoring) whilst specialists and management deal with the higher-level programming and problem-solving tasks (Clegg and Corbett, 1986; Zammuto and O'Connor, 1992). The operator-control approach not only allows operators to develop new skills, but can result in better system performance because it enables a quick response to problems (e.g. Davis and Wacker, 1987) and allows the use of operators' implicit knowledge about the machine (e.g. Koestler, 1976; Kusterer, 1978; Manwaring and Wood, 1985; Wood, 1990). Recent evidence also suggests that devolving control enhances AMT effectiveness because operators learn to anticipate and prevent faults (Jackson and Wall, 1991; Wall *et al.* 1992).

The same argument has been applied to IM more generally. This is usually derived from the socio-technical systems perspective that suggests variances are best controlled at the source by those with the appropriate skills and knowledge (e.g. Cherns, 1976; Davis and Wacker, 1987; Trist *et al.* 1963). Giordano (1988, p. 176) suggests that giving operators control allows them to "draw on their experiences and understanding of the production process and to be flexible in the use of their skills to create innovative solutions for cost, quality, and efficiency problems at the point of production". Similarly, Susman and Chase (1986) argue that operator control maintains the "learning link" between those who detect variances and those who control them and, suggest that "multiskilled employees are in a better position to see relationships between specific actions and their consequences. This is highly important in integrated systems" (p. 268). Indeed, it is not surprising that recommendations for work design in IM align with socio-technical perspectives. Early applications of STS came from continuous process technologies (e.g. Susman, 1970) and, Integrated Manufacturing, with its emphasis on tight integration of functions and work 'flowing' smoothly, has many similar properties to this context (Susman and Chase, 1986).

In addition to the suggestion that control should be devolved to individual operators, a form of group autonomy is also typically recommended within IM. That is, the increased interdependence resulting from greater integration creates an information processing system best handled by devolving control to groups. In such situations, Cummings and Blumberg (1987, p. 49) argue that semi-autonomous work groups allow employees the flexibility to respond to changes in demand, share boring tasks, and gain "greater insight of the overall manufacturing process". A further advantage of autonomous groups, in conjunction with a product-based layout, is that they can foster a sense of 'product ownership' and customer orientation (Buchanan and Preston, 1992; Oliver, 1991). In contrast, a functional-based layout with traditional work organisation can result in an "illusion of independence between functions" where groups pursue separate goals, and blame problems on other areas (Oliver, 1991, p. 22). The people-based benefits that derive from changes to work design are considered by Ingersoll Engineers (1990) to be driving force behind the resurgence of interest in Cellular Manufacturing.

> The last few years have seen a realisation that technology alone is no solution to the challenges of manufacturing in a competitive world... the key to their success is people. The upsurge in Cell Manufacture follows that appreciation, and is part of the re-organisation of industry which has ensued (p. 7).

Manz (1992) takes the argument for group work designs further and suggests that, in contexts with ambiguous and changeable tasks, 'self-leading' teams rather than autonomous work groups are required. The former represent a more advanced form of operator control where group members have influence over the strategic decisions of 'what' functions the group performs and 'why', rather than just over 'how'. This means, for example, direct involvement in deciding the group's purpose, greater interaction with customers and suppliers outside the organisation, and empowerment to choose external group leaders.

From a different perspective, collective control has been highlighted by Klein (1991) as a critical issue with Just-in-time. It has been suggested that removing buffer stocks between work units can reduce individual discretion of timing and work methods (Klein, 1991; Turnbull, 1988), and there is at least one study that provides some support for this (Jackson and Martin, 1993). Some commentators describe this reduced discretion as "recreating the rhythm of assembly-line pacing in plants where there were previously opportunities for workers to determine (to some extent) their own work pace" (Turnbull, 1988, p.13). However, one way of compensating for this decrease in individual control is to devolve control at the group level (Jackson and Martin, 1993; Klein, 1991). For example, New and Clark (1989), suggest that by allowing JIT groups to queue a set amount of parts, team members can have autonomy over day-to-day scheduling. Klein (1991) also suggests a collective form of autonomy is more compatible with JIT. A practical example of this involved allowing group members freedom to change their work methods as long as product specifications were met. Careful attention also needs to be given to the management of the interdependency between the work group and other manufacturing processes. Some authors have suggested that this may restrict when and what activities the group performs (e.g. Klein, 1989; Oliver, 1991).

The arguments for devolving operator control have also been made in the management literature, such as that concerning empowerment (e.g. Thomas and Velthouse, 1990), transformational leadership (e.g. Schein, 1985), self-determination theory (e.g. Deci and Ryan, 1985), and high-involvement management (Lawler, 1986, 1992). The latter is probably the most encompassing, and is referred to elsewhere as 'high commitment' (Walton, 1985), 'high performance' (Buchanan 1987; Buchanan and McCalman, 1989; Hanna, 1988) and a 'continual improvement' approach (Hayes *et al.* 1988). High-involvement management is the extension of decision-making power, business information, rewards for performance, and technical and social skills to the lowest level of the organisation (Lawler, 1986). Thus, like the difference between self-leading and self-managing teams, it involves a more extreme form of operator self-determination than job enrichment alone (e.g. shopfloor employees are expected to contribute to decisions about strategy, investment, and other business issues). High-involvement is also a more broad-ranging strategy involving, not just changes in job design, but changes to management information systems and human resource practices to align them with the philosophy of employee involvement. Organisational transformations such as these are argued to be the best strategy when tasks are complex, high quality and fast lead times are needed, and when the environment is uncertain and uncontrollable (such as when product-innovations are needed regularly) (Lawler, 1992; Hayes *et al.* 1988). Some correlational studies support the view that high-involvement approaches are better for organisational performance in these situations (e.g. Denison, 1990; Mitchell, Lewin, and Lawler, 1990).

3.3.3 Summary of work design implications

In summary, it has been argued from a theoretical perspective that the most effective work design strategy within IM is likely to be the devolution of control to operators. That is, it was suggested that the techno-structural arrangements within IM jobs are likely to result in greater information processing requirements that, in turn, are best managed by operator control. Moreover, the interdependencies between tasks means that this control should be devolved at the group level. These conclusions are consistent with many commentators views that IM will be most successful with enskilled operators working in teams, and with observations that collective control can compensate for a loss of individual autonomy that might occur with JIT. Finally, the arguments for more complex work designs within IM concur with a growing management literature that argues for organisational transformations towards employee involvement.

There are two cautionary points to make at this stage. First, it may be that in some situations, the introduction of IM initiatives does not enhance the information processing requirements of the tasks, and thus effective performance could be achievable with low operator control. An example might be where JIT reduces the technical uncertainty of the tasks by simplifying the process and products to an extreme. Because of this, it may be possible for control to be established through having tight rules and procedures and traditional supervisors. This is most likely to be possible when the tasks are already simple (e.g. there are few product variations, the machinery is reliable), and when the wider production environment is relatively stable. However, the arguments for more complex job designs within IM relate specifically to those situations where this is not the case. That is, as outlined earlier in the chapter, the interest of this thesis is in those situations where mass production for mass markets is no longer appropriate, and where flexible and customised responses to changing markets are required. By definition, these more dynamic environments result in high production uncertainty that is best dealt with by enhanced operator control.

Second, even when IM initiatives do enhance the information processing requirements of the job, organisations do not necessarily adopt enskilling strategies. That is, although there are clear implications of IM for work design, this does not imply that there is a deterministic relationship between the two (Dean and Snell, 1991; Jackson and Martin, 1993; Webster, 1993). Many organisations do not make the adaptations to their work designs that are appropriate for the new technologies or strategies (e.g. Bratton, 1993; Child, Ganter, and Keiser, 1987). For example, after presenting three case studies of the implementation of Computer-Aided Production Management (CAPM), Webster (1993, p. 63) concluded that: "In general, CAPM technology did not alter the existing systems of work organisation within each company as much as the systems of work organisation altered the configuration and application of CAPM". Similarly, as described earlier, it has been observed that JIT can mean 'working harder, not smarter' (Turnbull, 1988), and decreases in an individual's control over the timing of work (Jackson and Martin, 1993; Klein, 1991). However, as these writers acknowledge, this reflects choices in the way these strategies are implemented. Turnbull (1988, p. 14) states that "JIT could, if suitably modified, offer the opportunity to reskill work and enrich the jobs of working people". Jackson and Martin (1993, p. 19) argue organisations can choose to enhance operator control rather than using simplification strategies to deal with production uncertainties, and that such a strategy “fits well with the JIT philosophy of increased worker involvement and ownership of production processes”.

There are several possible explanations as to why organisations fail to introduce more complex work designs when IM initiatives are introduced. As has already been discussed, for various organisational and managerial reasons, it is often easier to stick with the status quo (see section 2.2.4). The wider organisational context (including tradition, vested interests, institutionalised systems) can also be seen to suppress the redesign of jobs when new technology and strategies are introduced (Child *et al.* 1987; Wilkinson, 1983). A study by Dean and Snell (1991), for example, suggested that IM practices do not necessarily lead to changes in job design because of ‘organisational inertia’. Factors such as performance of the company, dependency on a parent organisation, and size all influence this tendency of organisations to retain their existing work design.

Nevertheless, although not all organisations adopt more complex work designs when they introduce IM initiatives, the tide certainly seems to be turning away from job simplification. For example, Lawler (1986) suggests there are around 200 new design plants in the US adopting self-managing teams, skill-based pay systems, and flat management hierarchies; and Walton (1985) claims there are at least 1000 plants in the US that are implementing self-management teams and that have transformed from a control culture to a commitment culture. Littler (1985, p. 21) argues that recent market changes and pressure have "forced many Western corporations to re-examine their philosophy of job design and control from a solid, 'down-to-earth' perspective - that of profits".

At a broader level, many commentators have described the changes taking place in manufacturing as a replacement of mass production methods with a production regime grounded in more flexible new technologies and working methods (e.g. Adler, 1985, 1986; Beaumont, 1987; Katz, 1985; Kern and Schumann, 1987, 1989; Kochan, Katz and McKersie, 1986; Sabel, 1982; Streek, 1987). This reversing of the fragmentation and standardisation of labour that underlies mass production has been hailed as the ‘end of Taylorism’ (e.g. Brodner, 1986; Hirschhorn, 1984; Piore and Sabel, 1984; Tolliday and Zeitlin, 1986). Of course, not all commentators share this view[1] (see Wood , 1989, and

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[1] For example, Piore and Sabel (1984) who, in The Second Industrial Divide , offer the view that 'flexible specialisation' will means enskilling the labour force, a closer link between the mental and manual tasks, greater control by the workers, more job security, and less alienation, are labelled as the 'optimists' by Phillimore (1989). There are also 'Pessimists' who agree that flexible specialisation is a serious challenge to Fordism, but that there are negative implications for labour and capital (e.g. Hyman,

Phillimore, 1989 for thorough analyses and descriptions of this debate), but it is widely acknowledged that there is a need for flexible production methods that will certainly affect work design practices.

Consistent with this, many commentators have argued that the new manufacturing paradigm will require a more skilled and integrated workforce (e.g. Wood, 1989); with management increasingly realising the "qualitative significance of human work performance" (Kern and Schumann, 1987, p. 160). The next section addresses this issue, and looks at the consequences of more complex job designs within IM for operator roles and performance requirements. In particular, in line with Wood's (1989) call for operators to be free from "narrow job centred orientations" (see section 1.0.1), the argument will be made that operators need to develop new and more appropriate orientations to their work.

3.4 IM and operator requirements

For many operators working within traditional Tayloristic jobs, the introduction of more complex jobs with Integrated Manufacturing will mean radically different roles. Zuboff (1988) describes this as transforming a set of highly specialised jobs into semi-professional positions, and Susman and Chase (1986) argue that employees need to perform 'roles with open-ended boundaries'. Much emphasis is given to thinking ahead and doing more than the standard job. For example, Hayes *et al.* (1988) claim:

> Rather than trying to pre-specify responses for every possible circumstance, those directly involved have great flexibility to respond to situations as they arise, to develop better approaches to their jobs, and to seek out and remove the root causes of recurring problems (p. 250)

Similarly: the managing director of Rover UK suggested that enhanced performance within the factory comes from the fact that "everyone now has two jobs. First to build the case, second to find ways of doing it better" (Caulkin, 1993, p. 24); Hohn (1988, p. 98) argued that for machinists in a German textile company, "it's not so important to be able to reconnect the thread, what matters is to see what's likely to happened and what you need to do to prevent it snapping"; and workers at Toyota in Japan are "encouraged to think actively, indeed proactively so they can devise solutions before problems become serious" (Womack *et al.* 1990, p. 99).

1988); and there are 'sceptics' who argue that mass production is still the major mode of production, being more flexible than is commonly assumed.

Essentially, operators are expected to perform roles where the boundary of expected behaviours is stretched and they are required to do much more than just operating machines. They will also typically be required to perform this extended role with less direction from a supervisor. Thus, the reliable performance of a fixed set of prescribed tasks required in Tayloristic-based jobs is no longer the appropriate criterion of performance. A 'high-performing' operator is required; that is, someone who is multiskilled, highly motivated, who proactively uses his/her local expert knowledge and initiative, who works co-operatively in a team, who has a broad understanding of production, and who is self-directed and learning-oriented (e.g. Buchanan, and McCalman, 1989; Vaill, 1982).

3.4.1 Work orientations

What sorts of changes are required within an operator for them to be able to perform this new role? Based on the above description of how jobs will change with IM, it will be suggested that operators need to develop cognitive and collective skills, a wider knowledge base, and a willingness for self-direction. However, underlying these developments is a more fundamental change; that is, people need to develop an orientation to their work that aligns with the new performance requirements. They need to re-conceptualise the way they see their role, and their view of the work environment around them. As suggested in *Chapter 1*, employees need to undergo a new 'mental revolution' and develop a fundamentally different perspective than that fostered by Taylorism. Examining employee orientations as an outcome variable of job design within IM is the focus of this thesis. As such, the whole of the next chapter looks at the construct of orientations, the rationale behind the approach, and the specific research propositions. For now, the intention is to illustrate the nature of the new orientations that are required.

One example comes from a case study of the implementation of cells and TQM in an engineering company (Buchanan and Preston, 1992). Operators seemed to develop new views about their role and see problems previously seen as irrelevant to them as part of their role. This is indicated by a comment made by one manager: "They'll come and tell us when they foresee a problem coming, whereas before they wouldn't. If they saw a problem coming, they'd put their feet up" (p. 66). However, in contrast to the employees, foremen failed to accept a new facilitating role rather than a directing one, and continued to define performance as organising work and dictating operations. Not surprisingly, these views conflicted with operator's expectations who felt dissatisfied with foremen interfering with work scheduling and problem-solving.

Similarly, in their study of the introduction of high-performance work systems at Digital (Ayr, Scotland), Buchanan and McCalman (1989) highlighted the importance of production employees and supervisors developing a new understanding of their role. Management in the company encouraged employees to 'own' the systems they were assembling, including taking on board a wide range of problems and tasks. Although a long and painful process, employees developed this ownership over time and took on a much wider view of what their role was about. This is illustrated in a quote by a production control person:

> You can see the production guys, you can see the business guys, you can see the influence of the business plan changing ... you can see inventories building up, you can see the purchasing guys... you can hear the vendors coming in...You can see how profitable or unprofitable the whole business becomes... You can see the new products coming in...You can see how the whole thing links up. You just have a wider perspective. You can see all the repercussions of what you're doing (p. 148).

In a case study of the implementation of FMS (a form of AMT), Jones and Scott (1987) described how employees' developed broad orientations when their jobs were allowed to 'evolve' into an autonomous team. The employees (categorised as 'staff') worked flexibly, performing both programming and operating tasks, and built up a broad knowledge about the system. However, when a new personnel manager forced the operators to choose to be classified as either 'staff' or 'shopfloor' for administration reasons, these orientations began to reverse. One person, who decided to remain as staff, started to do most of the programming tasks, while the other two employees, who chose to be 'shopfloor', began to focus on machine tooling. The authors claim that these changes "seem to have led to a significant change in the outlook of the operatives which both they and the production engineers thought limits the optimal use of the FMS" (p. 34). Illustrating this, one of the employees on 'shopfloor' rates stated:

> Now if I walk past the machine and I think its been programmed to run too slow I'll do one of two things; I'll either tell the programmer and he'll make the changes, or I'll just think, 'Oh, he's made a mess of that one!' and let it go rather than tell him for the sake of saving thirty seconds on the job. There's no incentive now really.

Other writers have noted the importance of operators in IM developing appropriate conceptualisations of their roles and the work environment (Bratton, 1993;Kolodny and

Stjernberg, 1986; Zammuto and O'Connor, 1992). For example, TQM depends on operators developing a more customer-focused, participative role orientation (Wilkinson, Allen and Snape, 1991); and operators within a JIT system need to align their expectations about jobs with those inherent in a JIT culture. Oliver and Davies (1990) describe two case studies of Cellular Manufacturing and JIT where problems occurred because the demands of the new strategy did not align with traditional assumptions. For example, the employees did not understand or accept the idle time with JIT. They equated the amount of unfinished work to do with their job security, and thus having no visible work was very threatening. As described by a team leader: "people get very jumpy when there's no work and they try to create work" (p. 564). The authors suggest that new understanding needs to be "*installed* in the people", and they need to change the way certain aspects of manufacturing are interpreted and move from "just-in-case thinking to just-in-time thinking" (p. 564).

Finally, to illustrate the concept of orientation in a slightly different way, a description of two stone cutters is given. This was obtained from the documentation of one of the companies studied in this thesis.

> Two stone cutter artisans pursuing their craft were observed by travellers passing by. One traveller, seeing the first remarked on his diligence and effort: "What is it you're doing?", the traveller asked. "I am chipping away at this block of stone" came back the reply. To the second, also hard at work, the traveller posed the same question, "I'm an artist" the craftsman answered "I'm building a cathedral".

The latter craftsman's perspective can be seen as analogous to the way a worker performing a complex job within IM needs to perceive their role. Rather than seeing it as performing a set of standard tasks, a worker might see his or her role as one part of a set of interdependent operations aimed at making a certain product for a customer. Similarly, rather than seeing effective performance as consistently carrying out their tasks according to directions, they might see it as utilising their expert local knowledge to continually improve the production process. Such an orientation is more likely to result in the types of behaviours required within IM.

3.4.2 Performance requirements

As suggested above, part of developing a work orientation that is consistent with the new role involves employees developing an understanding of what is required of them for effective performance. That is, they need to be aware of and accept what skills, knowledge or personal qualities are required, and then seek to develop them. The precise requirements will partly depend on the specific changes to the jobs in the particular context. For example, at Digital in Ayr, no less than 18 skill and knowledge categories (each with 10 grades of depth) were identified as relevant for operators working in high-performance work teams (Buchanan and McCalman, 1989). Minimally, operators will need to accept the need to use more than basic technical skills. They also need 'normative qualifications' that allows them to be adaptable, highly motivated, and committed to the organisation; and 'innovative qualifications' to be able to make improvements to work processes and to cope in unstructured situations (Ollus *et al.* 1990; described in English in Alasoini, 1993). Several core skills, knowledge and personal qualities can be identified as critical for this higher level of performance within most IM contexts. These are described further. As will be described in *Chapter 5*, employees' perceptions of whether these requirements are necessary for performance of their job will form of the measures of their orientations.

3.4.2.1 Cognitive and collective skills

Workers in complex jobs within IM contexts will need to use cognitive skills to a much greater extent than workers in traditional manufacturing settings. Buchanan and McCalman (1989) describe the need for a 'knowledge' worker rather than a shopfloor operator. As already suggested, the knowledge technology requirements of tasks will be greater and thus require the use of higher level cognitive and analytical skills to operate the technology, solve and prevent problems, work flexibly, and influence business decisions (e.g. Bratton, 1993; Buchanan and Bessant, 1985; Helfgott, 1988; Hirschhorn, 1984; Majchrzak, 1988; Manz, 1990; McCalman and Buchanan, 1990; Perrow, 1984; Wilkinson, 1983). Greater interdependence between processes also means people need to process more information, and solve problems more quickly. For example, a manager in a cellular manufacturing/JIT environment suggested "we now need people who think on their feet not with them" (Tailby and Turnbull, 1987, p. 17). Several of the skills identified as necessary for high-performing operators at Digital included cognitive-based skills such as problem-solving skills, software skills, analysis and system design skills, and planning/forecasting skills (Buchanan and McCalman, 1989).

Forming groups around interdependent tasks and devolving autonomy to the work group was suggested to be the best work design strategy within IM. Working in teams will require interpersonal and team-working skills. Hackman and Oldham (1980) describe the importance of 'healthy interpersonal processes' that involve co-ordinating efforts and fostering commitment, weighting inputs and sharing knowledge, and inventing and implementing performance strategies. Skills such as being able to communicate, resolve conflicts, negotiate, share problems, and train others were identified as important for working in high-performance teams (Buchanan and McCalman, 1989; see also Parker, Mullarkey and Jackson, in press). In particular, a critical requirement seems to be social confidence, such as a willingness to speak out, ask questions, and challenge assumptions (Parker, *et al.* in press). This is particularly important within IM because of the greater interdependence between manufacturing functions. This requires people to be able to deal with the interface between boundaries (Zammuto and O'Connor, 1992). Kolodny and Stjernberg (1986, p. 296), for example, emphasise the need for operators to be able to speak up confidently to engineers if they see deficiencies or errors and to "have some experience with group decision making, some knowledge of problem-solving processes, some facility with confrontation methods and conflict management approaches, and some verbal skills". As noted in the Eurotecnet (1991, p. 27) report, these skills cannot be assumed: "For example, constructive co-operation at the round table cannot be taken for granted, particularly for older workers, who have lived, thought, and worked along Tayloristic lines for many years. Team-work has to be learnt". Several authors have similarly emphasised that successful groups require 'team-building' training to develop appropriate interpersonal skills (Grey and Corlett, 1989; Liebowitz and de Meuse, 1982).

3.4.2.2 Manufacturing and production knowledge

Underlying the skills described to date is a requirement for a broader, more complex knowledge base. It will no longer be sufficient to just have technical understanding of one or two processes. Employees need to know about the whole production process, including the interrelationships between the processes, and an understanding of how the individual contributes to the process. More specifically, Buchanan and Bessant (1985, p. 303) argued CIM operators need to understand the following: the production process (its layout, sequence of events and interdependencies); the product (its key characteristics and variability of raw materials); the equipment (its functions, capabilities and limitations); and the controls (the functions, capabilities, limitations, and the effects of control actions on performance).

Because of the interdependencies between all aspects of manufacturing in IM, employees will also need a wider understanding of the company, including its goals, the functions performed by non-production departments, and how the efforts of functions combine to meet these goals (Buchanan and McCalman, 1989). They also need to understand new manufacturing initiatives and their underlying principles (Oliver and Davies, 1990). This wider understanding is referred to in the Eurotecnet (1991, p. 29) report as 'design and organisational' competence, or the broadening of the horizons of workers at every workstation, as shown in the following quote:

> Today's workers must be multiskilled and capable of explaining what they are doing to their colleagues. They must be capable of understanding the interconnection between what they are doing and the overall success of the company.

A broadening of such knowledge was noted by Buchanan and McCalman (1989, p. 148), who reported one of the greatest benefits of employees working in high-performance teams as "their greatly expanded understanding of the nature of the business as a whole".

Philosophies of high-involvement also maintain that operators need to know about the total work system in order to contribute to the business. Lawler (1992), for example, suggests that a broader perspective allows employees to solve systemic problems more effectively, and to come up with more innovative solutions (see also Liu, Denis, Kolodney, and Stymne, 1990). Without this wider perspective, Lawler suggests that people will put forward solutions that look great from their perspective but that contain 'roadblocks' elsewhere because they do not know what goes on outside their limited area. Moreover, having a wider perspective is suggested to enhance people's commitment (because they understand issues better), to aid in self-management, and to facilitate communication (because of a better understanding of what others are doing).

3.4.2.3 Self-direction

Although high motivation is clearly important within IM (e.g. as a result of the vulnerability of low-inventory production to industrial disputes, Oliver and Davies, 1990), a specific type of motivation is particularly critical. That is, because the type of behaviours required within IM cannot readily be coerced, self-direction is required. For example, at Digital, management wanted "employees to be able to deal with manufacturing problems on their own initiative, without management intervention (and) expensive equipment to be operated effectively and faults to be identified and rectified rapidly, within the teams where possible" (McCalman and Buchanan, 1990, p. 17). Manz and Sims (1992, p. 1133) similarly stress the importance of "self-managing abilities" within autonomous conditions"; and Alasoini (1993, p. 322) argues that IM increases the need for 'motivational qualifications', or "the ability to take self-initiated action in one's own job and encourage oneself to exceed the minimum level of performance". The Eurotecnet report (1991, p. 28) refers to this as 'self-learning competence', or " an active power within people, making them engage continuously with all of their experiences (in an open and inquiring way) to understand and master them". This competence is suggested to be particularly important because much of the knowledge required within IM can only be learnt through an active self-learning process.

3.4.3 Summary of operator requirements

In summary, it has been suggested that employees within IM will need to take on a new role and develop additional skills and knowledge. It was argued that an essential part of this process is the development of work orientations that are appropriate to the new role. This involves developing 'ownership' for a range of problems, taking on board the principles of manufacturing strategies, and understanding the performance requirements of the new role (i.e. the need to use cognitive and collective skills, to develop a broad knowledge of production and manufacturing, and the need for self-direction). Of course, employees will ultimately need to develop these particular skills and knowledge; however, incorporating them into their role view can be seen as a 'higher level' requirement and is the issue of interest here. Table 3.1 summarises these points, and the earlier discussion, and lists the likely differences in job complexity within traditional and IM jobs and the different performance requirements and orientations needed.

3.5 Chapter conclusions: The need for a new approach

In this chapter I have described how the requirements for job design within manufacturing are changing. Simplified jobs are increasingly being seen as unsuitable for organisations trying to compete in a changing economic and technological world and, instead, complex jobs with high operator control are viewed as the best strategy. On the surface, this would suggest that the recommendations of organisational theorists for job redesign and increased participation are finally being realised (Hirschhorn, 1984; Kochan *et al.* 1986; Walton, 1985, Wood, 1989). That is, practice is at last 'catching up' with job design theorists' recommendations in the 1970's. However, for several reasons, current job design issues differ from those in earlier decades.

In particular, there is a more emphasis on operator performance within modern manufacturing contexts. In contrast to traditional, routinised environments where behaviour is mostly constrained by the system, individual performance within IM can have a much greater economic impact (Snell and Dean, 1992). Job redesign is increasingly being seen as a way of facilitating the higher levels of performance that are needed. Thus, a first key difference between the job design issues concerns the driving

Table 3.1: A comparison of the likely job complexity within traditional manufacturing and IM jobs, and the performance requirements and orientations needed.

Job complexity	**Traditional operator job**	**IM (high-involvement) role**
Task Complexity		
Technical task difficulty	• low (e.g. long run times due to large batches, rigid work flow, and few unpredictable problems)	• high (e.g. short run times due to small batch sizes, unpredictable problems with multiple solutions)
Interdependence	• low (e.g. large buffer stocks between stages, separate functions)	high (i.e. tightly integrated stages and functions)
Role Complexity		
Patterns of local control	• direct supervision • specified procedures and rules	• self-control with appropriate norms and expectations, plus • output control (e.g. setting and monitoring goals)
	• often individual-based control systems (e.g. piecework)	• often collective autonomy
Work Orientation		
(see Chapter 4 for a more detailed table).	• narrow, passive and short-term orientation to work (e.g. seeing good performance as involving mostly technical skills, and having traditional views about manufacturing).	• broad, proactive and strategic orientation (e.g. understanding the performance requirements of the new role, owning a range of problems, and having a strategic view of production).
Perf. req'ts		
Skills	• narrow skill-base	• multiple skills
	• mostly physical/ technical skills	• including technical, cognitive, collective and interpersonal skills
Knowledge	• narrow and task-based	• broad including knowledge of local production and wider manufacturing goals, functions and strategies.
Motivation and self-direction	• motivation required to arrive on time, put in consistent effort and do what told	• motivation to apply effort appropriately in a self-directed manner

force behind them. Although earlier job redesigns were primarily carried out to improve employees' QWL, increase their attendance, and enhance their motivation, the emphasis now is on restructuring jobs to improve employee performance. Related to this, and perhaps most important in terms of this thesis, the approaches to job redesign have different perspectives on job control. In earlier initiatives, it was assumed that greater job control improved employees' quality of working life and motivation. However, within IM it is generally argued that autonomy improves worker performance through freeing up the use of operators' existing knowledge and skills, and in facilitating further development of their skills, knowledge and orientations.

A further difference between the types of job redesign relates to their scope. Whilst earlier job redesigns often involved changing small numbers of jobs to improve well-being, current initiatives are typically part of organisation-wide, strategic applications aimed at improving the use of human resources (e.g. Littler, 1985). As suggested in the following quote, a larger scale of change is needed:

> Traditional approaches to work organisation involved tinkering with individual jobs only and these techniques had weak and limited effects. Broad-based organisational strategies are now necessary to develop and sustain the high levels of skill, commitment, and performance fundamental to continued international competitiveness and economic growth (Buchanan and McCalman, 1989, p. 33).

Because of this greater scope and strategic importance, it is suggested that the job redesign within IM needs to be supported by changes in management structures and human resource practices that foster a broader 'high-involvement' culture (e.g. Hayes, *et al.* 1988; Lawler, 1992). Earlier job design initatives were not often accompanied by such 'organisational transformations'.

Thus, it is clear that new forms of work organisation, wider in scope than those of the 1970's and driven by different forces, are emerging within IM. Yet despite these changing requirements for job design practice within the last decade, there has been little corresponding advance in research evaluating job design or its underlying theory. In the previous chapter, it was suggested that a more developmental and performance-oriented approach to job design was needed. The value of this is highlighted with the changes occuring within manufacturing. In particular, the greater emphasis on performance within IM means it is critical to understand the mechanisms that underlie performance change with job redesign. As described earlier, it is likely that the changes required of traditional employees will be substantial and will require changes in long-established orientations towards their work that, in turn, both reflect and foster the development of new cognitive and collective skills, and a broad knowledge-base. These types of developmental changes that are required for performance within IM, and the processes that facilitate them, need to be measured and evaluated.

A further reason for a more developmental approach to job design research within IM is that it aligns more closely with the management philosophies that often accompany the new initiatives. For example, some of the assumptions that underlie the high-involvement approach include "all employees are responsible, thinking adults who want to do their best; human resources are too valuable to waste or to leave untapped; creative talents and skills are widely distributed at all levels of an organisation and society" (Hayes *et al.* 1988, p. 250). This emphasis on learning and development as a foundation for enhanced competitiveness is also evident in other organisational transformation strategies, such as the 'learning organisation'. Lei and Goldhar (1993) highlight the importance of 'second-loop' organisational learning (Argyris and Schon, 1978) for the successful implementation of CIM. These authors suggest that the information processing demands of CIM need to be matched with a new learning-based management paradigm that "encourages experimentation, risk-taking, new approaches to problem definition and proactive thinking" (p. 228-9). In all such organisational-level transformations, changes will ultimately have to take place at the level of individual development. As O'Connor and Wolfe (1991, p. 336) argue, the attention given to the flexible, organic organisation designs has "tended to outpace the theoretical attention given to the individuals who will embody such organisational visions".

Thus, the emphasis on enhancing individual performance within modern manufacturing, in conjunction with a broader management emphasis on employee development and change, suggests that there is a need to broaden the way job designs are evaluated and investigated. The next chapter presents one such advance that has the potential to make job design research more appropriate to the new manufacturing paradigm - the examination of employees' orientations to work.

Chapter 4

Orientations as a new dimension to job design research: The key propositions

4.0 Introduction and rationale

In this chapter I develop the argument for the examination of employees' work orientations. This firstly involves a description of the construct of orientations and the dimensions that are of interest here, as well as a brief discussion as to how this construct differs from those typically assessed within job design research. Drawing together some general assumptions in the literature, I then specify the links between orientations, job design and performance within IM contexts. This results in two key propositions. The first is that the design of shopfloor jobs will affect employees' work orientations. More specifically, in relation to the context of IM, it is proposed that the development of new and more 'appropriate' orientations will depend on the extent to which the introduction of new initiatives involves enhanced operator control. Following on from this, it is proposed that, in those IM contexts where operators have complex jobs with high control, the extent to which they develop new and more appropriate orientations will affect their performance.

At this point, it is appropriate to note that the examination of employee orientations is put forward as an alternative and complementary approach to the job design models already in existence. That is, the focus on orientations throughout this thesis is not intended to deny the importance of examining the conventional predictor and outcome variables. For example, it is important to examine whether job characteristics have changed, particularly the level of control, because it cannot be assumed that the introduction of IM initiatives will enrich jobs. For similar reasons, the effects of these changes on conventional outcome measures (e.g. job satisfaction, psychological health, and stress) should be examined. However, considering only these standard variables leaves a void in job design research, and the rest of this chapter aims to demonstrate how examining employee orientations goes some way towards filling this gap.

4.1 The construct of employee work orientations

This section describes the general construct of orientations, including related theories and concepts, and the specific types of work orientations required within IM. Also discussed is the value of orientations as a construct that differs from those that are routinely assessed in job design research.

4.1.1 A general description

Orientation is defined in the Concise Oxford dictionary as: "a person's attitude or adjustment in relation to circumstances, especially politically or psychologically". In relation to the domain of work, orientations refers to the way people see their job and their work environment. The basic assumption underlying the assessment of orientations is that people have different constructions of their world, and that these differences are psychologically meaningful. This assumption underpins many theories in psychology and related disciplines. As early as 1781, the philosopher Immanuel Kant (1724-1804) emphasised that there is no 'reality' but that individuals' actively filter events through their mental categories. Stemming from this basic premise, there are many theories at the individual and organisational level that relate to the investigation of orientations.

From cognitive psychology comes the concept of schema first used by Bartlett (1932) and Piaget (1952) to represent meaning and knowledge. 'Schema' refers to a cognitive structure of organised prior knowledge, abstracted from experience with specific instances (Fiske and Linville, 1980). As such, schemata provide a basis for perceiving, remembering, inferring, and evaluating; that is, they guide subsequent perceptions and appraisals as well as retrieval of existing information. Other related concepts that are also considered to organise experience include scripts, frames or frameworks, cognitive maps, implicit theories, belief structures, and personal constructs. The latter concept was developed by Kelly (1955) in what is known as 'Personal Construct Theory'. This posits that people have unique systems of personal constructs with which they categorise objects, interpret the events that happen to them, and predict the future. These ideas have been widely used within clinical psychology, and therapies have been designed to alter people's construct systems.

Changes in orientations can thus be likened to changes in construct systems or schemata in that, even with no actual changes in the external world, events in the environment may be perceived and reacted to differently. From another perspective, they are similar to 'beta' and 'gamma' changes in perceptions rather than 'alpha' changes. These types of changes were first described by Golembiewski, Billingsley and Yeager (1976) in the organisational development literature. Alpha change refers to a change in the state being measured (e.g. if measuring perceived changes in supervisory behaviour, alpha would reflect an actual change in the behaviour). Beta change refers to a change in the individual's measurement continuum. For example, a person might have thought they were given a "moderate" degree of control, but after their awareness of the range of autonomy is broadened through changes in supervisory behaviour, they realise their supervisor previously provided them with very little autonomy and thus use the rating scale differently. Finally, gamma change involves "a redefinition or re conceptualisation of some domain, a major change in the perspective or frame of reference within which phenomena are perceived and classified, in what is taken to be relevant in some slice of reality (p. 135)". Thus, for example, if measuring supervisory behaviour, gamma change could be a change in conceptualisation from seeing supervision as an authoritarian, controlling role, to a boundary spanning, resource provision role with different assumptions about people. This typology is mostly used to argue for tighter methodological checks when assessing alpha change, although changes in the way people see things are often the intended outcomes of an intervention and should be considered as important in their own right (Golembiewski, 1986; Norman and Parker, in press).

Other writers have emphasised the importance of such changes. For example, Schein (1969) suggests that organisational change is dependent on a process of 'deep' change within people with the first step being:

> To develop alternative assumptions and beliefs through a process of cognitive re-definition of the situation. This process involves (1) *new definitions of terms* in the semantic sense, (2) *a broadening of perceptions* which changes the frame of reference from which objects are judged, and (3) *new standards of evaluation and judgement* (italics in original, p. 102).

Some organisational theories focus on concepts like orientations. For example, based on the idea of personal constructs, the sociocognitive perspective of organisational dynamics suggests that "organisational actions, including the creation and use of knowledge, are structured by the organised systems of constructs which organisational participants use to interpret and anticipate events" (Dunn and Gisberg, 1986, p. 957). The emphasis in understanding organisations is thus on determining the constructs and knowledge systems, and discovering "What are the 'rules' or 'scripts' that guide action?" (Smircich, 1983, p. 350). Research into organisational culture (e.g. Schein, 1985) and climate (e.g. James, Hater, Gent and Bruni, 1978) fits broadly within this framework. Theorists who focus on the management strategies' of 'organisational transformation' are also concerned with similar concepts (Porras and Silvers, 1991). For instance, Ledford and Mohrman (1993, p. 145) describe large-scale organisational change towards high-involvement as a "deep change, affecting the most fundamental aspects of an organisation, in this case the assumptions that people hold and that are embedded in the organisation design about authority, control, motivation and effectiveness"; and organisational learning is suggested to involve changes in frames of reference and underlying assumptions (see Argyris and Schon, 1978; Dodgson, 1993).

The concept of orientations thus relates to individual-level concepts such as schemata and personal constructs, and can be seen to have parallels with some organisational-level concepts. Whilst it might be desirable to differentiate orientations from related individual-level constructs, this is almost impossible given the varying terms that are used to refer to similar concepts, and the range of concepts expressed by the same term. For example, schema sometimes refers to an underlying representation that can only assessed by looking at mental processes, whereas others claim to be assessing schemata when using attitude and belief data (see Fiske and Linville's, 1980 comments about the validity of this concept). Orientations as assessed here do not attempt to assess people's underlying knowledge structures and processes; rather how these are reflected in their broader constructions of work. Orientations can be seen as a set of overarching beliefs, where beliefs are "mental representations of human understanding produced by active cognitive processing" (Sproull, 1981, p. 204).

With only a few exceptions (discussed later), very little research has examined anything like shopfloor peoples' orientations as an outcome variable or a performance predictor. Interest in related concepts such as schemata and frames has mostly been restricted to studies of management processes (such as McIntyre, *et al's.* 1984 study examining managers' frames of reference for effective performance). As such, it is necessary to describe the construct in detail. Here, two types of orientations are examined: role orientations and strategic orientations.

4.1.2 Role orientations

Role orientations refers to the way people see their role, and how they see it in relation to the work environment. Operationalising this could involve looking at what problems and tasks people see as relevant, what information they see as important, and what competencies they believe are needed to perform their role effectively. The sorts of dimensions that can be built into such measures include whether people have an active or a passive role orientation (e.g. seeing the most important job requirement as 'doing what their supervisor tells me' suggests a passive view); a broad or narrow view of their role (e.g. seeing customer satisfaction as relevant to them suggests a broader view); and an individual or group role orientation (e.g. seeing information about team-working issues as relevant suggests a group orientation).

At this point, one might ask whether people can possess different role views. That is, wouldn't people holding the same jobs see their role in the same way? The 'job-role differentiation approach' put forward by Ilgen and Hollenbeck (1991) serves to clarify this issue. This approach is based on the view that job-based research (i.e. job design and job analysis studies) typically examine only the functional content of jobs, while role-based research (e.g. looking at role conflict and ambiguity) focuses on the relationships among jobs, and the process of how they change and develop. In order to more usefully integrate these traditionally separate areas of research, Ilgen and Hollenbeck clarify the difference between jobs and roles. A job is defined as a set of 'established task elements' performed by one person, where 'established' tasks are those elements created by the organisation that exist independently of the job incumbent and are quasi-static. However, because jobs exist in a social environment that is dynamic and subjective, it is not possible for the organisation to anticipate all elements. This is particularly the case in complex environments. Thus 'emergent task elements' occur as a result of social factors, including the job holder who may self-generate these elements. Roles contain both established task elements and emergent task elements, and are thus broader and less precisely defined than jobs. They are also constructed by the incumbent:

> Jobs and roles are socially constructed and neither is objective. Jobs are social constructions of the prime beneficiaries or their agents, and roles are social constructions of the actors in the job incumbents role set, including him/herself (Ilgen and Hollenbeck, 1991, p.183).

Thus, returning to the original question, two job holders may have the same job but a different role, the latter arising from special characteristics of the incumbent (e.g. an expert may take on more emergent tasks) or contextual differences (e.g. some supervisors may devolve planning tasks, whilst others not). The extent of variation in job-role differences will depend on how they are combined (Ilgen and Hollenbeck, 1991). A bureaucratic prototype, typical of lower level jobs, is one where jobs and roles are almost synonymous and there is little room for expansion or emergent tasks. At the other extreme, is the loose cannon prototype where there is very little formal job description (and hence few established task elements) but a role largely negotiated by the job holder.

The distinction between jobs and roles has been noted in the literature on work design. Davis and Taylor (1972) describe early views of jobs as static, well-delineated entities that relate to the person's relationship with a product. That is, a job is "that portion of the employees' work role that deals with direct activities in relation to the object undergoing direct transformation" (p. 11). However, as this 'job' diminishes with technology, and man-machine and machine-product relations become more important, then the 'role' is vertically enlarged. Rather than performing more man-product functions (i.e. horizontal job enlargement), the role is expanded to include responsibility for quality control, co-ordination with others, and so on (i.e. job enrichment). As new behaviours are required - particularly social ones - then the concept of role becomes more important (Davis and Taylor, 1972;

see also Davis and Wacker, 1987). This was recognised within the STS literature, where 'occupational roles' were seen as the natural focus of autonomous work groups (Davis and Taylor, 1972; Emery, 1959; Trist and Bamforth, 1951), and it was suggested that group members experience their role as a gestalt rather than as a set of prescribed tasks (Emery, 1959). Thus, some job design researchers have recognised the importance of considering roles rather than jobs within complex environments, although this distinction has not directly influenced the questions investigated.

This perspective on roles and jobs can be applied to job redesign within IM. The changes required within IM contexts can be seen as a movement along the dimension from bureaucratic to looser prototypes. That is, rather than the traditional tight job specification of all the tasks for which an individual will be held accountable, operators within IM are expected to do whatever is necessary to meet broader goals. It is not possible or desirable to specify all the tasks, but rather for some tasks to emerge in response to changes in the person (e.g. enhanced skills or aspiration) and changes in the environment (e.g. new technologies and practices, changes in team composition). Thus, workers are not just being required to perform a new job (i.e. a new set of man-machine tasks), but rather to develop and to construct for themselves a new role that cannot clearly be specified, that includes social elements, and that requires them to use their initiative in order to meet wider role objectives. In a similar vein, Davis and Wacker, (1987) describe how, when jobs were redesigned in a food-processing plant, no set of detailed descriptions could convey either what was expected of workers by the company, nor what workers wanted from the company. They concluded that, after job redesign:

> In a narrow 'job-description' sense, one's job is a particular task assignment that may change daily; in a broad 'role' sense, one's job is to help carry out the responsibilities assigned to the team, to participate in team decisions, to cross-train, and to use one's judgement to contribute to the team's productivity, quality, maintenance and development (p. 433).

In terms of employees' role orientation, this means that workers need to see their tasks as emergent, and as involving a range of domains. Rather than being concerned only with extrinsic or individual-based goals, operators in integrated jobs need to develop a wider view of their responsibilities. They need to 'own' broader team goals (cost, quality, lead time, customer satisfaction) and problems that affect these goals (see section 3.4.1 for examples of operators who came to be concerned about, and to act on, problems that they previously would have ignored as 'somebody else's problem'). People also need to develop a new understanding and acceptance of the performance requirements of IM roles. Within traditional 'bureaucratic prototype' jobs, because of the low information processing requirements, effective performance usually involves following instructions or tightly specified procedures using technical skills. However, within the looser role required in IM, effective performance relies on flexibly and proactively using a range of different types of skills and knowledge to meet group and company goals (see section 3.4.2). Operators need to understand, and take on board, these new requirements. For example, failing to acknowledge the importance of working collectively may affect team cohesion and development. As Lawler (1992, p. 91) stated: "if an individual, for example, simply takes ownership over one part of the process and refuses to do other tasks, the rest of the team cannot learn that step in the process... (it is) difficult for them to own the entire product or process, and interferes with the team's growth and development".

Thus, returning to the dimensions of role orientation introduced earlier, an 'appropriate' orientation for complex jobs within IM will be one that is active rather than a passive, broad rather than narrow, and group-focused rather than individually-focused. If employees do not develop such an orientation, then job redesign interventions are likely to be blocked. Several commentators have noted that attempts to restructure work often fail because people hold rigid views about what their job involves and what they have been employed to do; a phenomenon described as the 'job myopia', 'its not my job' syndrome (e.g. Davis and Wacker, 1987; Karasek and Theorell, 1990), or a 'sod it' mentality (Woods, 1990). Davis and Wacker (1987, p. 438) suggest that "important needs go unmet because those who are first aware of problems shrug it off as not part of their job". Those who are then formally responsible for the problem do not learn of it until it has gone through bureaucratic channels and "by then, problem-solving is awkward, inefficient, and too late". Klein (1976) similarly described how Fordist job designs meant people had a very restricted role perception, and were not interested in anything beyond the immediate job cycle, such as changes within the firm that did not impinge on them or improvements that could be made to their environment.

4.1.3 Strategic orientations

Strategic orientations is the second type of orientation of interest in this thesis. This construct concerns employees' understanding of, and views about, manufacturing initiatives that affect their role performance. This differs from the concept of role orientations in that it focuses on people's attitudes about strategic principles, such as those concerning preventative maintenance, problem-solving styles, JIT, specialists' roles, and continuous improvement. However, role and strategic orientations are clearly related concepts because most of the changes to people's roles are a result of specific manufacturing strategies. People need to understand and accept these strategies in order to develop the type of role orientation required within IM. For example, for operators to see preventative maintenance as part of their role, it may be necessary for them to understand and accept that this strategy will save time and money in the long term, and it may be desirable that they realise the importance of having reliable machines for smooth JIT work flows. At the most basic level, having an appropriate strategic orientation for IM means that operators construe manufacturing strategies as relevant to them, rather than seeing them as entirely management's concern.

Appropriate strategic orientations are particularly important within IM as many of the initiatives are based on very different philosophies than those inherent in traditional manufacturing, and require very different types of behaviours from the shopfloor. Effective role performance is thus likely to depend on developing an understanding that: "involves both learning new knowledge and discarding obsolete and misleading knowledge. The discarding activity - unlearning - is as important a part of understanding as is adding new knowledge" (Hedberg, 1981, p. 3). For example, JIT requires that shopfloor employees need to unlearn the well-established 'just-in-case' mentality that 'the more produced, the better', and need to learn to build or produce only when there is a demand. An example was given in the previous chapter of operators who had not discarded the traditional belief that lots of visible work means future job security, and who thus felt threatened by the idle time within JIT.

In summary, the general construct of orientations, and the more specific facets of role and strategic orientations, have been described. I have suggested that operators within IM will need to develop broad, proactive role orientations and more appropriate strategic orientations. Table 4.1 presents a summary of this discussion, with a characterisation of the types of orientations required within complex IM contexts in comparison to those likely to be held by operators within traditional manufacturing companies.

Table 4.1: A characterisation of the role and strategic orientations likely to be held by operators within traditional and IM environments.

Type of orientation	Traditional simplified 'job'	High-performance role within IM
Role		
Tasks	• narrow, prescribed tasks defined by the organisation	• broad-ranging emergent tasks defined by the organisation, the team, and the individual
Performance	• passively following specified instructions or procedures (e.g. directed by supervisor) using mostly technical skills and knowledge	• flexibly, and in a self-directed way, using cognitive and collective skills, and requiring a broad knowledge of production and manufacturing
Goals/ problems	• short-term focus on individual goals/ problems (mostly extrinsic), with an orientation towards cost and quantity rather than lead time or quality.	• longer-term focus on individual goals/ problems (intrinsic and extrinsic) and customer-oriented goals/ problems (including lead-time, quality, cost and quantity).
Strategies		
Interest and awareness	• limited interest in strategies, seeing them as management's concern	• interested in strategies, and understanding that they affect operators' roles
Acceptance and understanding	• holding traditional views about production (e.g. 'push' and batch mentality; seeing quality control as policeman function)	• holding views that align with IM initiatives (e.g. an understanding of the 'pull' philosophy of JIT; an understanding of preventative maintenance)

4.1.4 Orientations as a unique construct in job design research

To date, it has only been implied that role and strategic orientations represent a unique developmental and performance-related construct in job design research. This section explicitly addresses this issue, and looks at the contribution of orientations above and beyond the key variables already used routinely in job design research.

First, orientations are a qualitatively different type of outcome variable to the affective reaction measures (e.g. job satisfaction, psychological health) usually used in job design studies. As described in *Chapter 2*, the latter outcome variables assess peoples' reactions to work. In contrast, orientations reflect people's active constructions of their role and work environment and, as such, deliberately capture developmental elements of the person, including relevant aspects of their personality, motivation and knowledge. The difference in these types of measures can be seen in Hackman and Oldham's (1980, p. 2-4) description of the work attitudes and behaviour of a fictional character, Ralph.

> Ralph doesn't work very hard at his job, and he doesn't have to. He knows how to get through a workday without getting too tired and attracting any special attention from his foreman... he is not angry, he is not interested in a better job (although he'd like more pay), and he is not interested in how well the company does. Ralph gets along. He knows his place, its reasonably comfortable, and he stays there.

Hackman and Oldham (1980) argue that it is unlikely that Ralph's attitudes and behaviours reflect fixed personality traits; rather, they are more likely to be the result of adapting to repetitive and unchallenging work. The authors describe how Ralph, when first joining the job, may have been involved, challenged and clearly 'satisfied' with his job. A couple of years later, frustrated and bored, he may have reported being 'dissatisfied'. Now several years later, having adapted to his job, he might again report being 'satisfied', albeit in a much more passive and resigned manner than when he first joined. The authors suggest that, because of these adaptive changes, self-report statements of job satisfaction are 'suspect' and it is necessary to 'go beneath the surface' of such responses. Orientations do this. They assess - not how people react to their jobs - but what they see them as. As such, they allow examination of 'deeper' changes in people that have not often been explicitly addressed in job design theory (Argyris, 1976).

Second, orientations can be seen as indicators of a person's developmental state while at work. Using the analogy of growing from a child to an adult, Argyris (1957, 1964) suggests that organisations can allow or restrict people's development along the following dimensions: from passive, reactive organisms to active and proactive ones; from dependent organisms to independent ones; from organisms requiring immediate need gratification to ones able to tolerate delayed gratification; from organisms able to deal only with concrete operations to those able to deal in abstractions; and from organisms with few abilities to ones with many abilities. Rigid organisational roles, formal hierarchies, specialised work and an emphasis on authority can result in a child-like state of passivity, dependency, shallow interests, a limited behavioural repertoire, and a short-time perspective. People's orientations to work can be seen as tapping similar dimensions to those suggested by Argyris, and thus examining orientations can reflect a person's position along the developmental continua. For example, traditional shopfloor employees who sees their role as performing a single task and calling the supervisor to deal with all problems could be seen as individuals who have not yet 'grown up' at work. In contrast, workers who believe their role is to flexibly apply multiple skills and use their initiative in order to achieve long-term goals can be seen as further towards the adult end of the developmental dimensions.

Finally, the value of orientations as a variable is that they tap the combined effects of many interactive processes occurring with job redesign. Orientations do not simply reflect an increased willingness, knowledge, or a more active personality. Rather, they reflect how all of these aspects come together to suggest how a person might act whilst at work. Orientations are not intended to be a proxy for any of these variables but are an important 'integrative' construct in their own right. This point will developed in the next two sections that will discuss the relationships between job design, performance and orientations.

This discussion is based around the schematic representation of the key constructs and variables shown in Figure 4.1. First, as suggested in this figure, it is proposed that the development of broader and more active orientations will be facilitated by job redesign. This will occur through a variety of mechanisms such as enhanced knowledge and motivation, and changes in certain aspects of personality. These specific mechanisms or their interrelations are not tested in this thesis; rather, they are used as possible explanations of the relationship between job design and orientations. Second, it is proposed that employees' work orientations relate to their performance. These propositions, in conjunction with an exploratory aim to consider the influence of human resource factors on orientations, form the basis of this thesis. I now discuss them in the next three sections.

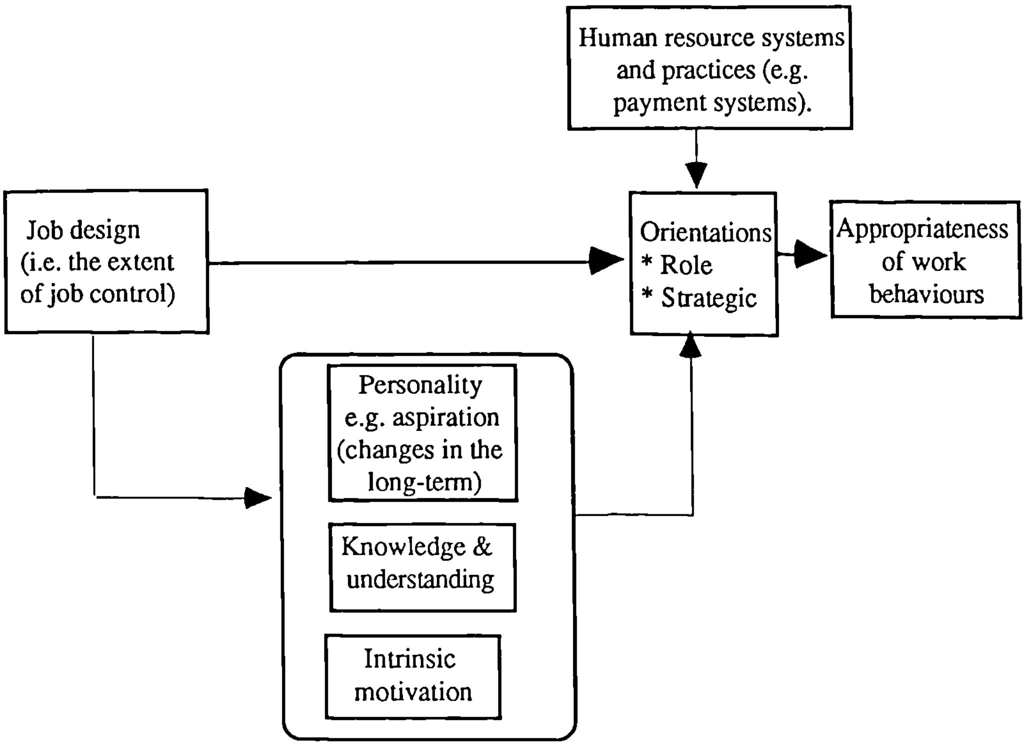

Figure 4.1: A schematic representation of the proposed relationships between job design, performance, human resource factors, and orientations

4.2 Job design and its effect on orientations

The first proposition is that job redesign within IM facilitates the development of broader, more proactive role orientations and more appropriate strategic orientations. Put another way, it is proposed that the extent to which IM involves enhanced job control, the greater the development of new and better orientations. The key focus is on job control rather than any other job characteristic variables (e.g. variety). This is because of the dominance and importance of this construct within the job design and organisational theory literature (see *Chapter* 2), and also because of the importance of this construct in other related areas (Wall and Davids, 1992). For example, job control is a central construct in relation to the labour process debate in sociological literature (e.g. Wood, 1990); it is a critical concept in the stress literature (e.g. Karasek, 1979); and it is important in some learning theories, such as learned helplessness (e.g. Weiss, 1990) and exploratory learning (Grief, 1992).

The proposition involves at least two assumptions. First, it assumes that employees in traditional jobs do not already have broad, active and strategic orientations. Some suggestion for this has already been presented, such as the phenomenon of 'job myopia' of operators in traditional jobs. Secondly, this proposition assumes that if employees in traditional jobs do have narrow orientations, then this is partly a result of the simplified job design. For example, as implied by Hackman and Oldham's (1980) description of the hypothetical employee Ralph, and Argyris's (1957, 1964) descriptions of people in mechanistic organisations, the narrow orientations held by traditional employees appear to be a result of people adapting to a lack of control and challenge rather than due to a fixed personality feature. Further support for these assumptions is described.

In general, the narrowing and pacifying effects of simplified jobs has been documented in early writings. Commentators such as Adam Smith (1776[1974]) and Karl Marx (1867[1970]) noted the alienating consequences and negative effects of Taylorised production jobs on people's development. These observations were supported by later research that showed that workers in simplified jobs reported lowered job aspirations, resignation, and apathy (e.g. Kornhauser, 1965; Turner and Lawrence, 1965). Baldamus (1951; cited in Emery, 1959, p. 180) described many workers as being in a state of 'dull contentment'; that is, "a sort of borderline satisfaction apparently quite distinct from the elation experienced in pleasurable activities or the quieter satisfaction of an engaging task, but so prevalent in industry as to warrant some consideration". According to Baldamus, this is an adaptive state that a normal worker in a simplified job achieves: "by a process of *narrowing down his psychological field* to the task at hand, putting out of mind any alternative attractions, and thus suppressing certain of his impulses and tendencies" (italics added). Bruggerman, Groskurth and Ulich (1975) similarly described a state of 'resigned satisfaction' where, because of the unavailability of other jobs and ways to change the situation, a worker lowers his/her level of aspiration and becomes resigned to the job. Argyris (1957) suggested that in jobs where people do not have the chance to develop, if they do not adapt by fighting the organisation (e.g. through creating unions) or leaving it physically (i.e. through absence and turnover), then they leave it 'psychologically' by becoming uninvolved, indifferent, and more focused on extrinsic elements of work. The latter is emphasised by Goldthorpe and colleagues in their studies of car assembly workers. Shopfloor employees were shown to have a strong instrumental orientation to their work (i.e. focused on payment) that, in turn, influenced the job people chose, the meaning they gave it, and how they defined their work situation (Goldthorpe, 1966; Goldthorpe, Lockwood, Bechofer, and Platt, 1968).

Although not explicitly stated, it is easy to imagine how employees in a state of 'dull contentment' or 'resigned satisfaction' would have a narrow, passive view of their role, and have little interest in or awareness of in wider strategic issues. Frese (1982) likens the adaptive process to organisational socialisation where a new member of an organisation takes on a new role and its values. Through this socialisation process, Frese (1982) suggests that management strategies may affect the 'personalities' of workers (where personality is fairly loosely defined). Specifically, he raises the critical question: "whether Tayloristic forms of work organisation lead not only to higher feelings of monotony, lower job satisfaction, extreme division of labour *...but also to a completely new outlook on work*" (p. 216, italics added; see also Klein, 1976; Wood, 1990). Looking back to Taylor's early writing, this certainly seems to be what was intended. Taylor (1911) explicitly stated that a central feature of Scientific Management involves taking on new mental framework. He summarised Scientific management as:

> not any efficiency device, ... not a new system of figuring costs; it is not a new scheme of paying men; it is not time study; it is not motion study; it is not divided foremanship... these devices are useful adjuncts to scientific management... in its essence, scientific management involves a *complete mental revolution* on the part of the working man (Taylor, 1912, p. 26-7; italics added).

This mental revolution basically involved an acceptance of the roles allocated to people. That is, where it is accepted that managers and engineers take on all the mental work (such as planning tasks and making decisions), while workers take on only the manual work. Essentially, Taylor was advocating that employees adopt a narrow orientation to their role where they only concern themselves with a limited range of prescribed, manual tasks. Extrinsic rewards were recommended to facilitate the adoption of this role: "management must also recognise the broad fact that workmen will not submit to this more rigid standardisation and will not work extra hard, unless they receive extra pay for doing it" (Taylor, 1911, p. 29).

These Tayloristic assumptions about what workers should be doing, and their motivations for doing so, are bound up in the design of the jobs and most of the manufacturing practices and systems within traditional factories (e.g. payment with individual bonus systems, time study departments, accounting procedures). Hence, it is not surprising that employees take on board narrow, passive and extrinsic orientations, and soon quash any desire to behave in more proactive ways. Karasek and Theorell (1990, p. 174) observed that comments reflecting a narrow role view, such as 'that's not my department' and 'its not good to rock the boat around here" probably reflect "learned responses to early job experiences in which taking initiative and using extra skills and judgement were severely penalised as overstepping the bounds of one's (unnecessarily restricted) authority". The process then becomes circular. If people do not exercise their discretion and judgement, then these skills and attitudes associated with them may be lost (e.g. Berkowitz, 1965 and Denny, 1982 provide evidence that if skills are not used they deteriorate over the life span). Hirschhorn (1984, p. 118-119) describes how, in conventional Fordist production systems, the foremen's role of controlling workers was self-reinforcing: "Workers took their job descriptions as the maximal rather than the minimal specification of duties, forcing the foremen to take all the initiative when contingencies and errors arose on the flow of work".

Given that the narrow and passive orientations of employees in traditional jobs are likely to be the result of a long-term adaptation process, the important question then concerns how this narrowing can be reversed. In general, it is likely that in the course of working, individuals will develop, maintain, and alter their views about their own roles and various organisational phenomena. As Dunn and Gisberg (1986, p. 958) assert: "Frames of reference change as organisational participants successively experience and (re)interpret events. Constructs and the organised frames of which they are parts represent working hypotheses that are revised in the course of experience". However, within a repetitive and simplified environment, such changes are likely to minimal and, if anything, tend towards developing even narrower perspectives. An individual's work orientation is likely to only change substantially when their role or the work environment changes. Entering into a new work organisation is one example of this (Van Maanen, 1976; Van Maanen and Schein, 1979), and Schein (1985) describes how organisations need to socialise new members to take on its central assumptions so that they perceive, think and react appropriately to work problems. Most importantly, when a person's job is re-designed to be more complex, this may allow and foster the development of broader, more appropriate work orientations.

Some support for the suggestion that orientations can change as a result of work experiences comes from findings that work can affect people's personality (see Brousseau, 1983, and Frese, 1982 for a summary of cross-sectional and longitudinal studies). For example, research has shown that locus of control is affected by successful performance on the job (Anderson, 1976; Andrisani and Nestel, 1976); that high autonomy strengthens individuals' intrinsic and people-oriented work values (Mortimer and Lawrence, 1979a), that holders of jobs with high task identity and task significance develop an increasingly active orientation toward their lives and experience less depression (Brousseau, 1978), and that people in more complex jobs develop less fatalism and a lower authoritarian attitude (Kohn and Schooler, 1982). The introduction of semi-autonomous work groups has also been shown to reduce feelings of helplessness (Frese and Grief, 1978; Ulich, 1978) and to increase the desire for promotion and information (Wall and Clegg, 1981). In

Karasek and Theorell's (1990) model of work and stress, some as yet untested links between jobs and long-term personality are suggested. First, they suggest a positive spiral whereby an active job (i.e. one with high control and high demands) and its opportunities for successful learning lead to an increased feeling of mastery. This, in turn, helps people to cope with the inevitable strain caused by the job, and thus further frees up their capacity to accept more challenging situations that promote more learning and positive personality change, ad infinitum. Second, a negative spiral is suggested where a high strain jobs leads to the accumulation of strain which, in turn, means people take on less challenging situations, learn fewer coping strategies, and thus feel less mastery. This lack of mastery then restricts people's ability to cope with strain and increased residual strain levels, ad infinitum (p. 103).

The evidence that work designs can affect people's generalised tendencies to behave, or see things in certain ways, suggests that changes in role and strategic orientations are feasible. Indeed, changes in orientations are likely to relate to, or be reflected in, changes in certain aspects of people's personality. For example, people who develop more intrinsic and people-oriented work values may move away from a narrow focus on achieving individual bonuses and begin to see their role as involving wider responsibility for shared group tasks. Similarly, if, as a result of being in a job with high control people develop enhanced feelings of mastery, this may lead them to take on a broader set of role behaviours. Thus, job redesign may allow or facilitate changes in orientations indirectly through its effect on relevant aspects of personality.

A second way in which job redesign might affect orientations is through a motivational mechanism. That is, broader and more proactive orientations might occur as a result of the increased motivation associated with more complex jobs. Higher motivation, in turn, means workers may be willing to put in more effort, or to apply this effort in more effective or self-directed ways. This can be likened to descriptions in the management literature of a paradigm change from control and coercion to commitment (e.g. Walton, 1985; Walton and Susman, 1987; see also Conger and Kanungo's 1988 writing on 'empowerment'). The traditional paradigm means strict controls, in conjunction with rewards and punishments, where tasks are assumed to have only instrumental value to workers and the worker's role is to comply (Block, 1987; Thomas and Velthouse, 1990). The new paradigm emphasises intrinsic task motivation where, under conditions of relaxed control and strong goal alignment, workers develop an internalised commitment to the task itself, seeing it as meaningful (Block, 1987; Schein, 1985), identifying with it (Bennis, 1989; Bennis and Nannus, 1985), or finding expressive value in it

(Shamir, House, and Arthur, 1989). Thus, through a motivation-based process, workers may become more intrinsically-oriented to engage in different types of tasks and, as result of this, expand their psychological boundaries about what tasks they see as part of their role. In describing the de motivational consequences of simplified jobs, Davis and Wacker (1987, p. 438) claim:

> Much energy that would be available for cross-training and spontaneous problem solving is instead diverted to protecting and aggrandising individual's narrow specialities. Ultimately, workers become alienated and lose their sense of organisational community when they see that they are stuck in a system of machine-like dead-end jobs which neither contribute to organisational effectiveness, nor address their needs for challenging, meaningful work.

A third process by which job re-design may change orientations is through its effect on people's knowledge and understanding. As described already (see section 2.3.1 and section 3.3.2) allocating control to operators enables them to use existing knowledge (e.g. Giordano, 1988), to develop new knowledge (e.g. Chmiel and Wall, 1993; Frese and Zapf, 1993; Wall *et al.* 1992) and may even result in more complex ways of applying this knowledge (Brousseau, 1983; Kohn and Schooler, 1978). This can be seen as similar to the training concept of 'exploratory learning', or learning that is facilitated by action (Greif, 1992). That is, autonomy frees up the opportunity for people to learn and explore in an active way, and this may enable people to learn more depth about various spheres (e.g. their understanding of a machine and how to prevent problems occurring), as well as increase their breadth of perspective and understanding about the work environment. Whilst changes in both of these types of learning are likely to affect people's orientations, changes to the latter will probably have the most impact. For example, realising that a fault can be prevented in a particular way may change a person's orientation slightly (e.g. they may attach more importance to a particular behaviour than before). However, realising that customers value lead times and quality, rather than just cost, may have a substantial impact of the way a person sees their role and their work environment.

There is some anecdotal evidence that more complex jobs may widen people's breadth of understanding and their perspectives on work. Rubinstein and Woodman (1984) described the consequences of complex jobs as "rewarding the incumbent with the perception to deal with complexity" (p. 11), and as allowing people to "achieve a far-sighted perspective" (p. 14). Within modern manufacturing, Wood (1989, p. 32) suggests that changes in work design may increase knowledge by:

> a) increasing the number of jobs to which an individual is exposed; (b) increases in workers' involvement in problem situations calling for diagnosis and considered judgement; and (c) increasing workers' *awareness of aspects of the production system beyond their immediate and narrowly defined role* (italics added).

In discussing traditional workers that appear to have narrow role perceptions (i.e. that focus purely on the immediate job cycle), Wood (1990, p. 184) asserts that team-working may broaden these operators' awareness is at least two ways: "It (team-working) may foster a definition of the 'job' that extends beyond the job cycle, and it may extend, through the team's responsibility for its own performance, to an awareness of wider issues, for example, problems of supplier relations (p. 184). Lawler (1992, p. 163) similarly suggests that when employees learn more horizontal and vertical skills "they gain an entirely different perspective on the organisation's operations, the way it is managed, and the information that supports the organisation".

However, despite much informed opinion and some case study evidence, there is little systematic research on how job redesign changes people's breadth of understanding and their perspectives, or indeed what is meant by such changes. It is not difficult to imagine how job redesign might broaden perspectives. Simply widening the range of tasks a worker has control over is likely to give employees a broader knowledge of the operations within the area, including how they interrelate and affect each other, and how they come together to result in the final product. Greater involvement with more complex tasks may also enhance people's understanding of the reasons things are done in certain ways, the broader implications of why they are performed, and lead to a better understanding of the constraints and contingencies affecting performance. People may learn more informal things about work (e.g. who to see in certain departments if problems arise), as well as more subtle aspects associated with group working (e.g. how to run meetings; how to solve conflicts).

A final, more indirect, *process by which job redesign within IM may affect* employees work orientations is through providing a broader structural and cultural framework that both changes people's orientations, and makes wider orientations possible. As described above, the narrow work orientations within traditional manufacturing are consistent not only with the job design, but with the personnel systems (e.g. payment, training, recruitment procedures), supervisory practices, and management structures. That is, Tayloristic principles of simplification and the division of mental and manual labour are *embedded* in organisational practices (such as time and motion studies) and structures (such as having a 'planning department'). Together, these give clear messages that employees are expected to behave in certain ways (e.g. following specific instructions), while managers and engineers are expected to behave in other ways (e.g. controlling employees, planning tasks). Job redesign is often associated with changes in these broader aspects (for example, supervisory roles usually need to be restructured; Oldham and Hackman, 1980), and this alters the messages people receive about how they should behave. Thus, job redesign can change not only people's jobs but the framework within which employees work and this, in turn, facilitates the development of new orientations and makes it possible for people to act on them.

To recap, job redesign can be seen as freeing up the potential for, or facilitating, the development of more self-directed and intrinsic-oriented personalities, greater willingness and intrinsic motivation, and broader knowledge and wider perspectives. Over time, these changes lead to, and will be reflected in, the development of new work orientations. It is likely that these processes occur together and are interdependent. This is best illustrated by an example. Consider some employees in a traditional environment with passive, narrow orientations whose jobs are redesigned to be part of an autonomous team. Initially, they may resist the changes and stick to their narrow jobs. However, as a result of being encouraged to do more tasks, they may develop a broader understanding of how they fit into the organisation and the implications of their individual performance for meeting the strategic goals of the company. With this wider understanding, and clearer links between effort and performance, employees might voluntarily become involved in other tasks (e.g. monitoring quality). This, in turn, might further enhance their understanding and feelings of competence, and they might become motivated to be more involved. Eventually, based on changes to their knowledge, motivation and skills, people may start to see their role in a new way (e.g. as negotiating new tasks and developing new skills in order to meet group and customer-focused goals). They may see 'problems' in the work environment that they would not previously have acknowledged as a problem, let alone their problem, and they may develop much more interest and understanding of the strategies the company is pursuing. Such orientations would be consistent with the new framework provided by the job redesign and its associated changes to organisational structures and practices.

In summary, there is much evidence, derived from arguments by highly informed people, that job redesign might lead to the development of broader orientations. In relation to IM, this means that, if new and more appropriate orientations are required, then the introduction of new manufacturing initiatives should be accompanied by job redesign. However, these arguments, although highly plausible, are based mostly on case study evidence that is disparate and unsystematic. To date there has been no empirical test of the link. This gives rise to the basic focus, and the key proposition of interest, in this thesis:

Proposition 1: To the extent that the implementation of IM initiatives results in job designs with increased control, operators will develop broader, more proactive role orientations and more appropriate strategic orientations.

When IM initiatives are introduced in conjunction with job redesigned, it is likely that people's orientations will develop at different rates and to varying extents as a function of all sorts of variables (e.g. their past experiences, aspirations, motivations, knowledge, and ability to learn). This leads to the second key argument of this thesis - that the extent to which people take on board the new orientations in such contexts will relate to their performance.

4.3 Orientations and individual performance

Much of the informal opinion about orientations in the IM literature has an assumption that people require an appropriate attitude towards their role and the work environment to perform effectively (Buchanan and Preston, 1992; Buchanan and McCalman, 1989; Kolodny and Stjernberg, 1986; Oliver and Davies, 1990). Further, from a theoretical perspective, orientations can also be seen as important predictors of performance. This is discussed in more depth.

The relationship between orientations and performance can be considered by looking at the type of performance required within IM, and hence the types of controls that are appropriate. As described already (see section 3.4.2), simply following directions or specific procedures will be inadequate within IM. People are required to engage in 'high-performing' behaviours, such as using their initiative to prevent problems and make suggestions for improvements. These sorts of behaviours are not simply the result of exerting greater effort (i.e. 'working harder'), but require the appropriate application of effort (i.e. 'working smarter'). Employees need to direct their energy in specific ways based on knowledge and skills developed through self-directed, flexible interaction with the work environment. This means performance cannot be coerced, and other control strategies are needed. For example, an appropriate response to a large pile of inventory may be to question why it has occurred and to prevent it from happening again. An inadequate response, based on a lack of understanding about JIT waste principles, may be to simply apply extensive effort to work through the pile. This latter response is based on only a limited understanding and thus, no matter how motivated the employee was to put in effort, or how much coercion took place, the behaviour would still be inappropriate.

This is in contrast to the behaviours required within tightly defined traditional, or 'bureaucratic', jobs (such as being on time, producing many components). These are dependent primarily on attendance and effort, and hence, to a large degree, they can be coerced through control mechanisms such as bonus schemes, and can be enhanced through motivational processes.

What sorts of control strategies are appropriate for the 'looser' roles within IM? Earlier (see section 3.2.2) it was suggested that when information processing requirements are high (as in many IM jobs), one of the key ways of controlling performance is through the establishment of norms and expectations for behaviour. This is consistent with Porter and Lawler's (1968) theory of performance that suggests good performance is dependent on having appropriate role perceptions. From this perspective, role perceptions are beliefs about the *direction* of the effort that is necessary to perform the role, not the level of effort. Thus, a highly motivated employee's effort may not result in high performance because of an incongruence between the employee's and the organisation's understanding of the role and how it should be performed (as in the example above). The extent to which a person's role orientation contains appropriate views of performance and responsibilities will thus predict performance. Strategic orientations can be seen in the same way; that is, as guiding the direction of effort in a way that is consistent with the underlying principles of the IM initiatives.

This, of course, does not mean that motivation is unnecessary. Indeed, it has been argued to be even more critical in IM environments because standard controls are no longer appropriate. In these situations, Thomas and Velthouse (1990) claim that 'intrinsically motivated behaviour' is required. This means self-directed behaviour that is not dependent upon supervision or rewards mediated by others, and behaviour that demonstrates flexibility, initiative, and resilience to obstacles (p. 672). However, as this view suggests, effort has to occur in conjunction with an appropriate orientation and understanding, otherwise effort may be misdirected. Similar arguments have been made in relation to the design of payment systems. It is argued that reward structures within high employee-control environments must foster appropriate 'norms' to ensure people exercise their discretion to the benefit of the company (e.g. Townley, 1989). Baldamus (1961, p. 40-1) described this as 'one of the new devices of control' where "the total situation is so handled as to condition the employee to the desirable frame of mind, rather than to stimulate him to perform specific actions".

Thus, there are good rational grounds, and clear theoretical reasons, for predicting that within IM contexts, the sorts of high-performing behaviours required depend on the appropriate application of effort; that is, effort that is based on an understanding of the work environment and that is applied in a self-directed manner without standard controls. The behaviours that are required cannot be rigidly specified and it is thus important that operators develop an 'appropriate orientation' towards their role and the wider strategic environment that will guide the application of effort. It is thus expected individuals' orientations will predict their performance of high-performing behaviours. The second research proposition is thus:

Proposition 2: Within IM contexts where operators have complex jobs, those who develop the broadest and most proactive role orientations and the most appropriate strategic orientations will be the best performers.

This prediction is restricted to situations where operators have control over their work. In contexts where operators' behaviour is constrained by tight management controls, then orientations are expected to remain narrow, and any differences that do exist are not expected to relate to performance. For example, within a traditional manufacturing company, variations in orientations amongst employees with low scope jobs may occur, but there is limited freedom to act on these orientations. This relates to the issue of 'strong' and 'weak' situations in personality research (e.g. Weiss and Adler, 1984). It is well established that in weak situations where there are few pressures to conform, personality differences are more likely to influence behaviour. However, in strong situations where the demands to conform are high, the person will be restricted in the behaviours that s/he may be willing or able to exhibit. Barrick and Mount (1993) suggest that high job autonomy corresponds to a 'weak situation', and present evidence that personality variables predict performance better in such contexts (see also Lee, Ashford and Bobko, 1990).

4.4 Non-job design factors: An exploratory aim

In addition to testing the propositions, a secondary aim of the thesis will be to investigate the influence of human resource (HR) factors other than work design on employees' orientations. In particular, this involves considering broader organisational practices and systems, such as payment methods, communication mechanisms, and supervisory practices. Given the implications for selection, recruitment and training, some attention is also given to the effect of biographical variables (such as age) and individual difference variables on orientations. These investigations of HR influences will mostly be qualitative and informal, with a view to generating a research agenda rather than testing specific hypotheses.

There are at least two reasons for examining these additional factors. First, from the perspective of job design, alterations often need to be made to broader HR systems and practices to facilitate the implementation of job redesign and to maintain the changes (Oldham and Hackman, 1980). Thus, if the development of new orientations requires enhanced control, then the change process will (indirectly) depend on congruence between job design features and the wider context. Second, there is increasing focus on the importance of HR factors in facilitating the transition from traditional to modern manufacturing (Hayes *et al.* 1988; Majchrzak, 1986; Monden, 1983; Snell and Dean, 1992). This stems largely from a recognition that the visibly successful Japanese system of management involves much more than particular work design or production techniques. Wood (1990) describes how various policies exist in the Japanese system of labour management to create an appropriately co-operative climate, such as a life-time guarantee of employment for core workers, an enterprise system of industrial relations, and assessment and reward systems based on broader contributions than performing a given job. Examining how such policies and practices affect the development of orientations within Western companies may thus be informative about the role of HRM in the conversion to high-performance manufacturing. Given that orientations are argued to direct behaviour, it makes sense to suggest that HR systems and practices that also influence behaviour (such as reward systems) will relate to individual's orientations.

4.5 Summary

In this chapter I have suggested that the examination of employees' role and strategic orientations represents an alternative more developmental and performance-based approach to job design research within IM. Based on informed opinion and established theories, I have made explicit some evolving assumptions about employees' orientations to their work. This has resulted in two key propositions. First, that the greater the extent to which the implementation of IM results in enhanced control, the greater the development of new and more appropriate orientations (Proposition 1). Second, it is proposed that, within an IM setting where employees have control, those who develop the most appropriate orientations will be the best performers (Proposition 2). A secondary aim of the thesis will be to investigate the influence of human resource factors on employees' orientations.

The next chapter describes the background to the empirical studies conducted to test these propositions, including the development of orientation measures.

Chapter 5:

Background to the empirical studies

My aim in this chapter is to provide background information to the empirical studies. The first section contains a description of the research strategy pursued, including the general approach, organisational access, the research design, selection of companies, and the types and sources of data. In the second section I focus on the operationalisation of employee orientations and the development of measures.

5.1 Research strategy

5.1.1 General approach

The strategy adopted in this thesis involves exploring the research propositions and the exploratory aims within a series of studies that are progressively more sophisticated in their research design. In the same way, the companies in which these studies are conducted contain successively more of the features necessary for a complete test of the research propositions. The first study is conducted in a traditional manufacturing company that employs management-control strategies rather than high-involvement principles. It is thus a bench-mark study, and is primarily used for the validation of orientation measures. The second study is carried out within a company that has made substantial moves towards the integration of manufacturing but has achieved this using specialist-control strategies with little employee involvement. Here, with the introduction of an IM initiative that is not accompanied by enhanced job control, it is expected that there will be no change in shopfloor employees' orientations. The third company made substantial moves towards integration whilst adopting a high-involvement approach during the course of the study. Using both a cross-sectional and a longitudinal research design, this context allows a complete test of the relationship between job design and orientations, as well as an examination of that between orientations and performance.

Essentially, the approach taken within the thesis can be summarised as a series of 'quasi-experimental case studies'. It has strong parallels with a case study approach; that is, "a research strategy that focuses on understanding the dynamics presented within a single setting" (Eisenhardt, 1989, p. 534). In common with this, the studies in this thesis involved collecting data from multiple sources to describe and interpret the complexities within the particular organisation. A case study approach has been suggested as particularly useful approach for studying longitudinal change processes (Van de Ven and Poole, 1990), and is thus highly appropriate here. In addition to this case study style of investigation, the approach within each study is quasi-experimental. That is, deliberate choices have been made about when and from whom data are collected (such as including comparison groups), and careful attention has been given to competing explanations of findings (Campbell and Stanley, 1966; Cook and Campbell, 1979). This allows tighter tests of the research propositions, and represents a rare approach in job redesign research where non-experimental case studies and correlational studies abound (e.g. Roberts and Glick, 1981; Wall and Martin, 1987). It meets a more general need, as argued by Pasmore *et al.* (1982, p. 1198), that "more closely controlled experimental introductions of work restructuring are called for, with appropriate groups serving as controls during the experiments".

This quasi-experimental case study approach was adopted so that the research propositions could be tested *within* contexts. That is, the objective is not to make comparisons across organisations, but rather to thoroughly explore the new research domain in companies with which the researcher was highly familiar. This is appropriate because the intention of the research is not to make definitive conclusions, but to develop new constructs and measures, test preliminary propositions, and generate an agenda for future studies. Graen (1976, p. 1228) makes a recommendation consistent with this for the investigation of role-making processes when newcomers enter organisations: that "the study is designed to seek an understanding of the phenomenon of interest within the context in which it is embedded rather than attempting to substantiate hypotheses across all contextual conditions".

5.1.2 Research access and design

At the time the studies were conducted, Britain was in a recession and many organisations were struggling to remain competitive. This is reflected in the experience of the five initial research sites (only three of which are included in this thesis). All five sites had redundancy exercises during the course of the research, two were taken over by competitors, and one was closed. This economic pressure on organisations meant that lost production time due to data collection was even more of a concern than usual in applied research. In describing the general difficulties of obtaining research access, Wall and Martin (1987, p. 79) suggest that there is a need "both to create strong research designs which minimise the intrusiveness of the research process, and.... (which) are of more immediate benefit to the organisation itself". In the studies reported here, initial access was usually based on existing contact between the companies and research colleagues. The author then made every effort to gain the data unobtrusively, to be responsive to company needs, and to provide quick feedback of findings to the organisation and respondents. In some cases, this process required an active involvement in job redesign or related interventions.

The general uncertainty surrounding the companies' survival also meant there was even more risk than usual involved in attempting longitudinal studies. In general, it is rare for job redesign studies to have longitudinal designs, and even more unusual for them to be more than instances of organisational change with possible consequences for work design (Wall and Martin, 1987). To improve this situation, these authors recommend creatively capitalising on naturally occurring developments within organisations that have clear implications for the design of work . This has been the approach within this thesis; that is, to seek out 'naturally occurring field experiments', to generate theory-based predictions about the effect of change on job designs, and then to work within the constraints to obtain the strongest research design possible. Of course, the expected changes did not materialise in every case; for example, in Company P (reported in *Chapter 6)* the planned changes to jobs did not come about within the time frame of the research. There were also some constraints on the type of companies selected. These are described next.

5.1.3 Description of companies

The three companies used in this thesis are medium-sized engineering firms with similar levels of technology. They vary in the type of manufacturing (e.g. component assembly, batch production), but were deliberately chosen to be companies for which concepts of IM were particularly relevant. That is, all were having to adapt to changing markets, and were required to enhance their competitiveness on multiple dimensions. Each firm was under pressure to meet customer demands more rapidly and flexibly, with higher levels of quality, whilst maintaining competitive costs. As such, companies were either in the process of introducing IM initiatives or were planning to do so. Within this framework of including companies for which IM is appropriate, however, there is much variation in the extent to which they have achieved integration, and in the extent to which they have adopted a high-involvement approach to work organisation. This is a strength of the research strategy for, as Pettigrew (1988) noted, choosing extreme cases along a theoretical dimension means the processes of interest are "transparently observable".

Table 5.1 presents a summary of the companies and their classification on three key variables: (1) the extent of integration of production stages, functions, and goals; (2) the complexity of shopfloor jobs; and (3) the extent to which their HRM policies support and facilitate complex forms of work organisation. The extent of integration is based on the earlier categorisation of IM into four main strategies: AMT, JIT, TQM and Cellular Manufacturing (see section 3.2). A check list of features for the first three of these strategies designed by Dean and Snell (1991) was used to classify each company. The classification of the extent to which shopfloor jobs are complex is based primarily on Clegg's (1984) description of objective job complexity (see section 3.3.1 and 3.3.2), and includes task difficulty (i.e. the amount of information processing requirements) and the extent of job control. These dimensions also fit closely with the key elements of Lawler's (1986, 1992) description of high-involvement, and with Hayes, *et al's.* (1988) description of a 'continuous improvement' organisation. Finally, HRM practices were classified using dimensions that Snell and Dean (1992) argued would maximise employee contributions in IM contexts, and thus support and facilitate high-involvement work design. They include: selective staffing practices to recruit the best workers (e.g. more money spent on selection practices); comprehensive training (e.g. more formal training, including many types of skills); developmental performance appraisal (e.g. managers spending time giving feedback and discussing problems); and equitable rewards (i.e. the degree to which employees are rewarded proportionately to their individual performance, and the degree to which the firm pays the employees the price they would command in the external labour market). A check-list of the features within each HRM practice provided by Snell and Dean (1992) was used to classify the companies.

The author classified each company on these three dimensions using the labels low, low-moderate, moderate, moderate-high, or high. These classifications were agreed with two research colleagues familiar with the companies involved and with the principles of modern manufacturing. No systematic attempt was made to relate the classifications to manufacturing organisations elsewhere; however, the author and colleagues agree that two of the companies represent good examples of extremes in terms of integration and involvement.

Table 5.1: Classification of companies on the extent of their integration, the complexity of work design, and the extent of high-involvement HRM

Company name and type	**Extent of IM**[1]					**Complexity of work design**[2]			**Degree of high-involvement HRM**[3]				
	AMT	TQM	JIT	Cellular layout	Overall	Task difficulty	Employee control	Overall	Selective staffing	Extensive training	Devel'l appraisal	Equitable rewards	Overall
Company P Engineering batch production *(Chapter 6)*	mod-high	low	low	low	low (except AMT)	low-mod	low	low	low	low	low	low	low
Company D Car seat assembly *(Chapter 7)*	mod-high	mod	mod-high	mod-high	mod-high	low-mod	low-mod	low-mod	low	low-mod	low	low-mod	low-mod
Company F after change Electronics component assembly *(Chapter 8,9)*	mod-high	high	high	high	high	mod-high	high	high	mod-high	high	high	high	high

[1] See *Chapter 3* for a description

[2] Based on Lawler (1992), Hayes et al. (1988), Clegg (1984).

[3] Based on Snell & Dean (1992)

As can be seen, Company P has low integration and has specialist-control work design strategies and human resource management practices. At the other extreme, Company F has high integration, and has a strong involvement-oriented philosophy that is reflected in the work design of shopfloor employees and the management of human resources. Finally, Company D has moderate to high integration but has low involvement of employees.

5.1.4 Types and sources of data

As has often been recommended, both qualitative and quantitative approaches are used in this thesis (e.g. Bryman, 1988; Silverman, 1985). Tests of the research propositions are based primarily on statistical analyses of the quantitative data derived from questionnaires with fixed-choice items. This use of questionnaire data is a cost-efficient, and reasonably undemanding way, of assessing orientations for a reasonable sample of respondents. However, where possible additional sources of data are used, including company records and memos (e.g. training material, strategy documents), performance data, and data from interviews (including repertory grid interviews, informal and formal semi-structured interviews). Using multiple methods of data collection allows triangulation of findings and thus stronger substantiation of constructs and hypotheses (Eisenhardt, 1989). Further, the different sorts of data provide information about different aspects of the research. For example, company documents (e.g. organisational charts; strategy documents) were used to make judgements about the extent of involvement and integration within the company; training material was often informative about the nature of changes and their likely effect on job design; and various personnel material (e.g. performance appraisal charts, job descriptions) was useful for the development of the orientation measures.

The use of interview data is based on the rationale that there are different ways of 'knowing', Qualitative approaches fit into a naturalistic or interpretative paradigm of research, rather than the positivistic, experimental approach that is the dominant mode of psychological inquiry. The naturalistic paradigm emphasises:

> description rather than explanation, the representation of reality through the eyes of participants, the importance of viewing the meaning of experience and behaviour in context and in its full complexity, a view of the scientific process as generating working hypotheses rather than immutable facts, an attitude which emphasises the emergence of concepts through the data rather than their imposition in terms of a priori theory, and the use of qualitative methods for research (Henwood and Pidgeon, 1992, p. 99).

Qualitative methods can be used prior to quantitative methods to ensure the appropriateness of the latter (the most common combination), after a quantitative phase, or in parallel with quantitative methods. A mixture of these occur in the studies presented here. Data from interviews are used to represent the complexity of the environment and people's views, and to provide rich context-informative descriptions. Over the course of the study, this information is also used to shape and refine the research questions, as well as the constructs and their measurement on quantitative dimensions, in this way allowing a "move from data towards theory" (Henwood and Pidgeon, 1992, p. 101).

In short, whilst quantitative methods were used as a cost-efficient means of gaining wide coverage of employees' orientations, qualitative data were used to shape the development of the quantitative measures, and to complement and supplement this approach.

5.2 Operationalisation of orientation measures

The aim of the thesis is to examine people's orientations towards their work; specifically, towards their role and the broader strategies within the company. One method of obtaining this information would have been to ask open-ended, direct questions in an interview (e.g. "what do you see your role as within this organisation?"). However, interviews conducted elsewhere by the author suggested that people found it very difficult to articulate answers to such questions. Moreover, a technique suitable for a written questionnaire was preferred as this enables orientations to be assessed for a group of respondents at one time. Thus, it was decided that more indirect ways of assessing orientations, with forced-choice written questions, represented the best strategy.

5.2.1 Description of role orientation measures

The concept of role orientation refers to how people construe their role (e.g. what it involves and how to perform it) and the work environment in relation to their role. Two types of measures were developed to assess role orientations. The first measure assesses the extent to which people see production problems as part of their role; that is, their 'ownership' of these problems. The second assesses people's perceptions of the requirements for effective performance of their jobs. Both of these measures indirectly assess the way an employee defines his or her role, and the direction of effort they believe is necessary for effective performance. A description of these measures and some response-check items is given next, followed by an outline of the procedure used to develop them.

5.2.1.1 Ownership of problems

Although the concept of ownership of goals, products, or the team is often referred to in the popular literature (e.g. Buchanan and McCalman, 1989; Lawler, 1992), it has rarely been explicitly defined. Here, ownership is operationalised as the extent to which an employee construes a range of production problems as 'of personal concern to them'; that is, as part of their role. The domain of problems involves those that should not belong entirely to an individual but should, within an IM context, be the collective responsibility of all employees in the area. That is, they are problems that are outside the boundary of a traditional narrow 'job' but that occur (or that could feasibly occur) within the work area.

For each problem, people were asked to indicate the extent to which the occurrence of each would be seen of as of personal concern to them on a scale from 1 ('to no extent') to 5 ('to a large extent'). Extent of concern was used as the index because these feelings are not constrained by anything other than the individual's orientation. If, for example, people were asked if they had a 'part to play in influencing' these events/problems, then other constraints such as supervisors, resources, and levels of autonomy might affect the answers. Of interest was the individual's awareness and ownership, not any other construct (e.g. perceived impact). In an attempt to legitimise perceptions of non-concern, the instructions to respondents clearly stated that some problems may be of no concern to respondents ("for example, they may be your supervisor's concern, or they may not be a problem at all').

The domain of problems covered three areas: problems with goal achievement (e.g. 'customers of the products you deal with are dissatisfied with what they receive'), operational inefficiencies within work that affect goal achievement (e.g. 'the way some things are done in your work area means a lot of re-work is needed'), and problems that affect the cohesion and co-ordination of the work group, that also might affect goal achievement (e.g. 'people in your work area are not co-ordinating their work efforts'). It was intended that the items would vary in their 'subtlety'. For example, concern for the goals might reflect a general awareness of the strategic objectives of the company. However, concern for problems that have a less direct effect on the achievement of these goals (such as group cohesion) may reflect an even greater awareness and ownership of the goals.

In each study, items covering the three problem domains were developed to ensure a consistent and complete assessment of ownership. The summed score of the individual items gives a measure of a person's ownership of problems that occur outside of their immediate task environment. It can be seen as defining a person's 'psychological boundary' of their role; that is, the range and depth of problems and issues the person would direct effort into addressing.

5.2.1.2 Perceptions of performance requirements

The second type of measure (with subsequent subscales labelled 'Production Knowledge' and 'Wider-production Knowledge') contained a checklist of items describing skill, knowledge, and behavioural requirements relevant to IM (e.g. 'knowing how to set priorities'). Respondents were asked to indicate the extent to which they believed each of these was important for effective performance of their job on a scale from 1 'not at all important' to 5 'extremely important'. This assessed peoples' awareness of the importance of certain competencies, rather than whether or not they actually possessed them. In many cases, these constructs would be related; however, people may recognise the importance of knowing or doing something, but because of various environmental constraints, not be able to act on this. For example, a person might not know the priority of customer orders yet may recognise such knowledge as crucial for the effective performance of their job. This represents a level of awareness beyond not recognising its importance at all, and it is this awareness that is of interest here.

Most items were phrased as knowledge requirements. That is, items were usually worded in terms of "knowing/ understanding" something, or in terms of "knowing how to" perform or engage in a particular behaviour (e.g. 'How important is it to know how to purchase materials?'). This was preferred to asking people whether they thought it was important to actually perform the behaviour (e.g. How important is it to purchase materials?), because high-performing employees may need to know how things are done (e.g. so they can understand the problems of other team member's) whilst not necessarily needing to perform the task themselves.

The domain of items was the set of core skills, knowledge, and behaviours that were important for high-performance within the particular context. To ensure the complete domain was assessed, items were included from specific categories of competencies. These categories stemmed from the literature-based analysis of the requirements for effective operator performance in IM (see section 3.4.2). Thus, the items covered the perceived importance of: cognitive skills (e.g. 'knowing how to anticipate and prevent problems'), collective skills (e.g. 'knowing how to share team member's problems'), local production knowledge (e.g. 'knowing the priorities of work in your area'), knowledge about events/issues beyond production (e.g. 'knowing what is happening in marketing'), and self-direction (e.g. 'being self-motivated and wanting to improve your own performance'). In each study, items were included that tapped all of these categories of high-performance requirements.

The summed score of the set of items thus assesses the extent to which employees attach importance to a range of factors that affect their performance within IM, beyond the narrow set of factors that would affect their performance in a traditional manufacturing environment.

5.2.1.3 Response-check scales for role orientation measures

The possibility exists that people will rate all items in a positive way because of a 'yea-saying' response-set rather than because of the particular item content. Typically, the way to avoid this response bias is to randomly mix up positive and negative statements. However, this was not possible given the style of the role orientation items. Instead, for both types measures, some response-check items were included. These were the same format as the other items, and were interspersed amongst them. However, the content of the response-check items was deliberately designed so that they would be non-discriminatory. Thus, it was expected that, in contrast to the role orientation items, the response-check items would not distinguish between employees within complex IM jobs and those within traditional jobs; would not predict performance within IM settings where operators have complex jobs; and would not change over time when employees' take on a new role within IM. Using such items, it was possible to determine whether people were discriminating between items rather than simply responding to all of them in the same way.

For the measure of ownership, the response-check items involved determining people's personal concern for problems that are likely to have an impact on an individual's narrow task performance. For example, the problems 'the materials/products you receive to work on are of poor quality' and 'you cannot produce at the maximum bonus rate' can be considered as problems that affect individual performance or well-being within any environment. As such, they would be expected to be as of much concern to shopfloor employees working in traditional manufacturing environments as to employees in complex IM jobs. Further, within the IM environments where operators have high operator control, these items would not be expected to discriminate between standard and high performance.

For the measure of perceived performance requirements, the response-check items assessed standard requirements. That is, they were focused on skills, behaviours or knowledge that would be necessary for effective performance in a traditional manufacturing environment, but would be standard (or assumed) in an IM environment. For example, 'knowing how to report problems to the supervisor' is something that is important in traditional environments, especially as most problems are not dealt with directly at the source but require a staff member's intervention. With the implementation of IM, reporting problems would not be expected to become any more important. This is in contrast to items that would be expected to assume greater importance with the introduction of complex IM jobs, such as those asking about solving and preventing problems.

The strategy adopted here has parallels with that adopted in the Marlowe-Crowne social-desirability scale that assesses people's need for approval (Crowne and Marlow, 1964) Some items in this scale describe behaviours that are "too good to be true" (e.g. 'I have never intensely disliked anyone'). People giving a 'true' answer to these items, and a 'false' answer to more realistic behaviours (e.g. 'I sometimes feel resentful when I don't get my own way') are likely to have strong needs for approval, and are thus likely to try and present themselves in a favourable light elsewhere throughout the questionnaire. Similar concepts are used in other personality inventories. For example, the Minnesota Multiphasic Personality Inventory (MMPI) contains a 'lie' scale to determine whether the respondent is projecting a falsely perfectionist view of himself or herself (Groth-Marnat, 1984).

5.2.2. Procedure for developing role orientation scales

The development of the role orientation measures involved three main steps.

1. Generation of context-appropriate items

To assess role orientations, items were developed by the author to cover the a priori categories of performance requirements (i.e. cognitive skills, collective skills, local production knowledge, wider production knowledge, and self-direction) and the categories of problem ownership (i.e. goal-achievement, efficiency and group-related problems). The same constructs were assessed in each study, but the surface characteristics of the scales (i.e. their specific item content) varied across organisations. One reason for this is that context has an important impact on the relevance of items and their meaning. Each context varies in the nature and goals of integration (IM is not a 'fixed' set of changes), therefore the required changes in roles and performance differ. For example, in one company, operators might be expected to have an in-depth understanding of end-customer requirements as this knowledge may influence their performance. However, expecting this may be unreasonable and inappropriate in another company. The actual terminology and meaning of words also differs across sites. For example, team-working may mean working as a shift in one site, or it may mean working together across shifts in another. It is clearly more important to assess the same construct rather than use the exact same terminology. The surface characteristics of the orientation measures also differed because companies had varying sources of data available to inform the measures (e.g. one company had written specifications of employee goals that were incorporated into the ownership measure), and placed different constraints on the measures (e.g. the amount of space available, the extent of management influence over items). Finally, the particular items used across sites varied because they were refined and improved over time.

These differences in the surface characteristics of items are not a concern in this thesis as the research propositions are explored within, rather than across, research sites. It is more important to ensure the a priori domains are assessed using items that are appropriate to the context. For example, to determine precisely what collective skills and knowledge might be required for effective performance, it is necessary to understand issues such as team sizes, layout, and information technology. Thus, for each site, the author collected data from many sources to gain an understanding of the context (e.g. from job descriptions, performance appraisal forms, company memos and documents about manufacturing strategies), and the appropriateness of the items was discussed with relevant personnel within the company (e.g. supervisors). In this way, the surface characteristics of the role orientation measures varied across studies to ensure they were appropriate, but the process of item-generation and the underlying dimensions of the measures remained constant and meant the same construct was assessed.

2. Placing of items into pre-defined categories by experts

The second phase involved getting experts to code the items into the a priori categories. Whilst the categories had face validity and were grounded in literature, the extent to which other people could reliably discriminate between the items using them was unknown. Thus, items were coded into categories by at least two (and sometimes three) additional researchers who had an understanding of IM and high-involvement.

A coding manual was developed for the coders to use (see Appendix 1). This included a broad description of IM and its likely effect on roles (based on Dean and Snell's 1991 conceptualisation), coding instructions, and descriptions of the categories. Where possible, the examples used to illustrate categories were not items used in any of the questionnaires. Whilst it was recognised that contextual information for each company would enhance coding accuracy, a decision was made not to provide this information. It was believed that the detail required - which would have been necessarily selective - would have been confusing and possibly misleading for coders. Instead, for each company, there was at least one other coder (in addition to the author) who had sufficient contextual knowledge to be considered an 'expert' for difficult decisions.

Coders were instructed to read through the manual and several pages of items prior to starting. They were asked to code each item, ticking the box of the category they believed it was most likely to fit in. If they believed an item could fit in more than one category, they ticked both and placed an asterisk in the category considered most appropriate. They were also asked to make comments where they were uncertain.

The total sets of items across all studies were then examined for agreement among coders and the author. For 85% of the items, there was 100% of agreement by all coders. These items were considered to reliably fit within the categories. However, the remaining items were discussed and checked further with the coders. The key problems concerned ambiguous items (which could be allocated to more than one category), unclear boundaries between categories, and difficulties due to not knowing the context. The latter were revealed when the 'experts' agreed but the other coder (or coders) did not. In these cases, additional contextual information was given to the 'non-expert' and they were asked to code the item again. If there was still disagreement, the item was considered ambiguous and excluded from the scale. Where the boundaries between categories had not been made clear enough, the coding manual was amended, categories were refined and coders were asked to recode those items. In any instances where differences were not resolved, the items were discarded. After this process, the consistency and accuracy with which the items were assigned to the categories was examined by looking at inter-rater agreement of the assignment of items. Cohen's (1960) Kappa coefficient (calculated using HANDY KAPPA; Jackson, 1983) was used to compare the level of actual agreement to the level of chance agreement defined in terms of the category proportions for each of several raters.

This coding procedure ensured that, whilst there were variations in specific items content, the measures used in different studies covered the same generic categories. Moreover, by ensuring that all categories were assessed by the set of items, the coding procedure ensured that the whole domain of orientations was included in each study.

3. Finalising the scales

After showing that the items could be reliably allocated to categories, the next step might have been to factor analyse the items using the respondents' data to see whether they made the same distinctions between items. However, there were problems with using factor analysis for this purpose. First, the case to variable ratio in most of the studies was inadequate for obtaining 'true' factors (for example, Gorsuch, 1983, recommends a subject to variable ratio of at least five to one with not less than 100 subjects for any analysis). Second, scales assessing comparable constructs across studies were desired and factor analysis is inclined to yield sample-specific factors (this expectation was confirmed by some exploratory factor analyses performed on the data). Third, the main purpose of the study was to examine the general construct of orientations and its relationship to other variables. The dimensional structure is not of particular interest at this stage in the research process. It is more important to have measures that adequately cover the domain of the construct. Essentially, the approach used here is similar to many job-analysis approaches, particularly those based on inventories or check-lists (e.g. the Job Components Inventory, Banks and Miller, 1984). Typically, multiple sources of information are used to generate a complete list of tasks and/or worker attributes needed to perform the job at a certain level. These are then placed in meaningful (usually a priori) categories by experts or job incumbents. It is too early in the life-span of orientation-type constructs to begin to apply the same principles as used in studies of theoretical structures (e.g. factors of self-esteem). Moreover, given the type of construct, it is questionable as to whether such an approach would be appropriate.

Instead of using factor analytic procedures, the intercorrelations between subscales derived from the a priori categories were inspected to determine whether separate scales were warranted. If the intercorrelations were high, the subscales were combined and the a priori categorical distinctions were not maintained. For the performance requirements measure, the a priori subscales typically collapsed into two groups: Production Knowledge (i.e. items about knowledge within the production area) and Wider-Production Knowledge (i.e. items about knowledge beyond the production area, such as marketing, design). In the case of the ownership items, the intercorrelations among the subscales based in a priori categories were high in most of the studies. Thus, a single measure (Production Ownership) was typically sufficient. More detail as to the specific intercorrelations and final scales for each study are contained within the relevant chapter, and in Appendix 3.

5.2.3 Measures of strategic orientation

This construct is concerned with people's orientation towards IM initiatives and principles. It was operationalised by eliciting the extent of employees' agreement or disagreement with statements about IM principles. A sample item assessing a person's orientation towards JIT is: 'It is important to keep making products, even if they go to stock rather than directly to customers'. A person who disagrees with this statement is likely to have some understanding of, and support, for JIT principles. However, to a person without much awareness of the JIT philosophy, this statement is likely to sound highly plausible. Because the items deliberately tapped a level of awareness and understanding of the principles, most items were worded as the antithesis of the target belief. This meant that the 'wrong' answer would seem legitimate and plausible to people who did not have strong views or understanding. (Some positive items were included in the scale to ensure people did not simply detect and respond to an obvious pattern). Thus, like the role orientation measures, the strategic orientation items provide an indication of a person's likely direction of effort, rather than just the level of effort. For example, a person who disagrees with the statement about JIT above (indicating some understanding of the principle) is likely to direct energy towards ensuring products are only made when needed.

Unlike the role orientation measures, where items were generated to cover conceptual domains, this measure simply contained a check-list of items. This was because there were no readily definable categories of beliefs that could be generalised across studies. Instead, the focus was on ensuring all of the critical principles relevant to the particular context were assessed. In this sense, the measure is similar to an indicator of stress where it is important to include the complete list of possible stressful events to appropriately measure stress (e.g. missing 'death of a family member' would make the measure less valid). Such measures can be described as 'cause' indicators where the latent variable is determined by the indicators. This is in contrast to an 'effect' indicator in which the latent variable determines its indicators (such as intelligence) (Bollen and Lennox, (1991). If a measure is a cause indicator, the classic assumptions of test theory and factor analysis (e.g. high internal consistency) do not necessarily make sense. For example, if a person has an understanding of flexibility, this will increase their score on the measure but it does not necessarily mean that scores on other items (e.g. JIT) should automatically increase. For cause indicators, it is argued that it is more important that the complete domain of indicators is included because "omitting an indicator is omitting a part of the construct" (p. 308).

This latter recommendation was followed, with the domain being the critical IM principles within the particular context. Some of the types of beliefs assessed were: inflexibility (e.g. 'in the long run, product-lines will be more efficient if people stick to what they already know well, rather than learning new things'); reactive versus preventative problem-solving; inventory control; just-in-time production; continuous improvement; production integration; and employee role performance. The sum of the items (with negative items reverse scored) was used as the indicator of a person's orientations towards the wider manufacturing strategies, and was labelled 'Strategic Beliefs'.

5.2.4 Summary of measures

Table 5.2 provides a summary of the measures developed to assess role and strategic orientations and the items they derived from. Briefly, there were two types of role orientation items: ownership of problems and perceived performance requirements. A coding procedure ensured that, whilst there were the surface content of some items varied, the items used in different studies covered the same a priori categories. Intercorrelations of the a priori subscales were inspected to determine whether distinctions between them were necessary. In most studies, this resulted in two scales of perceived performance requirements (Production Knowledge and Wider-production Knowledge) and a single scale of ownership (Production Ownership). To test for agreement bias for these measures, two response-check scales were developed: Knowledge Response Check (RC) and Ownership Response Check (RC). These scales contained control items (expected to be non-discriminatory) that were in the same format and style, and were interspersed among the orientation items. A measure of Strategic Beliefs was developed to assess people's strategic orientations. This measure was operationalised as people's agreement or disagreement with statements about the key IM principles within the particular context.

The next chapter presents tests of the validity of these orientation measures.

Table 5.2: Summary of orientation constructs, measures, and the items they were derived from

Core constructs	Measures of core constructs	Items from which measures were derived
Role orientations	1. Production Ownership: Assesses the broadness of people's orientations by examining their ownership of a range of production problems (e.g. 'if your end-customers were dissatisfied with the products you help build').	Ownership of problems: People are asked to indicate the extent to which they would see the occurrence of problems as of personal concern to them. The a priori domain of items includes problems with: goal achievement, efficiency, and group cohesion; as well as response-check items.
	2. Production Knowledge[1]: Assesses the extent to which employees recognise the importance of having a broad-ranging understanding of factors which affect their integrated role performance, beyond the narrow set of factors that directly affect their immediate task performance (i.e. includes the domains of: cognitive skills, collective skills, local production knowledge, and self-direction). For example, how important is 'knowing the priorities in your work area' and 'knowing how to find the root cause of problems'.	Perceptions of performance requirements: People are asked how important a range of skills and knowledge are to perform their work effectively. The a priori domain of items include: cognitive skills, local production knowledge, collective skills, self-direction, wider-production knowledge; as well as response-check items.
	3. Wider-production Knowledge[1]: Assesses the extent to which employees recognise the importance of having an understanding of factors outside of production in order to work effectively (e.g. how important is 'knowing what's happening in marketing and sales').	(as above)
Strategic orientations	Strategic Beliefs: Assesses people's endorsement of the key IM principles within the particular context (e.g. 'It is important to keep making products, even if they go to stock rather than directly to customers', reverse scored).	Statements about IM principles: People are asked to indicate the extent to which they agree or disagree with statements about IM principles

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[1] Note that 'response-check' scales (based on the response-check items) exist for these measures. *Knowledge Response-check* contains control items assessing the perceived importance of standard requirements for effective role performance in a traditional manufacturing environment. *Ownership Response-check* contains control items assessing personal concern for problems which are likely to have an impact on an individual or their narrow task performance.

Chapter 6

Orientations within a traditional company: Some validity data and a description

6.0 Introduction

The design of measures to assess role and strategic orientations was described in the previous chapter. The primary aim of this study is to examine the validity of these measures within a traditional manufacturing company (the internal reliability of the scales will also be reported). Three types of validity checks are performed:

Validity Check 1: In the most straightforward check, the intercorrelations of the orientation measures with each other, with conventional outcome variables, and with measures of related constructs are examined. It is expected that the orientation measures will be associated with each other (although not so highly as to suggest redundancy of the separate scales) and with related constructs; and that these associations will be higher than their correlations with the conventional outcome measures. The latter were argued to be tap different constructs, and thus should not be highly correlated with the orientation measures.

Validity Check 2: In this check, the construct validity of the measures is examined by comparing the orientations of staff members (i.e. supervisors and specialist staff) and shopfloor employees. Within a traditional company, staff members' jobs typically involve planning and problem-solving elements, while the roles of operators are limited to manual work (e.g. direct operators load, unload, and monitor the machines and indirect operators perform one function only). It is thus expected that the orientations scores obtained by staff members will be significantly higher (reflecting a broader, more proactive and strategic orientation) than scores obtained by shopfloor operators. Essentially, this tests a minimum requirement of the orientation measures. If the orientation measures do not discriminate between employees in different level jobs within a traditional manufacturing environment, thcy are unlikely to be sensitive to the changes in orientations for operators who are required to take on new roles in IM environments.

Validity Check 3: Finally, the validity of the measures is examined by comparing scores on the role orientation measures with scores on the relevant response-check scale for the shopfloor employees. Items in the response-check scales were written in the same format and style as the role orientation items, but were deliberately designed to capture views typically held by shopfloor employees in traditional manufacturing settings (see section 5.2.1.3). Thus, it is expected that, for the shopfloor employees within this traditional environment, scores on the response-check items should be higher than scores on the comparable orientation scales. That is, they should see 'standard' requirements as more important than 'high-performing' requirements; and they should see individual-oriented problems as of greater personal concern to them than more general production problems. Further, given the design of the items, it is expected that staff members should not report higher scores on the response-check scales than shopfloor employees (Note, as will be explained later, this check can only be made for the Knowledge Response Check scale).

A second purpose of the chapter is to provide a qualitative account of the orientations of shopfloor employees within traditional jobs. In the introductory chapters, it was argued that such employees will have narrow and passive orientations (see, for example, section 4.2). Here, data from interviews are used to explore this and, in doing so, serve to examine the general 'face' validity of the investigation of employees' work orientations.The interview data also serve as a reference point, or base-line, for studies in later chapters that present qualitative descriptions of the orientations held by employees within complex IM jobs.

The first part of the chapter sets the scene with details about the company and the Production Department. As well as providing necessary contextual information, this demonstrates that the organisation can be considered to represent a 'traditional' manufacturing company. The method and results of the validity checks are then described. Finally, the chapter closes with the descriptive account of employee orientations.

6.1. Setting the Scene

The study was carried out in the Production Department of a medium-sized engineering company in the North of England (Company P). It is an American-owned company that manufactures drill-bits for the mining and construction industry. Originally, Company P was locally-owned and run, employing around 800 people. There are now about 200 employees on site, with several waves of redundancies within the last two years. At the time of the study, there were approximately 128 direct operators (half skilled, and half semi-skilled), 21 skilled indirect operators (i.e. setters, quality inspectors, maintenance people), 9 unskilled indirect operators (labourers, etc.), 7 foremen, 5 production engineers, and 7 production planners.

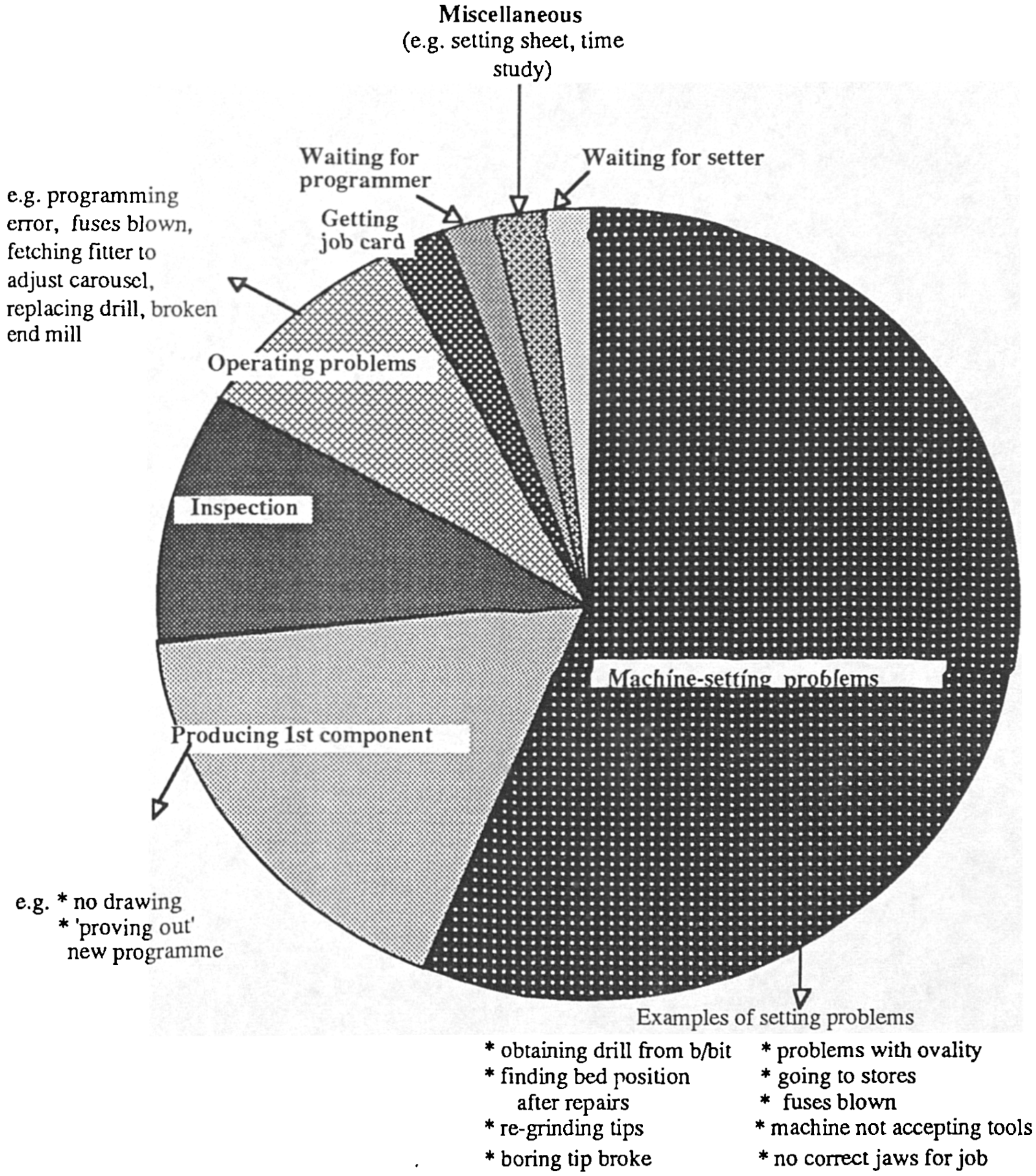
Within Production, there were seven major areas each with a separate foreman and production planner. Some areas corresponded to different types of products (i.e. were product-based) and some areas corresponded to a function (e.g. forge and heat-treatment). The major production operations included cutting, turning and shaping the steel; followed by intermediate quality inspection, heat treatment, and final quality inspection. Products are mostly made in small batches of between 5 and 200 items.

6.1.1 Strategies, work organisation, and HRM practices

In order to compete with two larger competitors, the company was required to produce better quality products more quickly, whilst maintaining a low cost per product. Increasingly, smaller batches were required. Several changes were taking place in Production to facilitate adjustment to these new market demands, including the introduction of customer audits of quality, the implementation of a computer controlled scheduling system (MRP II), the formation of single-operator machining cells, and the gradual replacement of older machinery with CNC machines. However, at the time of the study, these changes were at an early stage (e.g. MRP II was not running properly), and were introduced in a somewhat half-hearted manner. They were not driven by an overall vision for the company, and there was no attempt at an overall integration of manufacturing functions. The stages and functions of production remained separated, and although management desired faster lead times and better quality, few of the philosophies or structures associated TQM or JIT were in existence (e.g. steel was unreliable, operators did not check their own quality).

The organisation of work was manifestly based on Tayloristic principles. Direct operators carried out the steel turning and shaping, while separate 'indirect' operators were responsible for quality inspection, setting up of machines, and maintenance. Machine operators had no control over the scheduling of work, product designs or the programming of CNC machines, and the foremen performed a traditional supervisory role, including co-ordinating work, ensuring operators have tasks, checking job cards, dealing with disciplinary matters, and solving problems. This 'control' structure was reinforced by personnel practices. For example, operators were required to clock-on and clock-off their time at work, there was no systematic training or career development for shopfloor people, and operators were paid on the basis of an individual bonus system. There was no comprehensive communication of information to the shopfloor, nor any employee participation in decision making. Management's main contact with the workforce was through Trade Union representatives.

Perhaps not surprisingly, there were many problems within manufacturing. Because of the unreliability of steel supplies (in terms of both quantity and quality), large stocks were kept 'just-in-case' of orders, and production was usually determined by steel availability. The work flow often became unbalanced, both in terms of the sequence of processes (e.g. large queues at the forge) and the indirect-direct sequences (e.g. long waits for setters or quality inspectors). An analysis of the non-production time of six operators in cells (based on diaries collected by the author over a two-week period) found they experienced an average of 2 hours per shift not producing (i.e. about 25% of the shift). As illustrated in Figure 6.1, which shows a break-down of this non-production time, many of these problems could be prevented or minimised with better sequencing, planning and preventive action.



(e.g. setting sheet, time study)

e.g. programming error, fuses blown, fetching fitter to adjust carousel, replacing drill, broken end mill

e.g. * no drawing
* 'proving out' new programme

Examples of setting problems
* obtaining drill from b/bit
* finding bed position after repairs
* re-grinding tips
* boring tip broke
* problems with ovality
* going to stores
* fuses blown
* machine not accepting tools
* no correct jaws for job

Figure 6.1: Approximate breakdown of non-production time for six operators

As suggested by this figure, there was no preventative maintenance and staff spent a lot of time 'fire fighting' and reacting to problems. For example, a production engineer commented: "I find myself never having the time to sort jobs out properly. Instead it is mostly a case of doing just enough to get a job going instead of tackling it in a proper manner so that it does not occur again".

The bonus scheme was also a source of many difficulties. The demand for smaller batches meant increased amounts of setting and (because setting was paid at a lower rate than production time) this meant a loss of money for operators. The piecework system also meant operators had no extrinsic incentive (in fact, could lose money) to produce good quality work, to help others out, or to become more skilled. This lack of flexibility meant that operators could not easily be moved to meet changing demands. For example, there was often overtime in sections of the factory trying to cope with late orders, while in other areas people sat reading because they had already reached their bonus limit.

In summary, as stated in *Chapter 5* (section 5.1.3), this company can be characterised as having low integration, and control-oriented work design and human resource practices As such, is an ideal place to examine whether the orientation measures discriminate between staff members who have with controlling and planning roles and shopfloor employees who hold simplified, narrow jobs.

6.2 Validity Check

6.2.1 Method

6.2.1.1 General access and research procedure

Access to the organisation was based on extending some prior contact between research colleagues and the organisation. Some financial support for the collaboration came from a Department of Trade & Industry initiative (see Parker and Jackson, 1992). The primary contact in the organisation was the Production Manager, who accepted the researcher's proposal for an attitude survey followed by job design recommendations.

After a one-month familiarisation phase, involving informal discussions with shopfloor employees and foremen, the researcher established an 'Evaluation Team'. This was a representative group of people in Production, including the Personnel Manager, a union representative, a foreman, a production engineer, and four shopfloor workers. The formal aim of this team was to assist with the design, administration, and interpretation of a survey within Production. Informally, the researcher hoped that regular meetings would help to break down the barriers between management and employees. Meetings took place over an eight month period and seemed to achieve this latter aim. After an initial hesitancy to speak out, it was clear that most people enjoyed putting forward their views and management were surprised at how constructive many of the shopfloor people's suggestions were. The group also achieved the aim of identifying issues to be assessed in the survey, and members participated in the design of some questions.

6.2.1.2 Questionnaire administration

Despite initially agreeing to do so, the production manager decided that it was not feasible to administer questionnaires during work time and they would have to be completed at home. Little support came from the personnel manager who behaved inconsistently throughout the negotiation process. This decision was very discouraging for the team, who felt that management did not take the project seriously. It confirmed for some of them reservations expressed in early meetings that "nothing will ever change" with the current management. Moreover, it reflected poorly on the researcher as it showed a lack of influence.

A decision was made to ask employees to do the questionnaire at home. A memo was circulated to all employees informing them about the survey, its purpose, and how it would be administered. Questionnaires, instructions, and envelopes were then given to employees by the researcher at the clock-out points in each of the factories as people were leaving. The instructions stressed the confidentiality of the questionnaire responses. That is, although names were requested, this was purely to match respondents over time. Only researchers would see individual completed questionnaires, and results would be fed back at the group level so that no individual's views could be identified.

Each member of the Evaluation Team was given responsibility for collecting completed questionnaires for a designated area. They were trained by the researcher in issues of questionnaire administration and collection, and standard answers to potential questions were agreed on. Evaluation Team members also distributed postage-paid envelopes addressed to the University for people who felt uncomfortable about returning their forms to Company P employees. Names were checked off as questionnaires were returned to team members.

In spite of explanations that names were needed for longitudinal identification only (i.e. in the questionnaire instructions, in briefings from Evaluation Team members, and in the memo preceding questionnaire administration) there was some resistance to this. Those who felt nervous about using their name were advised to adopt any indicator they would remember to use in future surveys (e.g. their Mother's name). As indicated in this comment on a completed questionnaire, even employees who filled in the survey were still suspicious about its confidentiality: "I would like to comment but I still think the company will see these surveys. So I will keep my comments to myself. Sorry."

Response rates were relatively low. Seventy one people completed the questionnaire, approximately 45% of the total sample. A higher proportion of staff completed the survey; that is, 100% of the foremen; 71% of production planners; and 80% of production engineers. Team members believed that only the more motivated shopfloor employees filled in the questionnaires, and that very traditional employees (i.e. the "dinosaurs") were not interested. A pervasive feeling amongst those people who completed the questionnaire (and presumably more pervasive amongst those who did not) was that the survey would make no difference. For example, some sample comments in questionnaires were: “I can understand the motives behind this survey, but on completion and analysis will this or any other company act on your findings? I doubt it”; “It would be good if something constructive came out of this survey. But I doubt it.”

Results were fed back to the Evaluation Team members and the Production Manager in a 2-hour presentation session. A brief written report of the key results and recommendations was circulated to all employees who completed the questionnaire. This generated a lot of interest, and it was the opinion of several Evaluation Team members that if a second survey was done, the reception would probably be better.

6.2.1.3 Sample

There were forty four male shopfloor workers in the employee group, including twenty five skilled operators, ten semi-skilled operators, and nine indirect operators (setters and quality inspectors). There were sixteen male staff, comprising seven foremen, five production planners, and four Production Engineers.

Most of the shopfloor employees worked regular day shifts (68%), while some worked regular nights (18%) and a few worked alternate day/night shifts (14%). A similar percentage of the staff group to the shopfloor employees worked regular days (69%), and most of the remaining staff worked alternating days and nights (25%). For the shopfloor and staff group respectively, the mean age was 44 years (SD = 8.5) and 39.7 years (SD = 11.9); the average length of time in their current job was 6.6 years (SD = 8.4), and 9.1. years (SD = 7.1), and the length of time in the company was 16.1 years (SD = 9.0), and 17.5 years (SD = 10.3).

6.2.2 Measures

The measures used in the study, their origin, and their psychometric properties are described next. In each case, the internal reliability of the measure within the study is assessed using Cronbach's alpha coefficient (Cronbach, 1951). A high score (typically considered as .70 or above) signifies that the items are sufficiently interrelated to be considered an internally reliable scale; a low score indicates that this is not the case (Cortina, 1993).

6.2.2.1 Orientation measures

Three measures of role orientations (Production Knowledge, Wider-production Knowledge, and Production Ownership) and the measure of strategic orientations (Strategic Beliefs) were used to assess orientations. In each scale, items were designed to be appropriate to the context, and were checked with staff members familiar with IM concepts and with members of the Evaluation Team. The development of the scales was based on the procedure described in *Chapter 5* (see section 5.2.2 and 5.2.3). Appendix 3 contains more specific details of the process and the final item content for this study.

The number of items within each scale, and their internal reliabilities, were as follows: *Production Ownership* (9 items, Cronbach's alpha = .94), *Production Knowledge* (29 items, Cronbach's alpha = .97), *Wider-production Knowledge* (5 items, Cronbach's alpha = .86), and *Strategic Beliefs* (23 items, Cronbach's alpha = .85).

6.2.2.2 Response-check scales

Two response-check scales were developed to test for agreement bias: Ownership Response Check (RC) and Knowledge Response Check (RC). These scales contained control items that were in the same format and style as the Knowledge and Ownership items, respectively. However, these items were designed so they should be non-discriminatory; that is, so they would not distinguish between employees in IM jobs and those within traditional jobs, scores would not change substantially with the introduction of complex jobs in IM, and they would not predict performance within complex IM jobs (see section 5.2.1.3 for more details).

Ownership RC contained 3- items (Cronbach's alpha = .79) assessing personal concern for problems that are likely to have an impact on an individual or their narrow task performance (e.g. 'you cannot produce at the maximum bonus rate'). *Knowledge RC* contained 3-items (Cronbach's alpha = .83) assessing the perceived importance of standard requirements for effective performance in a traditional manufacturing environment (e.g. how important is it to 'know how to report problems to the foreman').

6.2.2.3 Job content measures

Measures of job content were included in the study. These were used to determine whether staff members report greater control and demands (as would be expected) than shopfloor employees. This is a necessary condition for Validity Check 2 which compares the orientations of members of people in these groups.

Jackson, Wall, Martin and David's (1993) developed a set of scales to assess important job characteristics in manufacturing contexts, including: Timing Control, Method Control, Monitoring Demand, Problem-solving Demand and Production Responsibility. The scales were shown to be factorially separate dimensions, have adequate internal reliability (Cronbach's alpha was greater than .70 for all scales except Problem-solving Demand, which had an alpha of .50 only), have adequate test re-test reliability (all test re-test correlations over one year were greater than .40) and to discriminate between different jobs in two samples. In the current study, shortened versions of the scales (based on selecting items with the highest factor loadings) were used because of space constraints. All the scales had a five point response scale from 1('no extent') to 5 ('very large extent'). The scales and their internal reliabilities in the current study are described.

Timing Control: This is a 4-item that assesses an individual's opportunity to determine the scheduling of his or her work behaviour (e.g. 'to what extent do you decide on the order in which you do things'). Cronbach's alpha for the three-item scale used in the current study was .77.

Method Control This is a 6-item scale designed to assess the individual's choice in how to carry out given tasks (e.g. 'can you vary how you do your work?'). Cronbach's alpha for the four-item scale used in the current study was .64.

Cognitive Demand This scale contained three items from the Monitoring Demand scale designed to assesses the extent of monitoring in a job (e.g. 'to what extent do you have to react quickly to prevent problems arising?'), and three items from Problem-solving Demand scale designed to assess more active cognitive processing to prevent or recover errors (e.g. 'to what extent do you have to solve problems which have no obvious correct answer?'). Although these were designed as separate scales, in the current study the scales were highly correlated (r = .65), a factor analysis of their items gave only one factor, and the internal reliability of the combined scale was substantially higher than the separate scales. Cronbach's alpha was .80.

6.2.2.4 Outcome measures

Some conventional outcome measures were included in the study to allow an examination of their associations with the orientation measures (i.e. Validity Check 1).

Anxiety-contentment, Depression-enthusiasm, and Tiredness-vigour: Scales designed by Warr (1990) were used to assess people's well-being at work. People were asked to indicate how much of the time, in the past month, their job had made them feel a variety of reactions (e.g. tense, miserable, calm) on a 5-point scale from 1 ('never') to 5 ('all of the time'). Three separate dimensions were shown to exist: Anxiety-contentment (6-items, Cronbach's alpha = .76), Depression-enthusiasm (6 items, Cronbach's alpha = .80), and Tiredness-vigour (6 items).

In the current study, only the highest-loading items were used in each scale because of space constraints. (An asterisk indicates the item was reverse scored). *Anxiety-contentment* was assessed by the items: tense, calm*, relaxed*, anxious, and worried. Cronbach's alpha was .72. *Depression-enthusiasm* was assessed by the items: miserable, depressed, gloomy, and enthusiastic*. Cronbach's alpha was .79 Finally, *Tiredness-vigour* was assessed by the items: lively*, lifeless, tired, and full of energy*. Cronbach's alpha was .72. In this study, the latter two scales were highly correlated (r = .77), and the internal reliability for the combined scales was higher than that for the separate scales (Cronbach's alpha = .86), these were combined into one scale called *Depression-vigour*.

Job Satisfaction: This is a 15-item scale designed by Warr, Cook, and Wall (1979) to assess the degree to which a person reports satisfaction with intrinsic and extrinsic features of the job. It is scored from 1 ('extremely dissatisfied') to 7 ('extremely satisfied'). The mean score for a blue-collar sample (N= 590) was 70.53, SD = 15.42. Warr *et al.* (1979) identified two sub-scales based on cluster analysis: extrinsic job satisfaction ($\overline{X}$ = 37.99, SD = 8.36, Cronbach's alpha = .74, .78) and intrinsic job satisfaction ($\overline{X}$ = 32.61, SD = 8.25 ; Cronbach's alpha = .79, .85). In the current study an extra item concerning the level of safety was also included. As the intrinsic and extrinsic sub-scales were highly correlated (r = .65), these were combined and only the total scale was used. Cronbach's alpha for this scale was .86.

Quality Commitment was assessed by 4 positively worded items (e.g. 'I am prepared to put in extra effort to meet quality goals'; 'I take personal responsibility of the quality of my own work'). Cronbach's alpha was .65.

6.2.2.5 Measures of related constructs

Some additional measures (Desire for Change, Job Involvement) were included in the study to allow an examination of their association with the orientation measures (i.e. Validity Check 1). It is expected that because these measures tap related constructs, they will be moderately related to the orientation scales.

Desire for Change: Employees were asked to indicate whether they would like to see the following changes: a company newsletter, changes to communications procedures, changes to job specifications, and changes to work processes. Cronbach's alpha of these items summed together was .61.

Job Involvement was assessed by seven items assessing people's self-reported intrinsic involvement in their job (e.g. 'I am very much personally involved in my job', The only thing I want from my job is money'). Cronbach's alpha was .70.

6.2.3 Results

6.2.3.1. Validity Check 1: Intercorrelations

The first issue concerns the intercorrelations among orientation measures, and their associations with measures assessing related constructs and with the conventional outcome variables. The correlation matrix is presented in Table 6.1.

As can be seen from this matrix, the orientation measures were moderately related to one another (r = .32 to r = .69) These correlations are not so high as to suggest redundancy, but are sufficiently high to indicate that they tap similar constructs. As expected, their relationships with conventional outcome measures were low to moderate. For example, correlations with Job Satisfaction ranged from -*.18 to .01 and correlations with Anxiety-*contentment ranged from .09 to .39. This confirms that the orientation measures are distinct from the outcome measures typically used in job design studies. Moreover, providing further evidence of construct validity, the orientation measures had moderate-sized intercorrelations with related constructs such as Desire for Change (r = .28 to r = .50), Quality Commitment (r = .27 to r = .43), and Job Involvement (r = .32 to r =.69). In contrast, as would be expected, the response-check scales had low correlations with Desire for Change (r = .02 to r = .36), Quality Commitment (r = -.19 to r = -.04), and Job Involvement (r = .06 to r =.19).

Table 6.1: Means, standard deviations and intercorrelations of measures used in the study, N = 60

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
Mean	3.60	2.95	3.38	3.30	4.06	3.45	3.09	2.78	3.51	3.95	4.45	2.72	2.63	3.42	3.88
(SD)	(.89)	(1.10)	(1.10)	(.41)	(.90)	(1.26)	(1.05)	(1.18)	(.94)	(.93)	(.79)	(.58)	(.74)	(.76)	(.63)
1. Production Knowledge	-														
2. Wider-Prod Knowledge	.69**	-													
3. Production Ownership	.63**	.51**	-												
4. Strategic Beliefs	.44**	.32*	.56**	-											
5. Knowledge RC	.57**	.29*	.27*	.15	-										
6. Ownership RC	.18	.12	.46**	.05	.33*	-									
7. Method Control	.19	.14	.07	.12	.05	-.32*	-								
8. Timing Control	.14	.09	.25	.09	-.06	-.09	.66**	-							
9. Cognitive Demand	.69**	.43**	.53**	.39**	.53**	.06	.40**	.21	-						
10. Job Satisfaction	-.15	.01	-.18	-.15	-.26*	-.29*	.39**	.38**	-.04	-					
11. Quality Commit.	.34**	.27*	.35**	.43**	-.04	-.19	.42**	.38**	.39**	.12	-				
12. Anxiety	.39**	.28*	.31*	.09	.28*	.17	-.00	.03	.25	-.49**	.14	-			
13. Depression	-.05	-.08	-.13	-.21	.10	.13	-.24	-.22	-.16	-.53**	-.19	.49**	-		
14. Desire for Change	.50**	.28*	.43**	.40**	.36**	.02	.02	-.14	.33**	-.32*	.32*	.41**	-.00	-	
15. Job Involvement	.49**	.32**	.50**	.69**	.19	.06	.38**	.34**	.47**	.13	.45**	.12	-.45**	-.31*	-

** p < .01, *p < .05

6.2.3.2 Validity Check 2: Comparisons between staff and shopfloor

A second validity check involves comparing the orientation scores for staff and for shopfloor employees within this traditional manufacturing environment. It is expected that staff members (who have planning and problem-solving roles) will have scores indicating broader, more proactive and more strategic orientations than shopfloor employees. That is, compared to shopfloor people, the staff members should report a greater range of production problems as of personal concern to them (i.e. higher scores on Production Ownership), attach greater importance to a range of proactive planning-based skills and knowledge within and outside of production that affect performance (i.e. higher scores on Production Knowledge and Wider-production Knowledge), and endorse to a greater extent the principles underlying relevant manufacturing initiatives (i.e. higher scores on Strategic Beliefs).

It is firstly necessary to check that the staff members have more control in their jobs than shopfloor people. Separate t-tests using independent group analyses were thus performed for each job content variable. As expected, staff members reported significantly[1] greater control than shopfloor employees over the scheduling of their work (i.e. Timing Control), t = -4.02, d.f = 55, p < .001, and over their choice in how to carry out given tasks (i.e. Method Control), t = -3.37, d.f = 55, p < .001 Also as would be expected, staff members reported significantly greater problem-solving and monitoring demands (i.e. Cognitive Demand) than shopfloor people, t = -5.01, d.f = 57, p < .001.

Given that staff members report greater job control than shopfloor employees, it is appropriate to examine whether these groups differ in their orientations. To perform this validity check, t-tests using independent groups analyses were conducted for each of the orientation measures. The means and standard deviations of scores for each groups, and the results of these t-tests, are shown in Table 6.2. As predicted, staff members scored significantly higher than shopfloor employees on all the orientation measures: Production Ownership, t = -4.04, d.f = 55, p < .001; Production Knowledge, t = -5.25, d.f = 57, p < .001; Wider-production Knowledge, t = -3.33, d.f = 57, p < .001, and Strategic Beliefs, t = 5.59, d.f = 58, p < .001. Thus, the measures clearly distinguish between jobs at different levels within a traditional manufacturing company, suggesting that the orientation measures fulfil a minimum validity requirement.

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[1] Throughout this thesis, when used in relation to results of statistical tests, 'significance' refers to 'statistical significance'.

Table 6.2: Means and standard deviations on orientation measures, and results of t-tests for differences between groups

	Role Group		Group differences
	Shop-floor N = 42-44	Staff N = 14-16	
Orientation measures	$\overline{X}$ (SD)	$\overline{X}$ (SD)	t^1
Production Ownership	3.06 (1.01)	4.22 (.86)	-4.04***
Production Knowledge	3.30 (.84)	4.43 (.29)	-5.25***
Wider-production Knowledge	2.68 (1.11)	3.67 (.69)	-3.33***
Strategic Beliefs	3.08 (.35)	3.75 (.43)	-5.59***

* p < .05; **p < .01, *** p < .001

[1] d.f for these analyses ranged from 55 to 58.

6.2.3.3 Validity Check 3: Comparisons using response-check scales

The final validity check involves examining scores on the response-check scales that were deliberately designed to function differently than the orientation measures.

First, for the shopfloor employees within this traditional manufacturing environment, it was expected that scores on the response-check items would be higher than those on comparable orientation scales. This was the case. Compared to a mean of 4.02 (SD = .89) for Knowledge RC, scores on the comparable orientation measures were significantly lower. That is, the mean for Production Knowledge ($\overline{X}$ = 3.30, SD = .84), and the mean for Wider-production Knowledge ($\overline{X}$ = 2.68, SD = .89), were both significantly lower than that for the response-check scale (t = -7.22, d.f = 43, p < .001; t = -7.94, d.f = 43, p < .001, respectively). This means that, as expected, shopfloor employees saw standard requirements (such as reporting problems to the supervisor) as more relevant to them than high-performance requirements (such as finding the root cause of problems).

Similar results were obtained for the Ownership items. The mean for the response-check scale ($\overline{X}$ = 3.57, SD = 1.18) was significantly higher than the mean for the Production Ownership scale ($\overline{X}$ = 3.23, SD = 1.05), t = -3.38, d.f = 41, p < .01. Thus, operators reported more concern for problems that relate to their narrow set of tasks than they did for wider-ranging production problems. To illustrate this further, looking specifically at direct employees paid on a bonus scheme, the problem they felt most concern for was 'You cannot produce at the maximum bonus rate (e.g. due to machine breakdowns, lack of training)'. The second most important problem was 'The materials/products you receive to work on are of poor quality'; a problem that has a direct effect on being able to produce the maximum bonus. On the other hand, broader goals and problems for which operators would be required to take responsibility in IM contexts (e.g. 'your end-customer is dissatisfied') were rated as of much less concern.

The second prediction was that, in contrast to the measures of Production Knowledge and Wider-production Knowledge, the Knowledge RC scale would not discriminate between shopfloor employees and staff employees. This scale assesses standard performance requirements (such as reporting problems, being technically skilled) that should not be any more important for staff in higher level jobs than for shopfloor people. This was the case. There was no significant difference between staff and shopfloor employees means on Knowledge RC, t = -.46, d.f = 56. This strongly suggests that the Response Check scale taps a different construct to the orientation scales, and thus provides additional evidence of the latter measures' construct validity. Further, it suggests that staff members (who scored higher on the orientation measures) were not simply responding in a more extreme manner to all items, but that they were discriminating between items of different content. (Note - the equivalent comparison for Ownership RC was not performed as some of the items, such as concern about not maximising the bonus, were not relevant to staff members.)

6.2.4 Summary of validity check

Overall, the above results suggest that the orientation measures have construct validity. They have moderate correlations with each other and with related constructs (such as Job Involvement), but have low correlations with measures of conventional outcomes. Staff members, who have high job control and who perform the 'mental' work within Production, have significantly higher orientation scores than shopfloor operators who perform a traditional, narrow shopfloor job. The latter see standard, technically-oriented skills and knowledge as most important for their performance, and they feel most concern for problems that affect their immediate job.

The narrow, passive and non-strategic orientations held by shopfloor employees are further reflected in comments made in interviews. The next section presents a brief selection of such comments to give a richer understanding of people's orientations within a traditional manufacturing setting. Prior to this description, however, it is worth clarifying a point about the orientations held by management and staff within traditional manufacturing contexts. Whilst the staff members in this company have a broader orientation than shopfloor people (e.g. seeing broader production problems as of concern), this can be considered as 'broad' only in relation to traditional shopfloor employees, and not in relation to staff within an IM context. In the latter, operators take on board the operational, day-to-day aspects of co-ordinating work usually performed by staff and, in turn, staff members need to adopt a new role with a fundamentally different orientation. For example, supervisors perform more of a planning, boundary control, resource-provision role than a 'foreman' role, and should see these new requirements as part of their role. Thus, some of the quotes and comments in this next section will suggest that foremen and other staff have inadequate orientations for IM. That is, whilst their orientations are broader than those of shopfloor employees in traditional jobs, they would nevertheless be inappropriate for the new supervisory roles required within IM.

6.3 A descriptive account of employees' work orientations

6.3.1 Source of data

The qualitative account is mostly based on formal tape-recorded interviews conducted with members of the shopfloor group (specifically, six operators, one quality inspector, one setter, and one union representative) and with one staff member (a foreman). In these interviews, people were asked questions tapping two general domains: (1) views about, and understanding of, production issues (e.g. customers, production goals); and (2) attitudes about their jobs (e.g. perceptions of control and responsibility, perceptions of performance requirements).

In presenting the qualitative data, I also draw on my knowledge derived from over 50 visits to this company. As well as the results presented in this chapter, I was involved in designing and facilitating a 'change in work practices' project with a pilot group, and setting up a trial communications project. Interviews were conducted informally throughout this process with many different shopfloor employees and with all managers within Manufacturing. My general understanding from this wider observation and interaction is used to guide the selection of comments reported below. Thus, although the quotes may not systematically representative, they were deliberately chosen to reflect commonly-held views.

6.3.2 Descriptive account

When directly asked about their job and what they felt wholly or partly responsible for, the shopfloor employees had clear but very narrow role boundaries. For example, one operator felt responsible for the quality of what he produced only until "its put on the floor", and another operator stated:

> I don't think I'm responsible for a lot, if you understand what I mean. I'm responsible for turning me work out and making sure its turned out properly, and that's about it really.

Similarly, the quality inspector felt responsible only for checking the quality of the products ("once the job's set up, its my job to make sure it conforms to the drawing") and the setter felt responsibility only for setting. Planning-based aspects of production, such as organising work, ensuring a smooth work flow, and solving problems, were seen as the supervisor's responsibility, as illustrated in this comment:

> The foreman should make sure that you've got work at side of machines and same when I've finished that job I should just go to foreman and say, 'look, I've finished this, what's next?' and that's as far as I should go in't it?

The foreman also saw that it was his job:

> To see that we get a fast through-put on job right through, to see that times are adhered to and the back of cards are not fiddled, keep costs down. Cleanliness of shop, health and safety things come into it too.

Related to these narrow views of their responsibilities, shopfloor employees had a very limited awareness of production beyond their immediate machine/s. This was clear from questions about products, customers, production goals, quality, and lead-time. For example, only one of the six operators interviewed had any idea about customers. One person described them as "just names on a sheet", and another stated: "the only thing I know about customers is when I look on the job chart". Similarly, although people speculated when asked, they lacked knowledge about production goals or strategies ("they just give me a list. The list is the target"). Some clearly stated that this was not part of their job: "All I know is what I'm trying to achieve like, and once I've done my job then its on to the next person and I lose contact with it, you know". A quality inspector remarked:

> You can only look around you and guess what they are trying to do. Are they building a stockpile in the warehouse or are they trying to run it order to order? I don't know. If I was to guess - the warehouse is pretty full so they've either got a lot of work on, or they're stock-piling, but I don't know.

Questions about people's views of the general efficiency of Production also revealed a lack of breadth and strategic understanding. Most people felt that Production was doing 'quite well', although this tended to be defined in terms of a lack of problems. For example, asked about how good or bad the lead-time is, one employee stated: "I don't know how long it takes to get from start to finish. I think delivery time is pretty decent. I don't think they really get far behind with them". Again, people often didn't see it as part of their role to know about such issues (e.g. "I don't think they are doing anything basically wrong. I mean, my world revolves around here and programming, so I don't know"). In answer to a question about how good the lead time was, the quality inspector stated:

> Hard to say. Don't get involved with this. Looking at start and finish (on the routings sheet) they always seem to be late. But whose fault is that? It could start at this end, which is nothing to do with me; or it could be through the process. I don't know.

When asked for ideas about improving aspects of production, employees often had a narrow perspective, as illustrated by someone's answer to a question about how to improve general production efficiency "Well, I've never really thought about it actually, you know, until you really asked me about it. We never get involved in anything like that so... We just do our job and that's it".

The narrowness of people's views was also reflected more subtly in their actual ideas about improvements and production strategies. Many comments revealed an implicit assumption that problems could not be prevented, such as "you're bound to scrap an odd one occasionally, its inevitable, like" and "well, its common (machine breakdowns) in every engineering company I think, you know". Such comments suggest a passive, accepting approach to problems. Moreover, most of the proposed solutions to problems reflected a traditional, technocratic approach to improving efficiency where the focus is on improving the machines rather than methods and people. For example, when asked to think of any ways of improving quality with an unlimited budget, several people thought new machinery was the only answer.

This brief sample of comments illustrates the narrow and often passive view of roles and the broader work environment held by shopfloor employees in this traditional organisation. This, of course, is not intended to imply that such views are intrinsic to these employees. Rather, they largely reflect the non-integrated organisation of manufacturing and the narrow jobs people hold. Manufacturing stages or functions (e.g. planning, quality, production) are not integrated structurally or even psychologically. For example, a foreman described most of the production problems as belonging to other Manufacturing functions. For example, he blames the planning department for steel-availability problems, the Quality department for problems with inspection (seeing a major way of improving quality as having 'more conscientious inspectors') and generally stated about production: "I mean, we can't help the things that go wrong - machines breaking, and things like that". If management perceive manufacturing functions as separate, it is not surprising that operators do not have an integrated view of production or the wider manufacturing context.

The narrowness of employees' jobs means they do not have the opportunity to learn about aspects of production beyond their areas. This was recognised by the employees. For example, in answering a question about improving quality, one operator described how he was "just in one place all the time doing one job" and therefore had few ideas. Nevertheless, he acknowledged that "I suppose if you did get moved about and worked in other departments you could happen see things where you could improve quality". Further, employees frequently expressed a desire to know more about production and the company. Management, on the other hand, seemed to make little effort to involve and inform employees. This seemed to have an alienating and 'narrowing' effect on people's attitudes. For example, when asked whether people should get more responsibility, one operator answered:

> Well, I think they (shopfloor) should get to know more what's going off.. what's going off with factory, because you get to know nowt... They don't give the bloke on shopfloor the incentive. As far as I can see he's just a number. That's our personal view. So me, I just come in, clock-in, clock-out, that's it.

Another person described how this lack of communication fostered a narrow attitude:

> There's no communication. So I come here, do me work to the best of my ability, and that's it, you know, because, really that's all we think Company P want out of us anyway, you know... I just come and do my job, that's what I'm paid to do anyway.

The effect of a lack of communication on people's attitudes was also indicated in a questionnaire comment:

> Management do not tell shopfloor anything about order books, customer satisfaction, company plans for the future. The morale of most people here is very low. If you tell people what is happening they will have a far greater interest and pride in their work and company. And not just come for money.

As well as not keeping them informed, many shopfloor employees felt that management did not listen to them. This was often commented on in the questionnaires (e.g. "This management will listen to your ideas, then tell you your ideas are no good, and do exactly what they want to do"). This management style does not foster shopfloor creativity and broadness of thinking.

A further factor in creating and sustaining people's narrow orientations was the payment system. Piecework directly acts against greater employee involvement and broader jobs because engaging in activities other than producing usually has a financial penalty (e.g. going to meetings is paid at a lower rate). It is simply not in people's interest to get more widely involved beyond 'churning out' products. Moreover, the system reinforces a management-employee division because people feel the piecework system reflects a lack of trust ("piecework is here because the production manager just doesn't trust the bloke on the shopfloor"). This is demoralising to many operators, and further fosters a passive, narrow orientation.

> If you've got flat rate I think you would get more enthusiasm out of a bloke on't machine, because he can say, ' Well, I'm not losing any money. Its good of Company P to pay us this flat rate, so, we'll get this...' It would make you more enthusiastic.

Comments by a foreman in an interview suggest that employees are not imagining this lack of trust. "Personally, I would like to keep a payment-by-results system simply because a flat rate would make my and other supervisors' jobs intolerable". He then describes how his current work load does not allow him to adequately "control" the situation: "When a person comes to me about down-time, if I've not been watching him in that shop, how do I know whether he's had two hours or four?". This mentality - that people cannot be trusted and must be controlled - is not conducive to employees' developing more involvement and broader orientations. This is further illustrated by the foreman's belief about the way to improve the quality of products and reduce the amount of rework:

> I mean we can talk to the men and try and get them thinking conscientiously. But at end of the day, only thing we can do is make 'em do the work on lesser rate of pay than what they get for producing. Its a penalty so they don't do it again.

The comments described thus far suggest that passive, narrow orientations held by operators are probably created (and certainly reinforced) by pervasive structural and cultural forces. As suggested in the introductory chapters, a narrow orientation is probably adaptive to the situation. This is illustrated in these final comments by an operator when asked whether he thought shopfloor people at the company should be given more responsibility:

> Yeah, I do, definitely, yeah. I do, yeah. [*Why?*] Well, I mean, its like me coming to work and saying, 'Right, I'm doing this today ...Sort my own jobs out, say right, 'You know that work there, organise it yourself and put it on where it needs putting on' or whatever, that type of thing, you know.

However, this same operator then immediately countered this enthusiasm with the comment:

> I don't think there's much chance of getting a lot more involved here anyway, if you understand what I mean... You're involved here turning your work out and that's about most involved... You can't really get involved in anything else, can you? 'Cause you're too busy actually producing your work, you know. I mean, you probably couldn't go 'Oh, I think I'll go and have a discussion for an hour about this with engineers like'. I don't think they'd like that because you should be turning your work out like. .... you'd never get your orders out really... No, there's not much chance of getting a lot of involvement really, I think everybody has got their jobs and that's it like.

This comment, and others by the same operator, seem to suggest a person who would like to be more involved but who has developed a self-protective attitude that it is simply not feasible.

Overall, this qualitative account has presented a richer view of the types of traditional views held by people in traditional manufacturing companies, and some of the forces that create and sustain these orientations. There is clearly a long way to go before these employees become the 'high-performing' workers described in the introductory chapters. That is, workers who "understand the interconnection between what they are doing and the overall success of the company" (Eurotecnet, 1991, p. 29), who "can think in broader terms along the lines of the whole process of product development" (op. cit. p. 27), and who "feel 'ownership' of the events taking place around them" (McCalman & Buchanan, 1990, p. 22). Comments suggest that changes to work design and other human-resource systems and practices (i.e. payment methods, communication mechanisms, supervisory and management styles) are likely to be needed for such a transition. This is consistent with Lawler's (1992) argument that power, information, knowledge, and rewards need to be devolved to shopfloor workers for them to develop the necessary attitudes and abilities to perform well. It is also consistent with arguments that successful manufacturing in today's competitive environment will require organisation-wide transformations (e.g. Lawler, 1986; Ledford and Mohrman, 1993) rather than merely 'tinkering' with the design of a few jobs.

6.4 Summary of chapter

The main aim of this chapter was to investigate the measures developed to assess employee orientations. In the first section I showed that orientations can be reliably measured, and that the specific scales that have been developed are valid. A descriptive account was then presented that illustrated the traditional, static orientations held by employees in traditional shopfloor jobs. It also demonstrated some of the possible factors that create and sustain these orientations.

Perhaps the most important outcome of this chapter, however, is that it demonstrates a clear convergence between data obtained from very different methodologies. That is, employees' quantitative scores on the orientation scales 'match' the in-depth quotes presented in the qualitative account. Employees had 'low' scores on the orientation measures (in comparison to staff members, and in comparison with their scores on response-check items); and interview comments revealed that shopfloor people had a narrow focus on the immediate job, reactive attitudes to problems, and limited, non-strategic perspectives of production goals and initiatives. These qualitative data have thus served to provide persuasive evidence that the orientation measures function as viable 'remote' indicators of rich and fundamental constructs.

In the next chapter I progress to an examination of the research propositions, and investigate employee orientations within a company moving towards greater integration of production.

Chapter 7

The effects of an IM strategy, 'Kaizen', on employee orientations

7.0 Introduction

Given the support for the validity of the measures and for the general approach described in the previous chapter, it is now appropriate to take the investigation further. Here, I present a longitudinal examination of the effects on employees' orientations of introducing an IM initiative that was not accompanied by job redesign. It was suggested in the introductory chapters that the development of new and broader orientations depends not only on the introduction of an initiative that serves to integrate traditionally-distinct aspects of manufacturing, but also requires the redesign of jobs to enhance operator control. As the intervention in this study did not attempt to enhance job control, it is predicted that employee orientations will not change. The longitudinal design of the study, in conjunction with the presence of a comparison group, allows relatively strong causal inferences to be made about the relationships of interest.

Examining change in orientations - or indeed failure to change - in such a context is important for several reasons. As argued above, it allows a test of the proposition that job redesign is needed for changes in orientations, and thus enables tighter specification of the conditions under which such change occurs. Further, from a measurement perspective, this allows an examination of possible demand characteristics with the orientation measures. If scores on the orientation measures increase when there is no basis to expect such an increase, this would suggest a possible effect due to testing, response bias, or demand-characteristics.

The investigation is also important for a third reason. That is, according to many commentators, the introduction of IM without enskilling operators and enhancing control represents a common approach to the implementation of IM (e.g. Dean and Snell, 1991). Not only do organisations often introduce IM initiatives without regard for the design of jobs, but the initiatives often serve to intensify work (Delbridge *et al.* 1992; Turnbull, 1986, 1988). Turnbull (1988, p. 7), for example, suggests that practices such as JIT and TQM can be used as "a method of eliminating to key imperfections in the Fordist system, making it possible to combine product diversity with mass production *without* any significant re-skilling". As shall become clear, the approach taken by the organisation described in this study represents a good illustration of this method of implementing IM. Investigating orientations within this context thus allows an analysis of the human effects of the 'intensifying approach', not only in terms of conventional outcome variables (such as job satisfaction) but in terms of outcomes that reflect employee growth and development.

The company in which the study was conducted, and the IM initiative that was introduced (i.e. a continuous improvement strategy called 'Kaizen'), are now described. The research design and predictions are then specified.

7.1 Organisational background

The study took place within the assembly section of a company that designs, develops, and manufactures vehicle seats and seat mechanisms for car manufacturers in the UK and Europe (Company D). Customers include The Rover Group, Nissan, Saab, Volvo Sweden, Volvo Holland, and General Motors. The company works in partnership with these customers to develop the exact products they need.

7.1.1 Production process and personnel

The factory that houses Company D was purpose-built in 1987 with a flow-line, cellular layout. There are ten production cells corresponding to product-types (e.g. Rover 800). Each cell contains three distinct stages: pressing, fabrication, and assembly. With the exception of a separate tool room, paint shop, and trim shop, the cells contain all the necessary equipment and functions to completely build the products. In pressing, steel is formed using large computerised pressing machines. The steel is then welded and shaped in the fabrication stage. In the assembly section (the area of interest in this study), components are assembled into seats or car slides and products are taken, via an overhead conveyor, to be painted, and then returned to the line for final assembly.

Each cell has a leader and a deputy leader who together are responsible for the operation and performance of the whole cell. Within the stages (i.e. pressing, fabrication, and assembly), there is also at least one line leader. The line leaders' official role is to ensure the line has adequate resources and to manage the line's boundaries. However, from pilot interviews with assemblers and leaders, it appears that line leaders perform a more traditional supervisory role including, for example, liaison with the cell leader and support staff (e.g. tool setters, maintenance), checking the final quality of products, fetching and despatching work, co-ordinating tasks, and solving problems. Assemblers typically perform only one task, although in principle they are able to perform more than one job in their work area. Most assemblers check their own quality and some 'setter-operators' also set up their own machines. Employees are paid a cell-wide bonus based on achieving targets set by management.

On the whole, there were not many high-involvement design features in place at Company D. Although there was a product-based structure with few management levels, control was concentrated in the hands of line and cell leaders. Similarly, whilst employees were officially 'multiskilled', little use was made of operators' flexibility. Further, a critical element of high-involvement organisations is that performance is rewarded (e.g. Lawler, 1992). Yet many operators saw the cell bonus as "a rip off" and a way to "screw the workforce". Other human resource policies that support high-performance forms of work organisation, such as career development schemes, selective staffing, and developmental training, were not in existence. In particular, recent waves of redundancies within the company meant there was no secure employment, as illustrated by these employee comments: "to be in employment today is a bonus for everybody" and "more mental security about the future plans is needed"

7.1.2 Production strategies and Kaizen

As a result of customer demands for fast delivery times and high quality, the company had moved towards greater integration to improve performance. A TQM programme had been implemented, and attempts made to improve the work flow to produce products 'just-in-time' for customers. However, these changes were insufficient. Company D's customers were expecting this high level of performance with no yearly price increases (or increases below the rate of inflation). Thus, to further improve efficiency and reduce costs, a decision was made to implement an IM initiative called 'Kaizen' within the assembly areas of cells.

Kaizen, the Japanese word for 'continuous improvement', is an integral part of most Japanese manufacturing practices. It is particularly central to Just-in-time, and has been described as the driving force behind the Japanese success in eliminating shopfloor worker complacency (Imai, 1987). Essentially, the principle underlying the Kaizen approach is that existing production methods are inadequate because of 'waste' or 'non-value added activities' (as opposed to 'value-adding activities' that generate the finished shape and material of the product). Kaizen is about continuous improvement in cost through removing this waste, in delivery time through systematically analysing and reducing lead time, and in quality through building quality into the process. A central feature of this process is suggested to be the involvement of shopfloor workers so that operators' local expertise can be used to solve problems and generate ideas for further improvement.

However, it has been suggested that if Kaizen and associated strategies are not implemented in conjunction with high-involvement work designs and a supporting empowerment culture, they can function as a management tool for intensifying work (e.g. Delbridge, *et al.* 1992; Turnbull, 1986, 1988). The never ending push for further improvement can result in what Parker and Slaughter (1988) refer to as 'management by stress' where "workers are never allowed to settle into a comfortable pattern" (Schonberger, 1982, p. 32). Removing waste can extend to eliminating all wasteful motions in the performance of work and even "worthless, parasitic persons" (Shimizu, quoted by Dohse, Jurgens, and Malsch, 1985). Terminology such as 'one operator saving' and 'unnecessary movement reduced' can be common. Indeed, the scientific emphasis and the type of language has many parallels with the earlier principles of work simplification. For example, Taylor (1911, p. 30) described how to scientifically analyse tasks in order to "do away with all unnecessary movements ... eliminate all false movements, slow movements, and useless movements". According to Turnbull (1988, p. 11), this emphasis on reducing waste can ultimately mean "operating the manufacturing process with even fewer workers upon whom the costs of production fluctuations and the burdens of productivity improvement are concentrated"; and the push towards single-unit production can mean "a recreation of the rhythm of the assembly line" where workers have less control over the pace and methods of work, and tasks are progressively standardised (p. 13).

From an analysis of the methods and motives of Kaizen implementation within this company, it is clear that management opted for an intensification rather than empowerment-oriented approach. There were no goals for employee development; rather, the specific targets were to achieve a batch size of one, reduce lead time by at least 50% ("move lead time from weeks to days, days to hours, and hours to seconds"), and reduce inventory and floor space requirements. This was to be achieved through the "aggressive elimination of waste", with waste defined as "everything above the absolute minimum of manpower, machinery, materials, and minutes required to produce the product that will delight our customers" (Kaizen training material, p. 10). The training course focused on the Toyota Production System as a model for educating people about continuous improvement, and provided exercises for them to analyse their work area. These analyses involved examining the time in seconds taken for all processes, tooling times, and even walking. The principle of 'Jidoka', or autonomation, was also emphasised. This aims to separate man and machine, and to design machinery that can run without operator intervention. This is a philosophy for managing new technology that contrasts radically with enskilling principles espoused by many commentators (e.g. Susman and Chase, 1986).

According to management within the company, the implementation process involved consultation with, and training of, the work force. However, whilst this may have happened in some instances, it did not appear to be a widespread policy. Several comments suggested that a participative approach was not used. For example:

> When R17 changed to Kaizen, suggestions made in my area were ignored by the 'cell leaders' setting it up. They always knew better. A lot of the changes they enforced have made the job harder and slower.
>
> The Kaizen way of working on the V-cell is being rushed, a lot of the objectives set out at the start for this new way of working have not been met, for example, bad parts, training, and new designs.

Moreover, only three of the shopfloor employees in this study actually went on training courses. Instead, mostly line leaders attended the course and then disseminated information to the shopfloor.

Kaizen also included setting up hourly production targets that then linked to the bonus system. Delbridge *et al.* (1992) suggest that within a strong control environment this can serve as a form of 'visible control' ensuring that, even when gains have been made, the pressure for better performance is maintained. Given the link between targets and bonuses, this seemed to be the way the system was used in this company. For example, one assembler commented:

> This management seem to insist on its 1 pound of flesh plus blood. The more you try to produce to help both yourself and the company financially, the more they take off you. i.e. U-cell (the Comparison Group) upped their output when management removed their ceiling on the amount of bonus employees could earn, management instantly upped standard piecework rates to bring the U-cell bonus level back in line with their original pay out. So now, we have to do approximately 25% more work to receive the same bonus before the ceiling was lifted: a complete waste of energy on the employees' part.

Overall, there was certainly little suggestion that Kaizen was implemented with any intention of enskilling operators or changing the broader control-oriented culture. The emphasis on 'eliminating waste' seemed to extend to people, and there was suspicion amongst operators that the real aims of Kaizen were to down-size the work force. A less extreme view is that Kaizen was purely a way of improving space and work-in-progress. To this end, Kaizen appeared to be successful in improving performance, as shown in the quote below from a company document:

> Thus far 7 lines have been completed with exceptional results; work in progress has been reduced further; there has been a saving in space of 30%; housekeeping has been improved as have working conditions; problems in quality are highlighted early and corrective action is taken quickly. The number of employees on these lines has been reduced allowing them to be re deployed on other cells and to a major new project starting later this year.

Comments made by members of a pilot group in interviews supported management's claim that there had been improvements in space, a smoothing of the work flow, and a decrease in work-in-progress (WIP). Because of this success, management decided to implement Kaizen more widely throughout assembly.

7.2 Research design and predictions

This study is longitudinal with two measurement points separated by six months. It is a quasi-experimental study with a research design most similar to that described by Campbell and Stanley (1966) as the 'non-equivalent control group' design. The experimental group is a group of employees that receive the 'treatment' (i.e. the implementation of Kaizen) one month after the first survey; and the comparison group is a group of employees who had been working under Kaizen for approximately three months at the time of the first survey (i.e. the group that piloted the initiative). These groups are referred to as the 'Intervention Group' and the 'Comparison Group', respectively. The research design and the timing of the measurement points is depicted in Figure 7.1.

				Time 1						**Time 2**
Months	0	1	2	3	4	5	6	7	8	9
Comparison Group	X			O						O
Intervention Group				O	X					O

X = introduction of Kaizen
O = measurement

Figure 7.1: Design of the study to investigate the effects of Kaizen

Although the primary focus of this study concerns people's orientations, it is necessary to determine the effects of the IM initiative on shopfloor workers' job control. This can be seen as a manipulation check of the effects of the intervention. In addition, changes in conventional psychological outcomes (e.g. job satisfaction, anxiety) are examined, and scores on some new measures designed specifically to assess pressures arising from the organisation of the work flow (e.g. the pressure associated with cluttered work space) are reported. These secondary analyses will give greater insight into the nature of changes occurring with the implementation of Kaizen, and will enhance understanding of the findings concerning orientations.

For each set of variables, group differences at both periods and changes over time are examined. Given the nature of Kaizen in this study, it is expected that there will be no group differences, or changes over time, in scores on job control. If this is the case, it is further predicted that there will be no significant differences between groups in role or strategic orientations at Time 1 or at Time 2, and there will be no significant change over time in these variables for either group. However, for the work flow pressure measures, it is expected that these will reflect the improvements in work-flow organisation that Kaizen strategies focus on. Thus, it is predicted that the Comparison Group (having experienced Kaizen) will have less pressure than the Intervention Group at Time 1, and that scores for the latter group will significantly improve over time when Kaizen is introduced.

As part of the exploratory aim of the thesis, some employee comments are presented that highlight the potential effects of non job design factors on people's orientations.

7.3 Method

7.3.1 Access and research procedure

The company was involved in a collaborative project between the Department of Trade and Industry and the research team (Parker and Jackson, 1992). Two other researchers in the team were the primary people involved with the company, although the author participated in each phase of the research (i.e. questionnaire design and administration), was solely responsible for the parts of the process involving orientations, and carried out all statistical analyses relevant to this chapter.

At each time, questionnaires were administered by the researchers in small groups (up to 15) during work hours. Confidentiality was emphasised (in the same way as in section 6.2.1.2), and the purpose of the study was described as being to independently evaluate the effects of Kaizen on employees. Response rates were high (approximately 80%). It was not possible to estimate the exact response rate because of internal movements across cells, absence, and redundancies that occurred over the course of questionnaire administration.

7.3.2 Measures

Intercorrelations between all the measures used in the study at Time 1 and Time 2 are shown in Appendix 4.

7.3.2.1 Orientation measures

Context-appropriate orientation items were generated using company documentation (including Kaizen training material designed by independent consultants) and data from pilot interviews. As far as possible (given the different context and greater space restrictions) items overlapped as much as possible with those used in the previous study. Using the procedure described earlier (see section 5.2.2 and 5.2.3), orientation scales were developed from these items. The coding and categorisation procedure for the role orientation scales, along with a list of items in all scales, is contained in Appendix 3.

As with the previous study, there was one measure of strategic orientations (Strategic Beliefs) and the measures of Production Ownership and Wider-production Knowledge were used as indicators of role orientations. However, there was an additional scale assessing role orientations. That is, because they were not highly correlated, an earlier a priori distinction between categories was maintained in this study. Rather than a single scale of Production Knowledge, there were two scales that both relate to knowledge requirements within the production area but focus on different aspects. The first, Local-production Knowledge, focuses on the extent to which employees perceive knowing about the operational aspects of the local work area as important for their performance (e.g. 'knowing about the work flow in your assembly area', 'knowing the priorities of work in your assembly area'). The second, Proactive Group Knowledge, assesses the perceived importance of knowledge and personal qualities needed for proactive behaviour (e.g. 'knowing how to anticipate and prevent problems') and for working in groups (e.g. 'knowing how to make decisions as part of a group').

For the final scales, the number of items and the internal reliabilities at Time 1 and Time 2, respectively, were as follows: *Production Ownership* (11 items, Cronbach's alphas = .90 and .95); *Local-production Knowledge* (4 items, Cronbach's alphas = .81 and .89); *Proactive Group Knowledge* (9 items, Cronbach's alphas = .86 and .84); *Wider-production Knowledge* (3 items, Cronbach's alphas = .67 and .79), and *Strategic Beliefs* (13 items, Cronbach's alphas = .86 and .89).

It should be also be noted that two validity checks commensurate with those in the previous study were conducted. First, inspection of the intercorrelation matrices showed that the orientation measures mostly had moderate correlations with each other, but low correlations with the conventional outcome measures (see the tables in Appendix 4). Second, a comparison of orientation scores for cell leaders who have a management role, line leaders who have supervisory roles, and assemblers showed that, as would be expected, there were significant (or almost significant) linear relationships between group membership and all orientation scales. That is, for each measure, cell leaders had the broadest orientations, followed by line leaders, followed by assemblers.

7.3.2.2 Job control and outcome measures

Additional measures were included in the questionnaire to examine the effect of Kaizen on job control and on conventional outcomes. Most of these scales were used in the previous study (see section 6.2.2.3 and 6.2.2.4), thus only their internal reliability's in the present study are described here: *Timing Control* (Cronbach's alphas = .80 and .87), *Method Control* (Cronbach's alphas = .81 and .68), *Anxiety-contentment* (Cronbach's alphas = .80 and .80), *Depression-enthusiasm* (Cronbach's alphas = .84 and .87) and *Job Satisfaction* (Cronbach's alphas = 89 and .92).

An outcome measures not used in the previous study was also included:

Psychological Strain: The 12-item version of the General Health Questionnaire (GHQ; Goldberg, 1972, 1978) was used to assess psychological strain. This measure was developed to detect minor psychiatric disorder in the general community. This has been shown to have validity coefficients of .77 and .72 when comparing GHQ-12 scores with independent clinical assessments (Goldberg, 1972), as well as high internal reliability. The scale has been extensively used in occupational studies (e.g. Banks, Clegg, Jackson, Kemp, Stafford, and Wall, 1980). Cronbach's alphas in this study at Time 1 and Time 2 were .80 and .90, respectively.

7.3.2.3 Additional measures

Some new measures were developed to assess common pressures resulting from poor work flow (the item content of these was based on pilot interviews). It was felt that these indices would tap the most likely outcomes of the Kaizen strategy, and thus their inclusion in the study would be informative. A factor analysis of the items yielded four factors. Items with high loadings on the factors were formed into sub-scales; two of which were highly correlated and thus combined into a single measure. The resulting three subscales are as follows:

Pressure: This is a 6-item scale assessing people's feelings of physical and mental pressure resulting from the amount and pace of their work. Sample items include: To what extent: 'do you find your job physically demanding?', 'are you under constant pressure at work?' 'do you find yourself working faster than you would like to in order to complete your work?'. Cronbach's alpha was .87 at both time periods.

Material Chasing: This is a 3-item scale assessing the extent to which people's jobs involve looking for and carrying materials and equipment (e.g. To what extent: 'is your work interrupted by having to fetch materials?'. Cronbach's alphas at Time 1 and Time 2 were .84 and .83, respectively.

Excess Work in progress (WIP): This is a 4-item measure assessing the extent to which work-in-progress disrupts working (e.g. To what extent: 'do you find work in progress gets in your way? 'is work in progress a nuisance?'). Cronbach's alphas at Time 1 and Time 2 were .84 and .81, respectively.

People were also asked to indicate their age, gender, job, length of time in current job, and length of time in company.

7.3.3 Sample

There were 35 employees who had valid data at both periods, with 15 and 20 people in the Comparison Group and Intervention Group, respectively. The mean age, length of time in the company, and length of time in the job for the Comparison Group and the Intervention Groups respectively were 39.8 (SD = 11.5) and 34.5 (SD = 10.12) years of age; 4.13 (SD = 2.5) and 4.55 (SD = 2.2) years in the company; and 2.4 (SD = 1.92) and 2.9 (SD = 2.1) years in the job.

7.3.4 Analyses

To examine changes over time, separate Repeated Measures Manovas were carried out for each variable (see Appendix 2 for guidelines to the use of Manova in this thesis). This strategy was preferred as multiple t-tests conducted separately for each group would have inflated the likelihood of capitalising on chance. Group differences at each time are also tested. This is particularly important at Time 1 because the change analyses do not give information about the equivalence of starting points. For both change over time and group difference, simple main effect statistics are reported rather than overall main and interaction effects. This allows a direct examination of the predicted pattern of results; that is, changes over time are examined separately for each group, and then group differences are examined separately at each period.

7.4 Results

Prior to presenting the main results, it is necessary to perform the manipulation check. That is, it was predicted that Kaizen would not have any real impact on the core features of peoples' jobs, particularly the extent of control, and would therefore not affect their orientations. The effect of Kaizen on job control is thus examined first, followed by the main results that investigate its effect on orientations. Some attention is then given to non job design human resource factors and their possible effects on orientations (i.e. the exploratory aim of the thesis). Finally, some additional effects of Kaizen are examined.

7.4.1 Effect on job control (a manipulation check)

Table 7.1 shows group differences and changes over time for the measures of job control. At Time 1, there were no statistically significant differences between the groups in their perceptions of control over the timing and scheduling of their work (Timing Control) or the methods used (Method Control). Taking out the line leaders from the samples (who were disproportionately represented across groups) scores on these variables were even more similar across the groups. There were also no significant changes in perceptions of job control over time for either group.

Table 7.1: Means and standard deviations, changes over time and group differences for job content variables

	Changes over time						**Group differences**	
	Comparison Group N = 15			**Intervention Group N = 20**				
Job content	Time 1 $\bar{X}$ (SD)	Time 2 $\bar{X}$ (SD)	F[1]	Time 1 $\bar{X}$ (SD)	Time 2 $\bar{X}$ (SD)	F[1]	Time 1 F[1]	Time 2 F[1]
Method Control	3.33 (.78)	3.36 (.52)	< 1	2.79 (.94)	2.93 (.86)	< 1	3.32	2.35
Timing Control	3.04 (.94)	3.25 (.87)	< 1	2.44 (1.11)	2.63 (1.13)	< 1	2.63	3.15

[1] Degrees of freedom for all F tests were 1, 33. Where F test for change over time is significant, the (-) and (+) indicate a decrease and increase in scores over time, respectively.

These results suggest that, as expected, Kaizen had minimal impact on people's job control. This finding is consistent with many of the comments written on questionnaires. For example, two assemblers stated:

> I agree in certain areas Kaizen looks to have improved the way things are done. But my job is still the same as it always has been with the exception of a little less room in some areas and a little more in others

> On the line, the job methods haven't changed, only the layout of the benches. All that has been achieved is (reduced) work in progress. The bending down and picking up has changed but all the jobs are the same.

Some comments made by employees suggest that jobs have been intensified:

> Yet the company - after five months of Kaizen - wants the extra 27 seats a day ... leading to assemblers just having to work faster in less flexible ways. This causes rushed products and bad feeling.

> There is no job satisfaction working on the Kaizen system where three men have to do the same work as five men used to under the old way of working.

One person commented that Kaizen has "created line leaders who think they are supervisors", a comment that implies a centralisation of control. This is not surprising as most of the few people who went on training courses for Kaizen were line leaders. Through holding on to information and knowledge about Kaizen, leaders could have increased their control over production.

Given these findings that Kaizen did not increase operator control (and may even have had an intensifying effect) the predictions made earlier concerning orientations hold.

7.4.2 Effect of Kaizen on orientations

It was predicted that there would be no significant differences in orientation scores between the Comparison Group and the Intervention Group at Time 1, and that the Intervention Group would not report significant increases its orientation scores over the period in which Kaizen was introduced. Both of these predictions were largely supported, as shown in Table 7.2. First, there were no significant differences between the groups on any of the orientation measures at Time 1. This was also the case when taking the line leaders out of the analysis. Second, for the Intervention Group, there was no significant change in Production Ownership, and there were significant decreases in Local-production Knowledge, F (1, 33) = 4.73, $p < .05$ and in Proactive Group Knowledge, F (1, 35) = 11.34, $p < .01$. The only significant increase occurred for Strategic Beliefs and this took place within both the Comparison Group and the Intervention Group, F (1, 33) = 7.95, $p < .01$ and F (1, 33) = 4.95, $p < .05$, respectively. It should also be noted that, at both times, the Comparison Group (which had experienced Kaizen for several months prior to the study) had higher Strategic Belief scores than the Intervention Group.

Thus, the implementation of Kaizen did not have a consistent broadening effect on people's orientation to their work. For those employees in the Intervention Group, their perceived ownership of production problems did not change, and their view of the knowledge and skill requirements for effective performance narrowed. Yet all employees, including those in the Intervention Group, continued to report greater endorsement of IM principles (note - the possibility of the increase in Strategic Beliefs being a testing effect cannot be ruled out).

Table 7.2: Means and standard deviations, changes over time and group differences for orientation variables

	Changes over time						**Group differences**	
	Comparison Group N = 15			**Intervention Group N = 20**				
Orientation Variables	Time1 $\overline{X}$ (SD)	Time2 $\overline{X}$ (SD)	F^1	Time1 $\overline{X}$ (SD)	Time2 $\overline{X}$ (SD)	F^1	Time 1 F^1	Time 2 F^1
Production Ownership	3.30 (1.07)	3.59 (1.04)	2.32	3.08 (.72)	3.08 (.77)	< 1	< 1	1.61
Local-production Knowledge	4.01 (.55)	3.71 (.63)	3.37	3.86 (.69)	3.56 (.63)	4.73* (-)	< 1	1.12
Proactive Grp Knowledge	3.75 (.59)	3.60 (.65)	1.85	3.81 (.52)	3.49 (.50)	11.34** (-)	< 1	< 1
Wider-prod'n Knowledge	3.59 (.63)	3.36 (.40)	1.08	3.44 (.77)	3.56 (.86)	< 1	< 1	< 1
Strategic Beliefs	3.60 (.68)	3.86 (.72)	7.95** (+)	3.20 (.73)	3.37 (.65)	4.95* (+)	2.36	3.62

** $p < .01$, * $p < .05$

[1] Degrees of freedom for all F tests were 1, 33. Where F is significant, the (-) and (+) respectively indicate a decrease and increase in scores over time.

7.4.3 An exploration of HR factors

To date, evidence has been presented to suggest that the lack of change in employee role orientations is a result of a failure to enhance job control. In addition to this, several HR factors also appear to work against the development of new and more appropriate role orientations. In line with the exploratory aim of this thesis, some of these potential influences are described.

Young (1992) argues that the successful implementation of strategies such as Kaizen requires a low likelihood that workers will be laid off (e.g. through Japanese-style labour agreements) as well as monetary and non-monetary rewards for improvements to the process. Neither of these two conditions were fulfilled in the current study. Recent redundancies in the company fuelled concerns that Kaizen would lead to job loss (a belief shared by employees in other organisations implementing Kaizen; see Young and Davis, 1990). For example, one line leader commented that management "face an uphill struggle convincing the majority that Kaizen is for their own good because of the distrust built up through redundancies in the past", and several comments made by employees related to redundancy fears (e.g. "One thing you can guarantee with Kaizen is that you achieve more production and loss of jobs in the long term"). Indeed, over half of the sample (56%) reported being 'unsure' as to whether Kaizen would lead to job losses in an item on the questionnaire.

Further, the reward system seemed to be alienating employees rather than motivating them to improve the process. As indicated earlier, the bonus system was used to 'squeeze' further gains in productivity by constantly upping targets (e.g. "The targets they set were way above what they should have been. Our bonus is non-existent, the targets set mean another section would be earning £10-15 more"). This use of the bonus system seems to coincide with Parker and Slaughter's (1988) description of Kaizen as 'management by stress' . Further, because the bonus was based on the whole cells' productivity rather than just the assembly section, this meant that employees often felt the pressure of targets that they could not necessarily control. For example, one operator described how Kaizen was only introduced in final assembly and not in the other two areas of the cell and "until quality is improved in these two areas, increased production targets cannot be reached despite all the efforts and pressure on the final assemblers".

The failure to support the changes with adequate training for all shopfloor employees also reinforced the intensifying, non-developmental perspective of Kaizen within the company. Comments from line-leaders suggested that training was critical in getting people motivated and involved with the changes, such as:

> Having been on a Kaizen course, I have seen first hand what is can do for all of us within the company. I think the next step for management would be to enable far more of the work force to go on these courses and understand Kaizen better, and to see the sincerity of the management over its introduction.

Thus, Kaizen was implemented without changing human resource policies, and indeed served to reinforce the traditional control culture. As a line leader appropriately stated, changes in broader organisational relations are needed before Kaizen will be taken on board:

> People are beginning to lose sight of the true nature of Kaizen. It is as much a state of mind than just physically changing the way you work. Unless the 'us them' attitude between management and the work force is eliminated, Kaizen may as well be thrown out the window.

Womack *et al.* (1990, p. 99) similarly described the need for employees to believe that their efforts will be reciprocated before IM initiatives are accepted. That is, they need "a sense that management actually values skilled workers, will make sacrifices to maintain them, and is willing to delegate responsibility to the team". This feeling of 'reciprocal obligation' appears to be lacking in the present company.

7.4.4 Some additional effects of Kaizen

In this section, I examine some issues that are somewhat peripheral to the investigation of orientations, but are nevertheless informative about the IM initiative and its effects on people and productivity. First, the effects of IM on work flow as a possible explanation of the performance benefits of Kaizen are examined. This is followed by an examination of the effects of Kaizen on conventional outcome variables. The complete tables for these results are given in Appendix 4 (Table A and B, respectively).

Thus far it has been shown that Kaizen has not significantly affected people's job control, and neither has it resulted in the development of broader orientations. However, this does not mean it was not effective. As suggested earlier, the main reason the company introduced Kaizen was to save floor space, improve housekeeping, reduce work-in-progress and, ultimately, reduce costs. Management and operators from the Comparison Group believed that Kaizen had achieved such productivity gains (see section 7.1.2). It was thus expected that there will be improvements in the measures of work flow pressure developed specifically for this study.

More specifically, it was predicted that the Comparison Group (having already received Kaizen) would report less pressure from the work flow than the Intervention Group at Time 1. It was also expected that people in the Intervention Group would experience less work flow pressure with the introduction of Kaizen. The first prediction was supported. That is, at Time 1, the Comparison Group reported significantly less Excess WIP and less Pressure than the Intervention Group, F (1, 33) = 5.13, $p < .05$, and F (1, 33) = 25.45, $p < .001$, respectively. Over time, employees in the Comparison Group continued to improve on these measures, with a significant decrease in the amount of Material Chasing, F (1, 33) = 4.35, $p < .05$. However, in contrast to what was expected, there was a significant increase in Pressure, F (1, 33) = 5.46, $p < .05$ for the Intervention Group.

Similar findings were found for the conventional outcome measures. For the Comparison group, there were no significant changes in Psychological strain or Depression-enthusiasm, and there was almost a significant decrease in Anxiety, F (1, 33) = 3.73, p < .10. However, the Intervention Group reported significant increases in Psychological Strain, F (1, 33) = 4.25, p < .05, in Depression, F (1, 33) = 4.63, p < .05, and almost significant increases in Anxiety-contentment, F (1, 33) = 2.61, p < .15.

Thus, for the Comparison Group, it appears that Kaizen was effective in improving work flow pressures (although the cross-section comparison at Time 1 does not rule out competing explanations like selection), and there were continued improvements in pressure and well-being beyond the immediate implementation period. However, Kaizen seems to have negatively affected the Intervention Group. Pressures due to the work flow, and feelings of anxiety, depression, and strain, have all increased. This may be because the positive effects of Kaizen on work flow are delayed; that is, it takes some time for appropriate solutions to be suggested and for this to affect well-being. Similarly, the results might also reflect a short-term negative response to change by members of the Intervention Group. However, comments from questionnaires suggest that the negative effects for these employees was partly a result of the non-participative manner in which Kaizen was introduced. For example, one person from the Intervention Group stated:

> In the last few months, Kaizen has been introduced onto the cell. On assembly it has been put in with no thought for how it will work, only one assembly worker was on the Kaizen team. It did not seem to have a lot of planning and all the work benches were made too small. None of the assembly team on my shift were asked about how we felt it could be made better.

The feelings of increased stress and pressure probably also reflect the constant emphasis on improvement. Given this pressure, in combination with low job control and a lack of involvement in the change, it is not surprising that this group reported feelings that reflect intensification.

7.5 Chapter summary and discussion

The first study reported in this thesis found that employees within a traditional manufacturing company had narrow and passive orientations, and there was some evidence that this was, at least in part, related to their simplified work designs. Here, the investigation was extended to an instance where an IM strategy was introduced without commensurate changes to job control. Indeed, several employees for whom Kaizen was introduced felt that their jobs had become less flexible and self-managing, with line leader's exerting more control and failing to involve operators in the change. Consistent with Turnbull's (1988) description of similar changes elsewhere: "there is evidence of an increase in workers' *responsibilities*, but there are no clear signs of any extension to either the level or exercise of workers' *capabilities*" (p 7).

As expected in such a case, employees did not develop new and more appropriate role orientations. There was no change in their ownership of production problems or in the importance they attach to high-performing work requirements; indeed, the latter decreased and employees' perceived a narrow range of cognitive, collective, and operational knowledge and skills as relevant to their performance. These results provide strong support for the proposition that the development of new and more appropriate role orientations requires not only the introduction of an IM strategy, but changes to the amount of control people have within their jobs.

Different results were found for the measure of strategic orientations, however. Strategic Beliefs scores improved over the course of the study for all groups, suggesting that development on this variable is not dependent on enhanced control. Moreover, the finding that the Comparison Group (which had experienced Kaizen for several months prior to the study) had higher Strategic Belief scores than the Intervention Group at both times suggests that the change relates - in some way - to the introduction of Kaizen rather than simply reflecting a testing effect. It is likely that the general exposure to Kaizen and its principles (e.g. through the company's marketing of the initiative, through training, and through information from line leaders) served to enhance people's strategic awareness, and thus those employees' most exposed to Kaizen have the highest scores on Strategic Beliefs.

Some additional qualitative data were also presented to examine the potential influence of HR factors on orientations. The lack of training, a fear of redundancy, and the coercive nature of the reward system all appear to have contributed to employees' not taking Kaizen on board.

However, in spite of the lack of positive change for operators, Kaizen did result in productivity gains and some comment of this is warranted. Work-in-progress decreased, space was saved, and fewer workers were required. This suggests high-involvement work design, and the development of broader orientations, may not be necessary for IM initiatives to achieve productivity gains. It has been suggested elsewhere that enriching jobs may not be necessary for better performance in environments where the work is relatively simple with few unpredictable events, where there is little need for co-ordination and problem-solving, and where the environment is stable (e.g. Lawler, 1992). The implication, then, is that Company D is an environment with low production uncertainty such that having highly skilled and autonomous workers would not further enhance performance. To some degree, the company appears to fit in this category. Although the environment was characterised by customer demands for fast delivery times and high quality at low cost, there was not a huge diversity of products. The variability had essentially been dispersed by the formation of product-based cells. Within each cell, employees had only to cope with relatively minor variations in products, and thus the technical difficulty of the tasks was relatively low.

On the other hand, however, the tasks were highly interdependent across the whole cell yet each essentially functioned as three sub-cells (for example, assembly was separated from fabrication and pressing). It is likely that the uncertainty arising from this interdependence would be better managed with workers within the cell operating as a semi-autonomous work group. Moreover, the definition of performance enhancement in this study was narrow and focused almost entirely on saving space and improving housekeeping. Whether additional performance gains (such as better quality, greater flexibility, more innovations) would have occurred - particularly in the long term - with job redesign and a high-involvement approach is unknown. No firm conclusion can be made about whether changes to job structures would have affected individual employees' performance. However, from a quality of working life and job reform perspective, opting for an enriching approach should always be preferred. As Turnbull (1988, p. 14) asserted, if management wished, strategies such as this "could, if suitably modified, offer the opportunity to reskill work and enrich the jobs of working people".

In summary, what is clear is that the simultaneous findings that employees did not perceive increases in autonomy, nor report broader role views, supports the proposition that enhanced control is necessary for the development of new role orientations. I now turn to a case where an IM initiative was introduced with simultaneous changes in job control.

Chapter 8

Job design and orientations: A qualitative account and a cross-sectional investigation

8.0 Introduction

The previous study showed that the introduction of a continuous improvement strategy 'Kaizen' had no demonstrable effects on employees' role orientations. This finding was expected given the absence of change to job control, and it provided support for the proposition that enhanced autonomy is needed to facilitate the development of broader role orientations within IM. In this chapter I progress the examination of this proposition one step further and take advantage of a situation where the introduction of an IM initiative (i.e. the introduction of Product-base Manufacture) also encompassed job redesign. That is, in addition to being involved in an IM initiative, a group of employees' experienced enhanced control over their work. It is thus expected that these employees will have broad, proactive and strategic orientations.

This prediction is examined in two ways. First, an in-depth qualitative account of the orientations of employees who piloted the IM initiative is given. Qualitative data provide "well-grounded, rich descriptions and explanations of processes occurring in local contexts...that helps researchers to go beyond initial pre-conceptions and frameworks" (Miles and Huberman, 1984, p.15). This approach is complemented by a questionnaire-based cross-sectional investigation in which the orientations of employees who have had the IM initiative intervention and their jobs redesigned are compared with those of employees who remain in conventional jobs. Both of these investigations of orientations require an a priori manipulation check that the introduction of Product-based Manufacture has enhanced the control in shopfloor employees' jobs.

Details about the organisational background in which the study was conducted, and about the IM initiative and its effect on work design are now provided. In addition to setting the scene, this serves to demonstrate that the initiative had a substantial integrating effect on manufacturing, and that the company clearly attempted to support this change with high-autonomy work design. This is followed by a more detailed description of the research design and predictions.

8.1 Organisational background

The study was conducted within the manufacturing department of an American-owned electronics company in the East Midlands (Company F). The company designs, manufactures and installs equipment to measure and control operations in such process industries as chemicals, nuclear power, and oil.

Company F is divided into two broad areas - manufacturing and staging. Within manufacturing, the production department is responsible for making printed circuit boards (PCBs) and standard sub-assemblies. It is characterised by relatively small batches and a high variety of products: about 100,000 boards are made per year of 230 different types. Once combined in sub-assemblies, these products are supplied world-wide to staging facilities (one of which is on site) for integration into larger systems built to suit the particular requirements of the customer.

Company F employs 412 people. About half of these are based in manufacturing. The factory is a clean and modern working environment, with good facilities and conditions of service. For example, all employees use the same canteen, and employees are currently better paid than in equivalent local companies. The work force is stable, with an average length of service of about five years. Only about 1% of Production employees belong to a union, and management usually communicates directly with the work force rather than through union representatives.

8.1.1 Manufacturing performance and initiatives

Historically, the company had been very successful. For example, in 1986 a decision was made to transfer PCB assembly in the USA to Company F rather than having two sites making the same boards. Company F was chosen because it was a greenfield site, had lower labour costs, was less unionised, and had more advanced technology. However, by 1988, the company was struggling to meet customer demands for a quicker response to orders and better quality products. Delivery dates were not being met because of long build cycle-times and the quality of products was unsatisfactory. Several initiatives were thus implemented to improve performance.

The first initiative (December, 1988) was a re-structuring of management to ensure a more co-ordinated effort from different Manufacturing departments. A team of managers from each department was formed that reported directly to the Manufacturing Director. This group of managers then planned and set 5-year targets for the following: Loss Prevention, Supplier Partnering, Total Quality, Product-based Manufacturing, Just-in-time and People Involvement. As can be seen in Table 8.1, these initiatives appear to have been successful in improving performance. For example, the build cycle time (the length of time from kitting to shipping) of 14 weeks in 1989 was down to two days by 1992. Quality has also improved, losses are lower, and there are less suppliers. These improvements have been made with fewer employees and fewer organisational levels.

Table 8.1: A summary of changes in manufacturing performance on key indicators

	Key indicators	Pre-1989	1989	1991	1992
Just-in-time outcomes	Delivery integrity	n.m[1]	50%	95%	97%
	Cycle time	14 weeks	10 weeks	10 days	2 days
	Inventory	£9.8m+	£7.92m	£3.71m	£2.2m
Total quality	5 zero-defect boards yield	82%	94%	n/a	n/a
	Overall yield	n.m	n.m	90.7%	94%
Human resources	Headcount (perm.)	243	197	185	165
	Organisational levels	5	5	4	3-4
Loss Prevention	Loss audit	25+	30.4	11.7	< 11
Supplier partnering	Vendor base	n.m	456	159	136

[1] n.m indicates that the quantity was not measured in the company at this time

At the beginning of this study, the Total Quality initiative was already underway. The company had achieved recognition for attaining certain standards (e.g. BS 5750), and all employees had undergone a quality education programme based on Crosby's Principles and 10-steps. The introduction of Product-based Manufacture (or product-lines) was the next step. This aimed to decrease cycle time, reduce inventory, improve on-time production and shipments, and create a climate for continuous improvement. As this is the strategy of primary interest here, it is described in more detail.

8.1.2 Product-lines

Prior to the changes, the layout of the production area was organised functionally with large batches of boards moving through several stages (i.e. kitting the components ready for a board, manual and auto-insertion of components into boards, flow-soldering, initial quality inspection, testing, final quality audit, and storage or shipping). The work-organisation was traditional and most operators performed only one narrow task. The testing procedures were performed by test examiners and, for the more complex work, test engineers. There were separate supervisors for each phase of production and some areas also had charge-hands who were responsible for day-to-day decisions. A planning department produced weekly master production schedules.

The functional organisation of processes, along with a strategy of recruiting low-level assembly personnel, was related to several production problems. For example, the work-flow often became unbalanced (e.g. at times, over 800 boards would be waiting for testing), and there was much rework. Management felt most operators identified only with their own function, had little sense of ownership of the product or of the production process, and viewed their job as performing set tasks in accordance with standard procedures. For example, one of the key production supervisors believed "about 90% of the people come here only to do a 'job'. They aren't worried at all about the products or what happens to them". Many of these problems are similar to those identified in other manufacturing companies with a functional layout of the production process (e.g. Oliver and Davies, 1990; Oliver, 1991).

To deal with these problems, and as a precursor to Just-in-time, management decided to re-organise production into product-lines. These were to be run by semi-autonomous work teams organised around groups of similar products. Flexible employees were ultimately expected to be responsible for meeting goals in the following areas: on-time production, quality, lead-time, employee-development, housekeeping, training, and cost/inventory. Each of these areas included smaller targets, such as reducing the batch size, removing non-value added processes (e.g. inspection), and reducing the physical handling of products (a cause of quality problems). It was expected that responsibility for meeting these goals would require learning new skills (such as target setting, scheduling, performance monitoring, process and work flow analysis) and new attitudes. For example, the manual used for implementation described the need to foster "common aims and goals among product-line staff", and "ownership for the product and the team". The ultimate aim was to empower workers to be a 'thinking worker' capable of making their own decisions.

Implementation of product-lines proceeded in a staggered way. First, a pilot product-line was created (this is referred to here as the 'Pioneer Team'). This was set up to allow an evaluation of the strategy before implementing teams across the whole shopfloor. About nine months later, a second team (referred to here as the 'Second-phase Team') was established with the same supervisor.

Overall, the introduction of product-lines within this company was an ideal place to test the research proposition concerning orientations, job design and IM. First, it is clear that prior to product-lines, manufacturing was not integrated across the stages or functions of production. However, with the introduction of product-lines, the company aimed to integrate these separate aspects of production to achieve better performance on cost, quality, and lead time. As suggested in Table 8.1, over the period that product-lines were introduced (mid 1989-early 1992) performance on these goals improved substantially. Further, the pathway to gaining better performance was through an involvement-oriented approach where control was devolved to operators. The key driver of product-lines, the Production Manager, had a people-oriented approach to the introduction of IM, and genuinely believed in empowerment and employee development. In a Masters thesis based on this company, a production supervisor stated:

> The culture in the production area is one of high involvement of all employees in various activities apart from direct manual work. The workforce and the individual teams are consulted on every major change in process or work design. The concept of motivation through ownership is well understood and practised by the production management groups (Lodhia, 1993, p. 41)

8.2 Research design and predictions

The study took place at a point where there were three natural groups. The first group was the Pioneer Team. At the time of the study, this pilot product-line had been functioning as a semi-autonomous group for about 15 months. The qualitative account is based on interviews with members of this group. A second product-line (the Second-phase Team) was implemented about nine months after the pilot team, and had been functioning as a product-line for six months at the time of the study. The remainder of the shopfloor employees had traditional simplified jobs, and serve as a natural comparison group (or a 'non-equivalent control group' as defined by Campbell and Stanley, 1966). This group of employees is referred to as the 'Traditional-Job Group'.

The research design for the cross-sectional study is shown in Figure 8.1. This is equivalent to the 'static group comparison' design described by Campbell and Stanley (1966) where one group (in this case, two) has received the intervention (i.e. reorganisation into product-lines and job redesign) while a comparison group has not.

Prior to examining orientations either qualitatively or quantitatively, it will be necessary to check that the members of the groups that have received the intervention (i.e. the Pioneer Team and the Second-phase Team) have greater job control than those employees who are in conventional jobs. This manipulation check will make use of data from an earlier survey (Time 0) in which all employees were assessed on their levels of job control and job complexity.

				Time 0[1]												**Time 1**
Months	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Pioneer Team (In product-lines for 15 months)	X															O
Second-Phase Team (In product-lines for 6 months)							X									O
Traditional-Job Group																O

X = work reorganisation into product-lines

O = measurement

[1] Survey data from an earlier time (used for the manipulation check only)

Figure 8.1: Design of the cross-sectional study to investigate product-lines

On the basis that job control has increased (as will be tested in the manipulation check), it is predicted that the employees in the Pioneer Team will demonstrate broad, proactive and strategic orientations to their work in the interviews. For the cross-sectional analyses, is predicted that the Pioneer Team and the Second-phase Team will have broader orientations than the Traditional-Job Group, and that the Pioneer Team will have broader orientations than the Second-phase Team. The latter prediction is based on the premise that orientations take time to change; thus the longer the employees have functioned as a product-line with enhanced autonomy, the greater the change.

As a secondary examination, the group members will also be compared on conventional outcome variables (e.g. Job Satisfaction, Psychological Strain). Existing job design theory would predict that employees with more complex jobs will be more satisfied and more psychologically healthy. It is expected this will also be the case here. However, outcome measures such as Job Satisfaction were developed in response to the negative psychological and health-effects of simplified jobs, and they were not designed to assess developmental changes. In contrast, the rationale behind the orientation measures was that they would be sensitive to the sorts of developmental and learning-based changes required within IM contexts. It is thus expected that the latter measures will be more sensitive to the differences in the groups than the conventional outcome measures.

It is also expected that the orientation measures will be more sensitive than the self-report measure of a person's commitment to quality (i.e. Quality Commitment). This measure differs from the orientation measures in that it is individually-based. That is, the items focus on concern about the quality of the individual's work rather than concern with the quality of other people's work or the quality of the end-product. As a major emphasis within IM (and strategies such as product-lines) is the achievement of integrated group goals, it is expected that the orientation measures will be more sensitive to changes in employees than the measure of quality commitment.

8.3 Method

The methods for the qualitative investigation of orientations and for the questionnaire-based cross-sectional study are described in turn.

8.3.1 Qualitative investigation

The qualitative data derive from in-depth recorded interviews with the six Pioneer Team members conducted as close as possible to the time of questionnaire administration. The interviews were based around the question 'Is there any qualitative evidence that people whose jobs have been redesigned have developed new orientations?'. People were asked to describe their experiences of product-lines, aspects of their work (e.g. their responsibilities, their extent of control, problems they experienced), how they felt about these, and their beliefs about performance requirements. They were also asked some questions to try to determine their understanding of customers, general business issues, and IM principles.

These interviews are supplemented by data from earlier pilot interviews conducted with Pioneer Team members and their supervisor (i.e. just prior to the January 1991 survey). The aim of these interviews was to inform the development of the orientation measures to be used in the quantitative study; specifically, to generate the domain of items for the a priori categories, and to check that the categories were relevant for the context.

8.3.2 Cross-sectional comparison

8.3.2.1 Orientation measures

Three measures of role orientations (Production Knowledge, Wider-production Knowledge, and Production Ownership) and one measure of strategic orientations (Strategic Beliefs) were used for the cross-sectional comparison study. The development of these measures followed the general principles outlined in *Chapter 5*. Context-appropriate items were generated in collaboration with management using data from the pilot interviews, and from company documents that outlined the performance requirements management believed were necessary for operators in product-lines. The detailed coding procedure for the role orientation scales, and the final item content of all measures, is shown in Appendix 3.

The number of items and the alpha coefficients of internal reliability of the final orientation measures were as follows: *Production Ownership* (14 items, Cronbach's alpha = .96), *Production Knowledge* (28 items, Cronbach's alpha = .94), *Wider-production Knowledge* (9 items, Cronbach's alpha = .75), and *Strategic Beliefs* (11 items, Cronbach's alpha = .77).

Commensurate with the previous studies, the orientation measures had moderate to high correlation's with one another, suggesting they tap similar constructs; and they had low to moderate correlation's with conventional outcome measures, suggesting they tap different constructs (see Appendix 5 for these intercorrelations).

8.3.2.2 Response check measures

Response-check scales for the role orientation measures were included. These scales contained items that were in the same format and style, and were interspersed among, the Ownership and Knowledge items. However, the items were designed so they should be non-discriminatory (see section 5.2.1.3 for more detail), and thus are not expected to differentiate between the groups.

Ownership Response Check (RC) contains 3 response-check items assessing personal concern for problems that are likely to have an impact on the individual and their narrow job (for example, 'you cannot keep up with the work you are given'). Cronbach's alpha was .76. *Knowledge Response Check (RC)* contains three response-check items that assess the perceived importance of standard knowledge and skills for role performance (e.g. 'knowing how to report problems to the supervisor'). Standard knowledge and skills are expected to be important within all manufacturing contexts. Cronbach's alpha was .66.

8.3.2.3 Job and outcome measures

Conventional measures of job content and outcomes were assessed in this study. The job content measures were used in the manipulation check (i.e. to determine whether the product-line members' had greater job control than the other employees), and the outcome measures were used to test the secondary predictions. These measures were contained in a separate questionnaire to the orientation measures. This general questionnaire formed part of a larger study conducted by a group of researchers, including the author who was involved in the design, selection of measures, and administration of this questionnaire as well as feedback of results to participants and Management.

Most of these measures have already been used in studies described in previous chapters (see section 6.2.2.3/4 and 7.3.2.2), and thus only the number of items and Cronbach's alpha for this study are given here. These were as follows: *Timing Control* (4 items, Cronbach's alpha = .82), *Method Control* (6 items, Cronbach's alpha = .81), *Job Satisfaction* (14 items, Cronbach's alpha = .93), *Anxiety-contentment* (5 items, Cronbach's alpha = .62; note - one item was dropped to improve reliability), *Depression-enthusiasm* (6 items, Cronbach's alpha = .89), *Psychological Strain* (12 items, Cronbach's alpha = .81), and *Quality Commitment* (11 items, Cronbach's alpha = .91).

Two additional measures of job content were also used in this study.

Boundary Control This is an 8-item scale developed to assess the extent of control an individual has over boundary activities including: carrying out routine maintenance, checking quality, initiating corrective action, fetching materials from stores, helping to train others, selecting new colleagues, setting up equipment, and controlling the scheduling of work. Cronbach's alpha was .69.

Job Complexity This is a 10-item scale designed by Warr, Cook, and Wall (1979) to assess a person's perceptions about the degree to which features that might give rise to intrinsic satisfaction are present in the job (e.g. recognition for good work, opportunities to use abilities). There is a five point scale from 1 ('not at all') to 5 ('a great deal'). For a blue-collar sample (N= 390), Cronbach's alpha was .86, the mean corrected item-whole correlation was .56, and a test-retest correlation over a six month period was .69. The mean score for the sample was 32.74 (SD. = 8.39). Cronbach's alpha in the current study was .92.

Some background questions were asked, including: age, gender, job title and brief description of duties, length of time in current job, and length of time working for company. Several items were also asked to satisfy company requirements, such as communication, co-operation, opinions about management, and safety attitudes. Some individual difference items were also included.

A correlation matrix of the key measures is shown in Appendix 5.

8.3.2.4 Procedure

The orientations questionnaire and the general questionnaire were administered by the researchers in small groups (5-20 people) within company time. Questionnaires took about 1 hour to complete. The usual instructions about confidentiality were given (see 6.2.1.2). As an earlier survey had been conducted by this research team, most people were familiar with the procedure and clearly trusted the researchers.

8.3.2.5 Sample

The total sample consisted of 54 shopfloor employees. There were 6 people in the Pioneer Team (mostly males), 10 people in the Second-phase Team (mostly females), and 43 people in the Traditional-Job Group (slightly more females than males). The mean ages of these groups were 25.5 years (SD = 5.32), 36.2 years (SD = 12.0), and 34.0 years (SD = 10.4), respectively. Employees in these groups had spent an average length of time people in the company of 4.0 years (SD = 3.16), 2.1 years (SD = 1.54), and 3.8 years (3.58), respectively. Not surprisingly, members of the Pioneer Team and the Second-Phase Team reported being in their job for much shorter times (i.e. an average of 9 months [SD = .41], and 3 months [SD = .50], respectively) than those employees in the Traditional-Job Group. The latter reported that they had been in their jobs for an average of 2.3 years (SD = 2.98).

The actual numbers of people in the sample and in the groups (and therefore the degrees of freedom) varies slightly in different analyses as a function of missing data.

8.4 Effect of product-lines on job control (a manipulation check)

Before qualitatively examining the orientations of the Pioneer Team members, or comparing them across groups using quantitative data, it is necessary to establish that the introduction of product-lines enhanced control within shopfloor people's jobs. This section presents two types of evidence relevant to this manipulation check. The first involves examining changes in job content from an earlier survey (Time 0 to Time 1); and the second involves looking at group differences at the time of this study (Time 1).

8.4.1 Changes from Time 0 to Time 1

Scores on job complexity and job content variables were available from a survey conducted one year earlier (Time 0). At this time the Pioneer Team had been officially been operating as a semi-autonomous work group for about 3 months, and all remaining employees (including those in the Second-Phase Team and the Traditional-Job Group) were in conventional jobs. Although the Pioneer Team members had been in product-lines for three months, there were no differences among the groups on Job Complexity, F (2, 38) < 1; Timing Control, F (2, 40) < 1; Boundary Control, F (2, 40) = 1. 50, p = .24; or Method Control, F (2, 38) = 1.36, p = .27). This suggests that all employees saw their jobs in similar ways at Time 0, and any effects of product-lines had not yet been felt by the Pioneer team.

The first part of the manipulation check thus consists of examining changes in perceived job content from Time 0 to Time 1. If the introduction of product-lines affected the work-design of employees as expected, there should be increases in Job Complexity and the measures of control for the Pioneer Team and the Second-phase Team (whose jobs were reorganised into product-lines), but not for the Traditional-Job Group (who remained in conventional jobs). A separate repeated-measures multivariate analysis of variance was thus conducted for each variable using SPSSx MANOVA (see Appendix 2 for guidelines to the use of this statistical technique in this thesis). Simple main effect analyses were then performed. As shown in Table 8.2, the Pioneer Team had significant increases in reported Job Complexity, F (1, 40) = 4.24, p < .05; Timing Control, F (1, 40) = 4.21, p < .05; and Boundary Control, F (1, 40) = 5.76, p < .05. For the Second-phase Team, there was a significant increase in reported Job Complexity, F (1, 40) = 10.76, p < .01 and increases (although not significant) in Timing Control, Boundary Control, and Method Control. In contrast, for the Traditional employees, there were statistically significant decreases over time for Job Complexity, F (1, 40) = 5.20, p < .05, and almost significant decreases for Method Control, F (1, 40) = 3.26, p < .10.

Table 8.2: Means and standard deviations for job content measures for three comparison groups, and changes over time from Time 0 to Time 1.

	Changes over time								
	Pioneer Team N = 6			Second-phase Team N = 5			Traditional-Job Grp N = 30		
Job content	Time 0 $\overline{X}$ (SD)	Time 1 $\overline{X}$ (SD)	F^1	Time 0 $\overline{X}$ (SD)	Time 1 $\overline{X}$ (SD)	F^1	Time 0 $\overline{X}$ (SD)	Time 1 $\overline{X}$ (SD)	F^1
Job Complex.	3.04 (.99)	3.67 (.99)	4.24* (+)	2.84 (.34)	3.93 (.65)	10.76** (+)	3.21 (.55)	2.90 (.71)	5.20* (-)
Timing Control	3.29 (1.05)	4.29 (.91)	4.21* (+)	2.70 (.72)	2.75 (.75)	.01 (+)	3.21 (.84)	3.19 (1.16)	.01 (-)
Boundary Control	3.22 (.69)	3.83 (.42)	5.76* (+)	2.69 (.28)	3.07 (.22)	1.85 (+)	3.01 (.50)	3.11 (.84)	.72 (+)
Method Control	4.13 (.55)	4.37 (.38)	.52 (+)	3.58 (.79)	3.83 (.53)	.61 (+)	3.62 (.65)	3.39 (.88)	3.26$^+$ (-)

** $p < .01$, * $p < .05$, $^+$ $p < .10$

[1] Degrees of freedom for all F tests were 1, 40. The symbols ('+') and ('-') indicate an increase and decrease in scores, respectively.

These results are consistent with expectations. The Pioneer Team and the Second-phase Team, whose jobs were re-designed to support Product-lines, reported more complex jobs and greater autonomy over time. The finding that there were no increases in these variables for the Traditional-Job Group suggests it was the job redesign that caused the changes in scores, rather than any other event occurring over the same period. Not surprisingly given the longer time the team had been established, the changes were more consistent and substantial for the Pioneer Team than for the Second-phase Team. The fact that at Time 0, when the Pioneer Team had been in operation for some three months, team members did not report significantly different control or complexity than the other employees also suggests that job redesign takes some time to take effect.

8.4.2 Group comparison at Time 1

The second part of the manipulation check consists of a direct comparison between the groups at Time 1 using the same samples as used for the cross-sectional comparison of orientations. It is expected that the Pioneer and Second-phase Team will have more complex jobs with greater control than the Traditional-Job Group, and that the Pioneer Team will have higher scores on these variables than the Second-phase Team.

Initially, a between-subjects multivariate analysis of variance was carried out using SPSSx MANOVA to determine whether there was any differences between the groups for the combined set of job content variables. With group as the independent variable, and the job content variables as the dependent variables, the relationship was significant, F (8, 100) = 2.78, p < .01. The association between the job content variables and group variable was high (eta-squared = .82). As shown in Table 8.3, univariate analysis of variances showed that there were significant group differences for each separate job content variable.

Table 8.3: Means and standard deviations for job content variables, and results of univariate comparisons

	Job design groups			**Statistical results**		
				Overall	Planned comparisons	
	1. Pioneer Team N = 6	**2. 2nd-phase Team N = 9**	**3. Trad'nal Job Group N = 40**	ANOVA	1&2 v 3	1 v 2
Job content	$\overline{X}$ (SD)	$\overline{X}$ (SD)	$\overline{X}$ (SD)	F^1	F^1	F^1
Job Complex.	3.67 (.99)	3.58 (.75)	2.87 (.65)	6.10**	12.06**	.05
Boundary Control	3.83 (.42)	3.01 (.64)	2.93 (.77)	4.11*	5.04*	4.58*
Method Control	4.31 (.37)	3.89 (.54)	3.43 (.89)	3.68*	7.08**	.95
Timing Control	4.29 (.91)	3.03 (.99)	3.04 (1.04)	4.04*	3.93	5.51*

** p < .01; * p < .05, $^{+}$ p < .15

[1] Degrees of freedom for all overall effect analyses are 2, 51 or 2, 52 and for all planned comparisons are 1,51 or 1, 52

Given that there was an overall relationship, it is appropriate to perform planned orthogonal contrasts to examine more particular patterns of group differences. The contrasts are orthogonal as they are not related to each other and do not overlap; and are planned since they were intended before the data were examined (Tabachnik and Fidell, 1989). The scores of the combined product-lines (i.e. the Pioneer Team and the Second-phase Team) and the Traditional-Job Group were compared. The multivariate planned contrast was significant for the combination of job content variables, F (4, 49) = 3.74, p = <.01; and univariate contrasts were significant for Job Complexity, F (1, 52) =

12.06, $p < .001$; Method Control, $F(1, 52) = 7.08$, $p < .01$; Boundary Control, $F(1, 52) = 5.04$, $p < .05$) and nearly for Timing Control, $F(1, 52) = 3.93$, $p < .10$. In each case, as expected, the combined product-lines reported more complexity and control than the Traditional-Job Group.

The second pattern of group differences investigated was a comparison of the two product-lines. The multivariate planned contrast between the Pioneer Team and the Second-Phase Team was not significant for the combined set of dependent variables. However, in terms of univariate contrasts, there were significant differences in the groups' scores for Boundary Control, $F(1, 52) = 4.58$, $p < .05$ and Timing Control, $F(1, 52) = 5.51$, $p < .05$. In each case, the Pioneer Team reported greater control.

Thus, in summary, the Pioneer Team and the Second-phase Team reported greater control and complexity than the Traditional-Job Group. The Pioneer Team had higher scores for Boundary Control and Timing Control than the Second-phase Team. These results are largely consistent with the above analyses of change over time (i.e. from Time 0 to Time 1), as well as with researcher observations and comments from team members. For example, one Pioneer Team member stated: "I think basically all C (the supervisor) is there for in the group now is to sort personal issues out. The actual running of the group is done by the group. Simple as that."

Given the success of the job redesign in increasing the control in their jobs, the prediction holds that members of the Pioneer Team and the Second-phase Team will have developed new and more appropriate orientations. The next section examines qualitative evidence that such changes has occurred for the Pioneer Team members.

8.5 Interview findings: A qualitative account

A brief description of the formation and early experiences of the Pioneer Team is given, followed by an exploration of changes in orientation for these employees.

8.5.1 Early experiences

The Pioneer team was formed in August, 1989 after management advertised within the company. It included an experienced member of the Staging facility, and four relatively low-skilled members drawn from the assembly, kitting and stores areas. The team began functioning as a semi-autonomous work group in October of the same year. It was responsible for the assembly and staging of a particular product, and thus integrated tasks previously undertaken separately in Manufacturing and in Staging. Initially, the team was managed by the production manager and supported by two manufacturing engineers, an assembly supervisor, and the test supervisor. Members of the support group maintained their original positions, giving assistance when requested. One of the engineers took over the role of team supervisor about one month after the product-line was formed.

Although the team was ultimately considered a success (e.g. delivery integrity for the products improved from delivering the right products on time about 33% of the time to about 80% of the time), there were early problems. For example, because it was an internal customer, Production gave the team low priority and were often late in delivering boards the team needed. There were also active conflicts between the Staging department and the Pioneer Team, and other manufacturing groups (such as manufacturing engineers) were generally unresponsive to the team. However, as shown in the comment by one of the Pioneer members, this situation improved with time:

> Well we really had people knocking us when we were first formed, like we've got the staging department, they're like the 'kings of cabinet building'... We used to take no end of knocking from them, and from a few other supervisors from other departments. But we managed to shut them up by showing them that, yes, we can produce the work and the quality as well. We've gained a lot of respect with people now.

In the early days of implementation, the team itself had problems. For example, members became demoralised as a result of failing to meet the targets (which, in retrospect, management agreed were unrealistic). They felt their expectations about product lines had been raised too high, and became frustrated with their inability to learn technical skills in sufficient time. There were also many interpersonal conflicts within the team that needed the supervisor's intervention. Altogether, it seemed that working successfully as an autonomous group involves a learning process that takes time. As will be suggested next, part of this learning includes the development of a new work orientations.

8.5.2 Changes in orientation

Comments that suggest changes in orientations are described below. To ease comparison with the quantitative data, these are organised into categories of ownership, perceptions of performance requirements, and strategic awareness.

8.5.2.1 Ownership

Throughout the interview, without prompting, the supervisor of the team repeatedly referred to the development of employee ownership. He described this as:

> Well, they feel they are in charge of the process as a group.. they have the full, how do you say it, control of the day-to-day running of the department. They can put their schedules together, them deciding what. Its not easy. Initially they felt: 'Its not my job. You're paid 20 grand to do that, you do it' sort of thing.

The supervisor believed that, prior to their involvement in the pilot team, the employees had lacked this sort of ownership. For example, talking about one person and her previous job, the supervisor said:

> She used to sit at a bench and her supervisor would give her a job to do and she would go and do a job and that was it. She didn't know where it went, and she wasn't worried. She didn't think how to improve the process, how to bring the lead time down. She wasn't worried about what is happening tomorrow.

In the early stages of product-lines, team members persisted with this sort of orientation. The supervisor said: "They didn't have a common purpose. They were in it for 'myself: I'm going to get on'. Not a single (group) objective. Just 'how can I get on quickly and impress people?'"

Over a six month period, and as a result of constant reinforcement and autonomy, the supervisor believed people developed broader ownership. This was consistent with comments made by team members that suggested they 'owned' problems and issues beyond a narrowly defined job. In particular, team members were highly focused around group goals, such as satisfying customers. For example, one team member stated: “My actual goal is customer satisfaction. I'll do anything to make sure the job goes out on the day its meant to. I'm totally focused on customer quality and delivering goods”. In response to questions about problems the team experienced, several comments were made that reflected people's concern for production issues outside of their primary set of tasks. For example, referring to problems of shipping the product, one member stated: "I think there must be a better way of doing it, yeah. I wish I could get my hands on it, but I've not got round to shipping yet". Similarly, other members speculated about causes for other problems, for example:

> There must be a reason for there being shortages... Everyone is saying 'production control are not loading the jobs', and they (production control) are saying 'purchasing have not ordered the stock' and purchasing will say something else. But I think you could sort the problem out if you knew what was going on.

Other quotes suggest ownership of group-related problems, such as the team lacking sufficient skills to meet goals:

> With our work schedules being tight, you can't move people around so much. What we've done recently is set up a training matrix, we've put down who's experienced in what field and then gradually in the next 18 months, maybe every 3 months, every six months, we're gonna swap people around, which I think is a good idea.

Thus, it seems the team members have ownership for the overall production goals, but also feel responsibility for maintaining and improving the efficiency by which these goals are met and for ensuring a co-ordinated group effort.

8.5.2.2 Perceptions of performance requirements

It was also expected that changes in orientations would be reflected in people's perceptions of how their role should be performed effectively; that is, what skills and knowledge people believe are required. From the interviews, it seemed that both the supervisor and Pioneer Team members had clear views on this. Perhaps the most fundamental (and implicit in the development of ownership) is learning self-direction; that is, learning to make decisions for yourself and use your initiative. For example, in response to a question about the sorts of skills needed to do the job, one team member commented:

> You've got to be able to sort out your own people problems without keeping running to the boss and everything. Sort out, OK you've got your schedule, but you've got *to sort out how its going to work. How you're going to do it.* How you're going to meet it. Sort out who is going where, where the best place for you to be is without somebody telling you, 'you go there'. You've got to be able to say well, suggest things, don't just be told 'well I needed this doing', go and do it!

This is the same member of the team that the supervisor described as originally having a very narrow view (see the second quotation in section 8.5.2.1). Thus, it seems this employee had originally seen her role in terms of a narrow set of passive responsibilities, being concerned only with the immediate task rather than broader, more long-term production goals. However, over time, she had come to see her role being self-directed and prepared to solve problems across a wide domain.

Similarly, another team-member was aware of this change within himself through comparing how he was in his previous job compared to his job within a product-line:

> I'm still responsible, but off me own back. I've not been 'put there'. I was 'put there' when I was in mechanical (previous job). But now I use my initiative. You get down to things and make sure things are running smooth.

The process of learning that effective performance requires self-direction is not easy, as illustrated by the supervisor's comment:

> Initially they were bewildered and didn't know what was expected from them. I kept pushing it into them that I am not a boss, but a resource.... they found it very difficult to make decisions or come to terms that they are there to make decisions. They still saw it as 'bosses' and workers. They wouldn't question things, they wouldn't query.

The quote above also suggests that an important skill people learn is to question things and make suggestions. This 'speaking out' seems to be a particularly important skill for group working:

> We're very good now to what we used to be. We still have personal clashes, which you're going to get, ain't you, but the good thing about our group really is that now most of them don't hold back what they say. Before in the group not many of them would say it.
>
> You won't learn anything if you don't (speak out). It will just be a traditional job where you get told what to do and you do it. If you let that happen, it will.

Thus, an important aspect of the new role orientation seems to be developing an understanding of the importance of non-technical skills, such as the interpersonal skills needed to work in groups. This was particularly the case for the most skilled person who came into the team. Although this person may have had most of the technical skills when the team was set up, there was room for development in other areas. The supervisor reported saying to this person: "there's more than technical (skills). There's interpersonal skills, running meetings, arguing logically so people can follow your reasoning, taking group decisions and so on". This member commented:

> I never had any interpersonal skills when I came into the Pioneer Team. I did, but not in the way I've got now. Now, I speak my mind, I'm good in meetings, and I'm good at meeting people like customers... I've been speaking at a conference with 68 people from this company. I was nervous, but I did it. Five years ago, I could never have.

After describing communication as an important skill, another team member stated:

> Being able to listen to people - that's another thing I learned the hard way. I never used to want to listen to people. You've just got to give them a bit of time, you know. If they say something, you know, it might be completely out of order, but you can interpret what they are saying, and you say 'Is this what you are trying to say?' and they say 'Oh yeah' or something like that.

Awareness of the importance of these sorts of skills relates to the issue of ownership of group-cohesion. If team members believed that having a co-operating, cohesive group was entirely the supervisor's 'problem', they would probably not see collective and interpersonal skills as particularly important for themselves.

Both the supervisor and the team-members felt an important requirement for good performance was knowing about production and about wider manufacturing issues. When asked about the difference between Pioneer Team-members and some new product-line people, the supervisor described a differentiating characteristic as "their awareness, their general awareness of processes, the product, the customers, of the business if you like". For example, the supervisor described a recent problem in the new product-line. The charge-hand was absent and nobody knew how to access the computer system to determine the work schedule. "I was tearing my hair out. I said 'how do you start a job? How do you know which is a priority?' They said: 'It's the one on top of the pile'. That's the difference! Pioneer Team members would know what needs doing, every one of them!". This was consistent with a comment by a Pioneer Team member:

> We are working to a customer order and know exactly where the jobs are going, and when they've got to go for. Whereas on the shopfloor, they don't know. I think product-lines make people more aware that the job has got to get done.

It was clear that team members had learnt more about things beyond the immediate production area, such as customers and other departments. For example, in comparing Pioneer Team members' actual understanding of customers to new Product-line people, they were much more aware. When asked questions about customers, Pioneer Team members know who they were and understood their different requirements. In contrast, comments from members of newly-formed lines suggested they knew little about their customers, such as "All I know is that there is a customer order, and that's how I know some of them go to the USA" and "I guess they go into systems here and to the States .. I don't really know where all our boards go". It was clear in these interviews with new product-line people that, not only did these employees have little knowledge about their customers, but that they perceived the question was irrelevant to them. They seemed to feel that there was little need to know about customers.

8.5.2.3 Strategic awareness

Because of time restrictions, and the general difficulty of assessing people's knowledge, efforts to look at people's understanding of strategies were limited to questions about product-lines and Just-in-time. With product-lines, team members seemed to have a good understanding of the rationale behind the strategy in terms of both organisational effectiveness and employee development. For example, in addition to describing the value of product-lines in enhancing people's skills and knowledge and in improving quality, one person stated:

> Before the Pioneer Team was set up, you got the stores, you got mechanical assembly, and you got small parts, you got staging, (etc.) I ain't got no figures for sure, but for all these separate activities that was done in different departments, you're waiting on each other all the time because everyone is busy as well. Now, on the board side, its all done in one function, then there's a test, then its straight out the door, which has got to be quicker than having all these different functions and different cost centres

Although Just-in-time had not been introduced at this time, people seemed to have an overall awareness of this strategy and how it might affect the way things were done. Knowledge and understanding of JIT were, not surprisingly, less well developed than their understanding of the product-line initiative.

8.5.2.4 Additional points

The interviews also highlighted three additional points that have important implications. First, autonomy was central in changing the way people see their role. In particular, the importance of the supervisor in devolving control *equally* to all people, and supporting it with appropriate training, seemed to be critical. Many descriptions of the way the supervisor had handled problems and issues suggested this. For example, when asked what makes a good supervisor, one of the team-members stated:

> Some of the traditional bosses, they are still bringing out certain people in the team and making them the team leader. And that's what they want to get away from... Like with one line, the supervisor always put one name on the board and they are seen as the boss so everyone else will go and say (to them) 'what shall I do next?'. But why can't they think for themselves? If a girl can say 'what shall I do next?', why can't she say instead 'shall I do this?'

Second, the change process seems to be a developmental and learning-based one that is dependent on increased knowledge and awareness. This is illustrated in this statement by the supervisor describing how he dealt with a new person in the team:

> He (the new person) finds it very different because you don't get work given to you on Monday morning to finish by Friday and then sit down and do it. I say to him, 'that's not what I want. I want you to know why you are doing it; where its going; if its wrong, how can we put it right? is there any way of doing it better? All kinds of things'. He just can't grasp it yet.

This sort of change seems similar to a gamma change where people develop an alternative frame of reference with new beliefs about what is relevant and important (Golembiewski, *et al.* 1976). Here, the problems that people perceive as relevant to their role (i.e. what they see as 'their problem'), and what skills and knowledge they see as important for effective performance of their role has changed. A team member's comment illustrates this process: "When I weren't into this team-work thing, I thought 'Why should I do this? Why are they doing this? Its a waste of time'. Then you start understanding the philosophy itself, and you suddenly appreciate it".

A third point raised in the interviews is that there are clearly individual differences in the speed and extent to which people change. It was felt by the supervisor and three of the members that some of the other members lagged behind in terms of performance, although there was a feeling that they could still improve. One member of the team reported frustration with the failure to change of two of the other employees:

> They've got this like childish attitude and you tell them something, like 'I can't do this now, you'll have to wait ten minutes because I'm busy' and they go mardy ... I think they're capable, but that it will take a long time because some people are like that, you know, you tell them off and they don't like it. I mean, I used to be like that for about the first 6 months of the group being formed, and then I sat down and thought. And then you know about a week, two weeks later, I changed my attitude completely.

8.5.3 Summary of the qualitative account

In summary, comments from interviews suggest that members of the Pioneer Team have redefined the way they see their role and work environment. They understand that effective performance requires them to do more than what they are 'told' to do, and they have ownership of longer term production goals and the mechanisms by which these goals are achieved. The changes were summed up by one team member as developing from a child to an adult:

> I've matured quite a lot, definitely have, because before, all right you know you work in this environment with a supervisor telling you what to so and you've got this thing inside you that 'OK, you know they are like parents, I'm a kid' and you tend to work like that. Even when I were in stores (prior to the introduction of product-lines), they used to ask me nicely, and it were good, but with the supervisor you still feel like a child. With this teamwork, since I joined the Pioneer Team, you sort of feel more mature. People treat you like an adult which is a really good thing. And if they are going on to product-lines (in the whole factory), and it they treat more and more people like adults, I think you know a lot of people will grow up.

This quote clearly supports Argyris's (1957, 1964) view described earlier (see section 4.1.4). Indeed, in general, the qualitative account suggests that team members are towards the 'adult' end of Argyris's dimensions of development (for example, they have become more proactive in using their initiative, less dependent on the supervisor, and more oriented towards long-term production goals rather than just individual short-term goals).

This qualitative account suggests that examining changes in people's orientations is a valuable approach in evaluating the effects of job redesign. The information obtained appears to go beyond that which would come from the traditional approach. The latter focuses primarily on outcome variables such as job satisfaction, and performance improvements are typically explained in terms of structural changes (e.g. quicker responses to problems) and individuals' being more motivated to put in effort. Consistent with the theoretical argument made earlier, the comments by employees in redesigned IM jobs presented here suggest that they learn and develop new orientations, and this then affects the appropriateness of their performance.

Although the qualitative data have provided a richer understanding of orientations, this approach can be susceptible to bias (e.g. from leading questions, selective use of quotes) and there are no widely agreed-on standards for assessing the validity and generalisability of the findings. In the words of Miles (1979): “How can we be sure that an ‘earthy’. ‘undeniable’, ‘serendipitous’ finding is not, in fact, wrong?”. Thus, to supplement the descriptive account and to test the specific hypotheses outlined earlier, quantitative analyses were performed. These are the focus of the next section.

8.6 A cross-sectional comparison

This cross-sectional study compares scores on orientation measures and the conventional outcome variables for the Pioneer-team (which had been operating as a product line for 15 months), the Second-phase Team (which had been in existence for 6 months) and employees in the Traditional-Job Group (who were in conventional jobs). The manipulation check showed that working in product-lines enhanced people’s job control and complexity.

8.6.1 Comparison of orientations across groups

It was predicted that members of the Pioneer Team and the Second-phase Team, having jobs with greater control and complexity, would report broader role orientations than those employees in Traditional-Job Group. It was further expected that people in the Pioneer Team, having been in existence longer (and having reported greater changes in job control), would report broader orientations than those in the Second-phase Team. These specific patterns of group differences can be tested using planned orthogonal contrasts at both the multivariate level (i.e. taking all the orientation variables together as a set) and the univariate level (i.e. considering each orientation variable separately).

However, prior to examining the specific patterns of group differences, it is necessary to establish whether there are any differences in orientations among the groups. To examine this, a between-subjects multivariate analysis of variance was conducted using SPSSx MANOVA with group as the independent variable and the set of orientation measures as the dependent variable. From this analysis, it was shown that group had a significant effect on the orientations variables taken together, $F(8, 98) = 2.14$, $p < .05$, with 85% of the variance in orientation scores being accounted for by this variable (eta squared = .85). Looking at the univariate relationships (i.e. a separate analysis of variance performed for each dependent variable), there were significant differences across groups for Production Ownership, F (1, 51) = 5.75, $p < .01$ and Production Knowledge, F (1, 51) = 4.19, $p < .05$) but not for Wider-production Knowledge, F (1, 51) = 2.02 or Strategic Beliefs, F (1, 51) < 1. Table 8.4 shows these univariate results.

Given that there are differences between the groups on the orientation variables, it is appropriate to perform planned orthogonal contrasts to determine exactly how the groups compare. First, it was predicted that the combined Pioneer Team (1) and the Second-phase Team (2) would report significantly broader role orientations than the Traditional-Job Group (3). The multivariate contrast (1 & 2 vs. 3) shows this was the case. That is, the combined product-line teams had significantly higher scores than the Traditional-Job Group on the set of dependent variables, F (3, 49) = 3.75, $p < .01$. Looking at the univariate results for the separate dependent variables (shown in Table 8.4), this contrast was significant for Production Ownership, F (1, 51) = 10.32, $p < .01$, for Production Knowledge, F (1, 51) = 8.01, $p < .01$, and was almost significant for Wider-Production Knowledge, F (1, 51) = 2.29, $p < .15$. There was no significant effect for Strategic Beliefs.

Table 8.4: Means and standard deviations of the orientation measures for each group, and results of univariate comparisons

	Job design groups			**Statistical results**		
				Overall	Planned comp'ns	
	1. Pioneer Team N = 6	**2. 2nd-phase Team N = 8**	**3. Traditional Job Group N = 40**	ANOVA	1&2 v 3	1 v 2
Orient'n variables	$\overline{X}$ (SD)	$\overline{X}$ (SD)	$\overline{X}$ (SD)	F^1	F^1	F^1
Production Ownership	4.12 (.92)	3.43 (1.10)	2.90 (.81)	5.75**	10.32**	< 1
Production Knowledge	3.26 (.47)	2.92 (.46)	2.49 (.73)	4.19*	8.01**	< 1
Wider prod. Knowledge	2.70 (.89)	2.06 (.67)	2.00 (.81)	2.02^{+}	2.29^{+}	< 1
Strategic Beliefs	2.63 (.31)	2.06 (.647)	2.00 (.81)	< 1	< 1	< 1

** $p < .01$; * $p < .05$, $^{+}$ $p < .15$

^{1} Degrees of freedom for all overall effect analyses are 2, 51 and for all planned comparisons are 1,51

The second prediction was that the Pioneer Team (1) would report broader orientations than the Second-phase Team (2). Neither the multivariate contrast (1 vs. 2) between these groups was significant, F (4, 48) < 1, nor any of the univariate contrasts for separate orientation variables (see Table 8.4). At face value, this suggests that the hypothesis was not supported. However, it should be noted that although the statistical tests were not significant, the Pioneer Team scored consistently higher than the Second-phase Team on all orientation measures except Strategic Beliefs. Moreover, because of the small samples sizes in these teams, the power of these comparisons is much lower than the power of the contrasts reported above. It may be that with larger sample sizes (and thus greater power for statistical tests) the differences between groups would have reached statistical significance.

In summary, as predicted, members of product-lines reported broader and more proactive role orientations than employees in conventional jobs. There was also some support for the hypothesis that members of the longer running product-line (i.e. the Pioneer Team) had broader role orientations than employees in the Second-phase Team, although these results were not significantly significant. Interestingly, commensurate with the previous study in *Chapter 7*, the measure of strategic orientations (Strategic Beliefs) functioned differently to the role orientation measures. That is, despite significant differences in the amount of control across the groups, there were no significant differences in employees' scores on Strategic Beliefs. Like the study investigating Kaizen, this suggests that changes in Strategic Beliefs are not dependent on enhanced control.

8.6.2 Comparison of conventional outcome measures across groups

It was hypothesised earlier that the orientation measures would be more sensitive to the differences in the groups than would the conventional outcome measures. To test this, the analyses reported above are repeated using the conventional outcome variables as the dependent variables.

To test for general differences across groups on these variables, a multivariate analysis of variance was performed using SPSSx MANOVA with the conventional outcome variables as the dependent variables (i.e. Job Satisfaction, Quality Commitment, Psychological Strain, Depression-enthusiasm, and Anxiety-contentment) and with group as the independent variable. The multivariate relationship between the combined dependent variables and group was not significant; nor were any of the univariate analysis of variances (i.e. Anovas) conducted for the separate outcome variables. This suggests that there are no differences between groups in terms of these measures.

Although the lack of any group difference means that it is strictly not necessary to perform planned orthogonal contrasts, these were conducted for the sake of completeness. The multivariate planned contrast of the difference between the combined product-lines and the Traditional-Job Group on all orientations was not significant, F (5, 43) < 1, nor was the multivariate planned contrast of the difference between the Pioneer Team and the Second-phase Team, F (5, 43) = 1.53. None of the univariate planned contrasts were significant. A summary of the univariate results is shown in Table 8.5.

Table 8.5: Means and standard deviations of conventional outcome measures for each group, and results of univariate analyses

	Job design groups			Statistical results		
				Overall	Planned comparisons	
Outcome variables	**1.Pioneer Team** N = 5 $\overline{X}$ (SD)	**2.2nd-Phase Team** N = 8 $\overline{X}$ (SD)	**3.Trad'nal Job Group** N = 38 $\overline{X}$ (SD)	ANOVA F[1]	1&2 v 3 F[1]	1 v 2 F[1]
Job Satisfaction	5.27 (1.22)	4.99 (.66)	4.75 (.91)	< 1	1.68	< 1
Quality Commitment	4.35 (.35)	4.08 (.58)	4.11 (.49)	< 1	< 1	< 1
Psychological Strain (GHQ)	.90 (.17)	.66 (.40)	.81 (.45)	< 1	< 1	1.01
Depression-enthusiasm	2.53 (.70)	2.15 (1.25)	2.56 (.91)	< 1	< 1	< 1
Anxiety-contentment	2.48 (.39)	2.67 (.71)	2.48 (.76)	< 1	< 1	< 1

[1] Degrees of freedom for all overall effect analyses are 2, 47 and for all planned comparisons are 1, 47

To describe the data from a different statistical perspective, a direct discriminant function analysis was conducted using the conventional outcome variables and the orientation variables as predictors of membership in the three groups. There was one significant function that maximally discriminated Pioneer and Second-Phase from the Traditional-Job Group, and the best predictors for this were Production Ownership (.74) and Production Knowledge (.56). Using a classification procedure (adjusted for unequal sample sizes), for the 48 cases, 81.25% were correctly classified into the correct group.

These results support the hypothesis that orientation measures are more sensitive to group differences than the conventional outcome measures in IM contexts. Indeed, if orientation measures not been included in this study, one might have concluded that the employees in complex IM jobs did not differ much from employees in conventional jobs. Yet it is clear that differences exist, and thus that assessing orientations within modern manufacturing contexts will be informative about different outcomes of job redesign.

8.6.3 Consideration of alternative explanations

One competing explanation for the finding that groups had different orientations is that the differences may reflect a response bias rather than any real change. For example, product-line team members may consistently respond in a more positive way because they want to please management or the researchers. However, the finding that the groups do not differ on conventional outcome measures or on the Quality Commitment scale suggests that, if there is a response-bias, it is not pervasive across all measures. This still leaves the possibility that there may be a selective response-bias used on the role orientation measures. Product-line employees may score highly simply because they have more awareness of what the measures are assessing, and may feel they should respond positively to them.

This alternative explanation can be tested using the response-check variables described in the measures section. These contained items that were deliberately designed not to discriminate between product-line employees and those in traditional jobs. Using SPSSx MANOVA, a between-subjects multivariate analysis of variance was performed. There was no significant multivariate relationship between the response-check variables and group, F (4, 104) < 1, nor any significant univariate relationships (see Table 8.6). Similarly, the multivariate planned contrast between the product-line employees and the Traditional-Job Group was not significant F (2, 51) < 1, nor was the multivariate planned contrast between the Pioneer Team and the Second-phase Team, F (2, 51) = 1.06, p = .36). None of the univariate planned contrasts were significant (see Table 8.6).

These findings, in combination with earlier results showing significant group differences for the orientation scales, suggest that the respondents were discriminating between different types of items and not simply answering with a response-set.

Table 8.6: Means and standard deviations of response-check scales for each group, and results of univariate comparisons

	Job design groups			Statistical results		
				Overall	Planned comp'ns	
Response-checks	**1. Pioneer Team** **N = 6** $\overline{X}$ (SD)	**2. 2nd-Phase Team** **N = 8** $\overline{X}$ (SD)	**3. Trad'nal Job Group** **N = 41** $\overline{X}$ (SD)	ANOVA F^1	1&2 v 3 F^1	1 v 2 F^1
Knowledge RC	3.33 (.21)	3.13 (.62)	3.07 (.60)	< 1	< 1	< 1
Ownership RC	4.22 (1.13)	3.50 (.91)	3.53 (.88)	1.56	1.34	2.15

[1] Degrees of freedom for all overall effect analyses are 2, 52 and for all planned comparisons are 1, 52

8.6.4 Summary of quantitative comparisons

In summary, employees whose work was reorganised into product-lines (i.e. members of the Pioneer Team and the Second-phase Team) reported significantly greater job control than a group of employees who had not undergone the IM intervention. As predicted given the enhanced control, the product-line members reported broader and more proactive role orientations than those employees in conventional jobs. Specifically, compared to the employees in traditional jobs, product-line people saw a broader range of integrated problems as part of 'their job', and had a wider understanding of the knowledge and skill required for effective performance within IM. Moreover, of the relevant measures used in the study, it is with respect to the orientation measures alone that the effects of the IM initiative are evident. There was no effect for the conventional outcome measures, and there was no evidence of a demand characteristic effect.

As would be expected given its longer history, the Pioneer Team consistently scored higher than the Second-phase Team on the orientation variables, although these differences were mostly non-significant. This probably reflects the small samples sizes and the subsequent lack of power in these tests compared to the power of contrasts with the larger-sized Traditional-Job Group. It may also reflect a lack of sensitivity in the orientation measures to more subtle differences in development. Methodologies that allow probing beyond a 'surface' awareness and global orientation - such as repertory grid or semi-structured interviews - may be needed to tap this level of difference.

As with the previous study, the Strategic Beliefs measure operated differently to the measures of role orientations, and scores were not related to the amount of control within the groups. It appears this measure either taps a different construct (for example, a level of general learning that all employees have experienced because of enhanced organisational communication), or it is more susceptible to testing effects (e.g. people 'learning the right answer' over time).

8.7 Summary of chapter

This chapter presented a qualitative and quantitative investigation of orientations in relation to job design and IM. Unlike the study reported in the previous chapter, the IM initiative introduced within the company was substantial, and was accompanied by changes to employees job control and complexity. The qualitative evidence confirmed that a team who piloted the IM initiative, and which functioned as a semi-autonomous work group, had developed broader orientations. This was followed up by a quantitative analysis that found the product-line employees scored significantly higher on the role orientation measures than those employees in traditional jobs. There were no differences on conventional outcome measure such as job satisfaction. This supports earlier arguments that the orientation measures assess different constructs to these outcome measures, and that they provide information over and above what is traditionally obtained in job redesign research.

Although the findings presented thus far are consistent with hypotheses, there are some competing explanations that cannot be ruled out with the 'static group comparison' design that was used (Campbell and Stanley, 1966). Internal validity is threatened by selection, mortality, and interaction between these factors; the major threat to external validity is the interaction of selection and the treatment.

The threat due to selection arises because there is no easy way of knowing whether the experimental and the control groups would have scored similarly on the role orientation measures *before* the introduction of product-lines. This is particularly the case with the Pioneer Team where members volunteered to become involved in the project. In Campbell and Stanley's (1966) terms, they 'sought out exposure to the treatment'. Thus, it may be that Pioneer Team members already had broader role orientations and it was this that prompted them to take on the challenge of joining a product-line. However, although this is logically feasible, there are two counter-arguments to this. First, when the people in the Pioneer Team put in their applications to become members of the pilot team, management involved with the initiative were disappointed by the particular volunteers. Only one experienced person wanted to be involved and nobody came forward from the most skilled function of testing. On the whole, the supervisor felt "they were pretty green, a really young team". The most experienced member put forward a similar view:

> Don't get me wrong, but I think how they've put it (product-lines) over was really a balls up because, when you start a new team up, you need the best people that's around the factory. I was lead to believe that we would get the best - the best kitter, the best tester, your best mechanics, whatever, but you didn't get them so I was a bit negative at first. But I'm happy now, I've swung a hundred percent round. Its been hard, but its easier now than it ever used to be.

Management eventually adopted the attitude that 'if it works with this group of people, it will work with the rest of shopfloor'.

The second point against a selection argument is that the Second-phase Team, who also had broader orientations than the control group, was not based on volunteers. Further, the composition of this team was very different from the Pioneer Team. Members of the Second-phase Team were on average about 10 years older than those in the Pioneer Team and, in contrast to the one female member in the Pioneer Team, they were nearly all females. The finding that such different groups - selected differently and of very different composition - both scored higher on the role orientations measure weakens (although does not rule out) selection as a rival hypothesis.

Another threat to internal validity inherent within this design is mortality (Campbell and Stanley, 1966; Cook and Campbell, 1979). That is, even if the groups had been the same to begin with, the differences in role orientation may have been due to selective drop-out from the groups. For example, people with low role orientations in the Pioneer and Second-phase Team could have dropped out (e.g. left the company) or not completed the questionnaire. However, in this case mortality is not a threat as no product-line members left the teams and all participated in the study.

Some of these threats to internal validity can be overcome by the use of a longitudinal design where the control group receives the treatment; in this case, if the employees in traditional jobs had their work re-organised into product-lines and their control enhanced. If members of this group develop broader orientations, it would strengthen the argument that changes in orientation are associated with job redesign rather than other factors such as selection. In the next chapter I present such a longitudinal extension of the current study. I also present an examination of the second research proposition - the relationship between orientations and performance.

Chapter 9

A longitudinal study of changes in orientations, and their relationship to performance

9.0 Introduction

There are three parts to this chapter. The first contains the longitudinal extension of the cross sectional study presented in the previous chapter. This is followed by an examination of the relationship between orientations and performance in the second part. This tests the proposition that, in situations where employees have high job control, those with broader, more proactive orientations will be better performers. In the final part of the chapter I address such the secondary aim of the thesis and investigate the influence of non job design factors on changes in orientations. This involves a more systematic analysis of some factors already raised as potentially important (i.e. organisational and contextual factors), as well some additional types of variables (i.e. personal factors and expectations about product-lines).

All of these investigations require an understanding of the nature of the change which took place within the company. A brief description is given next (note that general details about the company can be found in section 8.1 of the previous chapter).

9.0.1 Description of changes

As a result of the success of the Pioneer Team and the Second-phase Team, product-lines were introduced across the rest of the shopfloor in February, 1991. All the major stages of production (stores, kitting, assembly, and testing) were included in each line. The only functions excluded were flow solder (as there was only one machine) and final quality audit. This resulted in four additional product-lines of 24, 17, 5 and 10 employees. The smallest group was involved with the setting up and production of a new product. A product-support group was also formed to provide technical support to the product-lines. Layout changes were made about six months after teams were formed, and teams were located in separate areas of the factory.

To start with, there were four supervisors: one for the Pioneer and Second-phase Teams, one for the group with 24 people, one for the groups with 10 and 17 people, and one for the new-product group. However, after about nine months, one supervisor was made redundant and another re-deployed, leaving only two supervisors for all six groups. To make the larger groups more manageable, they were split into smaller product-based groups (i.e. a total of nine product-lines altogether) and team leaders were selected for each group. Holders of these positions were intended to serve as a point of reference to outside personnel wanting to deal with the team. They were not expected to function as charge-hands, and the position was to be rotated every six months. The exact development of this role was left to the individual groups.

Product-line members were responsible for achieving both production and employee development goals. To support this, teams developed public charts of their schedule and the primary performance indicators (e.g. on-time delivery; quality yield). Teams also collected their own attendance, absence, and sickness records. Skill matrices were used by each line to monitor individual and team skill levels and training requirements. Teams had weekly meetings to discuss the performance indicators, any problems in achieving the targets, and ideas for further improvements. The extent of self-management and the breadth of responsibility of the teams was very similar to the high-performance work teams described by Buchanan and McCalman (1989) and recommended by others (e.g. Lawler, 1992).

To support these Production-based changes, human resource practices and systems were altered to make them more appropriate to high-involvement working (see Lawler, 1992; Snell and Dean, 1992). For example, to facilitate greater flexibility, the number of salary grades was reduced from five to three, and the number of job titles was reduced from 15 to 3. Other changes included the introduction of a learning-based performance appraisal and career development scheme, improved training audits and procedures for on-the-job training, and recruitment procedures with greater involvement from line-managers and shopfloor employees.

9.1 Part 1: A longitudinal study of changes in orientations

This longitudinal study capitalises on a naturally-occurring change (i.e. the introduction of product-lines) and makes use of different groups that exist within Production. Its longitudinal design removes the threat of selection by examining changes over time for members of the Traditional-Job Group, and also allows an examination of the stability of orientation scores for the employees who are already in product-lines (members of the Pioneer Team and the Second-phase Team).

9.1.1 Timing of changes and research design

One month after the Time 1 survey reported in the previous chapter, product-lines were introduced across the remainder of the shopfloor. With the cross-sectional data as a reference point, two further surveys were conducted to evaluate the effects of this intervention. These surveys were carried out approximately 16 months and 23 months after the original survey (or 15 months and 22 months, respectively, after the introduction of product-lines across the whole shopfloor).

In the previous study, the groups of interest included the Pioneer Team, the Second-phase team, and the Traditional-Job Group. The first two teams had received the intervention (i.e. product-lines had been introduced) and, as predicted, members of them reported jobs with greater control and had broader role orientations than employees in the Traditional-Job Group. In the current study, no further changes in job control or complexity for the Pioneer Team or the Second-phase Team are expected. Employees in these groups are thus considered as a comparison group. For the purpose of analysis, these teams are combined into a single group to allow an adequate sample size when matched over time. As already established in the cross-sectional study, the groups were not significantly different from each other in terms of their scores on the relevant variables. These combined teams are referred to as the 'Changed Comparison Group'.

On the basis that product-lines were expected to affect their jobs differently, the Traditional-Job Group was subdivided into two separate groups for the current study. The first was the test engineers - a group of skilled technical specialists for whom product-lines were not expected to mean job enrichment. Instead, product-lines meant test engineers would be dealing with a narrower range of products, and would be expected to perform tasks within the line that require less skill than testing. Thus, although they would be performing a greater range of tasks, this would be counterbalanced by a decreased use of their specialist skills. Test engineers also had considerable autonomy prior to the introduction of product-lines and, although the intervention was likely to change their jobs, it was not expected to enhance their job control or complexity. Indeed, comparing their scores at the beginning of this study with an earlier survey (Time 0), they already perceived that their jobs had become less complex (see Appendix 6). Thus, given that no change in job control is expected for this group, the test engineers are considered as a second comparison group referred to as the 'Test Comparison Group'.

The next group is the remaining employees who were in the Traditional Job Group. This represents shopfloor people (i.e. assemblers, store people, and kitters) who were in conventional jobs at the start of the study, but whose jobs were reorganised into product-lines one month after the first survey. For these employees, product-lines is expected to enhance job control and job complexity in the same way that this intervention enriched the jobs of members of the Pioneer Team and the Second-phase Team. This group is thus referred to as the 'Intervention Group'.

The timing of the changes and the research design is summarised in Figure 9.1. Of the quasi-experimental designs described by Campbell and Stanley (1966), this design is most similar to the 'non-equivalent control group design' with the Intervention Group being the group that receives the treatment (i.e. X_1). The Changed Comparison Group and the Test Comparison Group both serve as non-equivalent control, or comparison, groups; members of the former have already received the treatment (X_1) and no further change is expected, and members of the latter are essentially receiving a different treatment that does not result in enhanced control (X_2).

This design has strong internal validity. It avoids the threats due to selection (as all employees receive the treatment, albeit at different times); due to history, testing, instrumentation and maturation (as any effects will be manifested for the comparison groups as well as the Change Group); and due to statistical regression (as the groups were selected for their job designs rather than having extreme role orientation scores). The threat of mortality and the interaction of selection with other variables (e.g. maturation, testing) are the major causes for concern. These are discussed later.

		Time 1^a								**Time 2**				**Time 3**
	Months	0	2	4	6	8	10	12	14	16	18	20	22	24
Intervention Group		O	X_1							O				O
Changed Comparison Group	X_1	O								O				O
Test Comparison Grp		O	X_2							O				O

X_1 = job re-design into product-lines with expected enskilling of jobs

X_2 = job re-design into product-lines with enskilling of jobs unlikely

O = measurement

^{a}This time period corresponds to the cross-sectional study reported in *Chapter 8*

Figure 9.1: Design of the longitudinal study to investigate product-lines

9.1.2 Research predictions

Assuming the introduction of product-lines affects the jobs of these groups in the expected way, specific predictions concerning their orientations can be made (summarised in Figure 9.2). However, prior to considering changes in orientations, it is necessary to determine the groups' starting points.

At Time 1 we already know from the cross-sectional study that the Pioneer and Second-phase Teams (now called the Changed Comparison Group) reported broader orientations than the members Traditional Job Group (now split into the Intervention Group and the Test Comparison Group). It is thus expected that the Changed Comparison Group will have report the broadest orientations at Time 1. Note that the orientation scores for the Test Comparison Group are not expected to be as broad as the Changed Comparison Groups' orientations at Time 1. This is because the test engineers were not working within product-lines and would be likely to have an individualistic rather than an group orientation to their work. The test engineers would nevertheless be expected to have more complex jobs and higher responsibilities than shopfloor operators in conventional jobs at Time 1. They thus should have broader orientations than members of the Intervention Group at the starting point. Overall, the pattern of orientation scores expected at Time 1 is broad for the Changed Comparison Group, medium for Test Comparison Group, and narrow for the Intervention Group.

	Time 1	**Time 2**	**Time 3**
Changed Comparison Group	Broad	Broad	Broad
Test Comparison Group	Medium	Medium	Medium
Intervention Group	Narrow	Broad	Broad

Figure 9.2: Predicted pattern of results for orientations (assuming the changes in job variables are as expected)

Regarding changes over time, for the Intervention Group, it is hypothesised that the introduction of product-lines will allow and foster the development of broader orientations (i.e. there will be an increase in scores from Time 1 to Time 2). It is expected that the broader orientations will be maintained from Time 2 to Time 3. For the Test Comparison Group and the Change Comparison Group, no changes in orientations are predicted. The Change Comparison Group have already had substantial changes to their jobs and already report broad orientations. Assuming they continue to have control and challenge in their jobs, it is expected that their orientation scores will be maintained. For the Test Comparison Group, jobs are not likely to become more complex, thus they are not predicted to develop broader orientations.

In addition to examining changes in people's orientations, changes in conventional outcome variables (Job Satisfaction, Psychological Strain, Anxiety-contentment, and Depression-enthusiasm) and Quality Commitment will be examined for each group. It is expected that there will be no changes for the Changed Comparison Group whose jobs have already been redesigned, nor for the Test Comparison Group whose jobs are not likely to be enriched. If anything, it is expected that scores for the Test Comparison Group will become worse on these variables. Consistent with literature that relates job enrichment to improved satisfaction and mental health (see *Chapter 2*), it is predicted that members of the Intervention Group will be less strained and more satisfied after the introduction of product-lines. However, as argued in the previous chapter (see section 8.2, it is also expected that orientation measures will be more sensitive to change than these outcome measures.

As an interesting side-line, people's self-reported perceptions of change at Time 2 (e.g. in their job knowledge, job satisfaction, and stress) are also examined. Although methodologically limited because of their subjectivity, retrospective accounts can shed light on the process of change.

9.1.3 Method

In addition to the Time 1 survey conducted in January, 1991 (used in the cross-sectional study), questionnaires were administered 16 months later in May, 1992 after the introduction of product-lines across the whole shopfloor. Questionnaires were then re-administered 23 months after Time 1 in December, 1992. The same method of administration and guarantees of confidentiality were given as in the cross-sectional study (see section 8.3.2).

9.1.3.1 Measures

With the exception of the measure assessing perceptions of change (described below), the measures of orientations, job characteristics, and outcome variables were the same as described in *Chapter 8* (see section 8.3.2). The means, standard deviations, and intercorrelations of the scales both at Time 2 and Time 3 are shown in Appendix 6. Internal reliabilities are shown for the orientation measures. With the exception of the

Ownership Response Check scale (discussed later), internal reliabilities assessed by Cronbach's alpha were all acceptable.

Perceptions of change: To assess people's retrospective perceptions of change as a result of being in product-lines, additional questions were included at Time 2. Employees were asked whether, since they had been in product-lines, they felt there had been changes in their: knowledge of the production process, knowledge of issues outside of production (e.g. other departments, customers), understanding of manufacturing goals and strategies (e.g. Just-in-time), ability to respond to and solve production problems, ability to anticipate and prevent production problems, job satisfaction, involvement with the job, and stress in the job. These items had a 7-point scale from 1('large decrease') through 3 ('no change') to 7 ('large increase').

9.1.3.2 Sample

The exact sample size and composition varies depending on whether groups are matched over time or treated independently (see Figure 9.3). On each separate measurement occasion, the percentage of employees in the sample compared to the total number of people available was high (i.e. there was at least an 80% response rate for each survey). Matching over time, there were 36 employees who had valid data on all three occasions. Some people missed filling in the questionnaire (especially at Time 2 when Production pressures were high), some people left the organisation, and some new people were recruited. There was a particularly high turnover of test engineers who were dissatisfied with their new roles. The threat of mortality is discussed later.

	Time 1	**Time 2**	**Time 3**	**Matched**
Intervention Group	N = 35	N = 27	N = 33	N = 24
Changed Comparison Group	N = 15	N = 14	N = 13	N = 6
Test Comparison Group	N = 13	N = 7	N = 7	N = 6
Total	63	48	53	36

Figure 9.3: Sample sizes of independent groups for each period, and for groups matched over three periods

The demographic characteristics are described on the basis of the matched employees as this group is the most important sample for assessing change. (Note that the pattern of characteristics is very similar when considering the groups separately on each measurement occasion).

The mean ages of the Intervention Group, Changed Comparison Group, and Test Comparison Group were 35.2 years (SD = 10.5), 29.0 years (SD = 11.8), and 26.1 years (SD = 6.9), respectively. The average length of time in the company (in the same group order) was 3.8 years (SD = 4.0), 3.50 years (SD = 3.2), and 3.0 years (SD = 2.3). The main differences in the groups relates to their gender. Most employees in the Intervention Group were female (70%) but most members of the Changed Comparison Group and the Test Comparison Group were male (70% and 80%, respectively).

9.1.3.3 Analyses

The primary method to assess change here was the use of repeated-measures analyses for those people present on all measurement occasions (using, as in *Chapter* 7, repeated-measures multivariate analysis of variance). Repeated measures analyses are preferred in terms of controlling for variation due to individual differences. However, one potential problem with this approach is that it is based only on the select group who have repeated data; a problem that is accentuated in this study given the long period over which it was conducted. To counteract this problem, independent groups analyses were performed to test for differences in scores for all respondents at each time period. Both of these approaches produced equivalent results and thus, for the sake of clarity, only the repeated measures analyses will be described here. For the main predictions results for independent groups analyses are reported in Appendix 6.

The results of simple main effects are reported rather than overall main effects and interaction effects. This involves examining change over time for each group separately, and examining group differences at each time period. The latter analyses are particularly important for Time 1 as the change analyses do not give information about the equivalence of starting points. (N.B. The group difference analyses at Time 1 are equivalent to those in the cross-sectional study except they are based on different sample sizes, have a further sub-division of the Traditional-Job Group, and have the Pioneer and Second-phase Teams combined).

Each multivariate analysis of variance was conducted separately for a single dependent variable as sample size did not permit combining variables into a doubly multivariate design.

9.1.4 Results

9.1.4.1 Effects on job content (a manipulation check)

The first set of results examines whether there have been changes in perceptions of Job Complexity, Boundary Control, Method Control, and Timing Control for each of the groups. This serves as a manipulation check that the intervention enriched the Intervention Group' jobs, but not the jobs of the Changed Comparison Group or the Test Comparison Group. The mean scores for the groups on these variables and summaries of the results are shown in Table 9.1.

As a background check, it is firstly necessary to confirm that the group differences at the start of the study were consistent with what was expected given results of the previous study (*Chapter 8*). Analyses of group differences at Time 1 showed there were significant differences in groups' scores for Job Complexity, F (2, 30) = 9.97, p < .001, Boundary Control, F (2, 30) = 3.82, p < .05, and Timing Control, F (2, 30) = 3.65, p < .05. As expected, employees whose jobs had already been re-designed (the Changed Comparison Group) reported more complex jobs with greater control than those in the Intervention Group whose jobs had not been re-designed. Further, members of the Test Comparison Group reported more complex jobs and greater control than operators in the Intervention Group. This was also expected as, at this time, the Test Comparison Group were performing specialist jobs with high responsibility and control.

Turning to the key analyses of interest, change over time, a separate repeated-measures multivariate analysis of variance was conducted using SPSSx MANOVA for each job content variable. It was expected that scores for the Intervention Group would increase, that scores for the Changed Comparison Group would remain high but would not change further, and that the Test Comparison Group would have moderate scores that would not change over time. These expectations were confirmed. There was a significant increase in the Intervention Group's perception of Boundary Control, F (2, 30) = 6.04, p < .01, and Timing Control, F (2 ,30) = 6.61, p < .01; as well as an almost significant increase for Method Control, F (2, 30) = 2.82, p < .10. For each of these variables, the increase was mostly from Time 1 to Time 2, with the mean at Time 3 being very similar to that at Time 2. These findings are consistent with the researcher's observations that Intervention Group had become substantially more autonomous, and with employees' comments in questionnaires and interviews. On the whole, these results suggest that the intervention was 'successful' in that it had a 'real' effect on the amount of job control experienced by members of the Intervention Group.

Table 9.1: Means and standard deviations for job content variables, and results of RM Manovas

	Changes over time												Group differences		
	Operators N = 22				Establisheds N = 6				Testers N = 6				F^1		
Job content	Time1 $\overline{X}$ (SD)	Time2 $\overline{X}$ (SD)	Time3 $\overline{X}$ (SD)	F^1	Time1 $\overline{X}$ (SD)	Time2 $\overline{X}$ (SD)	Time3 $\overline{X}$ (SD)	F^1	Time1 $\overline{X}$ (SD)	Time2 $\overline{X}$ (SD)	Time3 $\overline{X}$ (SD)	F^1	Time 1	Time 2	Time 3
Job Complex.	2.92 (.45)	3.06 (.41)	3.11 (.60)	< 1	4.16 (.26)	3.78 (.41)	4.13 (.65)	1.28	2.67 (.65)	2.58 (.45)	2.75 (.64)	< 1	9.97***	6.47**	7.72**
Method Control	3.52 (.97)	3.99 (.69)	3.84 (.79)	2.82+	4.17 (.55)	4.44 (.44)	4.77 (.41)	1.16	3.22 (.44)	3.00 (.74)	2.47 (1.06)	2.28	2.02	7.63**	12.81** *
Boundary Control	2.76 (.85)	3.35 (.76)	3.41 (.73)	6.04**	3.75 (.50)	3.81 (.85)	4.08 (.72)	< 1	3.17 (.78)	3.08 (.56)	3.14 (.60)	< 1	3.82*	1.47	2.99*
Timing Control	2.87 (1.06)	3.68 (.93)	3.68 (.89)	6.61**	4.17 (1.18)	3.97 (.89)	4.70 (.37)	1.47	3.29 (.89)	3.37 (1.04)	2.80 (.94)	< 1	3.65*	.61	7.62**

*** $p < .001$, ** $p < .01$, * $p < .05$, + $p < .10$

[1] Degrees of freedom for all F tests were 2,30

As hypothesised, there were no significant increases in any of the job content variables for the Changed Comparison Group or the Test Comparison Group. For the former, scores remained high over the period of the study; for the Test Comparison Group, although the results were not significant, there was a tendency for scores to decrease over time. Test engineers clearly did not experience product-lines as enriching. Their comments in interviews and the survey concur with this, such as:

> Before product-lines, I worked on a large range of products. Now I only work on two different types of boards which means I know these boards inside out. So now I am extremely bored!
>
> I am now expected to build boards, work in stores, etc. I spent 4 years getting good qualifications to ensure I wouldn't have to perform mundane tasks like that.

These results confirm that the intervention (i.e. the introduction of product-lines) was successful in enhancing control for the Intervention Groups' jobs, and that the increase in scores was not a result of general factors (i.e. history) that would have systematically increased scores for the comparison groups. Results from independent groups analyses were consistent with these conclusions.

9.1.4.2 Effects on orientations (the main predictions)

Given that the anticipated changes to jobs occurred, the predictions made about orientations hold. That is, it is expected that with the introduction of product-lines, the Intervention Group will develop broader orientations; further, that most of the changes in orientations will take place from Time 1 to Time 2 (rather than from Time 2 to Time 3) as this is the period where there was the greatest change to jobs. For the Changed Comparison Group and the Test Comparison Group, whose job control and complexity did not increase, orientations are expected to remain the same. Findings for repeated measures analyses relevant to these predictions are shown in Table 9.2 (Note that, although these are not the analyses of primary interest, group differences at each time are also shown for the sake of completeness). Also note that the independent group analyses were consistent with the findings from repeated measures (see Appendix 6 for more detail).

Results for Production Ownership and Production Knowledge, which are somewhat more straightforward, are presented first. This is followed by the results for Wider-production Knowledge and Strategic Beliefs.

Table 9.2: Means and standard deviations for orientation variables (based on matched groups), and results from RM Manovas

Orient -ion variables	Changes over time												Group differences		
	Operators N = 22-24				Establisheds N = 6-7				Testers N = 6				F^1		
	Time1 $\overline{X}$ (SD)	Time2 $\overline{X}$ (SD)	Time3 $\overline{X}$ (SD)	F^1	Time1 $\overline{X}$ (SD)	Time2 $\overline{X}$ (SD)	Time3 $\overline{X}$ (SD)	F^1	Time1 $\overline{X}$ (SD)	Time2 $\overline{X}$ (SD)	Time3 $\overline{X}$ (SD)	F^1	Time 1	Time 2	Time 3
Production Ownership	2.83 (.78)	3.62 (.59)	3.57 (.74)	12.36***	4.20 (.96)	4.14 (.86)	4.16 (.62)	< 1	3.38 (.47)	3.36 (.78)	3.56 (.69)	< 1	7.59**	2.12@	1.74
Production Knowledge	2.45 (.65)	2.85 (.67)	2.92 (.54)	5.71**	3.25 (.47)	3.26 (.50)	3.30 (.62)	< 1	2.86 (.82)	2.88 (.60)	2.55 (.39)	1.97	3.84*	1.02	3.02+
Wider-prod Knowledge	2.12 (.68)	2.03 (.68)	2.21 (.75)	< 1	2.56 (.76)	2.48 (.68)	2.54 (.72)	< 1	2.04 (.75)	1.70 (.66)	1.79 (.64)	< 1	1.06	2.04@	1.56
Strategic Beliefs	2.17 (.49)	2.29 (.48)	2.46 (.53)	4.60*	2.44 (.43)	2.90 (.59	2.58 (.42)	2.36@	2.65 (.26)	3.03 (.40)	3.02 (.27)	2.77+	2.96+	7.93**	3.33*

*** p < .001, ** p < .01, * p < .05, + p < .10, @ p < .15

[1] Degrees of freedom for all F tests were 2, 31 or 2, 32

Production Ownership and Production Knowledge

It is firstly necessary to confirm that group differences at the starting point of the study were in line with the findings from the previous investigation (*Chapter 8*). As expected there were there were significant group differences for Production Ownership, F (2, 31) = 7.59, p < .01 and for Production Knowledge, F (2, 32) = 3.84, p < .05. In each case, the Changed Comparison Group had a higher mean than the Test Comparison Group who in turn had a higher mean than the Intervention Group. This is the expected pattern given the groups' job designs at this time, and is consistent with the results presented in the previous chapter.

The key analyses concern change over time. Turning now to the results of the repeated measures analyses, there were significant changes for the Intervention Group in Production Ownership, F (2, 32) = 12.36, p < .001 and Production Knowledge, F (2, 32) = 5.71, p < .01, but there were no significant changes over time in scores on these variables for the Changed Comparison Group or the Test Comparison Group. This is consistent with findings that there were no significant group differences for either of these variables at Time 2 or Time 3. That is, at these later periods, it seems that members of the Intervention Group had begun to 'catch up' with those in the Changed Comparison Group in their ownership of problems that occur in integrated production environments, and their perceptions of the performance requirements that are necessary to carry out their new role.

These results can be stated in another way. Looking at the ownership items, operators in the Intervention Group initially perceived only six out of 21 problems to be at least of 'moderate concern'. Half of these were response-check problems; that is, problems which impact primarily on the individual rather than the group. Similarly, these operators initially perceived only six of the list of 54 performance requirements as at least 'moderately important', and two of these were the response-check items (i. e. knowing the work-to list, and knowing how to report problems to the supervisor). However, by Time 2, Intervention Group reported at least a moderate degree of concern for nearly all the problems listed, and they saw 16 of the 54 items as at least 'moderately important'. The latter included, for example, knowing about planning-based aspects of production (e.g. knowing about customer priorities), cognitive aspects of tasks (e.g. how to prioritise work), and group-working requirements (e.g. knowing people's roles in the work area).

These results are also consistent with management perceptions and with employee comments in interviews. For example, in his Masters thesis, the production supervisor repeatedly described how the introduction of product-lines "created a strong sense of ownership of the products assembled by the team" (Lodhia, 1993, p. 91). This was evident in interviews where operators' made comments about goals and problems at Time 2 to a much greater degree than at Time 1. For example, when asked about how the company was performing, one operator stated: "We have to do out best to stay on top. Make sure the boards and the stuff we ship out are the right boards and the right degree the customer wants. So we stay on top, and we don't need to get behind again". Ownership of the product was also reflected in another operator's description of her ideas for improving effectiveness. In one case, she went to the production manager to suggest greater shopfloor involvement with salespeople. That is, when customers visited the company, operators could explain what they were doing: "Not go into technology deeply, but basically condense it so that they get the message that you know your boards and what you're sending out.... I know its a bit of a scam, but when you're in business that's what you've got to do ain't it, if you want to sell".

The broader perception of performance requirements was also reflected in comments in questionnaires and interviews. For example, an operator in the Intervention Group stated:

> I thought to myself 'all these flipping charts and bloomin' meetings and things every week'. Then Paddy, our team leader, who does the charts and that, he was off for a week. And do you know, our work slipped down and we didn't think, we had no knowledge that it were going down... So you do need some guidelines to be there for you all the time, you know, targets and that for you to go at.

In particular, as in the previous study, group-working and interpersonal skills were seen as critical for performance. For example, one person commented:

> I think to work with the team at the moment is... its not so much your building of your boards and your testing, because you've got paper there and it tells you what to do and it helps you with what to do. You've got to be more understanding with people. You've got to be really diplomatic in what you say and how you do things with people. It is generally people.

In contrast, comments from test engineers tended to suggest a narrowing of perspective. For example, one person commented: "I have a very narrow view of company products, very narrow view of line"; and another stated: "With product lines my focus on different types of boards has gone and I only know about how to fix three types of boards, whereas I could have a chance of fixing approx. 100 types".

Strategic Beliefs and Wider-production Knowledge

Checking firstly for the pattern of group differences at Time 1, there were no significant differences between the groups at any of the time periods for Wider-Production

Knowledge. Whilst these results are inconsistent with the differences in job design across the groups, they concur with the results of the cross-sectional study that there were no significant differences between groups on this measure. For the Strategic Beliefs measure, there were almost significant group differences at Time 1, F (2, 32) = 2.96, p < .10; however, unlike the role orientation measures, at each period the Test Comparison Group scored consistently higher than the Changed Comparison Group, who scored higher than Intervention Group.

In terms of the main investigation of interest, the analysis of change, there were no significant multivariate or univariate changes over time for any of the groups on Wider-production Knowledge. This is consistent with the results obtained in the previous study that suggested that this variable was not sensitive to differences in operator control.

For Strategic Beliefs, as predicted, there was a significant increase over time for the Intervention Group, F (2, 32) = 4.60, p < .05. However, there was also an almost significant increase for the Test Comparison Group, F (2, 32) = 2.77, p < .10 and for the Changed Comparison Group, F (2, 32) = 2.36, p < .15. Given the small sample sizes in these latter groups (and therefore the reduced power of any statistical analyses) these findings can be considered as potentially important. This suggests that enhanced scores on Strategic Beliefs may not be specifically confined to situations where more complex jobs are introduced. This conclusion is consistent both with the previous study and with the study describing the implementation of Kaizen (*Chapter 7*) where it was concluded that people's strategic orientations develop irrespective of changes to job design.

9.1.4.3 Competing explanations

This section considers alternative explanations of the finding that scores on the role orientation measures (i.e. Production Ownership and Production Knowledge) increased for the Operator group but not for the non-equivalent control groups.

The first possibility is that, as described in the previous study (see section 8.7), the results are due to a response-bias that selectively applies to the orientation measures. To test this, a repeated-measures multivariate analysis of variance was conducted for each of the response-check scales (i.e. Ownership Response-check and Knowledge Response-check). These scales were deliberately designed to check against such biases. Results for these analyses are shown in Table 9.3. Table D in Appendix 6 shows the parallel results for the one-way analyses of variance conducted on independent groups.

Table 9.3: Means and standard deviations for response-check scales (based on matched groups), and results of RM Manovas

	Changes over time												Group differences		
	Operators N = 22-23				**Establisheds** N = 6				**Test** N = 6				F^1		
Response-check variables	Time1 $\overline{X}$ (SD)	Time2 $\overline{X}$ (SD)	Time3 $\overline{X}$ (SD)	F^1	Time1 $\overline{X}$ (SD)	Time2 $\overline{X}$ (SD)	Time3 $\overline{X}$ (SD)	F^1	Time1 $\overline{X}$ (SD)	Time2 $\overline{X}$ (SD)	Time3 $\overline{X}$ (SD)	F^1	Time1	Time2	Time3
Ownership RC	3.46 (.76)	3.80 (.90)	3.72 (.68)	1.38	4.22 (1.13)	4.17 (.86)	3.92 (.66)	< 1	4.00 (.76)	4.06 (.65)	4.11 (.40)	< 1	2.60^{+}	< 1	1.0
Knowledge RC	3.04 (.44)	3.20 (.74)	3.15 (.57)	< 1	3.44 (.34)	3.58 (.39)	3.33 (.69)	< 1	3.33 (.67)	3.11 (.72)	3.17 (.18)	< 1	2.20	< 1	< 1

[1] Degrees of freedom for all F tests were 2, 31 or 2, 32; $^{+}p < .10$

For both types of analyses, there were no significant changes over time or any significant group differences at each period for the Intervention Group. In other words, although employees in this group reported changes in the orientation items, they did not report increases for the response-check items. This suggests that they were not simply responding in a more extreme manner in order to obtain a high score. It should be noted, however, that this cannot be considered conclusive because of the unreliability of the Ownership Response Check scale.

Analysis of changes in scores for individual role orientation items also suggested the results were not just due to response-bias. For example, the only ownership item where there was a drop in concern was for the supervisor or team-leader being absent for a few days (e.g. the means dropped from 2.11 at Time 1 to 1.88 at Time 2). This is the only item where a decrease in concern would logically be expected. With the introduction of product-lines, team members would be expected to become more concerned about product-line goals and mechanisms of achieving them (i.e. Production Ownership), to remain as concerned about threshold or individual-level events (i.e. Ownership Response-check), and to become less concerned about the supervisor's absence as they become more self-managing. This pattern of responses was obtained, and it is unlikely to be purely a function of response bias.

Other competing explanations of the findings concern threats to the internal validity of the design. Mortality is a particularly likely threat as there were many missing values over time, and non-representative groups of employees may have been present for all three measurements. Although independent groups analyses were consistent with the repeated measures results, it may be that the employees in the independent groups were not representative of the total population (e.g. of people who left or joined the organisation). To examine this threat, t-tests were conducted to compare responses for the 'stayers' (i.e. people present at all three occasions) with responses from'non-stayers' (i.e. newcomers or people who dropped out of the sample) for all orientation variables for each group at each time period. Means and results of the t-tests are presented in Table 9.4. There were no significant differences between these samples for any of the analyses. That is, the people who answered the survey at all three time periods did not differ in their orientations at any one occasion from those for whom data were available on only one or two occasions. This suggests that mortality is not a likely explanation of the findings.

Table 9.4: Orientation scores for 'non-stayers' (1) and 'stayers' (2), and results of independent group t-tests

Orientation variables		Operators			Establisheds			Testers[a]
		Time 1	Time 2	Time 3	Time 1	Time 2	Time 3	Time 1
	N (1)	10 -13	3	7- 8	7-8	6-7	5	7
	N (2)	24- 25	20- 23	25	7	7	7	6
Production Knowledge	$\overline{X}$ (1)	2.35	2.83	2.59	2.93	2.88	2.56	2.3
	$\overline{X}$ (2)	2.42	2.85	2.88	3.06	3.07	3.12	2.86
	t (d.f)	t (32) = -.28	t (25) = -.05	t (30) = -1.40	t (12) = -.43	t (12) = -.66	t (10) = -1.51	t (11) = -1.27
Production Ownership	$\overline{X}$ (1)	2.50	3.85	3.04	3.37	3.64	3.90	3.27
	$\overline{X}$ (2)	2.78	3.53	3.48	4.05	4.04	4.08	3.37
	t (d.f)	t (31) = -.94	No d.f	t (30) = -1.16	t (12) = -1.23	t (12) = -.88	t (10) = -.42	t (11) = -.29
Wider-production Knowledge	$\overline{X}$ (1)	1.94	2.29	2.37	2.14	2.30	2.27	1.41
	$\overline{X}$ (2)	2.11	1.97	2.20	2.42	2.31	2.44	2.03
	t (d.f)	t (32) = -.56	t (24) = .78	t (23) = 1.23	t (12) = -.63	t (12) = -.04	t (10) = -.43	t (11) = -.166
Strategic Beliefs	$\overline{X}$ (1)	2.13	2.78	2.79	2.08	2.65	2.98	2.76
	$\overline{X}$ (2)	2.17	2.30	2.42	2.32	2.73	2.59	2.65
	t (d.f)	t (33) = .21	No d.f[b]	t (30) = -1.48	t (13) = .75	t (11) = .23	t (10) = -1.47	t (11) = -.36
Knowledge Response-check	$\overline{X}$ (1)	2.87	2.89	3.09	3.04	3.33	3.13	2.57
	$\overline{X}$ (2)	3.04	3.19	3.12	3.33	3.40	3.28	3.33
	t (d.f)	t (32) = -.81	t (25) = -.71	t (30) = -.10	t (12) = -1.07	t (12) = -.23	t(10) = -.37	t (11) = -1.80
Ownership Response-check	$\overline{X}$ (1)	2.98	3.83	3.39	3.52	3.90	4.07	4.0
	$\overline{X}$ (2)	3.45	3.73	3.67	4.19	4.00	3.92	4.0
	t (d.f)	t (32) = -1.54	No d.f	t(31) = -.88	t (12) = -1.24	t(12) = -.23	t(10) = .38	t (11) = .10

[a] No analyses were conducted for Testers at Time 2 and Time 3 as there was only one 'non-stayer'

[b] No d.f. signifies that the sample size of at least one group was too small to allow degrees of freedom for analyses

9.1.4.4 Effects on additional outcome variables (subsidiary predictions)

Some subsidiary analyses were also performed to examine changes in the conventional outcome variables and Quality Commitment as a result of product-lines. It was predicted that the Intervention Group would report scores reflecting more satisfaction, well-being and commitment, but that there would be no change for the comparison groups. It was also predicted that these differential patterns of change would not be as marked as those obtained for the orientation measures that were specifically designed to tap employee development. A repeated-measures multivariate analysis of variance was thus conducted for each variable, and simple main effects were reported. Table 9.5 shows the results.

Regarding change over time, as expected given the lack of change in job content, there were no significant changes on any of the outcome variables for the Changed Comparison Group. For the Test Comparison Group, there were significant changes for Psychological Strain, $F(2, 31) = 4.33$, $p < .05$ and Quality Commitment, $F(2, 31) = 5.13$, $p < .05$. Psychological Strain scores rose from a mean of 1.26 at Time 1 to a mean of 1.47 at Time 2, but then people reported less strain at Time 3 ($\overline{X} = .90$). Quality Commitment scores dropped from Time 1 to Time 2, such that at Time 2, commitment was significantly different for the groups. These results suggest that the changes made to test engineers' jobs, which involved skilling across a greater range of tasks but less use of specialised skills, had negative effects on these employees' well-being and commitment.

For the Operator group, contrary to what was expected on the basis of previous literature, there were no significant changes in these outcome variables over time[3]. This finding is discussed later.

It should be noted that there were significant differences in groups at Time 1, Time 2 and Time 3 for most of the variables. It is not necessary to go into detail but it is worth noting that in each case where a significant difference was obtained, the Test Comparison Group had scores indicating substantially lower satisfaction, lower commitment, and poorer well-being.

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[3] Additional analyses was performed with a distinction between extrinsic job satisfaction and intrinsic job satisfaction. These variables appeared to function in a similar way. There were no significant or nearly significant changes over time for intrinsic satisfaction or extrinsic satisfaction. There were significant group differences for intrinsic satisfaction: At each time period, Testers were substantially less satisfied than the other groups. For extrinsic satisfaction, Testers were significantly less satisfied only at Time 1.

Table 9.5: Means and standard deviations for conventional outcome variables, and results of RM Manovas

	Changes over time												Group differences		
	Operators N = 22-23				Establisheds N = 6				Testers N = 6				F^1		
Outcome variables	Time1 $\overline{X}$ (SD)	Time2 $\overline{X}$ (SD)	Time3 $\overline{X}$ (SD)	F^1	Time1 $\overline{X}$ (SD)	Time2 $\overline{X}$ (SD)	Time3 $\overline{X}$ (SD)	F^1	Time1 $\overline{X}$ (SD)	Time2 $\overline{X}$ (SD)	Time3 $\overline{X}$ (SD)	F^1	Time 1	Time 2	Time 3
Job Satisfaction	5.01 (.71)	4.93 (.50)	5.06 (.63)	< 1	5.34 (.87)	5.18 (.84)	5.48 (.99)	< 1	3.81 (.98)	4.04 (1.05)	4.06 (1.33)	< 1	6.95**	5.26*	4.76*
Psychol. Strain^a	.66 (.31)	.76 (.29)	.79 (.42)	< 1	.85 (.14)	.97 (.48)	.87 (.22)	< 1	1.26 (.54)	1.47 (.67)	.90 (.28)	4.33*	7.14**	7.30**	< 1
Quality Commit.	4.13 (.45)	4.14 (.46)	4.21 (.59)	< 1	4.29 (.49)	4.39 (.52)	4.45 (.53)	< 1	3.94 (.67)	3.46 (.58)	3.76 (.71)	5.13*	< 1	6.22**	2.13
Anxiety-contentment	2.35 (.63)	2.66 (.62)	2.46 (.53)	3.29+	2.67 (.31)	3.03 (.18)	2.73 (.76)	1.09	3.08 (.68)	2.97 (.39)	2.92 (.23)	< 1	3.71*	1.41	1.98
Depression-enthusiasm	2.33 (.74)	2.43 (.75)	2.34 (.67)	< 1	2.13 (.57)	2.57 (.56)	2.37 (.57)	< 1	3.67 (1.0)	3.44 (1.05)	3.22 (.89)	1.11	4.72**	3.97*	3.87*

** $p < .01$, * $p < .05$, + $p < .10$

[1] Degrees of freedom for all F tests were 2,30 or 2, 31

[a] A higher score means greater psychological strain

9.1.5 Results for self-reported change

In this section I examine people's retrospective perceptions of change as a result of product-lines[4]. This is a slight diversion from the change results that have been presented thus far, but it is expected that the findings will be informative about the change process. Retrospective accounts of change can present an insightful view of the phenomenological experience of change and, as will be shown, may suggest ways in which people have developed. Nevertheless, some caution is needed in interpreting retrospective accounts as memories are continually reconstructed as a result of current experiences (Ross and Conway, 1986), and views of change may reflect implicit theories people hold about the change process rather than any real recall (Ross, 1989). This is not to say that retrospective accounts of change are too subjective to be of use, but rather that they differ from concurrent assessments of change and should be considered separately.

Table 9.6 shows the percentages of responses in three categories for each item (note - because the distributions on most items were skewed, responses were collapsed from seven to three categories). Chi-squared analyses were performed for each item to determine whether the frequencies were distributed approximately equally across the categories. Further chi-squared analyses were conducted to determine whether the distribution of scores for each item differed as a *function* of group. Results for the analyses are considered firstly for those items assessing perceptions of change in knowledge and problem-solving ability (i.e items 1-5); followed by those items assessing perceived change in affective reaction (i.e. items 6-9).

9.1.4.1 Changes in knowledge and problem-solving skills

If people have learnt and developed as a result of the IM initiative and job redesign, as suggested by the results for the orientation measures, then a disproportionate percentage of people should report an 'increase' in their knowledge and understanding, and in their ability to solve and prevent problems. This was the case. That is, the distribution of scores for these items was significantly skewed, and more people than would be expected on the basis of chance alone reported an increase in these variables. For example, 87% of people reported an increase in their knowledge about the production process since being in product-lines.

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[4] Note that this asks about changes since the introduction of product-lines, which for the Changed Comparison Group occurred before Time 1.

Table 9.6: Percentage of people reporting a change in aspects of their job since the introduction of product-lines

Items	Response categories			Chi-squared results	
	Increase	No change	Decrease	General[1]	Group diff's[2]
1. Knowledge about production process	87	4	9	52.2***	2.17
2. Knowledge outside of production	66	32	2	28.6***	8.52^+
3. Ability to respond to/ solve problems	70	24	6	29.2***	1.19
4. Ability to anticipate prevent problems	65	31	4	24.3***	5.19
5. Understanding of Man. strategies	67	29	4	26.5***	1.6
6. Satisfaction with job	59	17	24	13.8**	15.2**
7. Involvement in job	70	13	17	23.9***	6.2
8. Amount of stress in job	56	31	13	7.86*	7.3

*** $p < .001$, ** $p < .01$, * $p < .05$

[1] These analyses test the null hypothesis that the frequencies are distributed equallyacross the categories (d.f = 2)

[2] These analyses test the null hypothesis that scores are distributed equally across the categories for the groups (d.f = 4)

These data were consistent with retrospective comments about change made in interviews and questionnaires. Several people felt that, since being in product-lines, they had learnt more about manufacturing and had also realised the importance of this knowledge for their performance. For example, when asked to describe ways in which s/he had changed, one employee stated:

> I've changed in the sense that I know more about what I'm doing and it is worth getting to know all this and all that.... cos sometimes people used to say, 'you know, you don't need to know this, you can get on with your work' and you used to go away. But now, if somebody says that, we say something else to them: 'We've got to know what's going on in the team, if its going right, if its going wrong'.

Thus, it appears that most people perceive they have learnt more and are better able to deal with or prevent problems as a result of being in product-lines. This finding, in conjunction with the finding that scores on orientations increased, provides support for the argument that developing new orientations is a learning-based process dependent on enhanced awareness and knowledge of production.

Valuable information can also be gained from looking at item differences. Most people reported an increased in knowledge about the production process (i.e. only 13% of people reported no change or a decrease in this); however, many more people reported no change or a decrease in their knowledge *outside* of production (34%), in their ability to anticipate and prevent problems (35%), and in their understanding of manufacturing strategies (33%). These findings are consistent with results for orientations presented earlier where, with the introduction of product-lines and job redesign, there were significant increases in the extent to which scores on Production Knowledge increased but no such increases for scores on Wider-production Knowledge.

Regarding the issue of knowledge outside of production, a further interesting finding is that there was almost a significant difference in the distribution of scores across groups, Chi squared = 8.52, $p < .10$. The Changed Comparison Group had a greater percentage of people than expected reporting an increase in this (100%) and the Intervention Group had less than expected (52%). It may be that learning about things outside of Production is something that becomes important after considerable time, when issues and problems within the Production area have been fully taken on board.

9.1.4.2 Changes in affective responses to jobs

As with the results for the above items, most people reported increases in their job satisfaction (59%), their job involvement (70%), and the extent of stress they felt in their job (56%). As shown by the significant results of the chi-squared analyses of the distribution of scores across categories, more people than would be expected on the basis of chance alone reported an increase in these aspects of their work. Consistent with the mixed effect of product-lines on employees' jobs, there was a significant group difference in self-reported change in job satisfaction, Chi-squared = 15.2, $p < .01$. Although nearly all of the Changed Comparison Group (91%) and over half of the Intervention Group (58%) reported an increase in their job satisfaction, only 14% of the Test Comparison Group reported such an increase.

For the Intervention Group and Changed Comparison Group, the fact that most people reported that their satisfaction had increased is apparently contradictory to earlier findings that there were no significant increases in Job Satisfaction scores. However, as already argued, Job Satisfaction measures are not designed to assess development. For example, they do not take into account changes in the expectations of employees. It may be that people are just as 'satisfied' at Time 2 with their jobs as at Time 1, but they have much greater expectations for their jobs after product-lines are introduced and want more from their work to be satisfied. The finding obtained here of a lack of change in Job

Satisfaction scores, in combination with self-reported changes in job satisfaction, suggests such a change in criteria. That is, although their actual satisfaction levels did not change over time, most people believed they are more satisfied than they were, and this suggests the criteria with which they are evaluating their jobs (i.e. what they expect) have been raised. This is similar to a beta-change described by Golembiewski *et al.* (1976) where a person, due to changes in awareness or understanding, re calibrates the rating scale they are using. These findings are consistent with the argument that the conventional outcome measures are not sensitive to the type of developmental changes hypothesised to occur as a result of job redesign.

9.1.5 Summary and discussion of results

The analyses to date have involved examining the effects of introducing product-lines on peoples' job content, their orientations, and other outcome variables. Some retrospective perceptions of change have also been described. The most important results to emerge so far relate to the research proposition involving job control and orientations. These are summarised and discussed first, followed by a brief discussion of the findings for the subsidiary analyses (i.e. changes in conventional outcomes), and some general comments about the implications of these results for IM.

9.1.5.1 Job control and orientations

The results support the proposition that, when introducing IM initiatives, change in role orientations among shopfloor employees is contingent upon more autonomous forms of work design (the findings for Strategic Beliefs will be discussed later). Where the introduction of product-lines increased job control (i.e. for the Intervention Group), people reported increased ownership for a range of problems, viewing production problems as more of 'their problem' and part of their role, and they developed a wider perception of the sorts of knowledge and skills needed to perform their job. Extra analyses and the design of the study suggested that these changes were not simply the result of response-bias, mortality, selection, or testing. Further, the finding that there were no corresponding changes in orientations in the comparison groups suggests that the increase in orientations are not simply the result of history, maturation, or other factors. The consistency of results with observational and qualitative data also enhances confidence in these conclusions.

In addition, the maintenance of high orientation scores for the Changed Comparison Group (i.e. employees' whose jobs had been redesigned more than three years earlier) suggests that the development of broad orientations is a relatively stable change. This is consistent with earlier arguments that a change in orientations can be seen as a developmental change, and can be likened to a 'gamma-change' in perspective that is not easily reversed (Golembiewski, *et al.* 1976).

One issue that deserves further discussion is that members of the Changed Comparison Group, especially those who in the Pioneer Team, have higher scores on all the orientation measures than employees in the Intervention Group at Time 2 or Time 3. That is, it appears that the latter employees have not completely 'caught up' with those who piloted the changes. One explanation of this relates to the research proposition. That is, even though the jobs of operators in the Intervention Group increased in complexity and control, the Changed Comparison Groups' jobs are still the most complex and autonomous (see Table 9.1) and thus broader orientations are required. This seems to be particularly the case for the Pioneer Team where, unlike the other groups, they build a complete end-product rather than just boards, their tasks overlap with the Staging department, and they are highly dependent on other product-lines for parts. The higher orientations of the Changed Comparison Group may also reflect a selection effect. Although members of the Pioneer Team were not considered to be 'ideal' candidates when they first joined the team, they nevertheless were different from the Intervention Group in that they voluntarily chose to be in the pilot team. Being in this team, they also received a great deal of technical support and management attention that the other groups have not received to the same degree.

It is important to note that, although the research proposition was supported for Production Ownership and Production Knowledge, there was no change in employees' scores for Wider-production Knowledge. That is, the extent to which they acknowledge the importance of knowing about issues such as marketing/sales, design, engineering, and customers did not change. This was consistent with employees' retrospective perceptions of change where fewer people reported an increase in their knowledge outside of production. Interestingly, these results relate to Management's perception of some of the residual problems with product-lines in the company. Historically, product-lines were conceived of and driven from within Production, and this, in turn, meant a lack of ownership of the strategy across the whole of Manufacturing. Various problems have emerged, especially at the interface between Production and support departments such as those involving engineering, planning, and purchasing. For example, the engineering department's priorities often do not match those of the product-lines who need prompt responses to repair machine breakdowns to keep the line flowing. If future changes are made to better integrate Production with other manufacturing departments, employees' might report increased scores on Wider-production Knowledge.

Somewhat different results were found for Strategic Beliefs. The Test Comparison Group scored higher on this variable than other groups at all times, and all groups' scores increased over time (although the changes for the Test Comparison Group and the Changed Comparison Group were not quite significant). This suggests that increases in scores on this variable derive from factors other than job design; a conclusion that is consistent with the results of the cross-sectional study (where there were no significant differences in scores between people whose jobs were redesigned and employees in conventional jobs), and with the study reported in *Chapter 7* (where there were increases in scores even when the IM initiative did not enrich jobs).

One possibility is that the increase in scores simply reflects a testing effect. Although this cannot be ruled out, it is more likely that the measure reflects a different construct to the role orientation measures. For example, consider the item from the Strategic Beliefs scale: 'Managers and Specialists (e.g. engineers) should be the people that make suggestions to improve production efficiency'. People may well understand that this should not be the case and may accept the reverse of this statement 'in theory', but 'in practice' people may not actually own the changes to their role that such a principle entails. The difference between strategic orientations and role orientations might reflect this difference.

Moreover, these constructs appear to reflect different learning processes. Changes in strategic orientations are not dependent on enhanced control. Instead, they appear to arise from supervisors' communications, from training courses, and from other 'messages' about the companies philosophies. This explanation would account for the fact that the test engineers scored highest on this measure. These employees, being more highly educated, are probably able to quickly understand the intent of the strategies and the principles underlying them, although this does not necessarily affect them taking on board what these strategies mean for their individual role (i.e. their role orientations). In contrast, as suggested by the relationship of these variables with job control, changes in Production Ownership and Production Knowledge may reflect experiential changes, or a 'learning by doing' process, that requires enhanced autonomy. For example, through working in an autonomous group, employees may develop broader awareness and interest in problems that occur, and thus come to feel they 'own' them.

9.1.5.2 Conventional outcome measures

Contrary to what was predicted, operators did not report greater job satisfaction, commitment to quality, or better mental health. The only change was in anxiety where operators reported greater Anxiety-contentment at Time 2 than at Time 1, but this then dropped off at Time 3. These findings contradict other research where increased control has resulted in increased job satisfaction and well-being (e.g. Wall, *et al.* 1986). There are several points to be made about this finding.

First, there may be something unique about the sample. In particular, it may be that Company F employees were highly content and satisfied relative to other samples before product-lines were introduced. Looking at Job Satisfaction scores for comparable samples that have used the same measure, this seems to be the case. At Time 1, prior to the intervention of product-lines for most employees, the mean score for the operators was 5.01 (SD = .71). This is higher than the mean obtained for the blue-collar sample used to obtain norms for the scale (Warr, Cook and Wall, 1979; $\overline{X}$ = 4.70, SD = 1.04). It was also higher than the starting point in another sample in which job redesign was shown to result in a significant increase in satisfaction (Wall, *et al.*. 1986). Specifically, in the study by Wall and colleagues, for the group whose jobs were changed over time (Group B), the mean Job Satisfaction score for a matched group of twenty five employees in traditional jobs was 4.60. With job redesign, this significantly increased to 5.20 at Time 2, and 5.00 at T3. Thus, the pre- job redesign mean for Company F was about the same as the post- job redesign mean obtained in Wall *et al.*'s change study. The pre- job redesign mean was also substantially higher than that reported by other employees in traditional jobs used in this thesis (i.e. $\overline{X}$ = 3.86 in Company P and $\overline{X}$ = 4.12 in Company D). Thus, it seems that the operators in Company F were already more satisfied and content than other employees working in traditional jobs. This probably reflects the general conditions at this company prior to intervention. That is, even though the operators worked in narrow jobs, the conditions were modern and clean, canteen facilities were shared by management, and operators were paid more compared to other companies.

Having a high baseline to begin with makes it harder to detect change (especially if these scales lack sensitivity at the positive ends). It can also alter the meaning of a 'lack of change' in that, rather than this being seen as a 'failure', it needs to be re-construed as a positive finding where 'high levels are maintained'. More generally, however, these results confirm the value of the orientation measures. That is, job satisfaction and other similar affective reaction measures are not intended to be sensitive to the types of developmental changes that can take place within employees. Some evidence for this came from the retrospective accounts by operators' in the Intervention Group at Time 2. It was suggested that a 'beta' change in job satisfaction may have occurred. That is, as a result of the job redesign, people's expectations for jobs and their view of what an ideal job involves may have increased, thus enhancing people's threshold for being 'satisfied' with a job. Buchanan and McCalman (1989) report a similar instance where employees in high-performing teams were asked whether they would like to 'go back' to traditional ways of working. The reported feedback was "Absolutely not. Why? Because its not challenging intellectually, we are involved in things we never dreamed of, we never dreamed we would get involved in, and now we are doing it naturally every day" (p.115). In a survey of the same employees, people felt team-working showed people they had capabilities they didn't realise before and increased their feelings of self-confidence.

This latter suggestion relates to arguments made in the introductory chapters that there is a need to go 'beneath the surface' of self-reported job satisfaction because existing job satisfaction instruments only measure a superficial attitude (Hackman and Oldham, 1980). Bruggerman *et al.* (1975) have proposed that different types of satisfaction exist according to people's aspiration level. For example, 'resigned job satisfaction' is where dissatisfaction is diffused by lowering aspiration, 'stabilised job satisfaction' is where the level of aspiration is kept constant, and 'progressive job satisfaction' is where the level of aspiration is enhanced and people seek new possibilities for development. In the current study, people may have moved from 'resigned' or 'stabilised' job satisfaction to 'progressive' job satisfaction. This movement would not necessarily be reflected in changes in scores on the measure of job satisfaction used in this thesis. Thus, either alternative measures of job satisfaction are needed that tap these different levels, or existing measures of satisfaction should be used in conjunction with measures such as orientations that are deliberately designed to tap growth and development. This is not to deny the value of the conventional outcomes which, even as indicators of 'no change', are critical to the evaluation of IM initiatives. However, here the psychological effects of the job redesign were uniquely revealed by the orientation measures and this is a strong reason for their inclusion in job design evaluations.

9.1.5.3 General issues for Integrated Manufacturing

Although it was not a specific aim of this study to do so, the results highlighted some issues for IM. First, as identified by Kern and Schumann (1987), there can be 'winners' and 'losers' of the same intervention Operators within the Intervention Group and the Changed Comparison Group fall into the first category. Their jobs have been enriched and they have developed in the way they see their jobs and the work environment. Test engineers were clearly the 'losers' in the introduction of product-lines. Their jobs were not enriched and they became more strained and less committed to quality. They felt dissatisfied with the use of their skills, their potential for career development, and the company's attitude towards them. Not surprisingly, they did not develop broader orientations. The test engineers' experience is consistent with other job re-design studies where specialists have resisted changes such as multiskilling and group-working (e.g. Cordery *et al.* 1991). There is clearly a need for more research into the role of specialists within IM, particularly given arguments that devolution of support functions (e.g. production support, quality, maintenance, training) to cells in necessary for their success (Ingersoll Engineers, 1990; O'Brien *et al.* 1987). In such cases, practices can vary from a specialist simply being made accountable to the team and retaining sole responsibility for specialist skills, to specialists being integrated in the team, becoming multiskilled and sharing responsibility for the skill with other team members. These different roles are likely to have different consequences for employees' jobs and the groups' productivity.

In summary, the results in this section have provided strong support for the proposition that the development of new and broader role orientations is contingent on enhanced control. Changes in strategic orientations appear to be a reflect a more general effect, possibly facilitated by factors such as culture and education. Both types of orientation measures, however, operate differently to outcome measures that are usually used in job design studies and appear to tap more developmental-type changes.

9.2 Relationship between orientations and performance

The second proposition investigated in this thesis is that, within IM contexts where operators have complex jobs, those operators with broader, pro-active role orientations and more appropriate strategic orientations will be better performers. Earlier, it was argued that good performers in IM contexts are those who engage in high performing behaviours (e.g. making suggestions, solving problems across a broad domain). In line with Porter and Lawler's (1968) model, it was suggested that employees who understand the requirement to perform such behaviours and who incorporate this understanding into their orientations will direct their effort towards performing these behaviours. It was also suggested that having appropriate strategic orientations *would* guide the application of appropriate effort and thus would predict individual performance. The proposition was restricted to situations where employees' had sufficient control to act on their orientations.

The greatest difficulty in testing this research proposition is the accurate measurement of performance. Ideally, objective data at an individual level are required. However, even if the requirements of a job are very narrow (e.g. making a certain number of parts per day), it is often impossible to get such figures and they can be meaningless if they are obtained. For example, the number of parts made may be affected more by factors out of the operator's control (e.g. machine breakdowns) than by any operator actions. The problems are compounded if the jobs are group-based and complex, as is the case in the current study. Product-line members are required to perform multiple tasks and to co-ordinate their actions with the rest of the group. In such a case, objective data at the group level might seem most attractive. However, unless all groups work in the same conditions (e.g.with the same technology) and assess the same aspects of performance, comparing group productivity will be confounded with other factors. Similarly, comparing *change* in group performance does not take into account differences in potential for improvement due to different products, technology, and so on. Thus, group level data were not a feasible indicator of performance here.

Aldag and Brief (1979) suggested that "a good measure of job performance will exhibit a high degree of face validity, will be easily understood, and will tap those behaviours which are essential to organisational effectiveness" (p. 26). To meet these criteria, ratings from supervisors were used as the key measure of an individual's performance. Although this method is susceptible to supervisor bias, it deals with some of the problems described above. It allows assessment on complex job requirements that cannot be measured objectively (e.g. the way an operator deals with customers), it means the supervisor can take into account potentially confounding variables (e.g. the particular machine used) when assessing an individual's performance, and it allows for an individual's contribution to the group to be rated if this is an important factor.

A second source of performance data was the extent of employees' skill levels (i.e. the breadth and depth of skills). This data, obtained from skill matrices compiled by teams, is relatively objective and thus complements the use of more subjective supervisor ratings. The skills included in the matrices are those that have been identified by the teams to be critical for their effective functioning. As such, the extent to which an individual possesses these skills, either in terms of in-depth knowledge, broad coverage, or both of these aspects, is likely to be an important performance indicator. Skill level also indirectly taps other aspects of performance, such as willingness to learn, that are likely to be important within IM.

9.2.1 Design and predictions

Supervisor ratings were collected on two occasions, and skills data were collected on one occasion. Figure 9.4 shows when this information was obtained in relation to the questionnaire surveys.

Months	0	2	4	6	8	10	12	14	16	18	20	22	24
Survey	T1								T2				T3
Supervisor's ratings			P1							P2			
Skill data													S1

Figure 9.4: The timing of performance ratings and skill data in relation to the surveys

Four major associations are examined. First, employees' orientations at Time 1 are related to supervisor ratings of performance obtained four months later (P1). It is expected that orientations will predict performance ratings. For the employees who have already been working in product-lines (i.e. members of the Changed Comparison Group), the extent to which people have taken on board the new role requirements, as reflected in their orientation scores, is expected to relate to their performance. For the Intervention Group and Test Comparison Group, whilst they had only been formed into product-teams for a short time, they were nevertheless working within a high-performance culture. They had undergone Crosby quality training, they were familiar with the rationale and outcomes of the pilot product-line project, and they had received formal and informal information about the product-line strategy. They also had sufficient autonomy such that good performers could seek out different tasks and negotiate a broader role for themselves.

Second, the association between employees' orientation scores at Time 2 and supervisors' ratings of performance obtained three months later (P2) are examined. At Time 2, all employees had been working in product-based groups for at least 15 months. Role requirements had clearly changed, and employees had complex jobs with sufficient autonomy to develop and act on appropriate orientations.

Third, the association between employees' orientation scores at Time 3 and their skill breadth and depth at that time (S1) will be examined. It is expected that employees with a wider and/or more in-depth skill base will have broader orientations. This may be because their orientation (and the competencies and motivation that their orientations reflect) fosters their desire to take on more skills. Alternatively, it may be because taking on more skills increases employees' knowledge and awareness, and they thus develop a broader orientation.

Fourth, changes in performance ratings will be related to changes in orientation scores. This is a stronger test of the relationship between orientations and performance as any effects due to cognitive ability that are associated with individual performance ratings will be eliminated.

An additional potential link to performance will also be investigated; that is, the relationship between performance and two conventional outcome measures (i.e. job satisfaction and quality commitment). This is a subsidiary analysis only, and the main reason for carrying it out is to highlight differences between orientation measures and conventional affective reaction variables. Commentators from many different perspectives have argued that more satisfied workers will be better performers, including organisational (e.g. Gross and Etzioni, 1985), socio-technical (Emery and Trist, 1960) and human relations (e.g. Likert, 1961; McGregor, 1960) perspectives. Yet, reviews of research have consistently found the relationship between job satisfaction and performance to be relatively low (Iaffaldano and Muchinsky, 1985; Kelly, 1992; Vroom, 1964), with a variety of reasons being put forward to account for this (e.g. research design characteristics, measurement problems, rewards, and personality characteristics). From the perspective of this thesis, a problem with job satisfaction is that it is likely to reflect the amount of effort, but not the direction of effort, that an individual applies. This is in contrast to orientation variables that were deliberately designed to tap the likely *direction* of effort. Hence, it is predicted that Job Satisfaction and Quality Commitment will be less important predictors of individual performance than the orientation variables.

9.2.2 Measures

Two measures of role orientation (i.e. Production Ownership and Production Knowledge) and the measure of strategic orientations (Strategic Beliefs) were used in these analyses. Wider-production Knowledge was excluded as this measure did not change over time, and had no zero-order associations with performance ratings or skills scores.

9.2.2.1 Supervisor ratings of performance

The method used to obtain supervisors' performance ratings P1 and P2 varied slightly. The first set of performance ratings (P1) was based on repertory grid interviews (Kelly, 1955) with the three supervisors of Production employees. Using a triad procedure with employees as elements, supervisors' individual perfomance constructs were obatined. Supervisors' then rated operators on each of their constructs on a scale from 1 to 5; the higher the score, the closer the employee was to the positive end of the construct. For each individual employee, the ratings were summed and divided by the number of constructs to form an average performance score. Appendix 7 contains a more detailed rationale for and description of the repertory grid technique, and a summary of the constructs elicited by supervisors[1].

The second set of performance scores (P2) came from supervisors' ratings on the same five dimensions. These dimensions were the most salient of a larger set obtained from an extensive analysis of the repertory grid data from the above three supervisors, and from five other managers in the company (for details, see Parker *et al.* in press, and Appendix 7). The five dimensions include: self-directed, takes initiative and breaks new ground (vs. needs direction and instruction); committed to production goals and schedules (vs. a lack of commitment to goals and schedules); wide breadth of knowledge of the production process (vs. narrow knowledge); effective in dealing with others, such as speaking out, communicating well and helping others (vs. ineffective in dealing with others); and overall high performer (vs. overall low performer). The two supervisors of product-lines (one of the previous supervisors had been made redundant) were asked to rate employees on these dimensions using a five-point scale. An average performance rating was then obtained from the scores on these dimensions.

For both sets of performance ratings, analyses were conducted to examine whether different supervisors tended to rate employees higher or lower than their colleagues. First, for P1, an analysis of variance was conducted on the three supervisors' mean performance scores. There were no significant differences in the means, F (2, 49) = 1.57, suggesting the supervisors' used the 5-point scale in a similar way. Similarly, for P2, there was no significant differences in the two remaining supervisors' mean scores on the scales, $t < 1$, d.f. = 58. A summary table of these results in shown in Appendix 7. The correlation between the first and second set of ratings when there was no change in supervisor was .69. This seems realistic given the expected changes in people's performance over this period.

9.2.2.2 Skill data

Each of the nine product-lines had a unique skill matrix (completed by team members themselves) used to monitor individual and group skill development and training needs. Each matrix had a list of all the necessary skills within the product-line on one axis, and a list of all the team members on the other axis. For each individual, the competency level obtained for each skill was indicated from 0 (no competency) to 5 (capable of

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[1] It should be noted that the supervisors were not aware of any intentions of the author to relate these ratings to orientations; and the interviews were conducted by two other researchers who were not aware of this aim. The information on supervisor's constructions of performance was being collected as part of a wider project to improve the performance appraisal system (Parker, *et al.* 1994).

training others). A total skill score was obtained for each individual by summing the competency scores across the skills, and then dividing by the number of skills in the matrix. It is worth noting that the matrices were not used for remuneration purposes, and supervisors discouraged people from expecting a direct link between their skill scores and their pay.

Some validity data for this measure are provided by a comparison of mean skill scores for different groups. First, there were significant differences between the groups described in the longitudinal study, F (2, 49) = 8.53, $p < .001$. As would be expected, the Test Comparison Group was the most skilled ($\overline{X} = 2.06$), followed by the Changed Comparison Group ($\overline{X} = 1.85$), and then by the Intervention Group ($\overline{X} = 1.39$). Second, there were significant differences between the nine product-lines, F (8, 43) = 3.56, p = .003. The highest scoring group was one set up to manufacture a new product, which thus contained a disproportionate number of skilled specialists, and the Pioneer Team was the second highest scoring group.

The correlation between skills scores (S3) and the performance ratings (P2) was .52**. As would be expected, these indices are related. They are nevertheless sufficiently different to be considered as constructs that warrant separate analyses.

9.2.3. Analyses and results

9.2.3.1 Predicting performance ratings and skills scores

Separate hierarchical regression analyses were performed to examine: the effect of Time 1 orientation scores on the first set of performance ratings (Analysis A), the effect of Time 2 orientation scores on the second set of performance ratings (Analysis B), and the effect of Time 2 orientation scores on skills scores (Analysis C). Hierarchical regression was used as this method allows the entry of separate variables or blocks of variables in order of priority (see Appendix 2 for guidelines to the use of hierarchical regression in this thesis).

In each case, the first block of variables to be entered in the equation were 'dummy variables'. These were formed for each analysis to partial out supervisor effects (or, in the case of the skills scores, group effects). Entering these variables first allows a test of the importance of predictors over and above the variance accounted for by supervisor or group effects. Following this, the order of entry of dependent variables was Production Ownership, Production Knowledge, and Strategic Beliefs. Production Ownership was entered before Production Knowledge as it is a more succinct scale. Strategic Beliefs was entered last as it appeared to be a different construct to the role orientation variables. Summary results for each of these regression analyses are shown in Table 9.7.

In each analysis, the predictor variables had a significant effect on performance scores when all the variables were entered in the equation ($R = .49$, $R = .46$ and $R = .73$ for Analysis A, B and C, respectively). However, this overall figure includes the contribution of the dummy variables, and it is necessary to look at what variance is predicted by orientation variables alone.

For Analysis A, after entering the dummy variables, the entry of Production Ownership accounted for a significant increment in R^2 (F change = 9.26, $p < .01$) and explained a further 17% of the variance in ratings. There was no further increment in R^2 after entering Production Knowledge or after entering Strategic Beliefs. This does not mean, however, that the latter variables are not important for performance. Although Production Ownership was the only variable that had a significant independent contribution to the performance scores, the importance of this measure in preference to the others is mostly attributable to the order it was entered. In the final equation, beta weights for all the orientation variables were similar and none were significant. This latter finding reflects the intercorrelations between the orientation measures. In total, the orientations measures accounted for about 22% of the variance in the performance ratings.

For Analysis B, a similar amount of variance in performance scores was independently accounted for by orientation scores (19%). However, in contrast to the previous analysis, Production Ownership did not have a significant independent contribution to the equation. Instead, Strategic Beliefs was a particularly important predictor. It was the only variable with a significant zero-order correlation and a significant beta weight. It also had a significant independent contribution above and beyond Production Ownership and Production Knowledge.

Finally, for Analysis C, the orientation measures accounted for 15% of the variance in skills scores over and above the 37% accounted for by group membership. Production Ownership had a significant independent contribution, accounting for about 5% of this variance, with Strategic Beliefs accounting for a further 10%. Production Knowledge did not make an independent contribution to the prediction.

Table 9.7: Regression results with Time 1 orientations as predictors of Time 1 ratings (Analysis A), Time 2 orientations as predictors of Time 2 ratings (Analysis B), and Time 3 orientations as predictors of skills scores

Step No	Variable entered into the equation	**A. Predicting Time 1 ratings** N = 48			**B. Predicting Time 2 ratings** N = 43			**C. Predicting Time 3 skills** N = 53		
		Hierarchical Results		Final Results	Hierarchical Results		Final Results	Hierarchical Results		Final Results
		R	R^2 Change	Beta's	R	R^2 Change	Beta's	R	R^2 Change	Beta's
1.	Dummy Variables[1]	.14	.02	-.02 .12	.14	.02	-.27+	.60**	.37**	range from -.18 to .34
2.	Production Ownership	.44*	.17**	.19	.19	.02	-.01	.65**	.05*	.17
3.	Production Knowledge	.46*	.02	.24	.29	.04	.14	.66**	.01	.08
4.	Strategic Beliefs	.49*	.03	-.19	.46*	.13*	-.40*	.73**	.10**	-.34**

***$p < .001$; ** $p < .01$; * $p < .05$; $^{+}p < .10$

[1] Note that the dummy variables for Analysis A represent supervisor effects for 3 supervisors; for Analysis B represent supervisor effects for two supervisors, and for Analysis C represent group effects for the 9 product-lines.

9.2.3.2 Predicting change in performance ratings

Regression analyses were performed to determine whether change in the orientation scores predicts change in performance ratings. These analyses were conducted on only those employees who had performance ratings from the *same* supervisor at both times, and who also completed the survey at all three time points. This resulted in a sample size of about 25 people. A new dummy variable was formed that captured the variance of the two supervisors who were present at both times.

A hierarchical regression procedure with Time 2 performance ratings as the dependent variable was used. First, the variance due to supervisor effects was partialled out by entering the dummy variable. Next, the Time 1 performance ratings were entered into the equation, thus effectively creating change in performance scores. Orientation scores at Time 1 were then added, allowing a test of the question: Do orientations at Time 1 predict changes in performance? The final predictor entered into the equation was a difference score for the role orientation measures; that is, the difference between the mean of Time 2 and Time 3 scores and the Time 1 score, calculated using the equation (Time 2 + Time 3) / 2 - Time 1. This allowed an answer to the question: Do changes in orientations predict changes in performance above and beyond initial orientations?

This procedure of entering Time 1 orientations followed by difference scores was preferred to using only the difference scores to predict changes in orientations. The latter (referred to as 'dynamic correlations' by Wall and Payne, 1973) do not take into account differences in initial levels. For example, a person with a very high score on orientation variables at Time 1 will not have the same scope for improvement as a person with a low score on these variables, thus distorting the results.

Because of sample size restrictions, separate regression analyses were performed for each orientation variable. Moreover, as recommended by Stevens (1986), to increase the power of the tests (i.e.the probability of rejecting the null hypothesis when it is false) a more liberal alpha value of .10 was used.

Results for each regression analysis are shown in Table 9.8. Most of the variance in performance ratings at Time 2 was accounted for by ratings at Time 1. Nevertheless, changes in Production Ownership had a significant independent contribution to the equation (R^2 change = .08, $p < .10$). The beta weight was positive (beta = .39, $p < .10$) suggesting that employees whose performance ratings increased also reported an increase in their ownership of problems. Changes in Production Knowledge contributed 6% to the equation, although this was not a significant amount. Changes in Strategic

Beliefs did not have a significant independent contribution to changes in performance, adding only about 1% of variance to the equation.

Caution is needed in interpreting these findings as the sample size is very small. A significant finding with a small sample size may indicate either a particularly large effect (because the power of the analysis is low) or a 'quirky' result due to, for example, a few extreme cases. To check against the possibility of individual outliers distorting the results, a plot of change in ownership against change in performance was inspected. This suggested there were no distorting outliers. Moreover, using recommended statistical criteria (Stevens, 1986; Tabachnick and Fidell, 1989), there were no univariate or multivariate outliers. No cases had z-scores greater than absolute value of 3.00, no cases had Mahalanobis distances greater than the recommended value, and there were no influential cases where the change in the regression coefficient due to omitting the case (i.e. Cooks' distance) was greater than one. Thus, while the finding may be sample specific, it is clearly not the result of a few extreme cases.

9.2.3.3 Conventional outcome measures as predictors

The relationship between job satisfaction and quality commitment with performance was examined. It was predicted that these variables would be less predictive of performance in IM contexts than the orientation measures. Parallel analyses to those described above (i.e. Analysis A, B and C) were conducted with these measures as predictors instead of the orientation variables. In each case, the supervisor dummy variables were entered before the outcome measures.

Considering firstly the Time 1 performance ratings. As predicted, after entering the dummy variables, Job Satisfaction and Quality Commitment did not have a significant contribution (R^2 change = .02, F change < 1). Neither beta weights in the final equation were significant. In contrast, for predicting Time 2 performance ratings, these variables had a significant contribution after entering the dummy variables (R^2 change = .26, F change = 5.73, $p < .01$). The beta weights were -.17 (n.s.) and -.39 ($p < .10$) for Quality Commitment and Job Satisfaction, respectively. These negative beta weight suggest that people who were less satisfied and who had lower commitment were more likely to be better performers. For the prediction of skills scores, the conventional outcome variables did not have a significant independent contribution (R^2 change = .03, F change = 1.67). However, like the prediction of Time 2 ratings, the beta weights for Quality Commitment and Job Satisfaction in the final equation were both negative: beta = -.08 (n.s.) and -.26 ($p < .15$), respectively.

Table 9.8: Separate regression analyses for each orientation measure, with change in orientation score as predictors.

		Production Ownership N= 23			Production Knowledge N = 19			Strategic Beliefs N = 22		
		Hierarchical Results		Final Results	Hierarchical Results		Final Results	Hierarchical Results		Final Results
Step No	**Variable entered into the equation**	R	R^2 Change	Beta's	R	R^2 Change	Beta's	R	R^2 Change	Beta's
1.	Supervisor Variance	.28	.08	.28	.31	.09	-.23	.31	.10	.17
2.	Performance Time 1	.72***	.44***	.56**	.73**	.44**	.88**	.72***	.41***	.55**
3.	Orientation Measure Time 1	.73**	.00	.37	.75**	.03	-.55$^+$	.74***	.04	.26
4.	Orientation Measure Change (T2+T3) - T1	.78**	.08$^+$	.39$^+$	.79**	.06	-.46	.75***	.01	.08

***p < .001; ** p < .01; * p < .05; $^+$p < .10

In summary, it was certainly not the case that highly satisfied and committed employees are perceived as the best performers. Indeed, as there was a negative relationship between performance and these outcome variables, the tendency was for the reverse to be true. This is most likely a reflection of the extreme scores on these variables held by the test engineers at this time. That is, the test engineers had higher than average performance ratings and were also the least satisfied group with the lowest reported commitment. These results serve to further illustrate the difference between orientation measures and those conventionally used as outcome variables in job design research.

9.2.4 Summary and discussion of performance analyses

The results support the second research proposition that those people with broader and more appropriate orientations will be better performers within autonomous IM contexts. The combined orientation measures were significant predictors of supervisors' performance ratings on two separate occasions, and also predicted employees' skills scores. The consistency of results across different periods, and with two types of performance indicators, increases confidence in these findings. Moreover, there was evidence to suggest that change in orientations predict change in performance ratings, thus ruling out the interpretation that orientations function simply as proxy variables for cognitive ability. All in all, the results suggest that the development of broader orientations is necessary for effective performance within IM, thus enhancing the validity of this approach.

The relative importance of different orientation measures varied across analyses. For the prediction of Time 1 performance ratings (P1) the orientation measures were equally important. However, for the prediction of Time 2 ratings (P2), the only variable with a significant independent contribution and significant beta weight was Strategic Beliefs. For the prediction of skills scores at Time 3, Production Ownership had a significant contribution to make, although Strategic Beliefs made an even greater contribution. It seems that, whilst all the measures are sensitive in the early stages of change, over time Production Ownership loses some of its discriminatory power and Strategic Beliefs remained sensitive to differences in performance. Interestingly, only change in Production Ownership was related to *change* in performance ratings.

One possible explanation of these results is that, as suggested earlier, enhanced Strategic Beliefs may reflect a raised awareness and understanding that derives from multiple sources, such as training programmes, the presentation of business information, and supervisory communication. Changes in role orientations, on the other hand, may be a more dramatic 'gamma-type' change that occurs as a result of interaction with the complex IM jobs did not develop new orientations, even with extensive training and support. Age is frequently put forward as an explanation of this, with many managers believing that older people do not adapt well to change. Certain personality factors, such as desire for challenge, may also affect the extent to which people take on board new orientations.

The purpose of this section is to more systematically examine the influence of such factors on the development of orientations. Four groups of factors are considered: contextual factors (such as management support); expectations about the IM intervention; biographical variables (such as age and gender); and individual difference variables (such as desire for challenge). For each set of factors, analyses are performed to determine whether scores on the variables at Time 1 predict *change* in orientation scores over the period in which product-lines were introduced (i.e. from Time 1 to Time 2). These analyses are exploratory in nature and the focus is on identifying avenues for further inquiry rather than testing hypotheses (as such, details of the measures and the results tables are given in Appendix 8). Small sample sizes restrict the power of the analyses, and thus interesting trends are noted using statistical criteria as a guideline rather than as a rigid cut-off point.

9.3.1 Method

9.3.1.1 Measures

The same orientation measures as used in the performance analyses are included in this investigation (i.e. Production Ownership, Production Knowledge, Strategic Beliefs). The predictor variables, summarised next, are from the Time 1 survey.

Biographical variables included: age in years, organisational tenure, job tenure (in years completed) and gender (male = 1, female = 2). A square root transformation was applied to length of time in the job as this variable was significantly skewed and had two univariate outliers.

The individual difference and contextual variables were either existing scales or were formed from factor analysis. Appendix 7 describes the derivation and intercorrelations of the variables in more detail, and presents a complete list of all the items in the scales. Here, a brief description of the variables is presented (grouped according to the regression analysis they will be examined within). All scales (except Network Size) have a five-point response-scale from 1 ('strongly disagree') to 5 ('strongly agree').

Individual difference variables

Confidence: This is a 5-item scale containing items assessing perceived competence ('e.g. I am good a thinking of better ways to do things', 'I can do just about anything when I set my mind to it') Cronbach's alpha was .83.

General Locus of Control: This includes two items assessing people's perception of control over their life and the future (e.g. 'What happens to me in the future mostly depends on my own efforts'). The items differ from those in the Confidence scale in that they are more general and refer to life outside of work. Cronbach's alpha was .73.

Persistence and Challenge: This is a 4-item scale assessing the extent to which people like to work hard, take on responsibilities and persist at problem-solving (e.g. 'I work hard to be the best at what I do'). Cronbach's alpha was .67.

Tolerance of Role Ambiguity: This is a 3-item subscale concerning people's tolerance of not knowing exactly what their role responsibilities include (e.g. 'In general, I like to know exactly what is expected of me', reverse scored). Cronbach's alpha was .51.

Preferences for Methodical: This is a 3-item scale assessing people's preference for working in a methodical way, doing things one step at a time, and leaving things tidy. Cronbach's alpha was .50.

Contextual factors

Communication: This is a 5-item scale concerning the extent to which people believe their supervisor keeps them informed about issues, changes, departmental objectives, and expected results. Cronbach's alpha was .84.

Consultation: This is a 6-item scale assessing the extent to which employees perceive that management consults them and 'practises what they preach'. Cronbach's alpha was .79.

Team-working: This is a 4-item scale concerning the extent to which people believe others in the department work co-operatively as a team. Cronbach's alpha was .82.

Co-worker Support: This is a 5-item scale concerning the amount of help people perceive they get from others in the work group to deal with work and interpersonal problems. Cronbach's alpha was .83.

Network Size: This contains 2 items assessing the number of people 'you need to work closely to in order to do your job' and 'you need to talk to in order to get information or materials to do your job'. The response scale for both items was: 1(no people), 2 (1-3 people), 3 (4-5 people), 4 (6-9 people), 5 (10 or more people). Cronbach's alpha was .82.

Expectations about product-lines

Positive for Jobs: This is an 10-item scale assessing people's perceptions of the extent to which their job will change in positive ways with product-lines, including increasing the opportunity to develop more skills, the amount of responsibilities, how interesting the work is, the amount of control over work, the amount of flexibility, the amount of pay, and the job's status (Cronbach's alpha was .81).

Positive for Business: This is a 4-item scale examining the extent to which people perceive product-lines will be good for the company business. Cronbach's alpha was .90.

9.3.1.2 Analyses

To examine whether these variables influence the extent of change in orientations, hierarchical regression analyses were performed. Separate analyses were conducted for each of the three orientation measures with each of the four groups of variables as predictors. This meant a total of 12 regression analyses. Strictly speaking, to guard against spurious results due to multiple tests, the alpha level should be made more stringent. However, with the small sample size in this study, this would dramatically decrease the power of the test. Stevens (1986) suggests a more liberal alpha (such as .15) when the sample size is small. Here, an alpha of .10 is used, although results with probability values less than .20 will be mentioned.

For each regression analysis, the dependent variable was change in orientation scores from Time 1 to Time 2. First to be entered into the equation was the orientation scores at Time 1. This was entered before the predictor variables, thus enabling a test of their importance having taken into account peoples' initial orientations. Also entered prior to the predictor variables were two dummy variables that captured the variance associated with different group membership. This was necessary to ensure that the different characteristics of the groups did not dominate the prediction of change[1]. Following the

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[1] Using the whole sample without the group variance partialled out gave a very similar pattern of relationships, although the size of the relationships were larger. (This was also the case when only members of the Intervention Group were included in the sample). The most conservative results are reported here.

entry of dummy variables to capture group effects, the predictor variables were entered into the equation.

9.3.2. Results and discussion

Results for each of the groups of variables are considered separately, and only significant or almost significant findings are presented. More detailed results can be gained from the tables in Appendix 8.

9.3.2.1 Biographical variables

Length of time in the job and gender were the most important factors in predicting change in orientation scores. First, length of time in the job had a significant positive association with change in Production Ownership (Beta = .31, p < .10), and an almost significant association with change in Production Knowledge (Beta = .22, p < .20). This finding is not particularly surprising: the longer people have been in an enriched job, the more they are likely to have changed. More interesting is the significant association between change in Production Knowledge and gender (beta = .38, p < .05). Women were more likely than men to report an increase in Production Knowledge with the introduction of product-lines. One possibility worth exploring is that women have traditionally been recruited to perform low-level assembly tasks, and remain in these positions because of the male dominated power structure of the organisation (see, for example, Firth-Cozens and West, 1991). When their jobs are re-designed, this may give women an opportunity to fulfil their potential that otherwise may not have existed. Another finding worthy of further investigation is that age was not significantly associated with change. This conflicts with commonly held views that older people do not cope as well with change.

9.3.2.2 Individual difference variables

On the whole, the findings concerning individual difference variables suggest that certain types of people may be more likely to adjust to changes in the role requirements within IM contexts. The most consistent result occurred for Persistence and Challenge. This was an important predictor of change in Production Ownership (beta = .24, p < .10), Production Knowledge (beta = .32, p < .05), and Strategic Beliefs (beta = .33, p < .05). This shows that those people who report a preference for working hard and being challenged are most likely to develop broader work orientations. In addition, Tolerance of Role Ambiguity was an important predictor of change in Production Ownership (beta = .26, p < .05), suggesting that people who can tolerate imprecise role descriptions are most likely to develop ownership of production problems. Finally, General Locus of Control and Preference for Methodical were additional significant predictors of change in Strategic Beliefs (beta = .37, p < .05 and beta = -.27, p < .10, respectively). Thus, people who believe they have control over their lives and who do not prefer to do things methodically (as suggested by the negative beta weight) were also more likely to develop broader orientations over time. The low reliability of the latter two measures means some caution is needed in interpreting these findings.

If these findings are shown to reliable, there are clearly important selection implications. Moreover, as suggested by arguments in the introductory chapters that jobs can affect people's personality (e.g. Kohn and Schooler, 1978; Frese, 1982; Seligman, 1975), it may be the case that these variables can change as a result of job redesign and training. For example, an individual with a need for very precise role descriptions could be made aware of how this might make it hard for them to adjust to a multiskilled job, and positive steps could be taken to facilitate greater tolerance. Similarly, a person may prefer a methodical approach to their work because this is what their job has always demanded. When the job is enriched, people may adapt and develop new preferences.

9.3.2.3 Expectations about product-lines

Having positive expectations about the effect of product-lines on jobs (e.g. that product-lines would make work more interesting) was also important. Positive for Jobs had a strong and significant relationship with change in Production Knowledge (beta = .42, $p < .05$), and was almost a significant predictor of change in Production Ownership (beta = .28, $p < .15$). This suggests that early attention to people's beliefs about the strategies may be conducive to the developmental process.

Interestingly, although important for change in measures of role orientations, neither of the expectations variables were related to changes in Strategic Beliefs. This finding is consistent with the differences between these types of measures suggested earlier. It was postulated that Strategic Beliefs reflects a general awareness of strategies and, as such, it is not surprising that peoples' expectations about product-lines do not relate to changes in their Strategic Beliefs. On the other hand, negative expectations about product-lines would probably interfere with people's engagement and involvement in more complex product-line jobs. It was suggested earlier that it is this active involvement and learning that facilitates change in Production Ownership and Production Knowledge. Consistent with this, the more positive people are about product-lines, the more they are likely to increase scores on these role orientation variables.

9.3.2.4. Contextual factors

Results suggested that people's perceptions of contextual issues at Time 1 affected the extent to which they developed new orientations over time. For Production Knowledge, a significant additional amount of variance in change scores (20%, $p < .05$) was accounted for by this group of variables. In particular, Co-worker Support (beta = .28,

$p < .10$) and Communication (beta = .42, $p < .05$) were important predictors. Thus, the more people believe that their supervisor communicates to them and the more they feel supported by co-workers, the greater the extent to which they develop a broad view of the performance requirements of their role. It is interesting to note that Communication also had a strong positive correlations with people's expectations about product-lines. This suggests that the more people are kept informed, the more positive they feel about product-lines. Thus, in light of the previous results, by fostering more positive beliefs about the intervention,
supervisory communication may also be an important indirect factor in changing people's orientations.

It should be noted that the lack of importance of Team-Working as a predictor (especially compared to Co-worker Support) probably reflects the fact that 'teams' had not been widely established at Time 1.

9.3.3 Summary and discussion of exploratory change analyses

In summary, my aim in this section was to explore some predictors of change and to generate avenues of further inquiry. Clearly, the findings presented may be specific to the particular sample and the type of change, and the exploratory style of analysis may have capitalised on chance. However, although the importance of particular variables might not be definitive, the results suggest that changes in orientations can be affected by non- job design variables. This is discussed further in terms of factors that are unique to an individual (i.e. personal factors) and organisational or contextual factors that are located outside of individuals.

9.3.3.1 Personal factors

Biographical and individual difference variables appear to affect the development of orientations. Further replication and extension of these analyses is warranted, not least because of the possible implications for selection and training. Many commentators have argued for the importance of selecting the 'right' people for IM. Snell and Dean (1992), for example, suggest that "firms using integrated manufacturing, in which more advanced or specialised skills are required, will be more likely to use selective staffing procedures to find the best and brightest workers" (p. 473). The problems in brownfield sites of not being able to select people have also been noted in several case studies. For example, a manager a Digital lamented the fact that they were not able to hire new employees "because a lot of work has gone into converting people who weren't quite with it, or who weren't with it at all" (Buchanan and McCalman, 1989, p. 113). Similarly, amongst the employees in the pilot job re-design in Company F (reported in

Chapter 8), it was felt by supervisors and group members that some people had not 'grasped' the change; and over a year after jobs were re-designed across the whole site, management still felt that 20-30% of the people had not really taken the new role on board. However, despite the considerable amount of informed opinion and case study evidence that certain types of people will perform better within IM, there has been little research on the topic. Further studies are needed to determine what individual difference variables and biographical factors affect the development of orientations; research which might ultimately identify people who will 'grasp' the new role.

If this challenge is taken up, there is much scope to improve such research. In particular, the influence of personality could be more systematically examined. First, the personality factors could be more carefully chosen on theoretical grounds, allowing more specific predictions to be made. A useful starting point would be to systematically consider the 'Big Five' dimensions of personality (Digman, 1990). These include: neuroticism, or emotional instability; extraversion, or the need for stimulation and activity, assertiveness, and the quantity and intensity of interpersonal interaction; openness/ intellect, or flexibility of thought, and tolerance of and sensitivity to feelings, experiences and new ideas; agreeableness, or a compassionate rather than antagonistic interpersonal orientation; and conscientiousness, or the degree of organisation, persistence, and motivation in goal-directed behaviour. The personality factors found to be important in this study tapped dimensions that can be seen as similar to conscientiousness (i.e. preferring to work hard and be challenged), and openness or intellect (i.e. preference for non-methodical, tolerance of role ambiguity). Interestingly, a recent meta-analysis found that conscientiousness and extroversion were important predictors of performance in a range of occupations (Barrick and Mount, 1991). Thus, it might be particularly important to look at the effect of these variables on the development of orientations.

A second way in which this research could be taken forward is to take an interactive perspective and to consider how the job redesign and other factors might foster change in these aspects of people. That is, taking the view that not only do these 'personality' factors affect people's experiences of job redesign, but that people's job experiences will affect their personality. For example, being exposed to broader and more active jobs might result in people developing greater aspiration, self-confidence, and intellectual flexibility. This argument will be developed further in the final chapter.

9.3.3.2 Contextual factors

These exploratory analyses also suggested that the development of orientations can be facilitated by attending to wider contextual factors (such as communication systems) and factors that affect employees' expectations about change. This is consistent with the qualitative accounts of change in the previous chapters, and with arguments that the success of modern manufacturing strategies will involve organisation-wide transformations(e.g. Lawler, 1992). Given the obvious practical implications of these sorts of analyses, further investigations will be immensely valuable. This is discussed further in the next chapter.

9.4 Summary of chapter

Three key findings have emerged from the longitudinal study presented in this chapter. First, strong support was found for the major research proposition investigated within this thesis. That is, the development of new and more appropriate role orientations within IM contexts was found to be dependent on the introduction of more autonomous forms of work design. An interesting finding that was not predicted concerned the measure of strategic orientations (i.e. Strategic Beliefs). Scores on this variable increased regardless of change in job control suggesting that broader cultural and contextual factors, rather than work redesign, affect people's strategic awareness. The second key finding to emerge concerned the relationship between employee orientations and performance. Both role and strategic orientations were shown predict performance within IM. Finally, as part of the secondary aim of the thesis to look at the influence of non job design factors, analyses showed that both contextual factors (such as communication systems) and personal factors (such as gender and people's desire for challenge) are likely to contribute to the development of new orientations. In summary, these results suggest that to develop the work orientations that are necessary for effective performance within IM, new initiatives should be both accompanied by job redesign and by attention to cultural, contextual, and individual factors.

In the next chapter, these results are summarised in conjunction with those from earlier chapters. Some implications and contributions of this approach to job design are put forward.

Chapter 10:
Discussion and conclusions

10.0 Introduction

My main aim in this chapter is to integrate the results from the studies reported in this thesis and to discuss their theoretical and practical implications. This includes outlining the significance of the findings for job design research, as well as putting forward suggestions for improved methodologies, further theoretical developments, and potential applications in other domains. I also take advantage of the opportunity to look beyond the specific construct of orientations to consider wider manufacturing issues and further extensions to job design research.

The basic aim of this thesis was to present an alternative, and complementary, approach to job design research that is more developmental and performance-oriented than existing approaches, and thus more appropriate within IM contexts. This aim arose from two separate perspectives. First, an historical critique *of job design research demonstrated* that the dominant theories are narrow, in terms of both a limited focus with regard to outcome variables and a lack of attention to non-motivational explanations of enhanced performance. A need for a broader range of outcome variables that do not assume a 'static' individual and that might also account for changes in performance was identified.

The second and more specific call for a new approach emerged from a consideration of job design issues in modern manufacturing. The need for organisational flexibility and responsiveness to customer demands has seen the rise of IM initiatives aimed at reducing cost, improving quality, and minimising lead time. More complex work designs have been widely presented as necessary for employees to best cope with the demands of IM and to develop the sorts of skills, knowledge and motivation they need for 'high performance'. In such situations, when more complex jobs are introduced within IM contexts, the rationale for and scope of job redesign differs from earlier initiatives to improve people's QWL, and raises new research questions. In particular, the need to understand how performance is enhanced with job redesign, as well as the need to consider developmental changes that might facilitate this enhanced performance, are emphasised.

A new dimension of job design research was thus put forward. It was argued that examining employees' orientations towards their role and the broader strategic environment would improve understanding of individual development at work, would contribute to the prediction of performance, and would thus be a valuable approach to job design research within IM. Two key research aims were outlined: (1) to explore the relationship between job design features (notably control) and employees' work orientations, and (2) to examine the relationship between orientations and performance. The results of the studies carried out to investigate these research aims are summarised and discussed in the first section of this chapter.

An exploratory aim of this thesis was to examine how non job-design human resource factors might facilitate or restrict the development of new work orientations. Results and issues relating to this aim are discussed in the next section. The final section then goes beyond the specific construct of orientations to look at some wider issues within IM, and to present a broader approach to job design research.

A prerequisite for this research was the development of reliable and valid measures of orientations. Thus, before moving on to examine the results and their implications, it is necessary to review evidence that the measures of orientations were adequate.

10.0.1 Measurement of orientations

Measures of role and strategic orientations were developed to assess the way people construe their role and wider manufacturing strategies, respectively. Role orientations were assessed with two types of measure. First, Production Ownership assesses the extent to which people see a range of integrated production problems as relevant to them (i.e. as part of their role) rather than 'someone else's' problem. The second type of measure was two scales of perceived performance requirements: Production Knowledge and Wider-production Knowledge. These scales assess the extent to which people see a range of knowledge and skills as relevant to their effective performance. Production Knowledge focuses on people's view of the importance of operational knowledge and skills within the production area (such as knowing work priorities), and Wider-production Knowledge concerns the extent to which people see issues outside of production as relevant to them (such as knowing about other departments). A measure of strategic orientations (i.e. Strategic Beliefs) was developed to assess the extent to which people endorse the principles underlying key IM initiatives.

Throughout the study, internal reliabilities of the orientation measures as assessed by Cronbach's alpha (Cronbach, 1951) were high. This suggests that the orientation measures have adequate internal consistency; that is, items are tapping the same basic construct and are sufficiently interrelated to be considered an internally reliable scale (see Cortina, 1993 for an in-depth discussion of the alpha coefficient).

Several different kinds of evidence for the construct validity of the new measures were obtained throughout the studies. First, the orientation measures were consistently shown to have moderate to high correlations with each other and with related constructs (convergent validity) yet only low to moderate correlations with conventional outcome measures (divergent validity). Second, a minimum requirement of the measures is that, within traditional manufacturing environments, they distinguish the orientations of people in specialist and supervisory roles from those of shopfloor operators. This was shown to be the case in the first and second study (see *Chapter 6* and *Chapter 7,* respectively). Third, evidence for the validity of the orientation measures came from the differential pattern of results obtained with the response-check scales. The latter were deliberately designed to tap a traditional orientation to jobs (i.e. a technically-based, individual orientation), and it was thus expected that shopfloor workers in conventional jobs would score highly on these items. This was shown to be the case in the first study where shopfloor workers scored significantly higher on these response-check items than on the equivalent orientation measures (see *Chapter 6*). Further, as expected, the orientation measures were sensitive to employee development with job redesign, but there were no parallel change in the response-check scales (see *Chapter 9*).

Additional evidence for the measures' validity came from the longitudinal studies in which there were instances where, as predicted from the lack of change in job content, there were no changes in orientations. These findings suggest that there are not obvious demand characteristics of the measures such that people automatically respond more positively to them on repeat measurement. The relationship between orientations and independently collected performance ratings and skill data also suggest these measures are not simply the result of social desirability, response set, or other such factors. Further, the finding that there were changes in orientations when job control was enhanced suggests that these measures are not just a proxy for cognitive ability variables such as intelligence, since the latter would not be expected to increase over this relatively short time period, if at all. Finally, the clear convergence between employees' scores on the orientation scales and in-depth quotes suggested that the quantitative indices function as viable indicators of rich constructs.

In summary, the orientation scales had high internal reliability and their construct validity was demonstrated in multiple ways. The measures were also useful to management within the organisations and, in some cases, helped to focus the programme for change.

Although there are some measurement issues and possible extensions or refinements (discussed later), the measures were clearly adequate to test the research propositions.

10.1 Orientations and job design research: Is there added value?

This section contains a summary of the empirical findings and their implications in relation to the first research proposition concerning job design and orientations, and then in relation to the second proposition concerning orientations and performance. Following this, some refinements and extensions to the approach are put forward, and measurement issues are discussed. (Note that wider implications of the findings, such as what they suggest for IM interventions, are addressed later).

10.1.1 Job design and orientations

The main aim of this thesis was to examine the relationship between work design and orientations. It was proposed that increased control would lead to the development of broad, proactive role orientations and strategic orientations that are 'appropriate' to the new manufacturing philosophies. In other words, part of the research looked at the value of orientations as an outcome variable of job redesign. It was suggested that orientations would reflect people's development at work and function as an 'integrative' construct that reflects people's breadth of understanding about their work environment, their intrinsic motivation, and relevant aspects of their personality. As such, it was expected that orientation measures would be informative in different ways to the affective reaction variables routinely used in job design studies.

An implicit assumption of this research proposition is that operators within traditional manufacturing environments will tend to have narrow and passive work orientations, and that this is, at least in part, a product of simplified work design. Support for this assumption came from the first study (*Chapter 6*). Questionnaire results showed that shopfloor operators in traditional jobs saw standard technically-based knowledge and skills as more relevant to them than broader, proactive competencies, and they had much greater ownership of individually-oriented problems (such as not achieving a high pay bonus) than wider production problems (such as customer dissatisfaction). Concurrent with this, interview data demonstrated that the shopfloor employees had a limited view of their own responsibilities (e.g. "I'm responsible for what comes off the machine to when I put it on the floor"), with a parallel belief that supervisors were there to direct them, solve their problems, and co-ordinate their efforts. At a general level, similarities can be drawn between these shopfloor employees and the alienated workers described by earlier commentators (e.g. Baldamus, 1958), and their behaviour fitted the descriptions of 'job myopia' (e.g. Davis and Wacker, 1987; Karasek and Theorell,

1990) and 'child-like' dependency (Argyris, 1964) suggested to be prevalent phenomena in traditional factories. Although this study did not set out to investigate the relationship between job control and orientations, comments from interviews suggested that having simplified jobs contributed to employees' narrow perspectives.

The results of the second study (*Chapter 7*) were consistent with the proposition that the introduction of IM initiatives without accompanying change in job control has little or no effect on role orientations. This study investigated the introduction of Kaizen, a continuous improvement strategy, that, in this instance, was introduced without any attempt redesign jobs. Essentially, the initiative had many similar features to 'parallel' activities where the change has a narrow mandate, presents no threat to authority, and involves minimal changes to the power structure (Lawler, 1992). As would be expected from this, there was no broadening of role orientations. That is, employees did not report an increase in ownership of production problems, and actually perceived a narrower range of knowledge and skills as important over time. They also reported poorer psychological health and greater strain over this time period. These results thus indirectly provide support for the proposition that changes in job control are required for the development of broader role orientations, and are consistent with arguments that control may be important for reducing stress effects (e.g. Karasek and Theorell, 1990). Different results were found for Strategic Beliefs, however. Scores on this variable increased, suggesting that development in strategic orientations is not contingent on enhanced control and may result from the adoption of IM irrespective of any change in job design.

More generally, these results are consistent with the view that IM initiatives can serve to intensify work and enhance stress without any benefit to workers (e.g. Delbridge *et al.* 1992; Turnbull, 1988). Further, the finding that productivity gains were achieved without employee enskilling suggests that this relationship may be contingent on certain environmental features (e.g. Slocum and Sims, 1980) As described in *Chapter 7*, the company had a relatively certain production environment and it may be possible within such an environment to increase performance without enhancing control. This is particularly likely if, as in this case, the goals of performance enhancement are narrow. These implications of the findings for IM interventions are developed later.

The next study (*Chapter 8*) took the inquiry one stage further and compared the orientations' of employees whose jobs had been reorganised into 'product-lines' (which functioned as semi-autonomous teams) with employees in traditional jobs. In contrast to the previous study, this strategy encompassed changes to job control as an integral part of the intervention, as confirmed by the fact that employees in the re-designed group reported greater control than those in traditional jobs. Here, as expected with both the implementation of an IM initiative and increased job control, the product-line employees reported significantly greater ownership of problems and saw a wider range of skills and knowledge as relevant to their performance than employees in traditional jobs. Interview data were consistent with these findings; product-line employees demonstrated a strong sense of responsibility for production and group-cohesion problems, had many ideas about solving problems, and understood the need for self-direction and social competence. Again the measure of Strategic Beliefs operated differently to the role orientation measures, and scores were not systematically related to work design. Further, contrary to what was expected on the basis of earlier research, there were no significant differences between the traditional employees and those in redesigned jobs in their reported job satisfaction, psychological health, or commitment to quality.

At this point, although the findings were consistent with the proposition that job redesign is necessary for the development of new role orientations, the strength of conclusions was weakened by the study's cross-sectional design and the consequent threat of competing explanations. An extended study was reported in *Chapter 9*. This was a longitudinal study investigating the effects of introducing product-lines on jobs and orientations for three groups of employees: the Changed Comparison Group (employees who had already had their jobs designed), the Test Comparison Group (skilled test engineers for whom product-lines potentially meant deskilling) and the Intervention Group (operators who were in traditional jobs at the start of the study). The first two groups served as non-equivalent control groups and, as expected, there was no increase over time in control for these employees. However, also as predicted, the introduction of product-lines meant a significant increase in job control for the Intervention Group. Supporting the research proposition, a parallel pattern of results was obtained for the role orientation measures. Additional analyses ruled out competing explanations (e.g. mortality), and the findings were consistent with retrospective perceptions of change in the questionnaire, with employee interview data, and with management perceptions that product-lines had enabled the organisation "to tap into the knowledge base of those who, on a daily basis, see the details of the operation" (Lodhia, 1993, p. 91) and "has worked towards developing and energising the 'thinking' worker" (p. 94). As with the earlier studies (see *Chapter 7* and *Chapter 8*), work design did not have a specific effect on the measure of strategic orientations, Strategic Beliefs. Employees in all groups reported increased scores on this variable over time. Further, contrary to what was expected, there was no significant change in job satisfaction or psychological well-being for the operators. The only change was an initial increase in anxiety that then decreased by the time of the third survey.

Taken in combination, the studies reported here provide strong support for the first proposition that enhanced control is a prerequisite for the development of broader and more proactive role orientations. (The findings for Strategic Beliefs are discussed later). Evidence consistent with the proposition was obtained in three very different contexts, and the quantitative results were supported by in-depth qualitative accounts. At its simplest, these findings suggest that orientations function as an outcome variable of job redesign within IM contexts. That is, orientations systematically relate to the amount of control people have in their jobs. More than this, however, orientations appear to be an informative outcome variable. In the introductory chapters, part of the rationale for measuring orientations was that they function as an 'integrative construct' reflecting people's job-related knowledge and understanding as well as their motivation. It was thus suggested that orientations are a qualitatively different variable to the existing conventional affective reaction variables; a view that is supported by results of this thesis,

Although the conventional outcome measures and Quality Commitment were sensitive to negative changes (i.e. increased pressure for operators experiencing Kaizen, and the deskilling effects of change for test engineers in the final study), they did not suggest any positive effects of job redesign in the final studies. That is, scores on these variables did not differ for employees in traditional jobs compared to those in redesigned jobs (*Chapter 8*), and there was no change in scores for employees whose jobs were redesigned to be more autonomous (*Chapter 9).* In the latter study, the psychological effects of the job redesign were uniquely revealed by the orientation measures. To recap on the discussion of this issue in *Chapter 9*, the stability of scores on these outcome variables might be partly a result of the high pre-intervention baseline on these measures of the sample used in the final study. This means that there is less room for improvement on the scale, and thus a lack of change can be considered a positive result (i.e. as 'maintaining high levels'). More importantly, however, it was suggested that these affective reaction measures are not designed to be sensitive to developmental changes. That is, the changes that have taken place within employees in the high-involvement company included a 'deeper' level or a different kind of change that is tapped by orientation measures, but not by conventional outcome measures.

The above conclusion relates to the suggestion in the introductory chapters that orientations reflect people's developmental state at work. For example, a person who reports personal ownership for a range of problems, including those that do not have immediate consequences, was suggested to be closer towards the 'adult' end of Argyris's (1964) criteria than someone who feels concern for only a limited range of problems with immediate consequences. Consistent with this, the changes in orientation occurred at times when growth and development were expected (i.e. when their jobs were enriched), but did not occur in situations where no growth was expected. For example, in the study of the traditional factory (*Chapter 6*), operators had low scores on the orientation variables, and interviews data suggested they were at the lower end of Argyris's (1964) developmental dimensions. Their comments suggested that had short-term time perspectives, used few abilities, rarely thought about abstract concepts in relation to production, and were dependent on the supervisor for direction. Within Company F (see *Chapter 8* and *Chapter 9*), changes in orientations occurred in parallel with retrospective accounts by people about how they had developed and learnt as a result of job design. For example, one person whose orientations had changed, reported how he felt he was no longer a child at work, but an adult who had 'grown up'.

These findings confirm that examining employee orientations can make an important contribution to the diagnosis and evaluation of jobs within modern manufacturing environments. Orientation measures go 'beneath the surface' of affective reactions and assess the way people construe their roles and the work environment, and thus indirectly provide information about employees' developmental state at work. Orientations appear to be a useful 'tool' for evaluating work design in a way that keeps pace with the changes taking place in manufacturing, and there is likely to be substantial added value for practitioners and researchers alike in including these measures in job design studies.

However, perhaps even more important than its value as an indicator of job design outcomes, is that the construct of orientations opens up new avenues for theoretical development. That is, the findings in this thesis suggest that people do not just 'react' to job redesign but that they can, and do, change within themselves as a result of new work structures. In the introductory chapters (see section 4.2), a question raised by Frese (1982, p. 216) was cited as to whether simplified jobs lead to "a completely new outlook on work". The results presented here suggest this is the case and, even more importantly, demonstrate that such narrow outlooks can be reversed with job redesign and people can develop new frames of reference for their work. The finding that enhanced control was necessary for developing new and broader role orientations suggests that this development is dependent on 'exploratory learning', or learning that is facilitated by action (Greif, 1992), rather than other processes, such as exposure to a new culture or class-room training.

These findings are consistent with studies investigating entry into new jobs (e.g. Van Maanen, 1976) or professions (e.g. Becker and Geer, 1958) that show people construct new understandings and meanings about their roles. More generally, the results are consistent with the point made in the introductory chapters that work experience can socialise people's behaviours and personalities at work (e.g. Frese, 1982; Karasek and Theorell, 1990; Kohn and Schooler, 1978); with Action Theory arguments that active jobs allow people to learn (Frese and Zapf, 1993); and with the SIP perspective that past experiences affect people's wider construction of their jobs (Salancik and Pfeffer, 1978). The findings also support case study evidence that people change in developmental ways as a result of new work structures. For example, it has been observed that job redesign results in people developing new knowledge and wider perspectives (e.g. Buchanan and McCalman, 1989; Lawler, 1992; Wood, 1989), and in them becoming more capable and self-confident and thus desiring greater participation (Hackman, 1980; Karasek and Theorell, 1990; Katzell and Yankelovich, 1975; Kopelman, 1985; Lawler, 1986).

10.1.2 Orientations and performance

The second key issue of interest examined within this thesis was the relationship between employee orientations and performance. Drawing on relevant theories, an argument was made in the introductory chapters that the types of behaviours required within IM (e.g. using initiative, preventing problems) cannot be coerced; instead, employees need role perceptions and strategic views that guide their effort in appropriate ways. Case study evidence was then put forward that people require certain types of orientations in order to perform effectively in IM contexts (e.g. Buchanan and McCalman, 1989; Buchanan and Preston, 1992; Oliver and Davies, 1990). Based on this theoretical suggestion and empirical evidence, it was proposed that operators who have broader, more proactive role orientations and more appropriate strategic orientations would be better performers than those who did not. This prediction was restricted to those IM contexts where operators have sufficient job control to develop and act on their orientations. Thus, in other words, the development of new orientations was put forward as a means by which enhanced job control promotes high performance within IM environments.

This proposition was investigated in final study (*Chapter 9*). Orientations were shown to predict supervisory ratings on high performance dimensions at two different time periods, and to predict people's skill levels. That is, the higher people's scores on orientations, the more likely they were to be rated by supervisors as good performers, and the higher their skill scores. Most importantly, *change* in one of the role orientation measures (Production Ownership) predicted *change* in performance rating; suggesting that the relationship between orientations and performance was not simply a function of their joint relationship with cognitive ability variables.

This finding is important for job design research, and emphasises the value of orientations as a qualitatively different outcome variable. That is, few other outcome variables in job design research have been shown to have any links to performance. It has often been observed, for example, that job satisfaction does not consistently relate to performance (see Iaffaldano and Muchinsky, 1985; Kelly, 1992; Vroom, 1964). This is not surprising as there is little theoretical reason to expect variables such as satisfaction and commitment to relate to anything other than the intensity of effort. Orientations, on the other hand, were designed to tap the type and direction of effort that is required for effective performance within IM contexts. This suggests that examining orientations will be informative about employees' development towards 'high-performance', and will thus be a particularly useful approach to adopt when evaluating the effects of IM initiatives.

Even more importantly, the finding has implications for theory and suggests an alternative mechanism for enhanced performance with job redesign. As outlined in the introductory chapters, better performance resulting from job redesign is usually explained in terms of motivational processes (i.e. more motivated workers are prepared to put in more effort and produce better quality products) or, if in non-motivational terms, as a result of more efficient work systems and the facilitation of quicker responses to problems. However, the results in this thesis suggest that a learning process is a better explanation of performance improvements. That is, as a result of active and autonomous engagement in more tasks, people develop a new and better understanding of their role and how to perform it in relation to strategic objectives. In Porter and Lawler's (1968) terms, as a result of enhanced control, employees develop a more 'appropriate role perception' that then guides the direction in which they expend their effort. This is similar to the argument put forward in Action Theory that greater control leads to the development of improved operative image systems; the sophistication of which differentiates 'superworkers' from others (see Frese and Zapf, 1993). It is also consistent with: the views espoused by Wall and colleagues that operator control allows operators of AMT to develop fault-prevention strategies that then enhance system performance (see, for example, Wall *et al.* 1992), with IM literature that suggests operator control enhances employee performance through learning (e.g. Susman and Chase, 1986), and with high-involvement approaches that advocate devolution of control to employees so that they can develop broader perspectives to solve and prevent problems (e.g. Hayes, *et al.* 1988; Lawler, 1992). Finally, this perspective aligns more closely with general performance research in which there has been a swing in emphasis away from pure motivation-based mechanisms of work effectiveness to more cognitive and developmental explanations (Staw and Boettger, 1990).

From a practical perspective, the findings suggests that if 'high performance' is required within IM, then work redesign that enhances operator control may be a minimum prerequisite. This issue will be expanded later.

10.1.3 A disassociation between role orientations and strategic orientations

One of the interesting findings to emerge from the results that has not yet been discussed is the disassociation between the measures of role orientations (i.e. Production Ownership and Production Knowledge) and the measure of strategic orientations (i.e. Strategic Beliefs). Changes in role orientation measures occurred only when there were increases in job control (as predicted), while changes in Strategic Beliefs were not specific to this job design factor and scores increased even when there was no change in job control. Moreover, while both types of orientations predicted performance during the introduction of product-lines, the measure of strategic orientations was the most important predictor after the intervention, but did not predict change in performance scores. Although these results may seem conflicting, they make sense if it is assumed that changes in strategic and role orientations are a result of different processes and have different behavioural consequences.

This was explained in detail in *Chapter 9.* It was suggested that role orientations reflect people's personal acceptance of the effects of IM initiatives on their roles, and that change in this variable results from active involvement in a range of areas that then enhances understanding of and gives meaning to much broader production issues. This process was likened to 'taking off the blinkers' or a gamma change (Golembiewski, *et al.* 1976), where the changes in understanding and meaning are substantial and have clear effects on behaviour. In contrast, it was suggested that increases in Strategic Belief scores may reflect a gradual enhancing of strategic awareness that comes from a variety of information sources, such as from formal sources (such as supervisors, training courses, company memos) and from cultural messages inherent in the organisational structure and practices. Some support for these proposed differences between role and strategic measures came from the differential influence of people's expectations about product-lines on the extent of change in these measures (see section 9.3.2.3).

An alternative way of interpreting the difference between the orientation measures is that the degree of 'honesty' reflected in the measures may vary. That is, people's role orientation may reflect the extent to which people have personally accepted the principles of IM and have genuinely changed in the way they see their job. However, scores on Strategic Beliefs may reflect the extent to which people have been 'brainwashed' or have 'surface-learnt' management philosophies. Thus, an increase in this measure may occur because people have learnt 'what management wants to hear' and, due to feeling they should answer in socially desirable ways, thus respond with the 'right' answer.

However, there are counter-arguments to this suggestion. First, even if an increase in Strategic Beliefs is simply a result of learning the 'right' answer, this nevertheless represents a level of knowledge that the person did not have before. Of course, it is insufficient by itself, but it may be indicative that people have at least grasped some of the basic principles and are aware of the messages that management is trying to get across. Second, whilst the demand to respond in a socially desirable way could have feasibly acted as an influencing factor within the high involvement company (which made deliberate attempts to cultivate a particular employee attitudes and understanding), this factor seems less relevant within the control-oriented company implementing Kaizen. In this company, there was little management emphasis on cultural change (e.g. there was no direct attempt to change employees' attitudes or understanding) and yet scores on Strategic Beliefs still increased. Finally, the suggestion that this measure is simply picking up on 'brainwashing' or social desirability is inconsistent with the finding that Strategic Beliefs relates to performance ratings and skills scores, thus suggesting that it predicts people's behaviour. (Of course, there may also be more complicated explanations that contradict this - for example, supervisor might rate people who espouse the philosophies of IM as good performers regardless of how they act on the job, or might push them into skill development).

On the whole, the interpretability of the findings for Strategic Beliefs is not clear-cut and requires further investigation. However, if it is the case that changes in this variable reflect a cumulative learning experience based on a variety of sources (and this seems the most plausible explanation of the results), then it suggests that organisations should adopt two levels of intervention when introducing IM initiatives. To foster appropriate strategic orientations, it is necessary to focus on practices and systems that may enhance the understanding of IM principles, including both formal systems (e.g. training packages, communication systems) and informal, culture-related practices. This will be insufficient for the development of role orientations, and organisations should also restructure the work organisation to enhance employees' job control.

10.1.4 Summary of research aims and their implications

The findings show that the core aim of this thesis has been achieved. That is, a developmental and performance oriented approach to job design research has been presented; one which, in contrast to the existing approaches, is in keeping with the new manufacturing paradigm. Results have shown that enhanced control is necessary for the development of new and more appropriate role orientations that, in turn, are important for effective performance within IM. Strategic orientations, which do not require job redesign for their enhancement, also appear to be important for performance. Both role and strategic orientations thus 'add value', albeit in different ways, to research within modern manufacturing. At the most basic level, orientations can be seen as a valuable outcome variable above and beyond those already in wide use.

More importantly, the results open up new pathways for job design research. The introductory chapters contained a description of the dominant model in job design research - the Job Characteristics Model (Hackman and Oldham, 1976). This basically posits that job redesign results in satisfaction, motivation and, primarily as a result of putting in more effort, greater work effectiveness. This thesis suggests two significant movements away from this: first, that job redesign does not just affect people's motivation or their affective reactions to jobs but can fundamentally change people's understanding of their roles and the work environment; and second, that performance enhancement can be explained in terms of such changes. This redirects the focus of job redesign. Rather than being seen as a purely motivational intervention, it can be seen as a strategy where shopfloor autonomy enables and facilitates the types of development needed for enhanced performance within IM. Here, the focus was on the development of new and more appropriate work orientations, but there is no reason why other types of developmental changes (e.g. cognitive and personality development) cannot also be addressed. Indeed, what is perhaps most significant about the findings in this thesis is that they alert researchers to a host of developmental and learning-based changes that can be explored as outcomes of job redesign and as predictors of performance. This approach, which can broadly be referred to as a 'developmental-interactionist' approach, is discussed in more depth in the final section.

10.1.5 Research aims: improvements & extensions

With regard to the wider implications of the present findings, a first point to raise is the need for replication to test the robustness of the findings. It is particularly important to ascertain the reliability of the finding that orientations predict performance. The relationship was investigated in only one study, and this had a relatively small sample size (particularly for the analyses predicting change in performance). There are also some obvious benefits of using more 'objective' performance data. This would ensure that the relationship is not merely a function of supervisors rating certain employees higher because they espouse views consistent with management (i.e. regardless of their actual performance). The issue of causality for the relationship between performance and orientations also needs further investigation. For example, it has been assumed here that orientations predict performance; that is, appropriate orientations are necessary for effective performance. However, it may be that good performers actively seek out extra responsibilities and control (i.e. a broader role) and this is then reflected in their orientations (Ilgen and Hollenbeck, 1991 make a similar argument to explain the relationship between job complexity and performance). Finally, it was suggested that orientations affect the direction of performance. Yet it is unclear as to precisely what type of performance (e.g. persistence, role innovations, flexibility, problem-solving ability across many domains, extra-role behaviour) is most affected by orientations. As argued by Staw and Boettger (1990), there is a general need for applied researchers to broaden the performance construct and consider different types of behaviour.

Although the relationship between role orientations and control was well established, there is much value to be gained from a longitudinal study that investigates it within a company that has a lower baseline, or is more 'traditional', than the company used in the final study. In the latter, prior to any changes, employees were satisfied and unstressed relative to other samples and the human resource practices were reasonably compatible with high-involvement (e.g. there was no bonus scheme, union representation was low). It might be expected that, within a more traditional company, job redesign and changes in orientation might be more difficult to achieve partly because of the need to radically overhaul human resource (and other) systems, and partly because of the existence of narrow and entrenched orientations that limit people's acceptance and understanding of the changes. Oliver and Davies (1990) suggest that in such contexts, an 'organisational crisis' may be necessary to promote the necessary paradigm shift. On the other hand, however, if job redesign was successful within a very traditional company, the changes in orientations might be much more dramatic because of the greater room for improvement. Clearly, the extension of this approach to what might be seen as more 'typical' manufacturing companies is important.

There are many further conceptual and theoretical extensions that can also be pursued. For example, the relationship between control and orientations has been established here, but little attention has been given to other job design variables. Feedback might be a particularly important variable in the shaping of new orientations that are needed for performance. Dodd (1987), for example, found that performance on a word processing task was determined by an interaction between autonomy and feedback, but high autonomy on its own had no effect on performance. Similarly, there would be value in examining the effect of an increase in task variety *without* an increase in control on people's orientations. According to many commentators, such horizontal job enlargement is a likely outcome of introducing IM initiatives (e.g. Turnbull, 1986, 1988).

More generally, there is a need for theoretical development in relation to the mechanisms of change in orientations. It was suggested that job redesign can enhance people's understanding and knowledge, increase their intrinsic motivation, and (in the long-term) may affect relevant aspects of personality, and that these changes will be reflected in orientation scores. Based on the research reported in this thesis, however, it is not clear whether orientations do actually reflect *all* of these elements, or reflect them to varying degrees. Is it the case, for example, that orientations function purely as a proxy variable for knowledge rather than an important 'integrative' construct that tap motivational processes as well? This possibility seems unlikely, but it cannot be ruled out. Moreover, whilst it was assumed that job redesign can enhance all of these elements, only the link between control and motivation is reasonably well-established. Causal relationships between job redesign and knowledge and/or personality, although equally plausible, have less often been investigated. The value of such investigations is discussed in more depth in the final section of this chapter.

Finally, there is no reason why the ideas and propositions in this thesis could not also be extended to other contexts, such as white-collar environments. Many strategies used to integrate manufacturing are also occurring in these contexts to improve performance. Total Quality Management, and the customer ethos that this involves, is particularly prevalent within service industries (e.g. Delafield, 1993, describes Total Quality in the Post Office).

10.1.6 Measurement: issues and extensions

Although the orientation measures had adequate psychometric properties to test the propositions, there are some further issues concerning their wider applicability. These are considered below, along with some more general refinements and extensions to the measures.

10.1.6.1 Procedural issues: Context-specificity and dimensionality

In the current studies, the procedure adopted differed for the measures of role orientations and the measure of strategic orientations. For strategic orientations, context-appropriate items were developed to assess beliefs about the key IM principles relevant to the particular context. Context-appropriate items were also developed for the role orientation measures although, in contrast to the previous measure, the items were designed to fit a priori conceptual categories. Expert coders were able to reliably categorise the items into these categories, thus ensuring that all of the categories were covered, and that each category was distinguishable from the others in terms of the items (at least by experts). Within each study, the correlations among the categories using respondents' scores were inspected. Typically, the distinctions were not entirely clear and the items were collated into larger scales. The advantage of this procedure was that it allowed the same constructs to be assessed across studies, despite varying item content. This procedure also led to reliable and valid indices of orientation measures. However, two issues need to be addressed: the context-specificity of the items, and the dimensionality of the scales. These are discussed in turn.

Although many of the items used across studies were the same, the surface characteristics of some of them varied to reflect contextual differences. Several reasons for this were identified in *Chapter 5* (see section 5.2.2). Most importantly, the orientation measures were designed to assess change within people (i.e. their learning and development), and were not intended as an organisational-level diagnostic tool where companies are compared against each other. If comparisons across studies or against population norms are required, then it will be necessary to use measures that transcend context. This is the more common approach in job design research. However, the price to be paid with such measures is that differences within environments are often ignored and subtleties in item meaning cannot be interpreted. For example, an item assessing 'can you control how much you produce?' is usually treated as assessing method control. However, in some large batch environments, it may more accurately represent timing control, since the amount produced reflects when people decide to start and finish their work. Thus, in all cases, the development of context-free measures involves compromises in meanings. The question of interest here is whether this compromise is any more important for the orientation measures.

One factor that may influence the relative importance of context-specificity is the type of construct being assessed. It is likely that having general, context-free measures may be appropriate for outcome measures that mostly reflect motivational processes, such as job satisfaction. If there are slight differences in the interpretation of items across contexts, the construct being measured is not really affected. However, the need for context-specific items is enhanced when measures aim to capture understanding and knowledge. For example, knowledge-elicitation techniques employ a general technique to elicit information, with specific questions that relate to the context (e.g. Welbank, 1983). Given the intention of the orientation measures to tap people's understanding as well as their motivation, the specificity of the items is thus likely to be an important part of assessing the understanding dimension of the construct. Whether an appropriate degree of specificity can be obtained without using context-specific items is likely to depend on the organisation's level of development. This is explained below.

Having more subtle and specific items (and therefore probably more context-specific) will be particularly important within organisations that are already integrated to some degree. For example, consider the Production Ownership scale that assesses ownership of problems concerning goal-achievement (e.g. customer satisfaction), efficiency, and group-cohesion. Within very traditional environments, owning goal-achievement problems would represent a high level of awareness as these are usually not a concern of shopfloor workers. However, within a more developed context, most people may own goal-related problems, and items that examine people's ownership of particular problems that affect the meeting of customer goals may be more differentiating. For example, consider asking people whether they would see it as their problem if the percentage of defect-free products was 96%. This may or may not be a problem depending on the particular context (i.e. this percentage may be very good in some companies, but poor in others) and therefore a response to this item will more closely reflect a person's knowledge. Thus, the more specific are the items, the more useful they will be within environments that have already been exposed to concepts such as customer and goal orientation.

In general, the unique feature of orientations as a construct (in comparison to other job design variables) is that it focuses both on people's motivation and on their understanding, and how these come together in relation to the work environment. If the understanding dimension is lost through making the measures too general, then the value of the construct may be undermined. For this reason, the best solution would be for researchers and practitioners to use a flexible set of items that cover the theoretically-determined a priori categories. This set should comprise some 'core' items that transcend context and can be used within most manufacturing organisations, as well as some 'optional' items that are more context-specific. The latter could be selected from a pre-existing list, or they could be developed by the researcher/practitioner using general principles of item generation (e.g. how to identify salient problems that occur in the area). Ideally, the process of selecting or designing these optional items should occur in collaboration with relevant personnel within the company. This combination of items would enable comparison across contexts (using core items), as well as allowing more gradual change and development within contexts to be assessed (using core and optional items). By examining the relationship between the subset of core items with the subset of optional items, the researcher could assess the degree to which the same construct was being assessed.

The second measurement issue concerns that of dimensionality, and how to obtain a score from the set of items. Strategic Beliefs was identified as a 'causal' indicator where the indicators cause the latent variable, and where standard assumptions about internal consistency have little meaning and items do not logically have to correlate (Bollen and Lennox, 1991, see section 5.2.3) As such, the key goal in developing this measure was to ensure that the complete domain of core beliefs within each context was assessed. Items were then summed to form the scale. In contrast, the role orientation measures were treated as an 'effect' indicator where items are conceptualised as multiple partial-indicators of the same construct, and the emphasis is on developing internally consistent, yet distinguishable dimensions.

In continuing to treat role orientations as an effect indicator, there seems little point in performing exploratory factor analyses to obtain dimensions even if sample size is adequate. There is a strong likelihood that items will group according to non-psychological constructs (see Kline, 1993, for an illustration of how factor analysis can result in meaningless scales). For example, separate factor analyses of the performance requirement items within Company P and Company F both yielded many factors loosely coinciding with functional areas (such as production planning, maintenance, quality inspection). Further, even if the factor structures did result in meaningful scales, it is highly unlikely they will be the same across studies. Where the sample size is large, confirmatory factor analysis may be a more appropriate procedure. That is, the researcher specifies a priori factors and then tests to see how well the data fit this structure (see Nunally, 1978). Alternatively, if sample sizes are restricted the procedure used in the current studies, where items are already defined into a priori categories, should be adopted.

Another approach is to treat role orientations as causal indicators where the latent variable is determined by the indicators. That is, for example, considering Production Ownership as being determined by people's ownership of a range of manufacturing problems. Looking at the types of items within these scales, this seems a plausible argument. For instance, ownership of goals means an increase in overall ownership; however, this does not automatically mean that people will feel ownership for team-working problems. If role orientation measures are seen as causal indicators, then this suggests that, although internal reliability's of the scales were high in these studies, this is not the most important criterion. It is more important to ensure that the whole domain of items are covered, and to demonstrate the validity of the measures in terms of the effects of latent variable (here, this was demonstrated by looking at the effects of orientations on performance) (Bollen and Lennox, 1991). It also means that attempting to obtain factor-analytically distinct scales is not necessarily the only appropriate strategy, and that it is just as acceptable to have a complete 'check-list' that contains non-homogenous items.

10.1.6.2 Further refinements and alternative methods

In addition to considering the broader measurement issues raised above, there is scope for at least three types of refinements to the orientation measures. First, the high correlations between the a priori conceptual domains used in the role orientation measures suggests it may be worth experimenting with alternative conceptual schemes. Second, different ways of scoring the scales might be informative. For example, consider the measure of Production Knowledge. Rather than combining the highly correlated a priori categories (i.e. collective, cognitive, and local production knowledge and skills) into a set of items that is then summed, a score could be formed by considering scores on the separate scales. That is, if people had high scores across *all* the categories, they would score high Production Knowledge; however, if they had high scores within only one category, they would score much lower. This would effectively be treating Production Knowledge as a causal indicator where the categories, rather than the items, were the indicators.

Third, it may be worth experimenting with different forms of the existing scales, such as changing the response anchors or response requirements. Asking respondents to select (or even rank), for example, the ten skills/ knowledge that they see as most important for effective performance may force people to be more discriminating. In another study conducted by the author, people were asked to indicate the skills/ knowledge they would like more training in, as well as those that they perceive as important for their job. This then taps into different, but related, changes that may take place within people as a result of job redesign. People may be completely uninterested in training when working in a traditional job; however, as a result of the developmental processes that take place when their work is restructured, they may desire training in several different areas (this would effectively be an indirect measure of change in aspiration).

In addition to refining the existing measures, there is also scope to develop new measures or methodologies to assess the constructs. Developing interview-based measures may allow for a more discriminating assessment of orientations than the questionnaire scales. In *Chapter 8*, it was suggested that the orientation measures serve their intended purpose of evaluating broad-based changes but subtle or fine-grained changes in orientations probably require alternative, more qualitative methodologies. One approach may be the use of repertory grid interviews which are commonly used to assess people's schemata (see Lord and Maher, 1991). The author has experimented with using this approach to assess operator's constructions of effective role performance (i.e. getting operators to elicit constructs that differentiate between their team members), and there is room to experiment with other types of elements (such as using problems or events to look at people's ownership and understanding of problems). Other techniques used in job analysis could also be adapted to look at peoples' orientations and related constructs. For example, critical incidents technique could be used to elicit people's understanding and ownership of problems. Similarly, the sentence completion tests used in clinical psychology could be adapted to assess orientations (Goldberg, 1965; and see Himes and Watts, 1966 for an application in personnel psychology). Operators could be required to list, for example, 10 statements in response to sentences such as 'My role in this plant is...' and 'An excellent operator is one who...'. This may be an insightful and relatively quick way of assessing orientations.

10.1.6.3 Summary of measurement issues

In summary, the procedure adopted in this thesis was suitable for exploring the particular research aims set out here. However, for future studies that are concerned with comparisons across studies, it is recommended that a set of flexible items (core and optional) are developed around the a priori categories. A total score can be formed either by adding the set of items within each measure (i.e. treating it as a check-list), or by forming dimensions. For analyses of more fine-grained changes in orientations, it is unlikely that general items will be sufficiently discriminating and either context-specific items or more probing interview-techniques will be more appropriate. On the whole, as is always the case when a new construct is developed, there are numerous extensions and adaptations that can be made to the existing measures, and there are several alternative methods that could be used.

10.2 Orientations & human resource factors: An exploration

To date in this chapter, I have focused on the effect of job design features on employees' orientations. However, as yet there has been little attention given to other human resource (HR) factors - organisational or personal - that might affect employee orientations. The exploratory aim of the thesis was to consider such factors, and there are at least two reasons why this is warranted.

First, the success of job redesign depends partly on altering broader organisational systems and practices (Oldham and Hackman, 1980). Thus, given that enhanced autonomy has been shown to be necessary for the development of role orientations, it is clear that role orientations will be *indirectly* affected through any factors that affect the devolution of control, or that affect employees' motivation or ability to take on this control. A second reason for examining HR factors is that they might *directly* affect orientations. That is, the construct of orientations focuses on the way people see their roles and the wider strategic environment, and how this directs their efforts towards 'appropriate' behaviours within an IM environment. It is clear that organisational and personal factors (such as the reward system) also affect people's views about the type and direction of their behaviour, and thus are likely to impact on their orientations.

Several HR factors have been highlighted throughout the chapters as having possible consequences for orientations, including: appraisal and reward systems (*Chapters 6, 7, 8, 9*), supervisory roles and attitudes (*Chapters 6, 7, 8, 9*), training practices (*Chapters 7, 8, 9*), communication systems (*Chapter 6, 7, 8, 9*), the stability of employment (*Chapter 6, 7*), and management structures (*Chapter 9*). Rather than repeating the detailed accounts within each chapter, this section will draw out the most important factors, specify in more detail how they might influence orientations, and put forward some suggestions for further research. It should be noted that the focus in this section is restricted to contextual and organisational-level variables rather than personal factors (i.e. biographical and individual difference variables). The latter were investigated in the final study only and, as results from this have already been discussed, there is little gained from considering these factors further here.

10.2.1 Communication, employee participation, and training

Practices such as communication, employee participation, and training can influence the development of orientations indirectly through their effect on the job design process. For example, training can affect role orientations by enlarging or restricting the tasks people are capable of or are interested in performing (see *Chapter 8* for an illustration of how training problems restricted the flexibility of team member's roles). These factors can also potentially influence orientations directly by affecting people's understanding and motivation. From the studies in this thesis, it seems that there are at least three ways in which this might occur.

First, in the early stages of moving away from traditional narrow jobs, employees need a broader framework to understand why change is needed and what will be required of them. That is, people's eyes and ears need to be opened to events and issues beyond their immediate working area. This general raising of awareness is likely to come from communicating information about wider business and production issues to employees (such as that concerning market forces, company performance). As suggested by Hayes *et al.* (1988, p. 253), communication is necessary for "broadening people's perspectives and engaging them in the competitive task facing their organisation". There was a definite lack of this in the traditional company (*Chapter 6*). People did not have access to the 'big picture'; indeed, they did not even have the language or the concepts to understand strategic issues (for example, several people interviewed did not know what 'lead time' was). Thus, one of the key functions of communication may be in providing people with a framework and a shared language that enables them to think in new ways (see Buchanan and McCalman, 1989, for a detailed description of this view).

When IM initiatives are introduced, people need to accept the strategies and their effects of roles and performance requirements. Thus, the second way in which communication, training, and participation might affect orientations is through enhancing and facilitating this acceptance. For instance, within the traditional company (*Chapter 6*), a lack of information about business issues meant people were confused and mistrusting of IM initiatives that did not make sense from their narrow perspective (such as the need for small batches). Similarly, a lack of involvement in planning or making changes was identified as a likely contributor to the failure of Kaizen to affect orientations (*Chapter 7).* Some line leaders suggested that employees would have seen the 'sincerity of management' about Kaizen had they been given an opportunity to go on a training course. As Lawler (1992, p. 260-1) suggests, if such training is regarded as 'bother' and 'extra cost' then this "will send all the wrong messages to employees with respect to the organisation's commitment to employee development and the importance of learning".

In contrast, communication, training and employee participation were an integral part of Company F's approach to change, and there was both qualitative and quantitative evidence to suggest these processes were important for the development of orientations (*Chapter 8* and *Chapter 9*). A powerful example of this was the participatory manner in which JIT was introduced after product-lines. Although management provided the general direction, members of product-groups decided when and how JIT was to be introduced. JIT was then seen as a natural tool to use in order to achieve production targets that were 'owned' by team members at this stage. Involvement in the change process thus meant that this initiative did not work against the role orientations people had developed by this stage. This is consistent with Klein's (1989) view that involvement in the change process is particularly important when JIT is introduced into situations where employees are already working autonomously. Otherwise, workers may see JIT (with its emphasis on standardisation and no buffer stocks) as a reversal of the empowerment philosophy.

Finally, a third way in which these HR factors might shape orientations is through affecting people's knowledge and understanding. It has been argued throughout this thesis that employees within IM need specific types of knowledge to enable them to contribute to the business in new ways, such as knowing about strategies, processes, customers, and business issues. Lawler (1992) suggests that power and control without this knowledge is dangerous, and information and communication systems must be in place to support the type of performance required. Hayes *et al.* (1988, p. 249) similarly argue that employees within IM environments require information to "recognise operating patterns, identify cause-and-effect relationships, and diagnose and eliminate problems"; rather than the information required within Taylorised factories for control and co-ordination (such as descriptions of who is to do what and when), and for fixed responses to problems (such as detailed instructions and standard operating procedures).

Training also has a critical role in providing people with the specific knowledge necessary to take on high-involvement roles (e.g. Goldsmith and Clutterbuck, 1984; 1985; Lawler, 1986). This is particularly the case because there are several types of skills and knowledge that cannot necessarily be learnt on-the-job (such as using 'cause-and-effect' diagrams for quality control, Ishikawa, 1985), yet which are critical to changing the way people think about and solve problems (see, for example, the New Age Thinking courses described by Buchanan and McCalman, 1989). In particular, people's strategic orientations are likely to be dependent on training since many IM initiatives require an 'unlearning' of existing ways of thinking about production (see section 4.1.3). There is also a need to get the balance right. Wilkinson *et al.* (1992) describes a case study of the implementation of TQM where there was too much emphasis on 'hard techniques' (such as quality tools) and not enough attention to team-working and interpersonal skills.

10.2.2 Appraisal and remuneration

Appraisal and remuneration methods are an important aspect of the management of human resources (Guest, 1987). They are seen as capable of fostering employee commitment, providing incentive for flexibility, communicating shared norms, and directing performance (Geary, 1992). As such, they are likely to be highly relevant to the development of new role orientations. Some support for this suggestion came from the qualitative data presented throughout the thesis. The best way to illustrate this is to compare extremes; in this case, the payment system in the traditional company (*Chapter 6*) in contrast to that in the high-involvement company (*Chapter 8* and *Chapter 9*).

In the traditional company, direct operators were paid with an individual bonus (or piecework) system. This method of payment seemed to encourage a 'job' or 'bureaucratic orientation' (Lawler, 1992) where people have prescribed narrow and extrinsic views of their jobs, rather than the 'role' orientation required within IM. For example, the piecework bonus system facilitated a view of performance that was focused entirely on 'turning out' products, and limited employees' interest in other goals and issues, such as those concerning quality, flexibility and team-working. Piecework also appeared to encourage attitudes that were inappropriate to the initiatives the company was trying to implement. For example, by rewarding operators for how much they produce, piecework implies that the most important goal is to produce as much as possible and the best way to do this is to have large batch sizes. However, this mentality conflicts with the company's movement toward producing small batches to allow faster responsiveness to customers (see Oliver and Davies, 1990, for a similar observation). Similarly, the work study system (which determines piecework rates) supports the view that there is 'one-best way'; an attitude that clearly goes against the IM principle of continuous improvement.

In direct contrast to this, Company F used a performance-related payment system where pay is related to individual performance through an appraisal process. This involved supervisors, once a year, appraising their subordinates' performance on several dimensions. During the course of introducing IM, the performance dimensions were altered so that they better aligned with the company's business goals. Behaviours such as product-ownership, knowledge of the production process, and team-working were included in the appraisal, and less weight was given to traditional (and assumed) behaviours, such as attendance and being on-time (see Parker, *et al.* in press for a fuller description; and Buchanan and McCalman, 1989 for an account of a similar system). In this way, the reward system was reasonably compatible with the development of broader role orientations.

This system of performance-related pay is considered by many writers to be the best way to facilitate appropriate conceptions of behaviour (e.g. Lawler, 1992; Townley, 1989). Individual effort is conceptualised more broadly than with systems like piecework, and "is reconstituted to embrace not just the level of output, but also the quality of that output, the level of discretion and initiative exercised by that individual, his/her commitment to the team, and so on" (Geary, 1992, p. 34). Essentially, the use of such a payment system represents a 'norm-based method of control' (Geary, 1992) where management strategy shifts from one that relies on "*formal rules* as to how the work *is* to be done, to *implicit expectations* as to how it *should* be done" (Townley, 1989, p. 103). Geary describes three case studies where management deliberately tried to change people's orientations (described as 'mind set changes' and 'cultural changes') towards quality, flexibility and team-working through the use of pay-for-performance. Lawler (1992, p. 148) similarly argues that paying the person for what they contribute, rather than paying the job (e.g. like piecework methods), fosters "an orientation that says an individual should do what is right in the situation rather than what is called for by the job description". It should be noted, however, that it is critical with these systems that they are seen to *fairly* assess performance, otherwise performance-related pay can be just as limiting as individual bonus systems.

Based on the qualitative data reported here, in conjunction with other commentators' views, it appears that methods of remuneration are important influences on people's orientations. This is not to say that payment systems will be sufficient mechanisms to change orientations on their own. People will need to have the autonomy to develop and act on the broader orientations fostered by the payment system. However, as in the high-involvement company, the messages from payment systems must be congruent with, and serve to facilitate, the orientations required with job redesign in IM. It is thus important that the type of payment system is considered when jobs are redesigned within IM and, from a research perspective, that payment variables are incorporated in studies of orientation development within IM.

Turning this suggestion around, the construct of orientations is likely to be useful in research evaluating payment systems. For example, in describing a case study where changing the payment system lead to enhanced flexibility, Geary (1992, p. 45) raises the question "Did employee acquiesce to managerial requests for flexibility because of the financial inducements associated with merit pay or had the practice of HRM engendered a commitment to organisation goals through the internalisation of norms and behaviours?". Examining whether people saw flexibility as an important requirement for performance (i.e. this was seen as part of their role) or if they understood how it related to IM initiatives (i.e. their strategic orientations) might go some way towards answering this question.

10.2.3 Supervisory roles and behaviours

The importance of adopting new supervisory behaviours when jobs are redesigned into autonomous teams has been recognised in the job design literature (e.g. Cordery and Wall, 1985; Grey and Corlett, 1989; Hackman and Oldham, 1980; Walton, 1985). Rather than controlling and co-ordinating, the supervisor's role becomes one of facilitating the team's development, and includes activities such as setting objectives, training/coaching, managing boundaries, and providing resources. Based on this literature and the studies in this thesis, there appear to be at least three reasons why supervisors' adopting these behaviours is critical for employees' development of new role orientations.

First, supervisors have the key role in devolving control to the operators. If they cling to their controlling and directing role, this affects the extent of operators' job control (e.g. Cordery and Wall, 1985; Grey and Corlett, 1989; Hackman and Oldham, 1980) and thus, indirectly, will affect the development of new orientations. The importance of supervisor's devolving control equally to all employees, rather than a select few, was highlighted as necessary for employee development within Company F (*Chapter 8*). Likewise, cell leaders maintaining control and not devolving responsibility was identified as a barrier to understanding and 'owning' the Kaizen initiative in Company D (see also the case study by Buchanan and Preston, 1992).

Second, supervisors have a critical role in helping to foster employees' acceptance and understanding of their new role, as well as their wider understanding about the production process, strategies, goals, and business issues. Supervisors can be the most influential people in the learning process; being the first point of contact between management and the shopfloor, and often being responsible for organising training and conducting performance appraisals. Moreover, in the early stages of change, supervisors often have a clearer idea of the new employee role (through attending training courses, etc.) than the employees do themselves. This was highlighted by the supervisor of the pilot product-team who repeatedly described how hard it was to get people who were initially confused about their roles to understand exactly what was expected of them (*Chapter 8*). Similarly, another supervisor in the same company described an instance where a person came to them wanting to improve their appraisal rating. The supervisor suggested using their initiative more, and gave some examples how this might be achieved. The person went off, completed the suggested tasks and then returned saying, 'I've done that, what next?'. The supervisor then had to work hard to try and get this person to understand what 'initiative' actually means.

A third way in which the behaviours adopted by supervisors might affect peoples' orientations relates to the idea that people define their role with reference to others. For example, within the traditional company (*Chapter 6*) the foremen's role was clearly seen as following formal procedures, sorting out problems, organising work and co-ordinating tasks. Any questions from the researcher about employees taking up these responsibilities for themselves were met with answers that these were the 'foreman's job'. It seemed that, without foremen clearly carving out a new role for themselves, operators could not see themselves as taking on traditional supervisory responsibilities. Similarly, in the transition to product-lines in Company F (*Chapter 8* and *Chapter 9*), the supervisor of the pilot team remarked how he had to constantly tell and show people that he was not 'the boss who makes all the decisions' but a resource for people to make their own decisions. As he got increasingly involved in the new role (e.g. planning for the future), this meant he had less time to make day-to-day decisions and the distinction between roles became clearer. In a case study with a less successful transition to IM (Buchanan and Preston's, 1992), operators felt confused about, and frustrated with, their new roles because supervisor's would not adopt a 'hands off' style of supervision and kept interfering with operational decisions.

Thus, it is likely that supervisory behaviours indirectly affect the development of orientations by ensuring control is devolved equally amongst team-members, and directly affect them through changing employees' understanding about their role. One would expect that, if job redesign is implemented across a variety of groups, supervisors' behaviour will affect the differential development of orientations within the groups. Further, these studies also suggest a potentially important extension of the construct of orientations; that is, examining supervisor's orientations towards *their* role. This is a particularly important area of research given evidence that this is a critical transition, yet one that supervisors often find hard to make (e.g. Buchanan and Preston, 1992). As the example about using 'initiative' highlights, it may often seem easier to maintain control than engage in a difficult process of teaching people to do things for themselves. The difficulty of adopting the new role is accentuated because of a lack of established policies and procedures (Grey and Corlett, 1989), a lack of clear role models (Lawler, 1986), and where the requirement to achieve high production whilst allowing people to be participative can seem conflicting (Donaldson and Gower, 1975). Finally, at a time when their involvement is crucial to successful change, supervisors' may have fears about delegating themselves out of a job (Grey and Corlett, 1989). Thus, the construct of orientations (with the development of appropriate measures) could usefully be applied to studying this difficult, yet critical, process whereby supervisors develop new roles.

10.2.4 Summary and general conclusions

In summary, whilst enhanced control seems to be a necessary condition for the development of new role orientations, consideration of other organisational practices is important to ensure they guide people's behaviour in the same direction as the job redesign. This is consistent with organisational socialisation research that routinely looks beyond the influence of tasks and work role factors to include an examination of how interpersonal sources (particularly supervisors) and organisational attributes affect the role-making process (e.g. Feldman, 1981).

At a broader level, the importance of having congruent organisational practices can be seen as fostering a 'culture' that is appropriate to IM, where culture refers to a system of shared meaning and interpretation of organisational issues (Schein, 1985). The importance of culture was also noted by Oliver and Davies (1990) in their presentation of two case studies examining the introduction of IM initiatives. In these cases, "the new manufacturing strategy contained one set of assumptions about how the world 'ought' to be, and the existing culture contained quite another" (p. 568). They suggested that factors such as the payment system and the functionally-based shopfloor work organisation served to 'feed' the existing culture. More generally, they identified the lack of such factors as a key reason why greenfield sites have fared better with the introduction of IM initiatives than brownfield sites. Greenfield sites are often set up in specific locations, such as areas of high unemployment, so that investors can facilitate the necessary culture through, for example, being selective of their workforce, establishing flexible working practices, and even establishing single union agreements (Fucini and Fucini, 1990; Turnbull, 1988; Young, 1992).

These findings are also consistent with an increasing emphasis on human resource management (HRM) and the 'softer' aspects of modern manufacturing, particularly the establishment of a form of control that relies on establishing shared norms and values to guide behaviour. This has been variously called 'social control' (Oliver and Davies, 1990, p. 569), 'cultural control' (Child, 1984), 'third order control' (Hayes *et al.* 1988), and a 'norm-based method of control' (Geary, 1992). Oliver and Davies (1990) suggest that changing the manufacturing philosophy and social organisation of production are as important (if not more important) elements of the management strategy than are the 'harder' aspects such as introducing new technology. For example, Bratton (1993, p. 398) suggests that manufacturing organisations need to adopt a strategic approach to HRM where management must "treat employees as a valued asset rather than a variable cost, see training and development as an asset, and view empowerment and high trust employment relations as necessary prerequisites to recruit and retain an effective, and committed, workforce". Similarly, a survey of 'flexibility arrangements' emphasised the importance of attitude change and noted that this is the core of many industrial agreements that are negotiated (Industrial Relations Review and Report, 1984). Increasingly, as Turnbull (1986, p. 203) claims, British managers are adopting the Japanese views of HRM that "the organisation and management of employees, together with their attitudes, are perhaps the most important (and certainly the most idiosyncratic) resource on which productivity and competitive performance ultimately depend".

There is, however, a big gap between taking on this view and acting on it. The adoption of HRM, and the required attitude and cultural change, is not easily achieved in brownfield sites. Turnbull (1988) suggests that companies tend to adopt the more coercive elements of the Japanese HRM system (as, for example, at Lucas Engineering where lots of emphasis was given to the possibility of closure in order to bring about change), and whilst this may allow the *adoption* of management plans, but it may not foster the necessary commitment and co-operation for effectiveness *within* the system:

> Thus the introduction of 'high-trust' management techniques into an essentially 'low trust' environment, where management has traditionally attempted to reduce employee autonomy, discretion and influence through 'Tayloristic techniques', is unlikely to foster employee commitment towards managerial objectives (p. 204).

Thus, despite an increasing emphasis on HRM within modern manufacturing, the required cultural change cannot easily be brought about. This reiterates the value of investigating role orientations and how these are affected by organisational practices and systems. As Guest (1987, p. 511) claimed, people have relatively stable value orientations and associated work goals and practices that "can be altered in adulthood and through workplace experiences, but to achieve this requires a *coherent and strongly reinforced set of policies which outweigh countervailing forces*" (emphasis added). Thus, orientations can be seen as an important construct, not just for job design research, but for wider investigation of the social and cultural aspects of IM and how these are affected by human resource factors.

10.3 Broader implications and future directions

To this point, I have focused on the construct of orientations, both as a new dimension to job design research and as a variable of potential explanatory value in other human-resource related domains. I now extend the discussion beyond this in two ways. First, I consider the contribution of *the general results in this thesis (i.e. not just those relating to* orientations) to some wider issues within IM. This allows the reader to step back and look at this thesis from a different perspective. Second, I put forward some ideas for job design research that go beyond orientations.

10.3.1 Wider job design issues in manufacturing

Two issues are considered: the effects of IM on jobs and labour, and the relationship between job design and performance within IM. As a result of this discussion, some potential implications for government policies are briefly suggested.

10.3.1.1 The effects of IM on jobs and labour

A major debate relevant to IM concerns the general implications of these strategies for labour. At the broadest level, this is known as the 'flexibility debate' (National Economic Development Office, 1986, p. 4); a discussion dominated by sociologists, but also involving business people, unionists, politicians and journalists (psychological input is noticeably lacking). At one extreme, advocates of 'flexible specialisation' argue that economic and technological changes will see the end of Taylorism and Fordism, and the growth of functionally and numerically flexible firms that offer more rewarding work (e.g. Kern and Schumann, 1987; Piore and Sabel, 1984; Tolliday and Zeitlin, 1986). As has been described throughout this thesis, commentators adopting this perspective believe that IM initiatives will enhance operator control and increase their skills (e.g. Hutchins, 1989; Lawler, 1992; Monden, 1983; Schonberger, 1982; Tolliday and Zeitlin, 1986).

At the other extreme, stemming from Braverman's (1974) deskilling thesis is the labour process, or the 'degradation of work', view that any restructuring will always involve work intensification and increased managerial control (e.g. Shaiken, 1984). Thus, commentators who adopt this perspective argue that IM initiatives serve only to intensify jobs (see Delbridge *et al.* 1992; Turnbull, 1988 for detailed accounts). For example, Ichiyo (1984, p. 46, in Young, 1992) suggests these strategies often mean "the application of Taylorism by workers themselves"(see also Conti and Warner, 1993), and Delbridge *et al.* (1992, p.105) describe the ultimate goal of management adopting JIT and TQM as creating a system of "Total Management Control". Some of the main arguments of this perspective include that IM initiatives result in: 'multi-tasking' where workers perform a range of simple tasks on demand without being able to gain in-depth knowledge (Delbridge *et al.* 1992); a down-sizing of the workforce with the remaining workers having to perform more tasks, faster (McCune, Beatty, and Montagno, 1988; Turnbull, 1988); only 'cosmetic' autonomy where production decisions are dictated either by management or customer needs, and the tightly standardised procedures takes away choice over task execution (e.g. Klein, 1989); a constant pressure to improve processes that takes away worker's freedom to 'bank' their ideas and gain idle time or increased bonus earnings (Delbridge, *et al.* 1992), and that results in feelings of continuous pressure (Turnbull, 1988; Parker and Slaughter, 1988); and intensification through using peer pressure and a 'customer' ethos to get operators to work harder and not let each other down (Delbridge *et al.* 1992).

There is case study evidence to suggest that these forms of intensification can, and do, occur. Sayer (1986), for example, describes an instance where one Toyota worker performed thirty-five different production jobs and walked six miles in one day, and Sewell and Wilkinson (1992) report how TQM functioned as a systematic form of shopfloor surveillance. However, with the exception of some AMT studies (see Wall and Davids, 1992), and Jackson and Martin's (1993) study of JIT, there are very few studies that have systematically investigated the introduction of IM initiatives (Dean and Snell, 1991; Turnbull, 1988). Young (1992, p. 678) states that the enormous information and opinion about Japanese manufacturing practice in the U.S. 'is derived from anecdotes and small sample studies". This is also true of the dominant proponents of the labour process view in the U.K. While such an approach is informative especially within relatively new research domains such as IM it is nevertheless limited

Thus, the systematic approach taken in this thesis means the studies have a key contribution to the debate.

First and foremost, the results from this thesis echo a growing view that there is a non-deterministic relationship between IM initiatives and labour (Dean and Snell, 1991; Jones and Scott, 1987; Kelley, 1989; Phillimore, 1989). That is, there is no automatic tendency, or 'technological imperative', for the introduction of IM to result in either deskilling or enskilling. This is suggested by the finding that two instances of IM implementation had radically different outcomes; the introduction of Kaizen in Company D was consistent with the labour process perspective (*Chapter 7*), but the introduction of product-lines in Company F was more consistent with the flexible specialisation view (*Chapter 8, 9*). Given this non-deterministic relationship, it seems critical that management *actively* consider the issue of job design when introducing IM initiatives, rather than assuming it is predetermined one way or the other (see also Bratton, 1993; Hayes *et al.* 1988; Mortimer, 1985; Zuboff, 1988).

Further, what is unique about the results in this thesis is the clear demonstration that the introduction of IM initiatives *can* have positive effects on jobs and people's reactions to them, and that this not a 'theoretical fantasy' (Turnbull, 1988). In the final study, not only did operators report greater job control and new role orientations but, despite a lot of room for deterioration, they maintained high job satisfaction and low stress. Moreover, although their anxiety increased in the first year, levels returned to normal in the second year, suggesting that operators had learnt to cope with more demands. These results are in direct contradiction with many labour process theorists who assume that more complex jobs with greater responsibility will inevitably be 'bad' for people. The deliberate intention in Company F was to challenge people and allow them to grow; objectives and language that tend to be viewed cynically by many commentators as 'management devices' to intensify work. Yet most operators took on these challenges and reported that they did not want to go back to old ways of working. The only problems occurred with the test engineers, whose jobs were made less complex. These people did *not* feel sufficiently challenged and reported a deterioration in satisfaction and an increase in stress.

Not only are the assumptions of labour process theorists severely challenged by these findings, so is the methodology that is typically used. The conclusions made in the above study would probably not have been made if this had been a case study. First, as a group, the test engineers were angry and keen to espouse their negative views. They were also articulate and persuasive. It is highly likely that, had a researcher called for volunteers to interview, the test engineers would have been most forthcoming and probably would have swamped the views of the operators, for whom the change to product-lines was largely positive. This problem of 'vocal losers' is likely to be inherent in the design of many of the IM case studies. For example, in The Nissan Enigma, the authors concluded that 'control, exploitation and surveillance' were more accurate descriptions than 'quality, flexibility, and team-working' (Garrahan and Stewart, 1992, p. 59). Yet only 19 people out of thousands were interviewed (only 15 of whom were quoted in the book), and the rest of the data came from company documents. Not only do case studies of IM often have small and incomplete sample, but there is often a lack of information about how the sample was selected (see, for example, the case studies reported by Oliver and Davies, 1990 and Bratton, 1993) . The importance of a complete sample or, minimally, a non self-selected sample with details about the selection, is highlighted.

Second, although assessing change in job content might have been possible without collecting survey data, it would have been almost impossible to accurately evaluate the *effects* of this change. For example, the fact that people were already quite satisfied (relative to other production workers) would not have been known, and thus a reported lack of change in job satisfaction may have been seen as a 'failure'. Similarly, employees developed new meanings about their 'job' (as shown by the findings for orientations), and this was put forward as a possible reason for no reported increase in job satisfaction. Again this interpretation could not have been made readily through less systematic observation. Thus, to a labour process theorist, the fact that people were not more satisfied or less stressed - yet clearly taking on more responsibilities - may well have seen as an instance where people were being coerced (through, for example, the appraisal system) to do what management wanted. Further, had the study been a one-off observation immediately after the change, it may have been concluded that IM increases anxiety. However, as the full longitudinal results showed, this effect tapered off over time, suggesting that the same demands were no longer present or that people had learnt to cope with them.

In general, there is an urgent need for further systematic research that incorporates job design variables into the investigation of IM initiatives and evaluates them over time. This will help to more fully delineate the conditions under which IM initiatives are 'good' or 'bad' for people. One area that has received minimal research attention concerns the roles of specialist and support staff (e.g. production controllers, quality inspectors). For example, in the final study, the results may have been different if the test engineers had been allocated different roles (such as remaining as specialists within their product-line) or if they had been involved in designing the roles for themselves. Delineating the effects of IM initiatives on specialists and how these effects can be moderated is particularly critical given a decrease in the proportion of direct to indirect labour (Hayes *et al.* 1988). Similarly, the effects of IM initiatives on peripheral workers (i.e. temporary employment, short-term contract, and part-time workers) needs attention. Not only is this 'poor periphery' growing in size (Phillimore, 1989), but these workers (usually women, young people, or minority groups) typically have the least employment rights and are the most disposable. They thus may be particularly likely to be 'squeezed' with IM (Bratton, 1993; Wood, 1989).

10.3.1.2 IM , job design and performance

A further issue relates to whether, or under what conditions, the redesign of jobs leads to better organisational performance. This is critical question as managers are unlikely to invest effort into enhancing the autonomy of shopfloor jobs, and into changing HR practices to support this redesign, if the same performance gains can be made with a control-oriented approach.

Based on the results of this thesis, it appears that performance can be enhanced by job redesign. Enhanced control was shown to be an important factor in the development of broad, proactive and strategic orientations which, in turn, predicted employee performance. Although not explicitly tested, the implication is that greater control also affects those aspects that were suggested to underlie orientations (i.e. knowledge and understanding, intrinsic motivation, and certain personality factors). Thus, job redesign can be seen as necessary to facilitate the changes in employees that are needed for effective performance within IM.

However, this is not to say that management will necessarily change people's jobs when introducing IM initiatives (see Jackson and Martin, 1993; Turnbull, 1986; Wilkinson *et al.* 1992 for examples). As described earlier (see section 2.2.4) changes in job designs may be blocked by managerial or organisations sources of inertia (Clegg, 1984; Dean and Snell, 1991; Kelley, 1989). Moreover, it is likely that job redesign will not always necessary. The relationship between operator control and enhanced performance may be contingent of the level of production uncertainty (Clegg, 1984; Slocum and Sims, 1980). Lawler (1992), for example, argues that devolving control to employees at the lowest level may not be necessary when the work and technology are simple, when the environment is stable (e.g. product types do not change often), or when there are particular characteristics of the labour market (e.g. there are low labour costs and poorly skilled labour). In these cases, it may be possible for management to ensure adequate work performance by simplifying work and direct supervision. For example, in the study of the introduction of Kaizen (*Chapter 7*) one explanation of the finding that performance gains were achieved without job redesign was that the company had a relatively certain production environment.

A further explanation of this outcome related to the narrow goals of Kaizen and the limited definition of 'performance enhancement'. Management sought, and obtained, gains in cost, lead-time, space, and housekeeping. In contrast, in the high-involvement company, management wanted to make better use of their human resources; they wanted a flexible, 'thinking' and highly committed workforce to improve lead-time, delivery integrity and quality (*Chapter 8* and *Chapter 9*). This raises another contingency in the relationship between job design and performance within IM; that is, what management actually *require* from the strategic change. Jones and Scott (1987) make a similar argument in relation to FMS, suggesting that there is considerable uncertainty and ambiguity about the most significant gains of programmable automation in the literature (e.g. Ingersoll Engineers, 1982; Jaikumar, 1986). They assert:

> If these new systems are simply the extension to small batch manufacturing of established dedicated (or 'Fordist') types of cost saving advantages (in terms of higher machine utilisation, reduced set-up times and unit labour costs) then it may well be that, from a point of view of conventional management, all the old rigid and specialised work roles are still appropriate.
>
> However, if alternatively, the advantages are more intangible and 'qualitative' then flexible and semi-autonomous work groups would seem to be essential (p. 35).

These intangible benefits include, for example, operators who have new combinations of skills and "new mental frameworks" that ensure "errors can be quickly corrected or ad hoc modifications can be made if unanticipated problems occur" (p. 32). In turn, this allows responsiveness to design changes, market flux and innovation in production methods; and these are likely to be the principle contribution of an FMS in "the demanding commercial environments of the 20th Century" (p. 35; see also Wood, 1990 for a similar argument). Thus, if management require more than saving costs and labour - which is typically the case in situations of high production uncertainty (and indeed, typically why IM initiatives are introduced) - then job redesign should be considered as part of the strategy.

There is a clear need for more research that investigates the relationship between job redesign and performance, and its moderators. One strategy would be to compare the effects of different job design on performance across similar organisations, particularly in terms of their effects on longer-term performance. There is also much to be gained from in-depth investigations within organisations where the 'intangible' performance-related benefits of job redesign are carefully monitored over time. This, in turn, requires methodologies to assess these more subtle benefits of job redesign. (The final part of this chapter relates to this need).

I now turn to some potential policy implications of these observations about job design, IM and performance.

10.3.1.3 Some policy implications

There is currently substantial debate about the future of manufacturing in this country. The general issue concerns the best strategy for competitiveness. That is, should manufacturing in Britain try to compete on the basis of low wages, low technology and a low skill-base? Or should this industry enskill and focus on high 'value-added' products?

From an economic perspective, results of this thesis suggest the latter strategy. All indications are that the world economy has changed and it is no longer enough to compete on the basis of cost alone. Largely as a result of Japanese competition, the threshold of acceptable quality has increased, there is a demand for increased product variety and rapid responses to changing customer demands, and there is a need for full utilisation of new technology (Hayes *et al.* 1988; Lawler, 1992; Womack *et al.* 1990). As suggested by many commentators, and supported by the results of this thesis, these goals cannot readily be achieved through low wages and traditional control-oriented approaches. Womack *et al.* (1990) site the example of Hyundai, a car manufacturer in Korea. Although a high-volume and low wage production strategy was initially successful in undercutting Japanese prices in the U.S. and Europe, it soon fell apart as the Koreans lost their cost advantage (because workers demanded higher wages) and extensive quality problems with the cars began to surface. As these authors claimed "the next Japan was no longer the next Japan" (p. 262). Similarly, Lawler (1992, p. 34) argues that where labour costs are high and the competition is global, the involvement-oriented approach is the best "way to utilise the ability of employees to add value to the product in a cost-competitive manner. If employees do not think, solve problems, and control themselves, they simply cannot add enough value to the product to compete with low wage employees elsewhere in the world". Thus, if Britain wants to compete on the basis of high quality and responsiveness to customer demand as well as cost (as it appears it needs to), then a more flexible and highly skilled work force is needed. Lowering wages and deskilling jobs will not foster the high performance needed in these situations.

An enskilling, high-wage strategy is also consistent with Western culture. According to Lawler (1992) some US cultural values (which overlap considerably with those in

Britain) include: individual rights, innovation, competition, teamwork, democratic processes, individualism, personal freedom, and entrepreneurial behaviour (see also Hofstede, 1991). Although in the past it has been recognised that management restrict individual freedom and decision making (i.e. through control-oriented work designs), this has been seen as the only way for organisations to be successful. Now, there is a clear alternative. As Lawler claims:

> The challenge for all organisations is to find a management style that helps them attract and retain the best and brightest employees and that fits the national cultural values of the country or countries in which they operate (p. 24).

Lawler suggests that the Japanese have done this, and have created an approach that fits their values, such as uniformity, discipline, group membership, conformity, attention to detail, respect for age, individual dignity, obligations to others, and loyalty to large organisations and to the country (Ouichi, 1981). However, these are not the predominant values in this country and thus what works in Japan may not be the best approach here. Manufacturing companies should not simply seek to mimic the Japanese approach but should adopt an enskilling strategy that is both competitive and consistent with dominant cultural values (Lawler, 1992; Young, 1992).

Without going into detail (this would be an entire thesis in itself), it is quite clear that if a highly skilled workforce is necessary for competitive manufacturing, then there are implications for government policies. As Lloyd (1989, p. 100) claims, it is not enough to focus on poor local management: "Instead, we need to ask why is there poor management, why is there a lack of training, why hasn't new technology been introduced. These are outcomes which describe much deeper problems". These 'deeper problems' are likely to relate to policies areas such as education, training, health and safety standards, employee rights (e.g. payment levels, bargaining and striking rights, union membership, participation), shorter working weeks, union roles, manufacturing finance and (given that one of the consequences of IM might be a much smaller core of highly-skilled workers) unemployment programs. Considering all of these is beyond the scope of the thesis; however, training shall be put forward as an illustration of the need for government intervention.

In general, there is a lack of long-term, low-cost finance available for manufacturing in Britain (Ackroyd, Burrel, Hughes and Whitaker, 1988). Yet this is clearly necessary for funding the training and development needed for a highly skilled workforce, and for paying high wages to support this higher level of skill (Wilkinson and Oliver, 1989). For most of this century, British governments have insisted that training is the company's responsibility (Lee, 1989). This means most companies only train people when they are making profits and training is one of the first things to be abolished when economic pressures are high. However, as argued above, this is precisely when highly skilled and flexible people are needed (see also Piore and Sabel, 1984). Further, this means that the more costly and transferable the skills, the more likely firms are to dilute the skills to make them specific to the firm's requirements to prevent 'poaching' (Lee, 1989). This then restricts the portability of skills, reduces external mobility and, in combination with fewer positions available within the company (due to downsizing), may mean that workers feel 'trapped' (Wilkinson and Oliver, 1989). In contrast to Japan, individual career development across different companies is highly valued in Western cultures (Lawler, 1992). The government also has a critical role in providing the training that companies are particularly resistant to giving to the 'poor periphery', and in protecting their conditions of employment.

In summary, the studies reported in this thesis, in conjunction with other literature and informed opinion, suggest that adopting an enskilling approach to the introduction of IM initiatives can result in employee growth and development, enhanced organisational performance, and may even contribute to the manufacturing success of this country. The latter, however, is not just dependent on effective local management but requires supportive and strategic long-term government policies.

On the whole, this account highlights there is an important role for psychological research in contributing to our understanding of the social, economic and political implications of modern manufacturing.

10.3.2 Beyond orientations: Where can research go from here?

The investigation of orientations was framed within a broader approach to job design research that assumes that people do not just passively react to their job but can change and develop as a result of their interaction with it. This can broadly be referred to as a 'developmental-interactionist' approach in that it encompasses the assumption within life-span developmental psychology that people continue to grow and develop throughout their whole life span (e.g. Baltes and Schaie, 1973), and in that it takes on key aspects of the interactionist perspective of personality theories that people do not just react to environments but can actively change the environment and be changed by it (e.g. Bowers, 1973). This approach aligns closely with the occupational socialisation perspective described by Frese (1982) and with the learning perspective taken by Karasek and Theorell (1990). However, more specifically, it highlights the importance of job redesign as a mechanism for allowing and facilitating employee development and growth.

Once one accepts the view that people can grow, develop and learn as a result of job redesign, the potential areas of exploration are enormous and somewhat overwhelming, encompassing cognitive, social, and emotional domains. In this thesis, development has been construed rather loosely as progression along Argyris's (1964) criteria. This approach was appropriate since it was specifically adapted for work settings and the 'adult' end of the dimensions aligned with the sorts of behaviours required within IM. Yet growth and development can be conceived of from many perspectives. Relevant concepts could be applied from: theories of personality development, such as Loevinger's (1976) theory of ego development, Maslow's (1962) holistic theory, and Kelly's (1955) personal construct theory; theories of language and cognitive development, such as Piaget's (1970) developmental theory; and theories of physiological development. All of these perspectives (and there are no doubt more) contain constructs that could be applied to a developmental-interactionist job design theory. For example, from Piaget's theory, changes in 'egocentrism' (i.e. being able to see other people's perspective) could be seen as an outcome of job redesign where people learn the consequences of their actions on other people and processes.

Although this approach goes beyond the concept of orientations, it is still within the same framework and domain of inquiry. That is, the interest is in examining growth and development in relation to *work roles*, particularly in relation to 'high performance' within IM. Whether such changes extend outside the workplace is not of immediate concern since the focus is on development at work. (Thus, the term 'personality change' is avoided here because of assumptions that personality variables are fixed traits that transcend context). As an example, considering changes in an employee's locus of control in relation to various work and role-related issues (e.g. a sense of control over the quality of products) would be more appropriate than considering their feelings of control over general events in their life. Feeling in control of activities at work can be seen as tapping empowerment and growth, and is also likely to relate to performance. Although such an approach has rarely been applied to job design research, writers from other domains have noted the possibility. For example, Kahn argues that job redesign can allow people to become fully engaged in their roles; that is, where people "expand their selves within their roles" (1992, p. 333) and "employ and express themselves physically, cognitively, and emotionally during role performances" (1990, p. 694). This engagement is argued to lead to "active and full role performance", whereas disengagement refers to a physical, emotional and cognitive withdrawal of the self from the role, leading to a "passive, incomplete role performance" (Kahn 1990, p. 701).

To illustrate this developmental-interactionist approach in more depth, two types of development are discussed in relation to job design within modern manufacturing: *cognitive development* and *activity development* (note - the latter encompasses changes that might normally be referred to as 'personality development', see Adler and Weiss, 1988). This is not intended as a complete specification of all possible developmental pathways, but an illustration of some that might be potentially important for job design research within IM contexts.

10.3.2.1 Cognitive development

One of Argyris's (1964) developmental criteria was the movement from concrete thinking to abstract thought, and developmental psychologists have tracked how children develop more efficient ways of problem-solving, learn new perspectives, and develop more sophisticated cognitive schema's (e.g. Matlin, 1983). Here, it shall be argued that this sort of change can occur as a result of job redesign, and that it is likely to relate to performance within IM contexts.

As described in the introductory chapters (see section 2.3.1 and section 4.2), job redesign may enhance knowledge and understanding (i.e. the *content* of people's cognitions) as well as how this knowledge is used to solve problems and make decisions. This argument has been made throughout this thesis in relation to the development of orientations, but there is much to be gained from pursuing this line of inquiry for its own sake. What people know, and how they use their knowledge, clearly affects their performance (e.g. see Blumberg and Pringle's 1982 model of performance). This is especially the case in autonomous situations where they have the opportunity to use their knowledge. Moreover, there is much anecdotal evidence and observation that job redesign results in the development of a broader knowledge base (e.g. Wood, 1989), and some work done by German action researchers and Wall and colleagues has begun to address this issue. On the whole, however, very little research has systematically looked at changes in knowledge or cognitive processes as an outcome variable of job redesign and, in turn, as a predictor of performance.

There is much scope for investigation. Drawing on research in cognitive psychology, there are various distinctions that can be made between types of knowledge, such as procedural and declarative knowledge (Anderson, 1976) and implicit and explicit knowledge (e.g. Berry and Broadbent, 1986; see Broadbent, Fitzgerald and Broadbent, 1986; Cavestro, 1989; Leplat, 1990; and Wood, 1990 for applications of this concept to operator performance). Further, there are different domains in which cognitive development might occur. The research done by Wall and colleagues has focused on people's in-depth knowledge about specific machines and how this affects their problem-solving behaviour. However, there has been little interest in other domains such as employees' wider knowledge of manufacturing, including their understanding of the whole production process (e.g. the interdependencies between stages, customer priorities, order deadlines, and differences in products), of manufacturing as a whole (e.g. their knowledge about other departments such as marketing and sales), and of the business (e.g. who competitors are, what strategies are being introduced and why). One could also consider more 'informal', instrumental knowledge (such as how to get things done, who to see in certain departments if problems arise), as well as various forms of collective knowledge (such as knowing the roles and responsibilities of team members, how to work effectively within group, how to run meetings, and how to solve conflicts). There is scope to examine knowledge at the group level, and how this is distributed by group members. For example, Troussier (1987) suggests that work groups engaged in achieving the same goals (such as shift-work teams) develop different 'collective operative images' with varying levels of understanding of how the process works and the procedures to be carried out, and with different versions of the 'facts' and the solutions. More efficient groups are suggested to be those where information circulates freely and that possess "the knowledge which enable it, at all times, to elaborate adequate and realistic diagnoses and reactions" (p. 43).

A slightly different approach is to look at cognitive complexity as an outcome. This is typically construed of as an aspect of cognitive structure; that is as a pervasive personality variable that affects how a person perceives, processes, and organises information (Streufert and Nogami, 1989). As such, it might seem that the implications for job redesign theory and practice lie mostly in selection. However, some people claim that cognitive complexity (typically assessed by repertory grid methodology) is flexible and variable across domains (e.g. Scott, Osgood, and Peterson, 1979) and can be enhanced with training (e.g. Cronen and Lafleur, 1977; Streufert *et al.* 1988). More importantly, there is some evidence that the complexity of the environment can affect cognitive complexity. Schroder *et al.* (1967) argued that optimal differentiative and integrative functioning occurred with an intermediate amount of complexity in the environment. Brousseau (1983, p. 39) similarly claims:

> Jobs involving exposure to complex patterns of stimuli or information will increase individuals' level of cognitive complexity, principally by enhancing individuals' abilities to differentiate among, and to integrate, different patterns of information.

Thus, because it increases the complexity of the environment, job redesign may affect the way knowledge is structured and enhance people's cognitive complexity. Kohn and Schooler's (1978) study provides some support for this suggestion. However, as in their study, it is likely that any effect of job redesign on cognitive complexity will be a long-term rather than a short-term outcome.

10.3.2.2 Activity development

It has been suggested that 'high performance' in IM requires confident people who seek out problems, take control, and who are proactive. The latter is characterised by Bateman and Grant's (1993) as initiating and maintaining actions that directly alter the environment, scanning for opportunities, showing initiative, taking action, and persevering. It is assumed that people who exhibit such behaviours believe that they have personal control over the environment (e.g. high internal local of control), that they are capable (e.g. have a sense of self-efficacy and mastery), and that they desire stimulation and achievement (e.g. high growth need strength). These sorts of behaviours and underlying values are typically considered as dispositions (for example, Bateman and Grant consider proactivity as a fixed personality trait), and if applied to job design research, they are tested as moderators of the relationship between job design and outcome variables.

However, it is possible that job redesign can lead to *changes* in these variables, and thus facilitate the high performing behaviours required within IM. That is, having greater autonomy at work may lead to the development of internal locus of control, feelings of mastery and self-efficacy, and may even stimulate people's desire for growth and achievement (see section 2.3.1 and section 4.2). The behavioural effects of such changes might include greater proactivity, work role innovation, and 'active' behaviours such as goal-setting and forward planning. There is some support for this view. In earlier chapters, it was suggested that Tayloristic jobs designs can lead to passivity and a type of learned helplessness (Seligman, 1975) where people are alienated and passive (e.g. Blauner, 1964). By enhancing job autonomy, it was argued that these negative effects can be reversed (e.g. Frese, 1982). For example, Frese *at al.* (1992; reported in Frese and Zapf, 1993) showed a relationship between job control and developing initiative. They speculated that a lack of autonomy at work influences employees' 'control cognitions' such that they feel less confident about setting or achieving goals, and this causes passivity and lowered productivity. Similarly, Kohn and Schooler (1982) reported that the complexity of the job influenced people's self-directedness (i.e. they showed less fatalism and lower authoritarian attitudes), and some action researchers have begun to examine changes in 'action styles' (e.g. goal orientation, planfulness) that result from the work environment (Frese *et al.* 1987).

Changes in these action-oriented variables might also interact with cognitive development. For example, in Karasek and Theorell's (1990) theory of learning, 'feelings of mastery' represents one of the two global categories of personality that are affected by job structures. These authors argue that an active job with successful learning opportunities results in feelings of mastery and confidence. This then leads to better coping with strain that is inherent in the situation and, in turn, leads to greater capacity to learn from opportunities that occur in the job. The greater opportunity then results in even greater feelings of mastery, more learning, and so on, ad infinitum. A similar link between mastery and learning is also made by Brousseau (1983). Following on from the argument that more autonomous jobs enhance cognitive complexity, this author suggests that "increasing cognitive complexity allows individuals to formulate and pursue more elaborate plans and goals, thereby enhancing feelings of personal efficacy" (p. 39).

10.3.2.3 Summary and implications of this new approach

In summary, considering factors such as cognitive development and activity development as outcomes of job redesign is likely to move this area of research forward considerably. Not only will it lead to better diagnosis and evaluation of the extent to which jobs allow and foster growth and development, but it will enable the specification of new theoretical links between job design and performance.

More generally, there are *further advantages to and implications of adopting this* developmental-interactionist perspective to job design research. In particular, it is a positive view that suggests people can change in fairly dramatic ways. A survey of employees in traditional jobs may indicate, for example, that most people are content with their jobs and have low aspirations. However, rather than concluding that this is an inherent trait of the workers, an alternative view is that this passivity and narrowness may be 'unlearnt' if people's jobs are successfully redesigned. This is not meant to deny the fact that some people - regardless of their work environment - may prefer simple jobs. However, it does place a greater emphasis on the environment, and in this respect is more optimistic.

This perspective also introduces the important dimensions of time and intensity. Reversing the effects of Tayloristic jobs is a learning and unlearning process and, as such, will take time and concerted effort. Job redesign may have relatively immediate effects on affective reactions (e.g. job satisfaction, anxiety), but other sorts of changes (e.g. enhanced feelings of mastery, better problem-solving abilities) may be longer in developing. These latter more 'intangible' changes may be critical for performance enhancement in uncertain production environments, particularly in the long-term. Frese (1982, p. 219), for example, describes the difference between short term and long term productivity:

> Long-term productivity means that an individual or a work group has developed its full potential and is showing an active approach to work, raising the level of aspiration in this process, and readjusting the work accordingly. Short-term productivity on the other hand may mean that a maximum profitability is achieved without regard to the development of the full potential of the worker and often even reducing the chances to use the skills that the worker already possesses.

This comment emphasises the need for managers to take a longer-term perspective when evaluating the effects of job redesign. It also suggests that performance enhancement should be considered in broader terms than those of increasing effort, saving costs, or reducing the size of the labour force.

A final implication is that job redesign should be seen as a continuous process. That is, if people are growing and developing in capabilities and confidence, then their jobs also need 'room to grow'. Karasek and Theorell (1990) suggest that one of the problems with job redesign is that people's desire for more control can conflict with organisational rigidity that restricts the scope for development. These authors suggest that jobs should explicitly be designed to allow and further opportunities for development (see also Hacker, 1986; Clegg and Ulich, 1987). Ulich (1991) describes such a process as 'prospective' job redesign, and further recommends adopting 'dynamic' job designs in which the job is continually adjusted to the growing aspirations of the employee.

10.4 Post Script

This thesis sought to add a new dimension to job design research that would make it more applicable to modern manufacturing; that is, the investigation of employees' work orientations. This arose out of observations that for successful performance within modern manufacturing people need to reverse the Tayloristic mind-set and adopt a fundamentally new view of their role and the production environment Results from these studies suggest that the construct of orientations provides considerable 'added value' to job design studies within IM. More than this, however, the construct serves to spark new theoretical perspectives in what has become a static research domain. In many ways this thesis has only scratched the surface, but the scratch has gone deep enough to suggest a seam of gold awaits researchers who take this approach forward.

References

Abernathy, W., Clark, K., and Kantrow, A. (1981). The new industrial competition. Harvard Business Review, 59, 51-68.

Ackroyd, S., Burrell, G., Hughes, M., and Whitaker, A. (1988). The Japanisation of British industry? Industrial Relations Journal, 19, 11-23.

Adler, P. (1986). New technologies, new skills. California Management Review, Fall, 9-28.

Adler, P. (1985). Technology and us. Socialist Review, 85, 67-98.

Adler, P. S., and Borys, B. (1989). Automation and skill: Three generations of research on the NC case. Politics and Society, 17, 377-402.

Adler, S., and Weiss, H. M. (1988). Recent developments in the study of personality and organisational behaviour. In C. L. Cooper, and I. Robertson (Eds.), International Review of Industrial and Organisational Psychology, (pp. 307-330). London: John Wiley and Sons Ltd.

Alasoini, T. (1993). Transformation of work organisation in time-based production management: The case of three Finnish electronics plants. The International Journal of Human Factors in Manufacturing, 3, 319-333.

Aldag, R. J., and Brief, A. P. (1979). Task Design and Employee Motivation. Illinois: Scott, Foresman and Company.

Algera, J. A. (1983). 'Objective' and perceived task characteristics as a determinant of reactions by task performers. Journal of Occupational Psychology, 56, 95-107

Anderson, J. R. (1976). Learning, Memory and Thought. Hillsdale: Erlbaum.

Andrisani, P. J., and Nestel, G. (1976). Internal-external control as a contributor to and outcome of work experience. Journal of Applied Psychology, 61, 151-65.

Argote, L., and Goodman, P. S. (1986). Investigating the implementation of robots. In D. Davis and Associates (Eds.), Managing Technological Innovation: Organisational Strategies for Implementing Advanced Manufacturing Technologies, (pp. 127-153). San Francisco: Jossey-Bass.

Argyris, C. (1976). Problems and new directions for industrial psychology. In M. D. Dunnette (Ed.), Handbook of Industrial and Organisational Psychology, Chicago: Rand McNally.

Argyris, C. (1964). Integrating the Individual and the Organisation. New York: Wiley.

Argyris, C. (1957). Personality and Organisation. New York: Harper Collins.

Argyris, C., and Schon, K. A. (1978). Organisational Learning: A Theory of Action Perspective. Reading, MA: Addison-Wesley.

Asplund, C. (1981). Redesigning Jobs: Western European Experience. Brussels: European Trade Institute.

Babbage, C. (1835). On the Economy of Machinery and Manufacturers. London: Charles Knight.

Baldamus, W. (1961). Efficiency and Effort: An Analysis of Industrial Administration. London: Tavistock.

Baldamus, W. (1958). Types of work and motivation. British Journal of Sociology, 2, 44-58.

Baltes, P. B., Reese, H. W., and Lipsitt, L. P. (1980). Lifespan developmental psychology. Annual Review of Psychology, 31, 65-110.

Baltes, P. B., and Schaie, K. W. (1973). Lifespan Developmental Psychology: Personality and Socialisation. New York: Academic Press.

Banks, M. H., Clegg, C. W., Jackson, P. R., Kemp, N. J., Stafford, E. M., and Wall, T. D. (1980). The use of the General Health Questionnaire as an indicator of mental health in occupational studies. Journal of Occupational Psychology, 53, 187-194.

Banks, M., and Miller, M. (1984). Reliability and convergent validity of the Job Components Inventory. Journal of Occupational Psychology, 57, 181-184.

Barrick, M. R., and Mount, M. K. (1993). Autonomy as a moderator of the relationship between the big five personality dimensions and job performance. Journal of Applied Psychology, 78, 111-118.

Barrick, M. R., and Mount, M. K. (1991). The Big Five personality dimensions and job performance: A meta-analysis. Personnel Psychology, 44, 1-26.

Bartlett, F. C. (1932). Remembering: A Study in Experimental and Social Psychology. Melbourne: Cambridge University Press.

Batemen, T. S., and Grant, J. M. (1993). The proactive component of organisational behaviour: A measure and correlates. Journal of Organisational Behaviour, 14, 103-118.

Beaumont, P. B. (1987). The Decline of Trade Union Organisation. London: Croom Helm.

Becker, H. S., and Geer, B. (1958). The fate of idealism in medical school. American Sociological Review, 23, 50-56.

Beekun, R. I. (1989). Assessing the effectiveness of socio-technical interventions: Antidote or fad? Human Relations, 42, 877-897.

Bennis, W. (1989). On Becoming a Leader. Reading, Mass: Addison-Wesley.

Bennis, W., and Nanus, B. (1985). Leaders. New York: Harper and Row.

Berkowitz, B. (1965). Changes in intellect with age. Journal of Genetic Psychology, 107, 3-14.

Berlinger, L. R., Glick, W. H., and Rogers, R. C. (1988). Job enrichment and performance improvements. In J. P. Campbell, and R. J. Campbell (Eds.), Productivity in Organisations, San Francisco: Jossey Base.

Berry, D. C., and Broadbent, D. E. (1986). Interactive tasks and the implicit-explicit distinction. British Journal of Psychology, 79, 86-94.

Bessant, J., and Haywood, W. (1985). The introduction of Flexible Manufacturing Systems as an example of Computer Integrated Manufacturing. Unpublished paper, available from the Department of Business Management, Brighton Polytechnic

Bessant, J., and Lamming, R. (1989). Design for efficient manufacture. In R. Wild (Ed.), International Handbook of Production and Operations Management, London: Cassell.

Blackler, F., and Brown, C. (1986). Alternative models to guide the design and introduction of new information technology into the work organisation. Journal of Occupational Psychology, 59, 287-314.

Blau, G. J., and Katerberg, R. (1982). Towards enhancing research with the Social Information Processing approach to job design. Academy of Management Review, 7, 543-550.

Blauner, R. (1964). Alienation and Freedom: The Factory Workers and His Industry. Chicago: University of Chicago Press.

Block, P. (1987). The Empowered Manager. San Francisco: Jossey-Bass.

Blumberg, M., and Gerwin, D. (1984). Coping with advanced manufacturing technology. Journal of Occupational Behaviour, 5, 287-314.

Blumberg, M., and Pringle, C. (1982). The missing opportunity in organisational research. Academy of Management Review, 7, 360-369.

Boddy, D., and Buchanan, D. A. (1986). Managing New Technology. Oxford, England: Basil Blackwell.

Bollen, K., and Lennox, R. (1991). Conventional wisdom of measurement: A structural equation perspective. Psychological Bulletin, 110, 305-314.

Booth, J. (1987). JIT at Beavers: A case study. Proceedings of the 4th European Conference on Automated Manufacturing (pp. 87-108).

Bowers, K. S. (1973). Situationism in psychology: An analysis and critique. Psychological Bulletin, 80, 307-336.

Brass, D. J. (1985). Technology and the structuring of jobs: Employee satisfaction, performance and influence. Organisational Behaviour and Human Decision Processes, 35, 216-240.

Bratton, J. (1993). Cellular Manufacturing: Some human resource implications. The International Journal of Human Factors in Manufacturing, 3, 381-399.

Braverman, H. (1974). Labour and Monopoly Capital: The Degradation of Work in the Twentieth Century. New York: Monthly Review Press.

Broadbent, D. E., Fitzgerald, P., and Broadbent, M. (1986). Implicit and explicit knowledge in the control of complex systems. British Journal of Psychology, 77, 33-50.

Brodner, P. (1986). Skill based manufacturing verses 'Unmanned factory" - which is superior? International Journal of Industrial Ergonomics, 1, 145-153.

Brousseau, K. R. (1983). Toward a dynamic model of job-person relationships: Findings, research questions, and implications for work system design. Academy of Management Review, 8, 33-45.

Brousseau, K. R. (1978). Personality and job experience. Organisational Behaviour and Human Performance, 22, 235-252.

Bruggeman, A., Groskurth, P., and Ulich, E. (1975). Arbeitszufriedenheit. Bern: Huber.

Bryman, A. (1988). Quantity and Quality in Social Research. London: Unwin Hyman.

Buchanan, D. A. (1992). High performance: New boundaries of acceptability in worker control. In S. L. Sauter, J. J. Hurrell, and C. L. Cooper (Eds.), Job Control and Worker Health, Chichester: John Wiley.

Buchanan, D. A. (1987). High performance: Long live high performance work design! Personnel Management, May, 40-43.

Buchanan, D. A. (1979). The Development of Job Design Theories and Techniques. Aldershot: Saxon House.

Buchanan, D. A., and Bessant, J. (1985). Failure, uncertainty, and control: The role of operators in a computer integrated production system. Journal of Management Studies, 22, 292-308.

Buchanan, D. A., and Boddy, D. (1982). Advanced technology and the quality of working life: The effects of word processing on video typists. Journal of Occupational Psychology, 55, 1-11.

Buchanan, D. A., and McCalman, J. (1989). High Performance Work Systems: The Digital Experience. Surrey: Routledge.

Buchanan, D., and Preston, D. (1992). Life in the cell: Supervision and team-work in a 'Manufacturing Systems Engineering' environment. Human Resource Management Journal, 2, 55-76.

Burbridge, J. T. (1979). Group Technology in the Engineering Industry. London: Mechanical Engineering Publications.

Butera, F., and Thurman, J. E. (1984). Automation and Work Design. Amsterdam: North-Holland.

Campbell, T. D., and Stanley, J. C. (1966). Experimental and Quasi-Experimental Designs for Research. Chicago: Rand McNally.

Caulkin, S. (1993). British firms resurrected by courtesy of Japan. The Guardian, May, p. 24.

Cavestro, W. (1989). Automation, new technology and work content. In S. Wood (Ed.), The Transformation of Work?, (pp. 219-234). London: Unwin Hyman.

Cherns, A. B. (1976). The principles of socio-technical design. Human Relations, 29, 783-792.

Child, J. (1984). The design of jobs and work structures. In J. Child, Organisation: Guide to Problems and Practice , 2nd edition, (pp. 23-55). London: Harper and Row.

Child, J., Ganter, H., and Kieser, A. (1987). Technological innovation and organisational conservatism. In J. M. Pennings, and A. Buitendam (Eds.), New Technology as Organisational Innovation: The Development and Diffusion of Microelectronics, (pp. 87-116). Cambridge, MA: Ballinger.

Chmiel, N., and Wall, T. D. (in press). Fault prevention, job design and the adaptive control of advanced manufacturing technology. Applied Psychology: An International Review.

Clegg, C. W. (1984). The derivation of job design. Journal of Occupational Behaviour, 5, 131-146.

Clegg, C. W., and Corbett, J. M. (1987). Research and development in humanising advanced manufacturing technology. In T. D. Wall, C. W. Clegg, and N. J. Kemp (Eds.), The Human Side of Advanced Manufacturing Technology, London: Wiley.

Clegg, C. W., and Corbett, J. M. (1986). Psychological and organisational aspects of computer-aided manufacturing. Current Psychological Research and Reviews, 5, 189-204.

Clegg, C. W., and Kemp, N. J. (1986). Information technology: Personnel where are you? Personnel Review, 15, 8-15.

Clegg, C. W., Kemp, N. J., and Wall, T. D. (1984). New technology: Choice, control and skills. In G. C. Van de Veer, M. J. Tauber, T. R. G. Green, and P. Gorney (Eds.), Readings in Cognitive Ergonomics: Mind and Computers, Berlin: Springer.

Clegg, C., and Ulich, B. (1987). In S. Grief, H. Holling, and N. Nicholson, European Handbook of Work and Organisational Psychology, Munich: Urban and Schwarzenberg.

Clegg, C. W., and Wall, T. D. (1987). Managing factory automation. In F. Blackler, and D. J. Oborne (Eds.), Information Technology and People: Designing for the Future, Leicester: British Psychological Society.

Cohen, J. (1960). A coefficient of agreement for nominal scales. Educational and Psychological Measurement, 20, 37-46.

Conger, J. A., and Kanungo, R. N. (1988). The empowerment process: Integrating theory and practice. Academy of Management Review, 13, 471-482.

Conti, R. F., and Warner, M. (1993). Taylorism, new technology and Just-in-time systems in Japanese manufacturing. New Technology, Work and Employment, 8 , 31-42.

Cook, D. T., and Campbell, T. D. (1979). Quasi-Experimentation: Design and Analysis Issues for Field Settings. Chicago: Rand-McNally.

Cordery, J. L., Smith, L. M., and Mueller, W. S. (1991). Attitudinal and behavioural effects of autonomous group working: A longitudinal field study. Academy of Management Journal, 34, 464-476.

Cordery, J. L., and Wall, T. D. (1985). Work design and supervisory practices: A model. Human Relations, 38, 425-441.

Cortina, J. M. (1993). What is coefficient alpha? An examination of theory and applications. Journal of Applied Psychology, 78, 98-104.

Cox, T. (1978). Stress. London: Macmillan.

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. Psychometrika, 16, 297-334.

Cronen, V. E., and laFleur, G. (1977). Inoculation against persuasive attacks: A test of alternative explanations. Journal of Social Psychology, 102, 255-265.

Crosby, P. B. (1984). Quality Without Tears. New York: McGraw-Hill.

Crosby, P. B. (1979). Quality is Free. New York: McGraw Hill.

Crowne, D. P., and Marlowe, D. (1964). The Approval Motive: Studies in Evaluative Dependence. New York: Wiley.

Cummings, L. L. (1982). Organisational Behaviour. In Annual Review of Psychology Vol. 33, Annual Reviews Inc: Palo Alto, Calif.

Cummings, T. G. (1986). A concluding note: Future directions of sociotechnical theory and research. The Journal of Applied Behavioural Science, 22, 355-360.

Cummings, T. G. (1978). Self-regulating work groups: A socio-technical synthesis. Academy of Management Review, 3, 625-634.

Cummings, T., and Blumberg, M. (1987). Advanced manufacturing technology and work design. In T. D. Wall, C. W. Clegg, and N. J. Kemp (Eds.), The Human Side of Advanced Manufacturing Technology, (pp. 37-60). Chichester, England: Wiley.

Cummings, T. G., and Molloy, E. S. (1977). Improving Productivity and the Quality of Working Life. New York: Praeger.

Cummings, T. G., Molloy, E. S., and Glen, R. A. (1977). Methodological critique of 58 selected work environments. Human Relations, 30, 675-708.

Cummings, T. G., and Srivastva, S. (1977). Management of Work: A Socio-Technical Systems Approach. Kent: Kent State University Press.

Davis, L. E. (1966). The design of jobs. Industrial Relations, 6, 21-45.

Davis, L. E., Canter, R. R., and Hoffman, J. (1955). Current job design criteria. Journal of Industrial Engineering, 6, 5-11.

Davis, L. E., and Canter, T. R. (1955). Job design. The Journal of Industrial Engineering, 6, 3-6.

Davis, L. E., and Canter, R. R. (1956). Job design research. The Journal of Industrial Engineering, 7, 275-282.

Davis, L. E., and Taylor, J. C. (1972). The Design of Jobs. Middlesex, England: Penguin Books.

Davis, L. E., and Wacker, G. J. (1987). Job design. In G. Salvendy (Ed.), Handbook of Human Factors, New York: Wiley.

Davy, J. A., White, R. E., Merritt, N. J., and Gritzmacher, K. (1992). A derivation of the underlying constructs of just-in-time management systems. Academy of Management Journal, 35, 653-670.

Dean, J. W., and Snell, S. A. (1991). Integrated manufacturing and job design: Moderating effects of organisational inertia. Academy of Management Journal, 34, 774-804.

Deci, E. L., and Ryan, R. M. (1985). Intrinsic Motivation and Self-Determination in Human Behaviour. New York: Plenum.

Delafield, G. (1993). Occupational psychology and Total Quality in Royal Mail. The Occupational Psychologist, 21, 4-6.

Delbridge, R., and Turnbull, P. (1992). Human resource maximisation: The management of labour under just-in-time manufacturing systems. In P. Blyton, and P. Turnbull (Eds.), Reassessing Human Resource Management, London: Sage.

Delbridge, R., Turnbull, P., and Wilkinson, B. (1992). Pushing back the frontiers : management control and work intensification under JIT/TQM regimes. New Technology, Work and Employment, 7, 67.

Deming, W. C. (1986). Out of the Crisis. Cambridge, Mass.: MIT Centre for Advanced Engineering Study.

Deming, W. E. (1982). Quality, Productivity and Competitive Position. Cambridge: MIT Centre for Advanced Engineering Study.

Denison, D. R. (1990). Corporate Culture and Organisational Effectiveness. New York: Wiley.

Denison, D. R. (1982). Socio-technical design and self-managing work groups: The impact of control. Journal of Occupational Behaviour, 3, 297-314.

Denny, N. W. (1982). Ageing and cognitive changes. In B. B. Wolman (Ed.), Handbook of Developmental Psychology, Englewood Cliffs, N. J.: Prentice-Hall.

Department of Trade and Industry/ PA Consulting Group. (1989). Manufacturing Into the Late 1990s. London: HMSO.

Digman, J. M. (1990). Personality structure: Emergence of the five-factor model. Annual Review of Psychology, 41, 417-440.

Dodd, N. G. (1987). The Interaction of Autonomy, Variety, and Feedback to Predict Satisfaction and Performance: A Laboratory Experiment. Unpublished doctoral dissertation, University of Nebraska.

Dodgson, M. (1993). Organisational Learning: A review of some literature's. Organisation Studies, 14, 375-394.

Dohse, K., Jurgens, U., and Malsch, T. (1985). From 'Fordism' to 'Toyotism'? The social organisation of the labour process in the Japanese automobile industry. Politics and Society, 14, 115-146.

Donaldson, J., and Gowler, D. (1975). Prerogatives, participation and managerial stress. In D. Gowler, and K. Legge (Eds.), Managerial Stress, Epping: Gower Press.

Drucker, P. F. (1990). The emerging theory of manufacturing. Harvard Business Review, 68, 94-102.

Dunham, R., Aldag, R. J., and Brief, A. P. (1977). Dimensionality of task design as measured by the Job Diagnostic Survey. Academy of Management Journal, 20, 209-223.

Dunn, W. N., and Gisberg, A. (1986). A sociocognitive network approach to organisational analysis. Human Relations, 40, 955-976.

Dunnette, M. D., Campbell, J. P., and Hakel, M. D. (1967). Factors contributing to job satisfaction and dissatisfaction in six occupational groups. Organisational Behaviour and Human Performance, 2, 143-174.

Edquist, C., and Jacobsson, S. (1988). Flexible Automation: The Global Diffusion of New Technology in the Engineering Industry. New York: Blackwell.

Eisenhardt, K. M. (1989). Building theories from case study research. Academy of Management Review, 14, 532-550.

Emery, F. E. (1959). Characteristics of Socio-technical Systems. Tavistock Institute of Human Relations. Document no. 527.

Emery, F. E., and Thorsrud, E. (1969). Form and Content in Industrial Democracy. London: Tavistock.

Emery, F. E., and Trist, E. L. (1960). Socio-technical systems. In C. H. Churchman, and M. Verhulst (Eds.), Management Science, Models and Techniques,Vol. 2, (pp. 83-97). Oxford: Pergamon.

Endler, N. S., and Magnusson, D. (1976). Interactional Psychology and Personality. Washington: Hemisphere.

Ettlie, J. (1986). Facing the factory of the future. In D. D. Davis (Ed.), Managing Technical Innovation, San Francisco: Jossey Bass.

Ettlie, J. E. (1988). Taking Charge of Manufacturing. San Francisco: Jossey-Bass.

Eurotecnet. (1991). Computer-integrated Manufacturing: Skills and Qualification Issues for Small and Medium-sized Enterprises. Report from the European Communities Task Force for Human Resources, Education, Training, and Youth. Luxembourg: Office for the Official Publication of the European Commission.

Feigenbaum, A. V. (1983). Total Quality Control, 3rd Edition. New York: McGraw-Hill.

Feldman, D. C. (1981). The multiple socialisation of organisation members. Academy of Management Review, 6, 309-318.

Firth-cozens, J., and West, M. A. (1991). Women at Work: Psychological and Organisational Perspectives. Milton-Keynes: Open University Press.

Fiske, S. T., and Linville, P. W. (1980). What does the schema concept buy us? Personality and Social Psychology Bulletin, 6, 543-557.

Fleiss, J. L. (1971). Measuring nominal scale agreement among many raters. Psychological Bulletin, 76, 378-82.

Ford, H. (1922). My Life and Work. New York: Doubleday Page.

Ford, R. N. (1973). Job enrichment lessons from A T and T. Harvard Business Review, 51, 96-106.

Ford, R. N. (1969). Motivation Through the Work Itself. New York: American Management Association.

Fraser, R. (1947). The incidence of neurosis among factory workers. Report No. 90 HMSO London: Industrial Health Research Board.

Frese, M. (1982). Occupational socialisation and psychological development: An under emphasised perspective in industrial psychology. Journal of Occupational Psychology, 55, 209-224.

Frese, M., and Greif, S. (1978). 'Humanisierung der Arbeit' und stresskontrolle. In M. Frese, S. Greif, and N. Semmer (Eds.), Industrielle Psycopathologie, Bern: Huber.

Frese, M., Stewart, J., and Hannover, B. (1987). Goal orientation and planfulness: Action styles as personality concepts. Journal of Personality and Social Psychology, 52, 1182-1194.

Frese, M., and Zapf, D. (1993). Action as the core of work psychology: A German approach. In M. D. Dunnette, I. M. Hough, and H. C. Triandis (Eds.), Handbook of Industrial and Organisational Psychology, Vol 4 (2nd edition), Palo Alto, CA: Consulting Psychologists Press.

Fried, Y., and Ferris, G. R. (1987). The validity of the job characteristics model: A review and meta-analysis. Personnel Psychology, 40, 287-322.

Fry, L., and Slocum, J. W. (1984). Technology, structure, and work group effectiveness: A test of a contingency model. Academy of Management Journal, 27, 221-246.

Fucini, J. J., and Fucini, S. (1990). Working for the Japanese - Inside Mazda's American Auto Plant. New York: Free Press.

Gailbraith, J. R. (1977). Organisation Design. Reading, Mass: Addison-Wesley.

Galbraith, G. R. (1973). Designing Complex Organisations. Reading, Mass.: Addison-Wesley.

Garrahan, P., and Stewart, P. (1992). The Nissan Enigma: Flexibility at Work in a Local Community. London: Mansell.

Garvin, D. (1987). Competing on the eight dimensions of quality. Harvard Business Review, 65, 101-109.

Geary, J. F. (1992). Pay, control and commitment: Linking appraisal and reward. Human Resource Management Journal, 2, 36-54.

Gilbreth, F. B. (1911). Brick Laying System. New York: Clark.

Gilbreth, F. B. (1914). Primer of Scientific Management. New York: Van Nostrand.

Giordano, L. (1988). Beyond Taylorism: Computerisation and QWL programmes in the production process. In D. Knights and H. Wilmott (Eds.). New Technology and the Labour Process (pp. 163-196). London: Macmillan.

Girden, E. R. (1992). ANOVA Repeated Measures. California: Sage Publications

Glick, W. H., Jenkins, J. G. D., and Gupta, N. (1986). Method versus substance: How strong are underlying relationships between job characteristics and attitudinal outcomes? Academy of Management Journal, 29, 441-464.

Goldberg, D. P. (1978). Manual for the General Health Questionnaire. Windsor, U.K.: National Foundation for Educational Research.

Goldberg, D. P. (1972). The Detection of Psychiatric Illness by Questionnaire. Oxford: Oxford University Press.

Goldberg, P. A. (1965). A review of sentence completion methods in personality assessment. Journal of Projective Techniques, 29, 12-45.

Goldsmith, W., and Clutterbuck, D. (1984). The Winning Streak: Britain's Top Companies Reveal their Formulas for Success. London: Weidenfeld and Nicolson.

Goldsmith, W., and Clutterbuck, D. (1985). The Winning Streak Workout Book. London: Weidenfeld and Nicolson.

Goldthorpe, J. H. (1966). Attitudes and behaviour of car assembly workers. British Journal of Sociology, Sept.

Goldthorpe, J. H., Lockwood, D., Bechofer, F., and Platt, J. (1968). The Affluent Worker: Industrial Attitudes and Behaviour. Cambridge: Cambridge University Press.

Golembiewski, R. T. (1986). Contours in social change: Elemental graphics and a surrogate variable for gamma change. Academy of Management Review, 11, 550-566.

Golembiewski, R. T., Billingsley, K., and Yeager, S. (1976). Measuring change and persistence in human affairs: Types of change generated by OD designs. Journal of Applied Behavioural Science, 12, 133-157.

Gooding, J. (1970). It pays to wake up the blue-collar worker. Fortune, 82, 133-139.

Gorsuch, R. L. (1983). Factor Analysis. Hillsdale, New Jersey: Lawrence Erlbaum.

Graen, G. (1976). Role-making processes within complex organisations. In M. D. Dunnette (Ed.), Handbook of Industrial and Organisational Psychology (1st edition), (pp. 1201-1244). Chicago: Rand McNally.

Graen, G. B., Scandura, T. A., and Graen, M. G. (1986). A field experiment test of the moderating effects of growth need strength on productivity. Journal of Applied Psychology, 71, 484-491.

Graham, I. (1988). Japanisation as mythology. Industrial Relations Journal, 19 (Spring), 69-75.

Grey, S. M., and Corlett, E. N. (1989). Creating effective operating teams. In R. Wild (Ed.), International Handbook of Production and Operations Management, (pp. 402-417). London: Cassell.

Grief, S. (1992). Computer systems as learning environments. In J. Valsiner, and H. G. Voss (Eds.), The Structure of Learning Processes, Norwood, N. J: Ablex.

Griffin, R. W. (1991). Effects of work redesign on employees perceptions, attitudes, and behaviour: A long term investigation. Academy of Management Journal, 34, 425-435.

Griffin, R. W. (1983). Objective and social sources of information in task redesign. Administrative Science Quarterly, 28, 184-200.

Gross, E., and Etzioni, A. (1985). Organisations in Society. Englewood Cliffs, NJ: Prentice-Hall.

Groth-Marnet, G. (1984). Handbook of Psychological Assessment. New York: Van Nostrand.

Gryna, F. M. (1988). Product development. In J. M. Juran, and F. M. Gryna (Eds.), Juran's Quality Control Handbook (4th Edition), New York: McGraw Hill.

Guest, D. (1987). Human resource management and industrial relations. Journal of Management Studies, 24, 503-521.

Guest, R. H. (1957). Job enlargement: A revolution in job design. Personnel Administration, 20, 9-16.

Guest, R. H. (1955). Men and machines: An assembly-line worker looks at his job. Personnel, 31, 496-503.

Gulowsen, J. (1972). A measure of work group autonomy. In L. E. Davis, and J. C. Taylor (Eds.), Design of Jobs, Harmondsworth, UK: Penguin.

Gunn, T. G. (1987). Manufacturing for Competitive Advantage: Becoming a World Class Manufacturer. Cambridge, MA: Ballinger.

Hacker, W. Activity: A fruitful concept in industrial psychology. In M. Frese, and J. Sabini (Eds.), Goal Directed Behaviour: The Concept of Action in Psychology, Hillsdale, NJ: Lawrence Erlbaum.

Hacker, W. (1986). Arbeitspsychologie. Bern: Huber.

Hacker, W. (1986). Complete v. incomplete working tasks: A concept and its verification. In G. Debus, and H. W. Schroiff (Eds.), The Psychology of Work and Organisation, Amsterdam: Elsevier (North Holland).

Hackman, J. R. Assessment of QWL experiments. Professional Psychologi t.

Hackman, J. R. (1989). Groups That Work (And Those That Don't): Creating Conditions for Effective Teamwork. San Francisco: Jossey-Bass.

Hackman, J. R. (1983). The design of work teams. In J. Lorsch (Ed.), Handbook of Organisational Behaviour, Englewood Cliffs, N.J.: Prentice Hall.

Hackman, J. R. (1977). Work design. In J. R. Hackman and J. L. Shuttle (Eds.), Improving Life at Work: Behavioural Science Approaches to Behavioural Change, Santa Monica, Calif.: Goodyear.

Hackman, J. R. (1975). On the coming demise of job enrichment. In E. L. Cass, and F. G. Zimmer (Eds.), Man and Work in Society, New York: Van Nostrand-Reinhold.

Hackman, J. R., and Lawler, E. E. (1971). Employee reactions to job characteristics. Journal of Applied Psychology, 55, 259-286.

Hackman, J. R., and Oldham, G. R. (1980). Work Redesign. Reading, Mass.: Addison-Wesley.

Hackman, J. R., and Oldham, G. (1976). Motivation through the design of work: Test of a theory. Organisational Behaviour and Human Performance, 16, 250-279.

Hackman, J. R., and Oldham, G. R. (1975). Development of the Job Diagnostic Survey. Journal of Applied Psychology, 60, 159-170.

Hackman, J. R., and Walton, R. E. (1986). Leading groups in organisations. In P. S. Goodman and Associates (Eds.), Designing Effective Work Groups, San Francisco: Jossey-Bass.

Hall, R. W. (1987). Attaining Manufacturing Excellence. Homewood, Il.: Dow Jones-Irwin.

Hall, R. W. (1983). Zero Inventories. Homewood, Ill.: Dow Jones-Irwin.

Hanna, D. P. (1988). Designing Organisations for High Performance. Reading, MA: Addison-Wesley.

Harding, D. W. (1931). A note on the subdivision of assembly work. Journal of the National Institute of Industrial Psychology, 5, 261-4.

Harrington, H. J. (1987). The Improvement Process: How America's Leading Companies Improve Quality. New York: McGraw Hill.

Hay, E. J. (1988). The Just-in-time Breakthrough: Implementing the Manufacturing Basics. New York: Wiley.

Hayes, R., and Jaikumar, R. (1988). Manufacturing's Crisis: New Technologies, Obsolete Organisations. Harvard Business Review, 57, 77-85.

Hayes, R. H., Wheelwright, S. C., and Clark, K. B. (1988). Dynamic Manufacturing: Creating the Learning Organisation. New York: The Free Press.

Hayes, R. H., and Wheelwright, S. C. (1984). Restoring Our Competitive Edge: Competing Through Manufacturing. New York: John Wiley.

Hedberg, B. (1981). How organisations learn and unlearn. In P. Nystrom, and W. Starbeck (Eds.), Handbook of Organisation Design, Vol 1, (pp. 3-27). Oxford University Press: Oxford, England.

Heiko, L. (1989). A simple framework for understanding JIT. Production and Inventory Management, 30, 61-63.

Helfgott, R. B. (1988). Computerised Manufacturing and Human Resources: Innovation Through Employee Involvement. Lexington, MA: Lexington Books.

Henwood, K. L., and Pidgeon, N. F. (1992). Qualitative research an psychological theorising. British Journal of Psychology, 83, 97-111.

Herbst, P. G. (1974). Sociotechnical Design. London: Tavistock.

Herzberg, F. (1968). One more time: How do you motivate employees? Harvard Business Review, 46, 53-62.

Herzberg, F. (1966). Work and the Nature of Man. New York: World of Publishing Co.

Herzberg, F., Mausner, B., and Snyderman, B. (1959). The Motivation to Work. New York: Wiley.

Hickson, D., Pugh, D., and Pheysey, D. (1969). Operations technology and organisational structure: An empirical reappraisal. Administrative Science Quarterly, 14, 378-397.

Hill, C. E. (1991). Almost everything you ever wanted to know about how to do process research on counselling and psychotherapy that you didn't know who to ask. In C. E. Watkins, and L. J. Schneider (Eds.), Research in Counselling, (pp. 85-118). Hillsdale, NJ: Lawrence Erlbaum.

Hill, S. (1991 a). How do you manage a flexible firm? The Total Quality model. Work, Employment, and Society, December, 397-415.

Hill, S. (1991 b). Why Quality Circles failed but Total Quality might succeed. British Journal of Industrial Relations, 29, 541-568.

Himes, A. M., and Watts, K. P. (1966). The Brook Reaction Test of interests. British Journal do Psychology, 57, 171-181.

Hirschhorn, L. (1984). Beyond Mechanisation: Work and Technology in a Post-Industrial Age. Cambridge, MA: MIT Press.

Hofstede, G. (1991). Cultures and Organisations: Software of the Mind. London: McGraw-Hill Book Company.

Hohn, W. (1988). What is qualification? Lifestyle and personality as selection criteria. In P. Windholf, and S. Wood (Eds.), Recruitment and Selection in the Labour Market, Aldershot: Avebury.

Howell, C., and Lorraine, D. (1987). The implementation of Just-in-time techniques and its impact on jmh Bostrom Europe. Proceedings of the 4th European Conference on Automated Manufacturing, (pp. 75-80).

Hulin, C. L., and Blood, M. R. (1968). Job enlargement, individual differences, and worker responses. Psychological Bulletin, 69, 41-55.

Hutchins, D. (1989). Just In Time. Aldershot, Hampshire: Gower Technical Press.

Hyer, N. L., and Wemmerlov, U. (1984). Formation of group technology cells. In American Production and Invention, Conference Proceedings, Synergy '84, Chicago, USA, November Falls Church, Virginia: Control Society.

Hyman, R. (1988). Flexible specialisation: Miracle or myth. In R. Hyman, and W. Streeck (Eds.), New Technology and Industrial Relations, (pp. 48-60). Oxford: Basil and Blackwell.

Iaffaldano, M. T., and Muchinsky, P. M. (1985). Job satisfaction and job performance: A meta analysis. Psychological Bulletin, 97, 251-273.

Ilgen, D. R., and Hollenbeck, J. R. (1991). The structure of work: Job design and roles. In M. D. Dunnette, and L. M. Hough (Eds.), Handbook of Industrial and Organisational Psychology (2nd Edition), (pp. 165-207). California: Consulting Psychology Press.

Im, J. (1989). Lessons for Japanese production management. Production and Inventory Management, 30, 25-29.

Imai, M. (1986). Kaizen: The Key to Japan's Competitive Success. New York: McGraw-Hill.

Industrial Health Research Board. (1931). Eleventh Annual Report. London: HMSO.

Industrial Relations Review and Report. (1984). Flexibility Agreements - Their Impact on Procedures. IR-IR, No. 316.

Ingersoll Engineers, L. (1990). Competitive Manufacturing: The Quiet Revolution. Rugby: Ingersoll Engineers Ltd.

Ingersoll Engineers (1982). The FMS Report. Bedford: IFS (Publications).

Ishikawa, K. (1985). What is Total Quality Control? The Japanese Way. Englewood Cliff: Prentice-Hall.

Jackson, P. R. (1983). An easy to use BASIC program for agreement amongst many raters. British Journal of Clinical Psychology, 22, 145-6.

Jackson, P. R., and Martin, R. (1993). The impact of just-in-time on job content, employee attitudes and well-being: A longitudinal study. MRC/ESRC Social and Applied Psychology Unit Memo 1340.

Jackson, P. R., and Wall, T. D. (1991). How does operator control enhance performance of advanced manufacturing technology? Ergonomics, 34, 1301-1311.

Jackson, P. R., Wall, T. D., Martin, R., and Davids, K. (1993). New measures of job control, cognitive demand and production responsibility. Journal of Applied Psychology, 78, 753-762.

Jaikumar, R. (1986). Post-industrial manufacturing. Harvard Business Review, 64(6), 69-76.

James, L. R., Hater, J. J., Gent, M. J., and Bruni, J. R. (1978). Psychological climate: Implications from cognitive social learning theory and interactional psychology. Personnel Psychology, 31(783-813),

Jelinek, M., and Goldhar, J. D. (1984). The strategic implications of the factory of the future. Sloan Management Review, 25, 29-37.

Jenkins, D. (1978). The West German humanisation of work programme: A preliminary investigation. WRU Occasional Paper No. 8.

Jones, B., and Scott, P. (1987). Flexible manufacturing systems in Britain and the USA. New Technology, Work and Employment, 2, 27-37.

Juran, J. M. (1989). Juran on Leadership for Quality. New York: Free Press.

Juran, J. M., and Gryna, F. M. (1988). Juran's Quality Control Handbook (4th Edition). New York: McGraw-Hill.

Kahn, W. A. (1992). To be fully there: psychological presence at work. Human Relations, 45, 321-349.

Kahn, W. A. (1990). Psychological conditions of personal engagement and disengagement at work. Academy of Management Journal, 33, 692-724.

Kanter, R. M. (1985). Change Masters: Innovation for Productivity in the American Workplace. New York: Simon and Schuster.

Karasek, R. A. (1979). Job demands, job decision latitude and mental strain: Implications for job redesign. Administrative Science Quarterly, 24, 285-308.

Karasek, R., and Theorell, T. (1990). Healthy Work: Stress, Productivity, and the Reconstruction of Working Life. New York: Basic Books.

Katz, H. (1985). Changing Gears. Cambridge, Mass.: MIT Press.

Katzell, R., and Yankelovich, D. (1975). Work, Productivity and Job Satisfaction. New York: The Psychological Corporation.

Kelley, M. R. (1989). Alternative forms of work organisation under programmable automation. In S. Wood, (Ed.) The Transformation of Work?, London: Routledge.

Kelly, G. A. (1955). The Psychology of Personal Constructs. New York: Norton.

Kelly, J. E. (1982). Scientific management, job redesign and work performance. London: Academic Press.

Kelly, J., and Clegg, C. C. (1982). Autonomy and Control at the Workplace: Contexts For Redesign. London: Croom Helm.

Kelly, J. (1992). Does job re-design theory explain job re-design outcomes? Human Relations, 45, 753-774.

Kemp, N. J., and Cook, J. D. (1983). Job longevity and growth need strength as joint moderators of the task design- job satisfaction relationship. Human Relations, 36, 883-898.

Kemp, N. J., Wall, T. D., Clegg, C. W., and Cordery, J. L. (1983). Autonomous work groups in a greenfield site: A comparative study. Journal of Occupational Psychology, 56, 271-188.

Kern, H., and Schumann, M. (1989). New concepts of production in German plants. In P. Katzenstein (Ed.), Industry and Politics in West Germany: Towards the Third Republic, Ithaca, NY: Cornell University Press.

Kern, H., and Schumann, M. (1987). Limits of the division of labour: new production and employment concepts in West German industry. Economic and Industrial Democracy, 8, 151-170.

Kiggundu, M. N. (1980). An empirical test of the theory of job design using multiple job ratings. Human Relations, 33, 339-351.

King, N. A. (1970). A clarification and evaluation of the two-factor theory of job satisfaction. Psychological Bulletin, 74, 18-31.

Klein, J. A. (1991). A re-examination of autonomy in light of new manufacturing practices. Human Relations, 44, 21-38.

Klein, J. A. (1989). The human costs of manufacturing reform. Harvard Business Review, Mar-April, 61.

Klein, L. (1976). New Forms of Work Organisation. Cambridge: Cambridge University Press.

Kline, P. (1993). The Handbook of Psychological Testing. London: Routledge.

Kochan, T., Katz, H., and McKersie, W. (1986). The Transformation of American Industrial Relations. New York: Basic Books.

Koestler, A. (1976). The Ghost in the Machine. London: Picador.

Kohn, M., and Schooler, C. (1982). Job conditions and personality: A longitudinal assessment of their reciprocal effects. American Journal of Sociology, 87, 97-118.

Kohn, M. L., and Schooler, C. (1978). The reciprocal effects of the substantive complexity of work on intellectual complexity: A longitudinal assessment. American Journal of Sociology, 48, 24-52.

Kolodny, H., and Stjernberg, T. (1986). The change process of innovative work designs: New design and redesign in Sweden, Canada and the U.S. Journal of Applied Behavioural Science, 22, 287-301.

Kopelman, R. E. (1985). Job redesign and productivity: A review of the evidence. National Productivity Review, Summer, 237-255.

Kornhauser, A. (1965). Mental Health of the Industrial Worker. New York: Wiley.

Kusterer, K. (1978). Know-how on the Job: The Important Working Knowledge of the Unskilled Worker. Boulder, Col: Westview Press.

Lawler, E. E. (1986). High Involvement Management: Participative Strategies for Improving Organisational Performance. San Francisco: Jossey-Bass.

Lawler, E. E. (1992). The Ultimate Advantage: Creating the High Involvement Organisation. San Francisco: Jossey-Bass.

Lawler, E. E., Mohrman, S. A., and Ledford, G. E. (1992). Employee Involvement and Total Quality Management. San Francisco: Jossey-Bass.

Ledford, G. E., and Mohrman, S. A. (1993). Self-design for high involvement: A large scale organisational change. Human Relations, 46, 143-172.

Lee, C., Ashford, S. J., and Bobko, P. (1990). Interactive effects of "Type A" behaviour and perceived control on worker performance, job satisfaction, and somatic complaints. Academy of Management Journal, 33, 870-881.

Lee, D. (1989). The transformation of training and the transformation of work in Britain. In S. Wood (Ed.), The Transformation of Work, London: Routledge.

Lei, D., and Goldhar, J. D. (1993). The implementation of CIM technology: The key role of organisational learning. The International Journal of Human Factors in Manufacturing, 3, 217-230.

Leplat, J. (1990). Skills and tacit skills: A psychological perspective. Applied Psychology: An International Review, 39, 143-154.

Liebowitz, S. J., and DeMeuse, K. P. (1982). The application of team building. Human Relations, 35, 1-18.

Likert, R. L. (1961). The Human Organisation. New York: McGraw-Hill.

Littler, C. (1985). Taylorism, Fordism, and job design. In D. Knights, H. Wilmott, and D. Collinson (Eds.), Job Redesign: Critical Perspectives on the Labour Process, Aldershot: Gower.

Littler, C. R., and Salaman, G. (1985). The design of work. In C. R. Littler (Ed.), The Experience of Work, Hampshire, England: Gower.

Liu, M., Denis, H., Kolodney, H., and Stymne, B. (1990). Organisational design for technological change. Human Relations, 43, 7-22.

Lloyd, C. (1989). Restructuring in the West Midlands' clothing industry. New Technology, Work and Employment, 4, 100-107.

Locke, E., and Henne, D. (1986). Work motivation theories. In C. L. Cooper, and I. T. Robertson (Eds.), International Review of Industrial and Organisational Psychology, Volume 1, Chichester: Wiley.

Locke, E. A., Sirota, D., and Wolfson, A. (1976). An experimental case study of the successes and failures in job enrichment in a government agency. Organisational Behaviour and Human Performance, 5, 484-500.

Lodhia, C. K. (1993). Manufacturing Strategy, JIT and Human Factors. Unpublished MSc Dissertation. University of Derby.

Loevinger, J. (1976). Ego Development: Conceptions and Theories. San Francisco: Jossey Bass.

Loher, B. T., Noe, R. A., Moeller, N. L., and Fitzgerald, M. P. (1985). A meta-analysis of the relation of job characteristics to job satisfaction. Journal of Applied Psychology, 70, 280-289.

Lord, R. G., and Maher, K. J. (1991). Cognitive theory in industrial and organisational psychology. In M. D. Dunnette, and L. M Hough (Eds.), Handbook of Industrial and Organisational Psychology, Vol 2 (2nd Edition), Pal Alto, Cal: Consulting Psychologists' Press.

Louis, M. R. (1980). Surprise and sense-making: What newcomers' experience in entering unfamiliar organisational settings. Administrative Science Quarterly, 25, 226-251.

Majchrzak, A. (1988). The Human Side of Factory Automation. San-Francisco: Jossey-Bass.

Manwaring, T., and Wood, S. (1985). The ghost in the labour process. In D. Knights, H. Wilmott, and D. Collinson, Job redesign: Critical Perspectives on the Labour Process, Aldershot: Gower.

Manz, C. C. (1992). Self-leading work teams: Moving beyond self-management myths. Human Relations, 45, 1119-1140.

Manz, C. C. (1990). Beyond self-managing work teams: Toward self-leading teams in the work place. In R.W. Woodman, and W.A. Pasmore (Eds.), Research in Organisational Change and Development, Vol 4, Greenwhich, Conn: JAI Press.

Manz, C. C., and Sims, H. P. Jnr. (1987). Leading workers to lead themselves: The external leadership of self-managing work teams. Administrative Science Quarterly, 32, 106-108.

Manz, C. C., and Sims, H. P. Jnr. (1982). The potential for 'groupthink' in autonomous work groups. Human Relations, 35, 773-784.

Martin, R., and Wall, T. D. (1989). Attentional demand and cost responsibility as stressors in shopfloor jobs. Academy of Management Journal, 32, 69-86.

Marx, K. (1867). Capital, Vol. 1. Moscow: Progress. Republished 1970.

Maslow, A. H. (1962). Toward a Psychology of Being. Princeton, N.J.: D. Van Nostrand Company Inc.

Maslow, A. H. (1943). A theory of human motivation. Psychological Review, 50, 370-396.

Matlin, M. (1983). Cognition. New York: CBS College Publishing.

McCalman, J., and Buchanan, D. A. (1990). High performance work systems: The need for transition management. International Journal of Production Management, 10, 10-25.

McCune, J. T., Beatty, R. W., and Montagno, R. V. (1988). Downsizing: Practices in manufacturing firms. Human Resources Management Journal, 27, 145-161.

McGregor, D. (1960). The Human Side of Enterprise. New York: McGraw-Hill.

McIntyre, R. M., Smith, D. E., and Hasset, C. E. (1984). Accuracy of performance ratings as affected by rater training and perceived purpose of training. Journal of Applied Psychology, 69, 147-156.

Meyer, S. (1981). The Five-dollar Day: Labour Management and Social Control in the Ford Motor company, 1908-21. New York: State University of New York Press.

Miles, M. B. (1979). Qualitative data as an attractive nuisance: The problem of analysis. Administrative Science Quarterly, 24, 590-601.

Miles, M. B., and Huberman, A. M. (1984). Qualitative data analysis: A sourcebook of new methods. London: Sage Publications.

Miller, K. I., and Monge, P. R. (1986). Participation, satisfaction and productivity: A meta-analytic review. Academy of Management Journal, 29, 727-753. referred to in Kelley, 1992.

Mitchell, J. B., Lewin, D., and Lawler, E. E. (1990). Alternative pay system for performance and productivity. A. S. Blinder (Ed.), Paying for Productivity: A Look at the Evidence, Washington DC: Brookings Institution.

Mitrovanoff, S. F. (1961). Scientific Principles of Group Technology. English Transition. Boston Spa: National Lending Library for Science and Technology.

Monden, Y. (1983). Toyota Production System. Georgia: Industrial Engineering and Management Press.

Mortimer, J. (1985). Integrated Manufacture. Berlin: IFS: Springer-Verlag.

Mortimer, J. T., and Lawrence, J. (1979 b). Occupational experience and the self-concept: A longitudinal study. Social Psychology Quarterly, 42, 307-323.

Mortimer, J. T., and Lawrence, J. (1979 a). Work experience and occupational value socialisation: A longitudinal study. American Journal of Sociology, 84, 1361-1385.

Nadler, G. (1963). Work Design. Homewood, Ill: Irwin.

National Economic Development Office (NEDO). (1986). Changing Work Patterns: How Companies Achieve Flexibility to Meet New Needs. London: National Economic Development Office.

New, C. C., and Clark, G. R. (1989). Just-in-time manufacturing. In R. Wild (Ed.), International Handbook of Production and Operations Managament., (pp. 402-417). London: Cassell.

Norman, P., and Parker, S. K. (in press). The interpretation of change in verbal responses: Implications for health psychology. Psychology and Health,

Northcott, J., Fogarty, M., and Trevor, M. (1985). Chips and Jobs: Acceptance of New Technology at Work. London: Policy Studies Institute.

Nunnally, J. (1978). Psychometric theory (2nd ed.). New York: McGraw Hill.

Oakland, J. S. (1989). Total Quality Management. Oxford: Heineman.

O'Brien, C., Chalk, S., Grey, S., White, A., and Wormell, N. (1987). An application in the automotive component industry. In C. Voss (Ed.), Just in Time Manufacturing, (pp. 303-317). Kempston, Beds: IFS (Publications) Ltd/Springer-Verlag.

O'Connor, D., and Wolfe, D. M. (1991). From crisis to growth at mid-life: Changes in personal paradigm. Journal of Organisational Behaviour, 12, 323-340.

Okumara, A. (1989). The globalisation of Japanese companies. In K. Shibagaki, M. Trevor, and T. Abo (Eds.), Japanese and European Management: Their International Adaptability, Tokyo: Tokyo University Press.

Oldham, G. R. (1976). Job characteristics and internal motivation: The moderating effect of interpersonal and individual variables. Human Relations, 29, 559-569.

Oldham, G. R., and Hackman, J. R. (1980). Work design in the organisational context. In B. Staw, and L. L. Cummings, Research in organisational behaviour, Vol 2. Greenwich, Connecticut: JAI Press.

Oliver, N. (1991). The dynamics of Just-in-time. New Technology, Work and Employment, 6, 19-27.

Oliver, N., and Davies, A. (1990). Adopting Japanese-style manufacturing methods: A tale of two (UK) factories. Journal of Management Studies, 27, 555-570.

Oliver, N., and Wilkinson, B. (1988). The Japanisation of British Industry. Oxford: Blackwell.

O'Reilly, C. A., and Caldwell, D. F. (1979). Informational influence as a determinant of perceived task characteristics and job satisfaction. Journal of Applied Psychology, 64, 157-165.

O'Reilly, C. A., Parlette, G., and Bloom, J. (1980). Perceptual measures of task characteristics: The biasing effects of differing frames of reference and job attitudes. Academy of Management Journal, 23, 118-131.

Osbaldeston, M., and Hepworth, A. (1975). White collar work structuring - the European experience. Paper presented at a seminar on Personnel Research in Europe. European Institute for Advanced Studies in Management, Brussels, March 25

Ouchi, W. G. (1977). The relationship between organisational structure and organisational control. Administrative Science Quarterly, 22, 95-113.

Ouchi, W. G., and Maguire, M. A. (1975). Organisational control: Two functions. Administrative Science Quarterly, 20, 559-569.

Ouichi, W. (1981). Theory Z: How American Business Can Meet the Japanese Challenge. Reading, Mass.: Addison Wesley.

Parker, M., and Slaughter, J. (1988). Choosing Sides: Unions and the Team Concept. Boston: South End Press.

Parker, S. K., and Jackson, P. R. (1992). Product-based manufacturing: Some issues for implementation. Report for a collaborative DTI funded project with the Institute of Occupational Ergonomics, Nottingham: Human Factors and the Management of Change in Small Manufacturing Organisations (SAPU Memo 1428).

Parker, S. K., Mullarkey, S., and Jackson, P. R. (in press). Dimensions of performance effectiveness in high-involvement work organisations. Human Resource Management Journal.

Parnaby, J. (1988). A systems approach to the implementation of JIT methodologies in Lucas Industries. International Journal of Production Research, 26, 483-92.

Parnaby, J. (1987). A systems engineering approach to fundamental change in manufacturing. Paper presented to the 9th Industrial Engineering Managers Conference, March 9, New Orleans.

Pasmore, W. A. (1978). The comparative impacts of sociotechnical system, job redesign and survey-feedback interventions. In W. A. Pasmore, and J. Sherwood (Eds.), Sociotechnical Systems: A Source Book, San Diego: University Associates.

Pasmore, W., Francis, C., Haldeman, J., and Shani, A. (1982). Socio-technical systems: A North American reflection on the empirical studies of the seventies. Human Relations, 35, 1179-1204.

Paul, W. J., and Robertson, K. B. (1970). Job Enrichment and Employee Motivation. Aldershot: Gower Publishing Company.

Pauling, T. P. (1968). Job enlargement- an experience at Phillips Telecommunications of Australia Limited. Personnel Practice Bulletin, 24, 194-196.

Pearce, J. A., and Ravlin, E. C. (1987). The design and activation of self-regulating work groups. Human Relations, 40, 751-782.

Pennings, J. M. (1987). Technological innovation in manufacturing. In J. M. Pennings, and A. Buitendam (Eds.), New Technology as Organisational Innovation, Cambridge, Mass.: Ballinger Publishing.

Perrow, C. (1984). Normal Accidents: Living with High-risk Technologies. New York: Basic Books.

Perrow, C. (1983). The organisational context of human factors engineering. Administrative Science Quarterly, 24, 570-581.

Perrow, C. (1967). A framework for comparative organisational analysis. American Sociological Review, 16, 444-459.

Perry, B. (1984). Enfield: A High Performance System. Bedford, MA: Digital Equipment Corporation, Educational Services Development and Publishing.

Peters, T. J., and Waterman, R. H. (1982). In Search of Excellence. New York: Harper Collins.

Pettigrew, A. (1988). Longitudinal field research on change: theory and practice. Paper presented at the National Science Foundation Conference on Longitudinal Research methods in Organisations, Austin.

Phillimore, A. J. (1989). Flexible specialisation, work organisation and skills: approaching the 'second industrial divide'. New technology, work and employment, 4, 79-91.

Piaget, J. (1970). Piaget's theory. In P. H. Mussen (Ed.), Carmichael's Manual of Child Psychology, Vol 1, New York: Wiley.

Piaget, J. (1952). The Origins of Intelligence in Children. New York: International Universities Press. Originally published in 1936.

Pierce, J. L., and Dunham, R. B. (1976). Task design: A literature review. Academy of Management Review, 1, 83-97.

Piore, M., and Sabel, C. (1984). The Second Industrial Divide: Possibilities for Prosperity. New York: Basic Books.

Porras, J. I., and Silvers, R. C. (1991). Organisational development and transformation. Annual Review of Psychology, 42, 51-7.

Porter, H. F. (1917). Four big lessons from Ford's factory. System, 31, June.

Porter, L. W., and Lawler, E. E. (1968). Managerial Attitudes and Performance. Homewood, IL: Irwin.

Rice, A. K. (1958). Productivity and Social Organisation: The Ahnedabad Experiment. London: Tavistock.

Roberts, K. H., and Glick, W. (1981). The job characteristics approach to task design: A critical review. Journal of Applied Psychology, 66, 193-217.

Ross, M. (1989). Relation of implicit theories to the construction of personal histories. Psychological Review, 96, 341-357.

Ross, M., and Conway, M. (1986). Remembering one's own past: The construction of personal histories. In R. M. Sorrentino, and E. T Higgins (Eds.), Handbook of Motivation and Cognition, (pp. 122-144). New York: Guilford Press.

Rousseau, D. M. (1977). Technological differences in job characteristics, employee satisfaction, and motivation: A synthesis of job design research and socio-technical systems theory. Organisational Behaviour and Human Performance, 19, 18-42.

Rubenstein, D., and Woodman, R. W. (1984). Spiderman and the Burma raiders: Collateral organisational theory in action. The Journal of Applied Behavioural Science, 20, 1-21.

Sabel, C. (1982). Work and Politics: The Division of Labour in Industry. Cambridge: Cambridge University Press.

Salancik, G. R., and Pfeffer, J. (1978). A social information processing approach to job attitudes and task design. Administrative Science Quarterly, 23, 224-253.

Sayer, A. (1986). New developments in manufacturing: the Just-in-time system. Capital and Class, 30, 43-72.

Schein, E. H. (1969). Mechanisms of change. In W. G. Bennis, K. D. Benne, and R. Chin, The Planning of Change (2nd edition), London: Holt, Rinehart and Winston.

Schein, E. (1985). Organisational Culture and Leadership. San Francisco: Jossey Bass.

Schein, E. H. (1980). Organisational Psychology. Englewood Cliffs, NJ: Prentice Hall.

Schleicher, R. (1973). Intelligenzleistungen Erwachsener in Abhangigkeit vom Niveau beruflicher Tatigkeit. Probleme und Ergebnisse der Psychologie, 44, 24-25.

Schneider, B. (1985). Organisational behaviour. Annual Review of Psychology, 36, 573-611.

Schonberger, R. J. (1987). World Class Manufacturing Casebook. New York: Free Press.

Schonberger, R. J. (1986). World Class Manufacturing: The Lessons of Simplicity Applied. New York: Free Press.

Schonberger, R. J. (1982). Japanese Manufacturing Techniques: Nine Hidden Lessons in Simplicity. New York: Free Press.

Schroder, H. M., Driver, M. J., and Streufert, S. (1967). Human Information Processing. New York: Holt, Rinehart and Winston.

Scott, W. A., Osgood, D. W., and Peterson, C. (1979). Cognitive Structure: Theory and Measurement of Individual Differences. Washington, D.C. and New York: V. H. Winston and Sons and Halsted Division, Wiley.

Seashore, S. E. (1981). Quality of Working Life Perspective. In A. Van de Ven, and W. F. Joyce (Eds.), Perspectives on Organisation Design and Behaviour, New York: Wiley-Interscience.

Seeborg, I. (1978). The influence of employee participation in job redesign. Journal of Applied Behavioural Science, 14, 87-98.

Selgiman, W. E. P. (1975). Helplessness: On Depression, Development and Death. San Francisco: W. H. Freeman.

Sewell, G., and Wilkinson, B. (1992). Empowerment or emasculation? Shopfloor surveillance in a total quality organisation. In P. Blyton, and P. Turnbull (Eds.), Reassessing Human Resource Management, London: Sage.

Shaiken, H. (1984). Work Transformed: Automation and Labour in the Computer Age. New York: Holt, Reinhart, and Winston.

Shamir, B., House, R. J., and Arthur, M. B. (1989). The transformational effects of charismatic leadership: A motivational theory. Working Paper, Reginald Jones Centre for Strategic Management, The Wharton School of Management, Philadelphia, PA.

Sharit, J., Chang, T. C., and Salvendy, G. (1987). Technical and human aspects of computer-aided manufacturing. In G. Salvendy, Handbook of Human Factors, New York: Wiley.

Silverman, D. (1985). Qualitative Methodology and Sociology. Aldershot, Hants.: Gower.

Slaughter, J. (1987). The team concept in the US Auto industry. Paper presented to the Conference on the Japanisation of British Industry, 17-18 Sept. Cardiff Business School

Slocum, J., and Sims, H. (1980). A typology of technology and job design. Human Relations, 33, 193-212.

Smircich, L. (1983). Concepts of culture and organisational analysis. Administrative Science Quarterly, 28, 339-358.

Smith, A. (1776). On the Wealth of Nations (reprinted 1974). Harmondsworth: Penguin.

Smith, C. (1989). Flexible specialisation, automation, and mass production. Work, Employment and Society, 3, 203-20.

Snell, S. A., and Dean, J. W. J. (1992). Integrated manufacturing and human resource management: A human capital perspective. Academy of Management Journal, 35, 467-504.

Sorge, A., Hartman, G., Warner, M., and Nicholas, I. (1983). Microelectronics and Manpower in Manufacturing. Aldershot: Gower.

Spector, P. E. (1985). Higher-order need strength as a moderator of the job scope-employee outcome relationship: A meta analysis. Journal of Occupational Psychology, 58, 119-127.

Sproull, L. S. (1981). Beliefs in organisations. In P. C. Nystrom, and W. H. Starbuck (Eds.), Handbook of Organisational Design Vol. 2, (pp. 203-224). New York: Oxford University Press.

Srivastva, S., Salipante, P., Cummings, T., Notz, W., Bigelow, J., and Waters, J. (1975). Job Satisfaction and Productivity. Kent: Kent State University Press.

Staw, B., and Boettger, R. (1990). Task revision: A neglected form of work performance. Academy of Management Journal, 33, 534-559.

Stevens, J. (1986). Applied Multivariate Statistics for the Social Sciences. Hillsdale, New Jersey: Lawrence Erlbaum Assoc.

Stone, E. F. (1986). Job scope-job satisfaction and job scope-job performance relationships. In E. A. Locke (Ed.), Generalising From Laboratory to Field Settings, Lexington, Massachusetts: Lexington Books.

Stone, E. F. (1976). The moderating effect of work-related values on the job scope-job satisfaction relationship. Organisational Behaviour and Human Performance, 15, 147-167.

Streeck, W. (1987). The uncertainties of management in the management of uncertainty: Employers, labour relations and industrial adjustment. Work, employment, and society, 1, 281-308.

Streufert, S., and Nogami, G. Y. (1989). Cognitive style and complexity: Implications for I/O Psychology. In C. L. Cooper, and I. Robertson (Eds.), International Review of Industrial and Organisational Psychology, London: John Wiley and Sons Ltd.

Streufert, S., Nogami, G. Y., Swezey, R. W., Pogash, R. M., and Piasecki, M. T. (1988). Computer assisted training of complex managerial performance. Computers in Human Behaviour, 4, 77-88.

Susman, G. I. (1976). Autonomy at Work: A Socio-technical Analysis of Participative Management. New York: Praeger.

Susman, G. I. (1970). The impact of automation on work group autonomy and task specialisation. Human Relations, 23, 567-77.

Susman, G., and Chase, R. (1986). A sociotechnical systems analysis of the integrated factory. Journal of Applied Behavioural Science, 22, 257-270.

Susman, G. I., and Dean, J. W. J. (1989). Strategic use of computer-integrated manufacturing in the emerging competitive environment. Computer Integrated Manufacturing Systems, 2, 133-138.

Tabachnik, B. G., and Fidell, L. S. (1989). Using Multivariate Statistics, (2nd Edition). New York: Harper and Row.

Tailby, S., and Turnbull, P. (1987). Learning to manage Just-in-time. Personnel Management, January, 16-19.

Taylor, F. W. (1947). Scientific Management. New York: Harper and Row.

Taylor, F. W. (1911). The Principles of Scientific Management. New York: Harper Collins.

Taylor, J. C. (1979). Job design criteria twenty years on. In L. E. Davis, and J. C. Taylor (Eds.), Design of Jobs, Santa Monica, Cal.: Goodyear.

Taylor, J. C. (1977). Experiments in work system design: Economic and human results (Part 1). Personnel Review, 6(3), 21-34.

Thomas, J., and Griffin, R. W. (1983). The social information processing model of task design: A review of the literature. Academy of Management Review, 8, 672-692.

Thomas, K. W., and Velthouse, B. A. (1990). Cognitive elements of empowerment: An interpretative model of intrinsic task motivation. Academy of Management Review, 15, 666-681.

Thompson, J. (1967). Organisations in Action. New York: McGraw-Hill.

Thornley, D. H., and Valentine, G. A. (1968). Job enlargement: Some implications of longer cycle jobs on fan heater production. Phillips Personnel Management Review, 12-17.

Tolliday, S., and Zeitlin, J. (1986). Introduction: Between Fordism and flexibility. In S. Tolliday, and J. Zeitlin, (Eds.) Between Fordism and Flexibility, (pp. 1-25). Oxford: Basil Blackwell.

Townley, B. (1989). Selection and appraisal: Reconstituting "social relations"? In J. Storey, (Ed.) New Perspectives of Human Resource Management, London: Routledge.

Trist, E. L., and Bamforth, K. W. (1951). Some social and psychological consequences of the Longwall method of coal-getting. Human Relations, 4, 3-38.

Trist, E., Higgins, G., Murray, H., and Pollack, A. (1963). Organisational Choice. London: Tavistock.

Trist, E. L., Susman, G., and Brown, G. W. (1977). An experiment in autonomous group working in an American underground coal mine. Human Relations, 30, 201-236.

Troussier, J. (1987). Consideration of the collective dimension of work. New Technology, Work and Employment, 2, 37-46.

Turnbull, P. J. (1988). The limits to "Japanisation" - Just-in-time, Labour relations and the UK automotive industry. New Technology, Work and Employment, 3, 7-20.

Turnbull, P. J. (1986). The 'Japanisation' of production and industrial relations at Lucas Electrical. Industrial Relations Journal, 17, 193-206.

Turner, A. N., and Lawrence, P. R. (1965). Industrial Jobs and the Worker. Cambridge, Mass.: Harvard University Press.

Ulich, E. (1991). Arbeitpsychologie. Stuggart: Poeschel.

Ulich, E. (1978). Uber mogliche Zusammenhange zwischen Arbeitstatigkeit und Personlichkeitsen-twicklung. Psychosozial, 1, 44-63.

Umstot, D. D., Bell, C. H., and Mitchell, T. R. (1976). Effects of job enrichment and task goals on satisfaction and productivity: Implications for job design. Journal of Applied Psychology, 61, 379-94.

Vaill, P. B. (1982). The purposing of high-performing systems. Organizational Dynamics, Autumn, 23-39.

Van Beck, H. G. (1964). The influence of assembly line organisation on output, quality and morale. Occupational Psychology, 38, 161-72.

Van de Ven, A. H., and Morgan, M. A. (1980). A revised framework for organisational assessment. In E. E. Lawler, D. A. Nadler, and C. Camman (Eds.), Organisational Assessment: Perspectives on the Measurement of Organisational Behaviour and the Quality of Working Life, New York: Wiley.

Van de Ven, A., and Poole, M. S. (1990). Methods to develop a grounded theory of innovation processes in the Minnesota Innovation Research Program. Organisational Science, 1, 333-56.

Van Maanen, J. (1976). Breaking in: Socialisation to work. In R Dubin (Ed.), Handbook of Work, Organisation and Society, (pp. 67-130). Chicago: Rand McNally.

Van Maanen, J., and Schein, E. H. (1979). Toward a theory of organisational socialisation. Research in Organisational Behaviour, 1, 203-264.

Vernon, H. M., Wyatt, S., and Ogden, A. D. (1924). On the extent and effects of variety in repetitive work. Medical Research Council Industrial Fatigue Research Board Report. London: HMSO.

Volpert, W. (1989). Work and personality development from the viewpoint of the action regulation theory. In H. Leymann, and H. Kornblush (Eds.), Socialisation and Learning at Work: A New Approach to the Learning Process in the Work Place and Society, (pp. 215-232). Aldershot, UK: Avebury.

Volpert, W. (1975). Die Lohnarbeitswissenschaft und die Psychologie der Arbeitstatigkeit. P. Brobkurth, and W. Volpert (Eds.), Lohnarbeitspsychologie [In], Frankfurt am M: Fischer.

Voss, C. A. (1987). Just-in-time Manufacture. London: IFS (Publications) Ltd.

Voss, C. A., and Robinson, S. J. (1987). Application of just-in-time of manufacturing techniques in the United Kingdom. International Journal of Operations and Production Management, 7, 46-52.

Vroom, V. H. (1964). Work and Motivation. New York: McGraw Hill.

Walker, C. R. (1950). The problem of the repetitive job. Harvard Business Review, 28, 54-58.

Walker, C. R., and Guest, R. (1952). The Man on the Assembly Line. Cambridge, Mass.: Harvard University Press.

Walker, R. E., Guest, R. H., and Turner, A. N. (1956). The Foreman on the Assembly Line. Cambridge: Harvard University Press.

Wall, T. D., Clegg, C. W., and Jackson, P. R. (1978). An evaluation of the Job Characteristics Model. Journal of Occupational Psychology, 51, 183-196.

Wall, T. D., and Clegg, C. W. (1981). A longitudinal field study of group work design. Journal of Occupational Behaviour, 2, 31-49.

Wall, T. D., Corbett, M. J., Clegg, C. W., Jackson, P. R., and Martin, R. (1990). Advanced manufacturing technology and work design: Towards a theoretical framework. Journal of Organisational Behaviour, 11, 201-219.

Wall, T. D., Corbett, J. M., Martin, R., Clegg, C. W., and Jackson, P. R. (1991). Advanced manufacturing technology, work design and performance: A change study. Journal of Applied Psychology, 75, 691-697.

Wall, T. D., and Davids, K. (1992). Shopfloor work organisation and advanced manufacturing technology. In C. L. Cooper, and I. Robertson (Eds.), International Review of Industrial and Organisational Psychology, (pp. 363-398). Chichester: Wiley.

Wall, T. D., Jackson, P. R., and Davids, K. (1992). Operator work design and robotics system performance: A serendipitous field study. Journal of Applied Psychology, 77, 353-362.

Wall, T. D., Kemp, N. J., Jackson, P. R., and Clegg, C. W. (1986). Outcomes of autonomous work groups: A long-term field experiment. Academy of Management Journal, 29, 280-304.

Wall, T. D., and Martin, R. (1987). Job and work design. In C. L. Cooper, and I. T. Robertson (Eds.), International Review of Industrial and Organisational Psychology, (pp. pp 61-91). Chichester: Wiley.

Wall, T. D., and Payne, R. L. (1973). Are deficiency scores deficient? Journal of Applied Psychology, 53, 322-326.

Wall, T. D., and Stephenson, G. M. (1970). Herzberg's two-factor theory of job attitudes: A critical evaluation and some fresh evidence. Industrial Relations Journal, 1, 41-65.

Walton, R. E. (1985). From control to commitment in the work-place. Harvard Business Review, March-April, 77-84.

Walton, R. (1979). Work innovations in the United States. Harvard Business Review, July-August, 88-98.

Walton, R. E. (1977). Work innovations and Topeka: After six years. Journal of Applied Behavioural Sciences, 13, 422-433.

Walton, R. E., and Susman, G. E. (1987). People policies for the new machines. Harvard Business Review, March-April, 98-106.

Warr, P. (1990). The measurement of well-being and other aspects of mental health. Journal of Occupational Psychology, 52, 129-148.

Warr, P. B., Cook, J. D., and Wall, T. D. (1979). Scales for the measurement of some work attitudes and aspects of psychological well being. Journal of Occupational Psychology, 52, 129-148.

Webster, J. (1993). Chicken or egg? The interaction between manufacturing technologies and paradigms of work organisation. The International Journal of Human Factors in Manufacturing, 3, 53-67.

Weiss, H. M. (1990). Learning theory and industrial and organisational psychology. In M. D. Dunnette, and L. M. Hough (Eds.), Handbook of industrial and organisational psychology, Volume 1 (2nd Edition),Palo Alto, Cal: Consulting Psychologists' Press.

Weiss, H. M., and Adler, S. (1984). Personality and organisational behaviour. Research in Organisational Behaviour, 6, 1-50.

Welbank, M. A. (1983). A Review of Knowledge Acquisition Techniques for Expert Systems. Towato, NJ: Rowman and Allanheld.

Wickens, P. (1987). The Road to Nissan: Flexibility, Quality, Teamwork. Basingstoke: Macmillan Press.

Wilkinson, A., Allen. P., and Snape, E. (1991). TQM and the management of labour. Employee Relations, 13(1), 24-31.

Wilkinson, A., Marchington, M., Goodman, J., and Ackers, P. (1992). Total quality management and employee involvement. Human Resource Management Journal, 2, 1-18.

Wilkinson, B. (1983). The Shopfloor Politics of New Technology. London: Heinemann.

Wilkinson, B., and Oliver, N. (1989). Power, control and the kanban. Journal of Management Studies, 26, 47-58.

Wilson, N. A. B. (1973). On the Quality of Working Life. Department of Employment Manpower Papers (7). London: HMSO.

Womack, J. P., Jones, D. T., and Roos, D. (1990). The Machine that Changed the World. New York: Rawson Associates.

Wood, S. (1990). Tacit skills, the Japanese model and new technology. Applied Psychology: An International Review, 39, 169-190.

Wood, S. (1989). The transformation of work? In S. Wood (Ed.), The Transformation of Work?, (pp. 1-43), London: Unwin-Hyman.

Wood, S., and Kelly. J. (1982). Taylorism, responsible autonomy and management strategy. In S. Wood (Ed.), The Degradation of Work?, (pp. 74-89). London: Hutchinson.

Work in America. (1972). Report of Special Task Force to Secretary of Health, Education and Welfare. Washington D.C: U.S. Government Printing Office.

Wyatt, S., and Ogden, D. A. (1924). On the extent and effects of variety and uniformity in repetitive work. Report No 26, Industrial Fatigue Research Board. London: HMSO.

Young, S. M. (1992). A framework for the successful adoption and performance of Japanese manufacturing practices in the United States. Academy of Management Review, 17, 677-700.

Young, S. M., and Davis, J. (1990). Factories of the past and of the future: The implications of robotics on workers and management accounting systems. In D. Cooper, and T. Hopper (Eds.), Critical Accounts, (pp. 87-106). London: Macmillan.

Zammuto, R. F., and O'Connor, E. J. (1992). Gaining Advanced Manufacturing Technologies benefits: The roles of organisation design and culture. Academy of Management Review, 17, 701-728.

Zicklin, G. (1987). Numerical control machining and the issue of deskilling: An empirical review. Work and Occupations, 14, 452-466.

Zipkin, P. H. (1991). Does manufacturing need a JIT revolution? Harvard Business Review, 69, 40-50.

Zuboff, S. (1988). In the Age of the Smart Machine: The Future of Work and Power. Oxford: Heinemann Professional Publishing.

Appendices

Appendix 1
Manuals used by coders to code role orientation items

1. Coding performance requirement items

Your task is to code a list of competencies into categories. The competencies (with the exception of some response-check items) cover the types of skills, knowledge, and personal qualities needed by operators in integrated manufacturing (IM) contexts.

Background

IM refers to the integration of stages of production (e.g. milling, drilling, hobbing), the functions of production (e.g. quality control, production planning), and the integration of manufacturing goals (i.e.. cost, quality and on-time delivery). For example, an integrated cell contains the machines, personnel (usually multiskilled operators), and resources necessary to build a complete, or almost complete product. The extreme form of this is where operators are collectively accountable for the whole process, from ordering supplies to shipping the end-product. This approach contrasts with the traditional organisation of the shopfloor, where there are distinct stages of production and operators perform a single operation (usually on a large range of product-types) before passing on work to the next stage.

Thus, IM can mean a new role for operators, where the boundary of expected competencies is stretched and new competencies are required for effective performance. Boundaries are stretched because operators have to do much more than just producing or monitoring. They are also expected, for example, to set targets, solve and prevent problems, monitor and analyse processes and performance, schedule work, and train others. Moreover, they are required to perform these tasks collectively as an integrated group, across a range of domains, without a traditional supervisor directing them.

Instructions

Your task is to place each of the items listed below into a category, by ticking the appropriate box. The categories are: Local-production Knowledge, Wider-production Knowledge, Cognitive Skills, Collective Skills, Self-direction, Response checks.

Procedure

1. Read through the category definitions and examples carefully.
2. Read through a couple of pages of items before beginning coding to gain familiarity with the types of items.
3. Code each item, ticking the box of the category you think it is most likely to fit into.

Note

- If an item seems to fall in two (or more) categories, then tick each category but place an asterisk by the tick in the category which you consider most appropriate. Please try to minimise the number of items for which you do this.
- Feel free to write comments to explain your choice or any uncertainties.
- Note that because an item is preceded by "knowing ..." this does not necessarily indicate it should be put into a knowledge category. For example, "knowing how to ..." probably refers to a skill.

4. Check over your answers

Categories

Local-production Knowledge

This category refers to production knowledge that is directly necessary to operate in an integrated cell, group, or plant; and where operators are partly or wholly responsible for broader aspects of production.

Do include items in this category which refer to integrated knowledge about the local work area. That is, for example, its structure/ composition (e.g. resources), what is going on (e.g. schedules), and its performance (quality, targets, etc.).

For example: Include "knowing what material has been purchased to build your products" as, although this does not specify the 'work area', this knowledge would be required for effective planning in an integrated cell.

Do not include items which refer to standard competencies (i.e. that would be just as relevant to a traditional operator as to an integrated operator), items that refer to cognitive-based skills, items that refer to more strategic knowledge, or items that refer to personal qualities.

For example: Do not include "knowing the long-term business plans". This sort of knowledge, whilst of strategic importance, is less relevant for the effective running of the work area.

Wider-production Knowledge

This category refers to knowledge or awareness beyond the local production area. This is more strategic-level knowledge. It is less necessary on a day-to-day operational basis but would be helpful for higher-level planning tasks and for motivating performance.

Do include items in this category which refer to a broader understanding of products and production as a whole, of non-production domains, of overall company goals, and customers.

For example: Include "knowing about the new strategies that could be applied to your work area" as, although this refers to the local work area, this sort of knowledge is more strategic in nature than local production knowledge.

Do not include, for example, "knowing about your work area's weekly targets" as this knowledge is more directly necessary for effective performance in an integrated cell.

Cognitive Skills

This category refers to cognitive-based skills that are required to work in an integrated manufacturing cell group. For example, rather than just producing or monitoring a process, operators are required to analyse the process (e.g. root causes, use SPC charts), solve and anticipate problems, look ahead, and so on.

Do include items which refer to skills that have a cognitive basis. That is, skills which involve substantial cognitive processing.

For example, include "knowing how to assess whether your work group has achieved its yearly targets" as this would include performing many cognitive-based operational tasks (e.g. analysing records, comparing results to targets, etc.).

And for example, include "knowing the root causes of machine faults". Although this does not use the words 'being able to' or 'knowing how to' which imply a skill, the item strongly implies the skill of being able to find root causes.

Do not include items which have a group orientation, which reflect knowledge rather than skills, or which are more focused on a willingness to be pro-active or self-directed.

Collective Skills

This category refers to the interpersonal and co-ordinating skills needed for working as a team.

Do include items which refer to: maintenance of the group's cohesion (e.g. conflict resolution), group development (e.g. training), and group co-ordination (group decisions, communication).

For example, do include "knowing how to speak out assertively in team meetings" as this is tapping into communication, a skill clearly needed for optimum group effectiveness.

Do not include, for example, "being willing to think of and make suggestions for better performance". Although this would affect the group, it taps to a greater extent a willingness to be pro-active and self-directed.

Self-direction

This refers to the personal quality of being able or willing to direct or extend oneself beyond the immediate job requirements without necessarily being asked.

Do include items which refer to the ability and/or willingness to extend oneself (e.g. learn new skills, try new ideas) as well as to think for oneself and use initiative.

For example, do include "being willing to think of and make suggestions for better performance" as this taps a willingness to extend oneself beyond just performing the job.

Do not include, for example, "being able to concentrate and hold attention for long periods of time" as this is a standard requirement of traditional operator jobs.

Response-check items

This category includes competencies which are not expected to change as a function of being in an integrated job (threshold-competencies), or competencies which are expected to become less important with an integrated job.

Do include 'taken for granted' items (standard-competencies) which refer to the basic performance of the job (e.g. monitoring processes), basic knowledge (e.g. safety) or basic personal qualities.

For example, do include "be a good time-keeper (i.e. arrive on time) " as this would be equally expected of operators working in integrated and non-integrated production environments.

Also include items which may become less important as an operator tasks on a more pro-active, broader role (e.g. “being able to think about things out side of work whilst doing your job”)

Do not include, for example, "being able to persist to get things done" as this implies a self-direction and determination which is not necessarily required in non-integrated manufacturing contexts.

2. Coding ownership items

The following is a list of problems that may occur at the work place. Your task is to code these into various categories of ownership.

Background

Operators in IM contexts require a higher level of intrinsic task motivation than operators in traditional organisations (e.g. Hutchins, 1988). This is often referred to as 'ownership' for the end-product and the meeting of goals. Thus, for example, it is expected that operators feel some concern for achieving high-quality, on-time delivery, and production costs. As well as these broad goals, operators should feel concern for the mechanisms by which these goals are achieved, such as problems which affect the cohesion of the group (as this will impact on whether or not the broader goals are achieved) and problems which reflect inefficiency within the work area. This differs from operators in traditional jobs who, whilst likely to feel concern for problems that would affect them as an individual (e.g. unsafe work area), but are more likely to see problems with broader work goals and mechanisms as the 'supervisor's problem'.

Instructions

There are three categories of problems: Goal-achievement, Group-cohesion, Efficiency as well as response-check items. Your task is to place each item listed below into one of these categories, by ticking the appropriate box.

Procedure

1. Read through the category definitions and examples carefully.
2. Read through a couple of pages of items before beginning coding to gain familiarity with the types of items.
3. Code each item, ticking the box of the category you think it is most likely to fit into.

   <u>Notes</u>

   - If an item seems to fall in two (or more) categories, then tick each category but place an asterisk by the tick in the category which you consider <u>most</u> appropriate. Please try to minimise the number of items for which you do this.
   - Feel free to write comments to explain your choice or any uncertainties.
   - Note that because an item is preceded by "knowing ..." this does not necessarily indicate it should be put into the knowledge category. For example, "knowing how to ..." usually refers to a skill.
4. Check over your answers

Categories

Goal-achievement

This category refers to problems that directly involve the broad goals of manufacturing: cost, quality, on-time delivery, and the overarching goal of customer satisfaction.

Do include, for example, "the cost of achieving budgeted volumes was very high for the month" as this directly relates to the cost goal of manufacturing.

Do not include, for example, "your machine breaks down" as, although this may affecting achieving the manufacturing goals, this should also be of individual concern to operators in traditional manufacturing contexts.

Group-cohesion

This category refers to group-related problems which will affect the attainment of the manufacturing gaols.

Do include items which refer to group cohesion (e.g. tensions in the group), group co-ordination, and group resources (e.g. skills, machinery).

For example, do include "some people in your work group cannot keep up" as this is likely to impact group cohesion and co-ordination.

Do not include, for example, "your cell did not achieve its weekly bonus" as, although this relates to a group, it reflects an extrinsic reward rather than intrinsic group motivation. It is also an event which operators in traditional jobs are very likely to feel concern about.

Efficiency

This category refers to problems that reflect the efficiency of operations, which in turn would affect the attainment of manufacturing gaols.

Do include all items which would affect the operational efficiency of the work area.

Do not include items which would primarily affect the group's cohesion, co-ordination, or resources; items which relate more to individual inefficiency; or items which relate to broader manufacturing goals.

For example, do not include "there are not enough skills in the group to meet requirements" as this primarily reflects a lack of group resources.

Response-checks

This category includes problems which are as likely be of concern (or not of concern) in traditional as well as integrated manufacturing contexts. This is because they are likely to have a direct effect on the individual (e.g. safety).

Do include items which are expected to be have a direct effect on the individual, and which are thus expected to be of concern in traditional as well as high-performing environments.

For example, do include, "your machine breaks down" as this individual-based event is likely to be of concern in a traditional as well as integrated manufacturing context.

Also include items which are expected to be of less concern as groups become more integrated and self-managing.

Appendix 2:
Guidelines on statistical techniques used in this thesis[1]

1. The use of multivariate analysis of variance in this thesis

Multivariate analysis of variance (Manova) is a generalisation of analysis of variance (Anova) to situations where there are several dependent variables. Two types of Manovas were used in this thesis: Between-subjects Manova, and Repeated-measures (RM) Manova. These are described in turn, followed by a description of the checks used to determine the suitability of the data for this statistical technique.

Between-subjects Manova (as used in *Chapter 8*)

Between-subjects Manova is where the mean differences among independent groups are tested, not for each single dependent variable, but for the *linear combination of the dependent variables*. Thus the question asked (and assessed by the multivariate F) is whether the independent variable affects the composite score created by the dependent variables. For example, a question addressed within this thesis is whether job design group has a significant effect on the combined orientation measures.

The key advantage of this technique over multiple Anovas is that it protects against inflated Type I error due to multiple tests of dependent variables that are likely to be correlated. It is nevertheless typically recommended that univariate (i.e. *Anova) results* are inspected but that they are interpreted cautiously, especially if the dependent variables are correlated. Anova results are thus reported in the analyses conducted within this thesis. Step-down analyses can be used to resolve the problem of correlated dependent variables; however, this technique was not used in the current study because there was typically no strong theoretical or practical reason to enter the variables in a particular order.

SPSSx MANOVA was used, with Adjustment (unique) made to allow for the non-orthogonality resulting from unequal sample sizes in each cell. Of the various alternatives available for assessing the significance of the multivariate effect, Pillais criterion was used as this is suggested to be the most robust when there are violations of assumptions, small sample sizes and unequal n's. Eta squared was used as a measure of strength of the multivariate association. This is computed from Wilks' Lambda (i.e. 1 Wilks' Lambda = eta squared) and represents the amount of variance accounted for in the linear combination of dependent variables by the independent variable.

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[1] These guidelines draw primarily on the recommendations made by Tabachnik and Fidell (1989) and Stevens (1986).

Repeated-measures Manova (as used in *Chapter 7* and *Chapter 9*)

RM Manova represents an alternative to RM Anova in that responses to the levels of the within-subjects IV (in this thesis, 'time') are viewed as separate DV's. The main advantage of this procedure over RM Anova is that it does not require the often-violated assumption of homogeneity of covariance (violation of this assumption means that the significant tests are too liberal). Other requirements (such as homogeneity of variance-covariance matrices and absence of multicollinearity and singularity) are also less likely to be violated. (Note - a further requirement for RM Manova, met in all studies in this thesis, is that there should be more cases than DV's in the smallest group).

For the RM analyses, simple main effects are reported (obtained using MWITHIN command in SPPSx). These test for differences across one variable (e.g. group) at each level of the second variable (e.g. time). This procedure is similar to investigating the interaction effects of an Manova, although it allows more detailed analysis of the specific pattern of predicted effects. Consistent with Girden's (1992) recommendation, separate error terms for each group level were used (i.e. each level is considered as a single-factor repeated measures study).

Assumptions

Prior to conducting either Between-subjects Manova or RM Manova, the assumptions underlying the use of this statistical technique were tested. This includes tests of univariate and multivariate outliers, linearity, multivariate normality, homogeneity of variance-covariance matrices, and multicollinearity and singularity. Manova is particularly sensitive to outliers and thus most attention was given to this issue. The presence of univariate outliers was investigated using SPSSx Frequencies, and the existence of multivariate outliers was tested using both Mahalanobis distance and Cook's distance measures. Using an alpha of .001 as the criterion for Mahalanobis distance, there were no outliers among the cases in any of the analyses; using Cooks' distances of greater than 1.0 as the criterion, there were no influential data points. Checks of linearity of the relationships between the dependent variables (using within-cell scatterplots between pairs of dependent variables) suggested there was no serious curvilinearity. Although there were some violations of multivariate normality were present in the data, the skewness was not caused by outliers. There were also some violations of the homogeneity of variance-covariance matrices; however, Manova is reasonably robust to violations of these assumptions, particularly when Pillais criteria is used to evaluate multivariate significance (as explained above). Finally, inspection of the determinant of the within-cell correlation matrix suggested there was no multicollinearity or singularity amongst the dependent variables.

2. Guidelines on the use of hierarchical regression

Hierarchical multiple regression is a procedure which allows the independent variables (IVs) to be entered into the equation in an order specified by the researcher. This then allows an assessment of the importance of each IV (or each block of IVs) at its own point of entry. In the analyses reported within this thesis, this was necessary to allow the entry of 'nuisance' variables first (e.g. supervisor effects, group effects) such that the key variables can be evaluated for what they add to the prediction over and above these theoretically unimportant variables. This hierarchical procedure is preferable to stepwise regression in which the order of entry is determined by statistical criteria. The latter method can result in over-fitting of the data and capitalisation on chance, and hence require a much larger ratio of cases to variables (Tabachnick and Fidell, 1989).

SPSSx REGRESSION was used to perform the regression analyses. A minimum of five cases to one variable (as recommended by Tabachnick & Fidell, 1989) was maintained in all analyses. The data reported for each analysis, and their meaning, are as follows:

1. *The variable (or variables) and the step it was entered*

2. *Multivariate relationship (R) after each step (adjusted for sample size).* The significance of this relationship is tested against the null hypothesis that the correlations between the DV and the IVs and all regression coefficients are zero.

3. *Change in the multivariate relationship (R^2 change) at each step.*
The R^2 change at each step in hierarchical regression corresponds to 'squared semi-partial correlations'. Tabachnick and Fidell (1998) recommend this statistic for evaluating the importance of predictors in hierarchical regression. It indicates the amount of variance added to the R^2 by each predictor at the point that it enters the equation; that is, it answers the question: how much does this predictor add to the R2 after the earlier predictors have contributed their share?

4. *Standardised beta values for the final regression equation.* The final beta weights indicate the contribution of the variable that is independent of the order of entry, but that may reflect shared variance with other predictors. This means that if predictors are highly correlated, using only beta weights to determine their relative importance may be misleading.

Assumptions

Prior to performing the regression analyses, several tests were performed for each data set to evaluate the assumptions which underlie the use of this statistical technique. This included testing for the presence of univariate outliers (using SPSSx Frequencies); multivariate outliers (using both Mahalanobis distance and Cook's distance measures); multicollinearity and singularity; and the normality, linearity, homoscedasticity and independence of residuals (using scatter plots of predicts scores against residuals). Often the predictor variables were skewed, and residual scores did not cluster along the centre-line of the residual scatter plot. However, the procedure recommended for dealing with these problems (i.e. transformation of these variables' scores) had only minimal effect on the results. Thus, transformations were considered unnecessary. Using the same criteria for Mahalanobis distances and Cooks' distances described above, there were no outliers among the cases or influential data points. Finally, there was no multicollinearity or singularity amongst the dependent variables in any of the data sets.

Appendix 3

Orientation measures: categorisation and final item content

This appendix contains a description of the categorisation process for the role orientation measures used in each study. The final items for each role orientation scale, as well as the items for the measure of strategic orientations (i.e. Strategic Beliefs), are also specified.

General information for coding role orientation items

For each study, three or four coders separately placed each of the items into the conceptual a prior sub-scales using the coding guidelines. For the ownership items, the categories of problems were: Goal-achievement, Efficiency, Group-cohesion, and Response-checks. For the performance requirement items, the categories were: Local-production Knowledge, Cognitive Skills, Collective Skills, Self-direction, Wider-production Knowledge, and Response-checks.

All items where at least two coders agreed were included in the sub-scales. Items where there was disagreement were excluded. Kappa statistics of interrater agreement were also calculated using HANDY KAPPA (Jackson, 1993) for the set of ownership items, and the set of performance requirement items, in each study. Kappa values greater than .60, the recommended minimum value (see Hill, 1991), suggest that the items can reliably be assigned to the categories. Z-scores are also calculated. These test the hypothesis of no more than chance agreement and, if they are significant, suggest that assignment to the categories is significantly better than chance (Fleiss, 1971).

For each study, after establishing that items could be reliably assigned by coders to the a priori categories, subscales were formed by summing the items within each category. Intercorrelations between subscales were then examined. If the intercorrelations were high (suggesting the a priori distinctions were not maintained), then subscales were combined.

Procedure and final items for Chapter 6 (Company P)

Three coders were used to code items within this study. Kappa statistics and the number of items where at least two people agreed for the sub-scales are shown in Table 1 below. The Kappa values were all categories were at least .60, suggesting the items were able to be reliably assigned to the categories. Further, the Z-scores for the hypothesis of no more than chance agreement were all significant, suggesting that assignment to the categories was significantly better than chance.

Table 1: Agreement statistics for the role orientation items in the first study

Category	No. items where 2+ agree	Kappa	SE Kappa	Z score (K/SE)
Ownership				
Goal achievement	3	.87	.38	2.25**
Efficiency	3	.89	.40	2.25**
Group-cohesion	4	.87	.38	2.19*
Response-check	3	.61	.32	1.91*
Performance requir'ts				
Cognitive Skills	7	.94	.21	4.47***
Collective Skills	10	1.0	.21	4.76***
Local-production Knowledge	9	.70	.21	3.33***
Wider-production Knowledge	5	.70	.21	3.33***
Self-direction	5	.85	.21	4.04***
Response-check	3	.92	.21	4.33***

*** p < .001, ** p < .01, * p < .05

Data from respondents, however, showed that the sub-scales were not easily distinguishable from one another. First, considering the ownership items, responses to the first three sub-scales were highly interrelated, sharing some 40% to 64% variance (mean = 53%). These were thus combined to form a single total scale labelled 'Production Ownership'. This total scale had high internal reliability (Cronbach's alpha = .94). The Response-check scale for ownership was more distinct from the remaining sub-scales, having 18% to 28% (mean 24%) common variance. This scale had an adequate internal reliability (Cronbach's alpha = .79) and was retained as a separate scale.

Second, the inter-correlation's between the performance requirement sub-scales were inspected. Local-production Knowledge, Cognitive Skills, Self-direction, and Collective Skills shared an average of 57% of their variance, each sharing over 50% with at least one other scale This suggested that although coders differentiated between the items, the respondents did not. The sub-scales were combined into one scale, which was labelled 'Production Knowledge' as all the items related to functioning within an integrated production environment. This scale had a high internal reliability (Cronbach's alpha = .97).

Wider-production Knowledge was retained as a separate scale, sharing on average only 31% of its variance (less than 45% with any other scale). This scale is also logically more distinct as it refers to knowledge and awareness outside of Production. Cronbach's alpha for this scale was .75. Finally, Threshold-Knowledge shared an average of only 29% of variance (less than 35% with any other scale) and was kept as a distinct scale.

The final items in each scale are indicated next.

Production Ownership

1. Orders for the products you deal with are repeatedly not being met on time
2. Customers of the products you deal with are dissatisfied *with what they receive*
3. The quality of the products made in your work area is not as good as it could be
4. There is much unfinished work sitting in your area
5. There is a pile of completed work in your area
6. The way some things are done in your work area means a lot of re-work is needed
7. Others in your work area are not pulling their weight
8. People in your work area are not co-ordinating their efforts
9. There is a lack of well-trained people in your work area

(Note items from the Goal-achievement, Efficiency, and Group-Cohesion sub-scales are items 1-3, 4-6, and 7-9, respectively).

Ownership Response Check

1. The materials/products you receive to work on are of poor quality
2. You cannot produce high-quality work (e.g. due to machine breakdowns, lack training etc.)
3. You cannot produce at the maximum bonus rate (e.g. due to machine breakdowns, lack of training)

Miscellaneous (ownership)

Your immediate boss is absent for a few days

Production Knowledge

1. Knowing the requirements of your end-customer
2. Knowing what skills everyone in your work area has
3. Knowing the capacity of all machines in your work area
4. Understanding how work-flows in your work area
5. Understanding how the MRP system works
6. Knowing the work schedule for your area
7. Knowing the priorities of work in your area
8. Knowing where work tends to get held-up in your area
9. Understanding the costing/budgeting in your work area
10. Knowing how to interpret production records (e.g. scrap levels) in terms of performance
11. Knowing the root causes of production problems that occur
12. Being able to measure and analyse problems in the production process (e.g. using SPC charts)
13. Being able to anticipate and prevent production problems
14. Being able to set targets
15. Being able to look ahead and anticipate future needs (e.g. equipment)
16. Being able to co-ordinate your work with what others are doing
17. Being able to make decisions as part of a group
18. Being able to handle conflicts and disagreements between people
19. Being able to train people
20. Being able to involve and motivate people
21. Being willing to pass on knowledge and skills to other people
22. Being able to understand other people's points of view
23. Being able to get on well with people
24. Being able to work as a team member
25. Being willing to challenge and question the way things are done
26. Being willing to try new ideas and ways of doing things
27. Being self-motivated and wanting to improve your own performance
28. Being willing to take on and accept new responsibilities
29. Being able to work out what to do when instructions are vague

(Note - items 1-9 were from the Local-production Knowledge sub-scale, 10-16 were from the Cognitive Skills sub-scale, 17-24 were from the Collective Skills sub-scale, and 25-29 from the Self-Direction scale).

Wider-Production Knowledge

1. Knowing what's happening in marketing/sales
2. Knowing what people in design are doing
3. Knowing the overall objectives of the company
4. Knowing what is different about the products made in this company compared to those made by competitors
5. Knowing what affects the profitability of this company's products.

Knowledge Response Check

1. Being technically skilled (e.g. operating machines, using equipment)
2. Being able to concentrate and hold attention for long periods of time
3. Being able to report production problems to appropriate people

Strategic Beliefs

1. Specialists (e.g. engineers) and managers should be the people that make suggestions to improve production efficiency
2. People on the shop-floor should be at least partly responsible for improvements to the production process
3. In the long run, production is more efficient if people stick to what they already know, rather than learning new things
4. Efficient workers get on with what they've been told rather than questioning things
5. Fixing problems as they arise is more efficient than trying to prevent them
6. Even if individual people are working hard, they may be unproductive as a group
7. The best way to deal with a production problem is to find out who is to blame
8. When an organisation is running smoothly, there's no need to think about changing things
9. It is important to keep making products, even if they go into stock rather than directly to customers
10. To keep ahead, one must continually look at ways of improving how things are done
11. In a well-run production department, an expensive machine should never be idle
12. In a production department, time spent not producing is time wasted
13. Giving information about customer requirements to everyone in a Production Department is a waste of effort
14. Customer satisfaction should be a personal goal for everyone in production
15. The most important goal of a production department is to keep producing no matter what
16. Things that are good for management can never be good for people on the shopfloor
17. Inspectors will always be needed to check the quality of operators' work
18. Even if they don't realise it, managers and workers all have a common goal
19. It is reassuring if there is always a large pile of work waiting for me to work on
20. When I see lots of work on the shop-floor waiting to be finished, I feel confident of this companies future
21. To do their job properly, supervisors must have technical knowledge of all aspects of the work area they supervise
22. If I know what to do and how to do it, I am not concerned about why
23. It is not my job to make important decisions about my work

Procedure and items for Chapter 7 (Company D)

In this study, four coders separately coded each of the ownership items. Kappa statistics for the coding of items are shown in Table 2 below.

Table 2: Agreement statistics for the role orientation items in the second study

Category	No. items where 2+ agree	Kappa	SE Kappa	Z score (K/SE)
Ownership				
Goal achievement	3	.74	.24	3.00**
Efficiency	3	.85	.26	3.30***
Group-cohesion	3	1.0	.26	3.78***
Response-check	3	.74	.25	3.00**
Performance requir'ts				
Cognitive Skills	4	.84	.22	3.76***
Collective Skills	3	.99	.22	4.58***
Local-production Knowledge	5	.79	.22	3.43***
Wider-production Knowledge	3	.72	.22	3.30***
Self-direction	2	.77	.22	3.55***
Response-check	3	.77	.22	3.55***

*** p < .001, ** p < .01, * p < .05

Although items were able to be reliably coded into different sub-scales, data from respondents showed that these sub-scales were not easily distinguishable from one another. First, responses to the first three ownership sub-scales were highly interrelated, sharing some 54 to 57 % variance (mean = 55.5 %) variance. These were thus combined to form a single total scale labelled 'Production Ownership'. The Response-check scale for ownership items shared less variance on average with the other measures (45%), although the amount shared was nevertheless quite high (this was probably because of the bonus system which meant it is harder to distinguish individual from collective ownership). Nevertheless, this scale was retained as a separate measure as it was developed to assess a different construct than the other scales. Moreover, it had differential correlations with other orientation measures than the Production Ownership sub-scales (e.g. the Response-check scale had a non-significant correlation with

Strategic Beliefs, whereas Production Ownership had a significant correlation with this measure).

Intercorrelations between performance requirement sub-scales were then inspected to determine whether respondents distinguished between them. The Self-Direction, Collective Skills, and Cognitive Skills sub-scales all shared substantial variance (average 58%) and were combined to form a scale labelled 'Proactive Group Knowledge'. Because they shared smaller amounts of variance (less than 50%), and had acceptable internal reliabilities as separate sub-scales, the remaining sub-scales (Local-production Knowledge, Wider-Production Knowledge, and the Response-check items) were kept as separate indices.

The final items in these scales are listed next.

Production Ownership

1. Orders for the products you assemble are repeatedly not being met on time
2. Customers of the products you assemble are dissatisfied with what they receive
3. The quality of the products assembled in your work area is not as good as it could be
4. The lead time taken to build a whole product in your assembly area is on the rise
5. Some machines and equipment in your assembly area are not being well maintained
6. There is much unfinished work sitting in your assembly area
7. There is a pile of completed work in your assembly area
8. In your assembly area, products are being handled unnecessarily
9. Others in your assembly area are not pulling their weight
10. People in your assembly area are not co-ordinating their efforts
11. There is a lack of well-trained people in your work area
12. There were strained relations among people in your work area

(NB: items from the Goal-achievement, Efficiency, and Group-cohesion sub-scales are items 1-4, 5-8, and 9-12, respectively).

Ownership Response Check

1. The materials/products you receive to work on are often of poor quality
2. Your cell did not achieve the productivity bonus
3. Your assembly area was not as safe as it could be
4. There were not many new orders coming in

Local-production Knowledge

1. Knowing the priorities of work in your assembly area
2. Knowing the resources available in your assembly area (e.g. peoples' skills, machine capacities)
3. Knowing about the work-flow in your assembly area (e.g. where work tends to get held up)
4. Knowing exactly how well your work area is performing
5. Knowing what goes on outside your assembly area (e.g. in Fabrication, Pressing)

Pro-active Group Knowledge

1. Being able to measure and analyse problems in the production process
2. Being able to anticipate and prevent problems
3. Being able to find the root causes of problems
4. Being able to plan ahead (e.g. anticipate future needs for your work area)
5. Being able to involve and motivate people
6. Being able to make decisions as part of a group
7. Being able to understand other people's points of view
8. Being willing to challenge and question the way things are done
9. Being able to get on with a job without raising objections, even if the way its done is not the best? (reverse scored)
10. Being willing to take on & accept new responsibilities

(NB: items from the Cognitive Knowledge, Collective Knowledge, and Self-Direction sub-scales are items 1-4, 5-7, and 8-10, respectively).

Wider-production Knowledge

1. Knowing about the end-customers of the products you help build (e.g. their requirements, their feedback)
2. Knowing general information about your products (e.g. how they differ from those made by competitors)?
3. Knowing the overall objectives of the company

Knowledge Response Check

1. Knowing about safety procedures and standards
2. Being technically skilled (e.g. use equipment)

Strategic Beliefs

1. Specialists (e.g. engineers) and managers should be the people that make suggestions to improve production efficiency
2. In the long run, production is more efficient if people stick to what they already know, rather than learning new things
3. Getting assemblers to learn new skills will eventually lower production standards
4. Efficient workers get on with what they've been told rather than questioning things
5. An assemblers' job is to build products, not to think about things like reducing set-up time and meeting targets
6. Fixing problems as they arise is more efficient than trying to prevent them
7. When an organisation is running smoothly, there's no need to think about changing things.
8. It is important to keep making products, even if they go into stock rather than directly to customers
9. In an assembly department, time spent not building products is time wasted
10. The most important goal in an assembly department is to keep building as much as possible
11. When I see lots of work on the shop-floor waiting to be finished, I feel confident of this company's future
12. With a good cell leader, assemblers shouldn't need to know about things like customer requirements and company objectives
13. It is not my job to make important decisions about my work
14. If I know what to do and how to do it, there is no point knowing why something needs to be done

Procedure and final items for Chapters 8 and 9 (Company F)

Three coders were used in this study. It should be noted that there were 7 items covering technical skills/knowledge (e.g. "knowing how to flow solder"). These skills were only broadly covered as they were not of primary research interest; they served primarily to enhance the "legitimacy" of this scale, particularly for those respondents who perceived many of the other skills/knowledge as unimportant. These items were not coded, or included in any of the scales.

Table 3: Agreement statistics for the role orientation items in the third and fourth studies

Category	No. items where 2+ agree	Kappa	SE Kappa	Z score (K/SE)
Ownership				
Goal achievement	2	.89	.22	4.11***
Efficiency	6	.75	.24	3.15***
Group-cohesion	8	.90	.27	3.37***
Response-check	3	.61	.21	2.83**
Performance requir'ts				
Cognitive Skills	9	.78	.15	5.10***
Collective Skills	12	.94	.16	5.80***
Local-production Knowledge	9	.75	.16	4.84***
Wider-production Knowledge	10	.89	.16	5.63***
Self-direction	0	-1.17	.26	-.05
Response-check	3	.77	.16	4.94***

*** p < .001, ** p < .01, * p < .05

For ownership subscales, responses to the first three were highly interrelated, sharing some 52% to 62% of variance in common. These were thus combined to form a single total scale labelled 'Production Ownership'. This total scale had high internal reliability (Cronbach's alpha = .96). The Ownership Response Check scale was more distinct from the remaining subscales, having 37% to 43% common variance. This scale had an adequate internal reliability (Cronbach's alpha = .76) and was retained as a separate scale.

The inter-correlation's between performance requirement sub-scales were inspected. Local-production Knowledge, Cognitive Skills, and Collective Skills shared an average of 61% of their variance, suggesting that although coders differentiated between the items, the respondents did not. The subscales were combined into one scale. This was labelled 'Production Knowledge' as all the items related to functioning within an integrated production environment. It had high internal reliability (Cronbach's alpha = .94). Wider-Production knowledge was retained as a separate scale, sharing on average only 42% of its variance. This scale is also logically more distinct as it refers to knowledge and awareness outside of Production. Cronbach's alpha was .75. Finally, the Response-check scale shared an average 44% of variance only and was kept as a distinct scale.

Items in the final scales are shown below.

Production Ownership

1. Orders for the products you assemble are repeatedly not being met on time
2. The end-customers of the products you deal are dissatisfied with what they receive
3. There is a pile of unfinished work sitting in your area
4. The way things are done in your area means products are re-handled unnecessarily
5. Other departments respond slowly after you have requested their assistance
6. There is a pile of completed work in your area
7. Someone in your area is not doing their share of work
8. Others in your work area have nothing to do
9. Some people in your work group are not as efficient as others
10. There is a lack of skilled people in your work group
11. There are strained relations among some members of your work group
12. A person has just joined your work area
13. Too many people in your area want to go on holidays at the same time
14. A number of people in your work group are not getting any training in new tasks

(NB: items from the Goal Ownership, Efficiency Ownership, and Group-Cohesion Ownership sub-scales are items 1-2, 3-6, and 7-14, respectively).

Ownership Response Check

1. The materials you receive to work on are faulty
2. A machine used in your work breaks down
3. You can't keep up with the amount of work you are given

Production Knowledge

1. Knowing how to carry out inspection
2. Understanding if the product conforms to requirements
3. Knowing about the area work-load and how it is distributed
4. Understanding the work-flow in your work area
5. Understanding what everyone's roles are within the work area
6. Knowing what skills other people in the work area have
7. Knowing the priority of work orders
8. Knowing the priority of customer orders
9. Knowing the long-term requirements of the work group
10. Understanding management information systems (e.g. DESK/VAX)
11. Knowing how to prioritise work
12. Knowing how to anticipate and prevent problems
13. Knowing how to assess the performance of the work group
14. Knowing how scheduling procedures are performed
15. Knowing how to measure process defects
16. Knowing how to analyse process defects
17. Knowing how to allocate tasks without the supervisor
18. Knowing how to identify potential conflicts
19. Knowing how to resolve conflicts
20. Knowing how to put over an idea
21. Knowing how to get your opinion heard
22. Knowing how to train other people
23. Understanding how to deal with a range of people
24. Understanding other people's points of view
25. Knowing how to go about resolving problems
26. Knowing how to share other team members' problems
27. Knowing how to involve and motivate people
28. Knowing how to get the most out of meetings

(NB: items from the Local production knowledge, Cognitive Skills, and Collective Skills sub-scales are items 1-8, 9-17, 18-28 respectively).

Wider-production Knowledge

1. Knowing who is the end-user of the products you deal with
2. Knowing the requirements of the end-customer
3. Knowing the overall objectives of the company
4. Understanding the relationship between marketing/sales and production
5. Understanding the relationship between loss prevention and production
6. Knowing who the key people in each department are
7. Understanding the costing in your work area
8. Knowing the overall objectives of the company
9. Knowing who your suppliers are

Knowledge Response Check

1. Knowing what work in your area is scheduled (i.e. work-to list)
2. Knowing how to report problems to your supervisor/team-leader
3. Knowing how to follow specific instructions

Strategic Beliefs

1. It is not my job to make important decisions about my job
2. If I know what to do and how to do it, I am not concerned with why it needs to be done
3. I can't be expected to be concerned about mistakes other people make
4. The people responsible for improvements to production should be specialists (e.g. engineers and managers)
5. Being productive means getting down to what I've been told and getting on with it
6. I could do my job perfectly well without knowing the company's overall objectives
7. In the long run, product-lines will be more efficient if people stick to what they already know well, rather than learning new things
8. Fixing problems as they arrive is always more efficient than spending time preventing things that may never happen
9. If current plans are successful, this organisation will no longer need to change the way it does things
10. It is important to keep making products, even if they go to stock rather than directly to customers
11. I find it re-assuring if there is always a large pile of work waiting for me to work on

Appendix 4

Extra results for Chapter 7

This Appendix shows the intercorrelation matrices of measures at Time 1 and Time 2 in turn (Table A and B). This is followed by a table looking at changes over time and group differences in work flow measures (Table C) and in conventional outcome measures (Table D).

Table A: Means, standard deviations and intercorrelations between measures at Time 1, N = 47

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
Mean	3.92	3.80	3.50	3.17	3.38	3.00	2.67	2.66	2.88	2.62	4.07	2.67	2.61	.75
(SD)	(.62)	(.53)	(.68)	(.89)	(.70)	(.87)	(1.04)	(1.17)	(.88)	(1.04)	(.82)	(.66)	(.76)	(.25)
1. Local-production Knowledge	-													
2. Proactive-grp Knowledge	.52**	-												
3. Wider-prod'n Knowledge	.55**	.43**	-											
4. Production Ownership	.26	.42*	.06	-										
5. Strategic Beliefs	.20	.19	-.01	.42**	-									
6. Method Control	.04	-.02	.05	.00	.20	-								
7. Timing Control	.00	.12	.29	-.22	-.06	.67**	-							
8. Excess WIP	.13	.38*	.11	.11	.14	-.18	-.12	-						
9. Pressure	.20	.11	.13	.27	.12	-.13	-.16	.35*	-					
10. Material Chasing	.14	.28	.10	-.02	.02	-.12	.02	.36*	.25	-				
11. Job Satisfaction	-.07	-.10	.04	-.03	-.19	.39*	.39*	-.47**	-.30	-.10	-			
12. Anxiety-contentment	.11	.00	.01	-.02	.17	-.22	-.05	.09	.34*	.17	-.55**	-		
13. Depression-enthusiasm	-.03	-.13	-.14	-.13	.18	-.37*	-.21	.25	.26	.14	-.73**	-.79**	-	
14. Psychological Strain	.25	.16	.12	-.05	-.02	-.26	-.15	.03	.24	.01	-.44**	-.71**	.69**	-

** p < .01, *p < .05

Table B: Means, standard deviations and intercorrelations between measures used at Time 2, N = 39

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
Mean	3.64	3.57	3.52	3.34	3.59	3.12	2.88	2.48	2.94	2.52	4.08	2.65	2.64	.81
(SD)	(.62)	(.57)	(.72)	(.94)	(.69)	(.75)	(1.02)	(1.00)	(.89)	(1.07)	(.93)	(.65)	(.80)	(.39)
1. Local-production Knowledge	-													
2. Proactive Group Knowledge	.21	-												
3. Wider-prod'n Knowledge	.52**	.30	-											
4. Production Ownership	.41*	.29	.35*	-										
5. Strategic Beliefs	.18	.01	-.22	.33**	-									
6. Method Control	.19	.23	.11	.23	.29	-								
7. Timing Control	-.12	.10	-.10	-.04	.02	.70**	-							
8. Excess WIP	-.08	.00	-.08	-.21	-.04	-.27	-.21	-						
9. Pressure	.10	-.20	-.03	-.16	-.08	-.21	-.32	.37*	-					
10. Material Chasing	.09	.06	.17	-.12	-.06	-.11	-.02	.54**	.52**	-				
11. Job Satisfaction	.02	.26	.07	.04	-.12	.41*	.53**	-.48**	-.64**	-.17	-			
12. Anxiety-contentment	.15	-.05	.17	.08	.00	-.35*	-.36*	-.37*	.52**	.36*	-.51**	-		
13. Depression-enthusiasm	.04	-.20	-.02	-.09	.06	-.47**	-.44**	.52**	.54**	.22	-.72**	.79**		
14. Psychological Strain	-.04	.07	.03	-.06	.06	-.47**	-.56**	.37*	.48**	.10	-.63**	.72**	.77**	-

** p < .01, *p < .05

Table C: Changes over time and group differences in work-flow variables

	Changes Over Time						Group Differences	
	Comparison Group N = 15			Intervention Group N = 20				
Work Flow Variables	Time 1 $\bar{X}$ (SD)	Time 2 $\bar{X}$ (SD)	F[1]	Time 1 $\bar{X}$ (SD)	Time 2 $\bar{X}$ (SD)	F[1]	Time 1 F[1]	Time 2 F[1]
Excess WIP	2.18 (.72)	1.96 (.73)	1.27	2.97 (1.34)	2.96 (1.06)	.01	5.13*	9.24**
Material Chasing	2.51 (1.17)	2.02 (.87)	4.35*	2.75 (.99)	2.95 (1.09)	.97	.34	6.91*
Pressure	2.54 (.98)	2.28 (.82)	2.61	3.17 (.78)	3.48 (.56)	5.46*	4.17*	25.45***

*** $p < .001$, ** $p < .01$, * $p < .05$

[1] Degrees of freedom for all F tests were 1, 33. Where F is significant, the (-) and (+) respectively indicate a decrease and increase in scores over time.

Table D: Changes over time and group differences for conventional outcome variables

	Changes Over Time						Group Differences	
	Comparison Group N = 15			Intervention Group N = 20				
Outcome Variables	Time 1 $\bar{X}$ (SD)	Time 2 $\bar{X}$ (SD)	F[1]	Time 1 $\bar{X}$ (SD)	Time 2 $\bar{X}$ (SD)	F[1]	Time 1 F[1]	Time 2 F[1]
Job Satisfaction	4.40 (.83)	4.42 (1.08)	.02	3.92 (.78)	3.73 (.74)	1.73	4.07*	3.26
Psychological Strain	.66 (.25)	.63 (.28)	.11	.79 (.21)	.95 (.42)	4.25*	3.25	5.61*
Anxiety-contentment	2.55 (.64)	2.29 (.54)	3.73	2.70 (.65)	2.88 (.67)	2.61	.77	8.04**
Depression-enthusiasm	2.50 (.79)	2.32 (.71)	1.29	2.64 (.69)	2.93 (.81)	4.63*	.49	3.90

*** $p < .001$, ** $p < .01$, * $p < .05$

[1] Degrees of freedom for all F tests were 1, 33. Where F is significant, the (-) and (+) respectively indicate a decrease and increase in scores over time.

Appendix 5
Extra results tables for Chapter 8

Table A shows the means, standard deviations and intercorrelations between measures for cross-sectional study. Table B shows changes for the Test Comparison Group from the Original survey (Time 0) to Time 1 for job content variables.

Table A: Means, standard deviations and intercorrelations between measure at Time 1

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
Mean	2.63	2.18	3.16	3.13	3.68	2.29	3.00	3.56	3.10	3.05	4.84	4.13	.79	2.53	2.53
(SD)	(.72)	(.72)	(.48)	(.92)	(.86)	(.48)	(.84)	(.87)	(1.13)	(.74)	(.90)	(.49)	(.40)	(.67)	(.90)
1. Production Knowledge	.96														
2. Wider-production Knowledge	.70**	.75													
3. Knowledge RC	.73**	.60**	.64												
4. Production Own'p	.70**	.44**	.45**	.96											
5. Ownership RC	.48**	.31*	.50**	.69**	.75										
6. Strategic Beliefs	.24	.09	.17	.41**	.21	.77									
7. Boundary Control	.32*	.19	.17	.22	.02	.18	.69								
8. Method Control	-.045	.17	.01	-.06	-.17	.11	.48**	.81							
9. Timing Control	.12	-.06	.005	.18	.10	.13	.50**	.44**	.82						
10. Job Complexity	.39**	.28*	.23	.22	-.03	-.04	.53**	.36**	.27*	.92					
11. Job Satisfaction	.18	.35**	.16	.10	-.03	-.32*	.09	.31*	.09	.65**	.93				
12. Quality Commitment	.30*	.41**	.38**	.31*	.21	-.09	.11	.19	.09	.32*	.63**	.91			
13. Psychological Strain	.09	-.01	.02	.19	.25	.23	-.00	-.19	-.07	-.24	-.46**	-.52**	.81		
14. Anxiety-contentment	.05	-.25	-.02	.22	.21	.15	.07	-.18	-.06	-.17	-.48**	-.46**	.66**	.62	
15. Depression-enthusiasm	-.11	-.27	-.16	.03	.14	.25	.08	-.23	.06	-.43**	-.74**	-.57**	.62**	.61**	.89

** p < .01, *p < .05; Note - Cronbach's alpha coefficients of internal reliability are shown on the diagonal

Table B: Change from Time 0 to Time 1 in perceptions of job content for the members of the Test Comparison Group

	Changes over time		
Job content variables	**Time 0** $\overline{X}$ (SD)	**Time 1** $\overline{X}$ (SD)	**t (11)**
Job Complexity	3.32 (.41)	2.82 (.65)	2.71*
Timing Control	3.42 (.85)	3.52 (.96)	-.27
Boundary Control	3.11 (.52)	3.42 (.52)	-1.72
Method Control	3.49 (.80)	3.43 (.99)	.17

* p < .05

Appendix 6
Extra results tables for Chapter 9

This Appendix contains the following tables:

Table A: Means, standard deviations and intercorrelations between measures at Time 2

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
Mean	2.92	2.01	3.25	3.61	3.86	2.48	3.42	3.90	3.68	3.13	4.82	4.07	.92	2.80	2.61
(SD)	(.63)	(.71)	(.68)	(.72)	(.89)	(.58)	(.78)	(.79)	(.93)	(.67)	(.75)	(.56)	(.47)	(.57)	(.83)
1. Production Knowledge	.91														
2. Wider-production Knowledge	.72**	.74													
3. Knowledge RC	.82**	.54**	.54												
4. Production Ownership	.44**	.31	.26	.87											
5. Ownership RC	.54**	.45**	.40*	.63**	.42										
6. Strategic Beliefs	.48**	.36*	.31	.37**	.43**	.79									
7. Boundary Control	.38*	.32	.45**	.09	.04	.16	-								
8. Method Control	.35*	.24	.43**	.10	.12	-.03	.76**	-							
9. Timing Control	.45*	.25	.40*	.19	-.02	.33	.71**	.66**	-						
10. Job Complexity	.44**	.57**	.38*	.28	.33	.14	.69**	.76**	.50**	-					
11. Job Satisfaction	.32	.33	.29	.26	.21	.01	.41*	.58**	.45**	.60**	-				
12. Quality Commitment	.29	.34	.29	.37*	.30	-.10	.45*	.66**	.26	.72*	.69**	-			
13. Psychological Strain	-.13	-.21	-.21	-.09	-.07	.31	-.22	-.41*	-.15	-.28	-.58**	-.46**	-		
14. Anxiety-contentment	-.01	-.03	-.02	-.14	-.04	.00	.00	-.14	-.27	-.16	-.40**	-.15	.37*	-	
15. Depression-enthusiasm	-.21	-.29	-.28	-.28	-.19	.17	-.16	-.34*	-.17	-.39*	-.71**	-.69**	.65**	.45**	-

** p < .01, *p < .05; Note - Cronbach's alpha co-efficients of internal reliability for orientation measures are shown on the diagonal

Table B: Means, standard deviations and intercorrelations between measures at Time 3

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
Mean	2.90	2.19	3.16	3.61	3.78	2.54	3.51	3.76	3.69	3.25	4.98	4.18	.82	2.62	2.49
(SD)	(.56)	(.71)	(.53)	(.74)	(.67)	(.54)	(.75)	(1.02)	(1.00)	(.73)	(.90)	(.62)	(.35)	(.55)	(.72)
1. Production Knowledge	.90														
2. Wider-production Knowledge	.57**	.82													
3. Knowledge RC	.67**	.29	.58												
4. Production Ownership	.47**	.27	.26	.91											
5. Ownership RC	.34*	.21	.37*	.69**	.05										
6. Strategic Beliefs	.13	.14	.09	.44**	.53**	.78									
7. Boundary Control	.41*	.18	.30	.22	.01	-.29	-								
8. Method Control	.53**	.40*	.26	.78	-.03	-.38*	.51**	-							
9. Timing Control	.50**	.17	.36*	.26	.07	-.25	.51**	.81**	-						
10. Job Complexity	.56**	.53**	.25	.32	.00	-.08	.59**	.65**	.60**	-					
11. Job Satisfaction	.51**	.36*	.39*	.32	-.01	-.31	.46**	.72**	.63**	.60**	-				
12. Quality Commitment	.51**	.19	.44*	.14	-.08	-.35*	.42*	.52**	.49**	.48**	.69**	-			
13. Psychological Strain	-.13	-.06	-.19	-.24	-.17	-.03	-.11	-.22	-.05	-.17	-.16	.01	-		
14. Anxiety-contentment	-.06	-.28	-.31	-.03	-.09	.17	.09	-.22	-.24	-.11	-.36*	-.19	.51**	-	
15. Depression-enthusiasm	-.27	-.31	-.23	-.27	-.14	.15	-.07	-.46**	-.38*	-.22	-.62**	-.43**	.28	.55**	

** p < .01, *p < .05; Note - standardised alpha co-efficients of internal reliability for the orientation measures are shown on the diagonal

Table C: Means and standard deviations for orientation variables (based on independent groups), and results for Manovas

	Operators				Establisheds				Testers			
	Time 1 N = 33-35	Time 2 N = 25-27	Time 3 N = 32		Time 1 N = 13-14	Time 2 N = 13-14	Time 3 N = 11-12		Time 1 N = 13	Time 2 N = 7	Time 3 N = 7	
	$\overline{X}$ (SD)	$\overline{X}$ (SD)	$\overline{X}$ (SD)	F (2, 87)	$\overline{X}$ (SD)	$\overline{X}$ (SD)	$\overline{X}$ (SD)	F (2, 37)	$\overline{X}$ (SD)	$\overline{X}$ (SD)	$\overline{X}$ (SD)	F (2, 24)
Production Ownership	2.70 (.79)	3.56 (.60)	3.39 (.90)	8.58***	3.75 (1.09)	3.84 (.82)	4.07 (.69)	< 1	3.32 (.61)	3.52 (.83)	3.69 (.72)	1.02
Production Knowledge	2.40 (.68)	2.84 (.62)	2.82 (.56)	10.02***	3.05 (.54)	2.98 (.51)	2.89 (.67)	3.17^{+}	2.56 (.82)	2.94 (.57)	2.54 (.36)	<1
Wider-prod'n Knowledge	2.07 (.82)	2.01 (.67)	2.24 (.70)	< 1	2.33 (.85)	2.31 (.61)	2.45 (.64)	<1	1.70 (.72)	1.71 (.60)	1.71 (.62)	<1
Strategic Beliefs	2.16 (.47)	2.33 (.52)	2.50 (.61)	3.39*	2.14 (.59)	2.69 (.63)	2.76 (.51)	4.09*	2.70 (.49)	3.09 (.39)	2.94 (.36)	5.67**

*** $p < .001$, ** $p < .01$, * $p < .05$, $^{+}p < .10$

Table D: Means and standard deviations for response-check scales (based on independent groups), and Anova results

	Operators				**Establisheds**				**Testers**			
Response-check variables	**Time 1** N = 33-35	**Time 2** N = 25-27	**Time 3** N = 32	F^1	Time 1 N = 13-14	Time 2 N = 13-14	Time 3 N = 11	F^2	Time 1 N = 13	Time 2 N = 7	Time 3 N = 7	F^3
	$\overline{X}$ (SD)	$\overline{X}$ (SD)	$\overline{X}$ (SD)		$\overline{X}$ (SD)	$\overline{X}$ (SD)	$\overline{X}$ (SD)		$\overline{X}$ (SD)	$\overline{X}$ (SD)	$\overline{X}$ (SD)	
Ownership RC	3.32 (.84)	3.74 (.92)	3.60 (.76)	1.84	3.97 (.97)	3.95 (.74)	3.98 (.63)	< 1	4.03 (.79)	4.19 (.69)	4.14 (.38)	<1
Knowledge RC	2.99 (.57)	3.16 (.69)	3.11 (.55)	< 1	3.26 (.45)	3.37 (.55)	3.30 (.64)	< 1	2.92 (.83)	3.05 (.68)	3.14 (.18)	<1

*** $p < .001$, ** $p < .01$, * $p < .05$, + $p < .10$

[1] d.f = 2, 91

[2] d.f = 2, 37

[3] d.f = 2, 25

Appendix 7
Information for the performance analyses (Chapter 9)

This Appendix includes the following:

1. A description of the rationale and steps in the repertory grid interviews used to generate supervisory ratings.
2. Individual supervisors' performance constructs generated from repertory grid interviews
3. Performance dimensions used in the second set of performance ratings
4. Comparisons of supervisors' mean performance ratings at P1 and at P2

1. Rationale and steps in the repertory grid interviews used to generate supervisory ratings

The repertory grid technique (described below) was considered preferable to semi-structured interviews as repertory grids are hard to fake (Easterby-Smith, 1980) and are more likely to produce "true" performance constructions rather than perceptions of what these should be. Repertory grids were also considered preferable to scores on performance appraisal forms used for grading purposes. The latter contained performance dimensions which supervisors and the Personnel Manager considered 'out-of-date' with actual role requirements for operators in product-lines. Moreover, these assessments were not necessarily comparable across individuals as they were based on expected performance for a particular salary level.

Repertory grids are composed of elements, constructs, and a linking mechanism . Elements are the entities used to generate the constructs. The linking mechanism is the method of relating constructs to entities (in this case, a 5-point rating scale). Elements should be homogenous (drawn from the same category), should provide representative coverage of the area to be examined, and there should number between 7 and 12 (Easterby-Smith, 1980). In the current study, the elements were operators in Production who the supervisor supervised, and the role descriptions used to generate specific people were: two excellent operators, two average operators, and two poor or 'not so good' operators. These categories were intended to ensure representative coverage of different levels of performance of operators. Supervisors were asked to describe differences between triads of employees in their work behaviour . The steps are described in more detail.

Step 1: Interviewees wrote on separate cards the names of two people for each role description. This meant 6 cards in total.

Step 2: Constructs were elicited from triads, where a group of three elements were selected at random. For each triad, interviewees were asked to describe a way in which two of the elements were the same and different from the third:

> "How are two of these people alike and different from the third in the way they are at work?[1] ".

This procedure resulted in constructs with contrasting poles (these were not necessarily logical opposites). Summaries of the constructs were written down on to the grid sheet by the interviewer. The wording was as close to possible to that used by the interviewee, and was agreed prior to writing it down.

If constructs were vague (e.g. "this person is introverted") the person was prompted to be more specific, with questions such as: What does being introverted involve? Can you give me an example of an introvert? On the whole, questions were 'what' and 'how' questions (rather than 'why is this important' questions which tend to produce more general constructs). The aim was to get as close as possible to behavioural (and therefore potentially measurable) descriptions.

Step 3: An additional construct - "overall high performer versus overall low performer" was added to the grid. This construct was subsequently related to other constructs to give an indication of their relative closeness.

Step 4: It was recognised that constructs vary in the extent to which they relate to 'effective performance'. Interviewees were thus asked to rate the importance of their constructs from 1 ("not important") to 5 ("extremely important") for effective performance.

Step 5: Interviewees were asked to rate each of the elements (plus the remaining operators not used for triads) on a 5-point scale for each of the constructs. Elements considered to be closest to the less desired end of the pole (very occasionally, this was arbitrary) were scored low.

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[1] Note that the work "performance" was not used in the question. It was considered that this word might bias interviewees to consider only certain narrow aspects of a persons' behaviour, knowledge, or skills.

2. Individual supervisors' performance constructs generated from repertory grid interviews

The constructs are listed in the order of the supervisor's perception of the importance of the construct for effective performance. The number in brackets indicates this importance from 5 (extremely important for good performance) to 1(not very important for good performance). The positive pole of the dimension is written in italics. Note that more detailed notes of these constructs were taken during the interview including specific behavioural examples.

Supervisor A: 8 constructs

1. (5) *Actively pursues improving of production process* vs. Does not actively pursue improving of production process
2. (5) *High degree of enthusiasm and self motivation* vs. Low degree of enthusiasm and self motivation
3. (5) *Confident in communication* vs. Not confident in communication
4. (4) *Systematic approach to achieving results* vs. Unsystematic approach to achieving results
5. (4) *Organised* vs. disorganised
6. (4) *Eager to take on more responsibility* vs. Not eager to take on more responsibility
7. (3) *Familiarity with range of company products* vs. Less familiar with range of company products
8. (3) Talking too much vs. *Not talking too much*

Supervisor B: 13 constructs

1. (5) Content with current job and little ambition to further himself, i.e. to take on more responsibility vs. *Ambitious, good level of education, desires chance to take on more/added responsibility*
2. (4) Low work rate, low pace vs. *High work rate (in terms of number of boards built/assembled/tested etc.)*
3. (4) Driven by others vs. *Self driven (self-motivated)*
4. (4) Low level of efficiency vs. *High level of efficiency*
5. (4) Individualist vs. *Good team member*
6. (4) Slow learner vs. *Fast Learner*
7. (4) Non-methodical approach (fire-fighting) dealing with issues problems as they arise vs. *Methodical approach to work (planning work)*
8. (4) Low level of commitment to product vs. *high level of commitment to product*

Supervisor B (cont.)

9. (3) Jack of all trades master of none vs. *[Master of one trade]*

10. (3) Higher level of supervision required vs. *low level of supervision required*

11. (3) Lacking self confidence (predominantly among team workers) vs. *High level of self confidence.*

12. (2) Introvert vs. *Extrovert*

13. (2) *Low level of technical ability* vs. High level of technical ability

Supervisor C: 11 constructs

1. (5) *Willing to accommodate new ideas or change* vs. Unwilling to accommodate new ideas or change

2. (5) *Determination to resolve problems* vs. Is not really determined to resolve problem

3. (5) *Willingness to help out in the cell* vs. Not automatically help out in the cell

4. (5) *Takes initiative* vs. Does not take initiative

5. (5) *Is goal oriented* vs. Is not goal oriented

6. (5) *Takes ownership* vs. Does not take ownership

7. (5) *Needs to know cell requirements (targets) in order to maintain control* vs. Does not need to know cell requirements (targets)

8. (4) *Good communication skills* vs. Not very communicative

9. (4) *Gets enthusiastic* vs. Carefree

10. (4) *Easily adaptable* vs. Not easily adaptable

11. (3) *Assuming leadership when problem arises* vs. Does not assume leadership

3. Performance dimensions used by supervisors at Time 2

At Time 2, supervisors rated employees on five performance dimensions. These were the most salient (i.e. the most frequently occurring) dimensions of a list of 12. It was considered too time consuming for supervisors to rate employees on all dimensions. The five dimensions, and the scores associated with the poles, were as follows:

The employee:

- *is self-directed, takes initiative, and breaks new ground* (5) vs. needs direction, needs to be told (1)
- *is committed to the goals and schedules* (5) vs. is not committed to the goals and schedules (1)
- *has broad knowledge of the production process* (5) vs. Has narrow knowledge of the process (1)
- *deals with others very effectively (e.g. speaks out, communicates well, and helps others)* (5) vs. doesn't deal with others effectively (1)
- *is an overall high-performer* vs. is an overall-low performer

4. Comparison of Supervisors' mean performance ratings at P1 and at P2

Table A: Comparisons of Supervisors' mean performance ratings at P1 and at P2

		Supervisor		
	A	B	C	
	$\overline{X}$ (SD)	$\overline{X}$ (SD)	$\overline{X}$ (SD)	**Statistical test**
Jan. 1991 **(P1)**	N = 24 3.36 (.50)	N = 15 3.34 (.98)	N = 13 3.48 (.71)	F(2,49) = 1.47
Aug.1992 **(P2)**	N = 24 3.01 (.76)	no longer present	N =29 3.23 (.71)	t (58) = .50

Appendix 8
Additional data for the exploratory analyses (Chapter 9)

This appendix contains:

1. A description of the measures used in the exploratory analyses
2. The tables of results used in the analyses (Tables A to D).

1. Descriptions of measures used in the exploratory analyses

Individual difference variables

The individual difference variables were formed from factor analysis of 24 items including 16 items from SHL's Work Styles Questionnaire, 4 items on perceived job competence, and 4 items of locus of control. From a principal components analysis, there were 7 factors with eigen values greater than 1. None of the factors had intercorrelations greater than .30, thus the solution from varimax rotation was interpreted. For each factor, items with loadings greater than .45 were summed to form subscales. Two subscales (corresponding to factors 6 and 7) had internal alpha coefficients less than .45 and were thus excluded. Asterisks indicate the item was reverse scored.

Confidence: 'I am good at thinking of better ways to do things' (.74); 'I am good at solving problems to do with work' (.74), 'I can do just about anything when I set my mind to it' (.62); 'People tend to come to me if they need help with solving problems' (.61); and 'When I make plans I am almost certain I can make them work' (46).

General Locus of Control: 'What happens to me in the future mostly depends on my own efforts'(.81); 'I feel in control of the way my life is going' (.80).

Tolerance of Role Ambiguity In general, I like to know exactly what is expected of me' (*.71); I feel uncomfortable if I do not know exactly what my responsibilities are' (*.70); 'I often find I do not know enough to solve the problems I encounter in my work' (*.61).

Preference for Methodical: 'I like to do things one step at a time' (.78); 'I prefer to do my job in a methodical way' (.72); 'I like to leave things tidy at the end of the day' (.55)

Persistence and Challenge: 'I work hard to be the best at what I do'(.70); I try to avoid added responsibilities in my job' (*.58); I am uneasy when faced with problems than have no single solution' (*.55); 'I enjoy the challenge of difficult targets'(.51).

Contextual variables

14 items concerning management actions and 12 items concerning attitudes to supervisors and work groups were factor analysed using principle components analysis. The solution accounted for 66.2% of the variance. There were seven factors with eigen values greater than one. Four of the factors were poorly defined with low reliabilities and were thus excluded. Items with loadings greater than .45 on any remaining factor and loadings less than .45 on any other factor were summed to form three subscales: Communication, Team-working, and Consultation. The items in these subscales and their factor loadings are described.

Communication: My immediate supervisor keeps me well informed about certain issues' (.80); 'I am clear about the results expected of me' (.75); 'When changes are made which affect me my supervisor clearly explains the reason for them' (.74); I am clear about the aims and objective's of my department's work' (.69); 'Supervision in my department involve me in discussing and planning changes' (.55).

Team-working 'People in my department do not work well together (*.86); 'The people in my department work as a team' (.81); 'The people I work with co-operate to get things done' (.81); 'In my department we are actively encouraged to get things done by helping each other' (.58)

Consultation 'Manufacturing management act without consulting the group' (*.80), 'Manufacturing management insist that everything be done their way' (*.69), 'Manufacturing management get the approval of the work group on important matters before they go ahead' (.64); By their actions, Manufacturing management show that they believe people are their most valuable effort (.48); Manufacturing management work closely together with common goals in mind (.48); Management show by their actions that they believe in what they say" (.47).

In addition, a scale of co-worker support and network size were included as contextual variables.

Network Size 'How many people do you need to work closely to in order to do your job? and 2. How many people at work do you need to talk to in order to get information or materials to do your job? The response scale for both items was : 1(none), 2 (1-3), 3 (4-5), 4 (6-9), 5 (10 or more).

Co-worker Support : Do you feel you can talk to your colleagues about a personal problems; Can you rely on your colleagues to help you out with a work problem; Can you talk to your colleagues about something that upset or annoyed you at work; Do your colleagues let you know when you have done a good job; Do you talk to your colleagues about interests you have in common?

Expectations about product-lines

A factor analysis was performed with six items concerning the general effects of the introduction of product-lines. Two sub-scales resulted from this analysis: Positive for Jobs, and Positive for Business.

Positive for Business To what extent do you agree of disagree with the following statements? The introduction of product-lines: is necessary for Manufacturing to stay in business ( ); will lead to greater efficiency ( ); will lead to better quality ( ), and will lead to more opportunities for progression/ promotion within the company ( ).

Positive for Jobs To what extent do you agree of disagree with the following statements? The introduction of product-lines will lead to: job losses (reverse-scored); more stress at work (reverse scored), my opportunity to develop more skills, the amount of responsibilities I have, how interesting my work is, the amount of flexibility I have in my work, the amount of control over my own work, the amount of flexibility I have in my work, my pay, and the status of my job.

Table A: Predicting changes in orientation measures with biographical variables as predictors

Block No	**Variable entered into the equation**	**Production Ownership**			**Production Knowledge**			**Strategic Beliefs**		
		Hierarchical Results		Final Results	Hierarchical Results		Final Results	Hierarchical Results		Final Results
		R	R^2 Change	Beta's	R	R^2 Change	Beta's	R	R^2 Change	Beta's
1.	Time 1 Role Measure	.69***	.48***	-.72***	.64***	.41***	-.80***	.48**	.23**	- .61***
2.	Establisheds	.69***	.00	-.01	.64***	00	.22	.58**	.11+	.40*
	Testers			-.02			.27@			.40+
3.	Age			-.07			-.06			-.02
	Sex	.75***	.08	-.06	.75***	.15+	.38*	.62**	.04	.06
	Length time in job			.31+			.22^			.22^
	Length time in comp.			-.22			.15			-.02

*** p < .001, ** p < .01, * p < .05, + p < .10, @ p < .15; ^ p < .20
Note: Sample sizes for all analyses range from 35 to 40

Table B: Predicting changes in orientation measures with individual-difference variables as predictors

		Production Ownership			Production Knowledge			Strategic Beliefs		
		Hierarchical Results		Final Results	Hierarchical Results		Final Results	Hierarchical Results		Final Results
Block No	Variable entered into the equation	R	R^2 Change	Beta's	R	R^2 Change	Beta's	R	R^2 Change	Beta's
1.	Time 1 Role Measure	.72***	.51***	-.71**	.63***	.39***	-.72***	.47**	.22**	-.68***
2.	Dummy Variables	.72***	.00	-.05	.63	.01	.06	.59**	.12*	.21@
				-.07			.01			.36*
2.	Confidence			.00			.04			.01
	Gen. Locus of Control	.81**	.14+	-.03	.73**	.13@	.08	.75**	.22*	.37*
	Persistence & Challenge			24+			.32*			.33*
	Tol. of Role Ambiguity			.26*			.03			-.12
	Pref. for Methodical			.11			-.02			-.27+

*** $p < .001$, ** $p < .01$, * $p < .05$, + $p < .10$, @ $p < .15$
Note: Sample sizes for all analyses range from 35 to 40

Table C: Predicting changes in orientation measures with expectation variables as predictors

Block No	Variable entered into the equation	Production Ownership			Production Knowledge			Strategic Beliefs		
		Hierarchical Results		Final Results	Hierarchical Results		Final Results	Hierarchical Results		Final Results
		R	R^2 Change	Beta's	R	R^2 Change	Beta's	R	R^2 Change	Beta's
1.	Time 1 Role Measure	.73***	.53***	-.75***	.62***	.38***	-.63***	.47**	.22**	-.59***
2.	Establisheds	.74***	.02	-.10	.62***	.08	.04	.59**	.12*	.34*
	Testers			.19			.19			.35+
3.	Positive for Business	.78***		.02	.69***	.10*	-.18	.59**		-.10
	Positive for Own Job		.05	.28@			.42*		.01	.13

***p < .001; ** p < .01; * p < .05; +p < .10; @ p < .15;
Note: Sample sizes for all analyses range from 35 to 40

Table D: Predicting changes in orientation measures with contextual variables as predictors

		Production Ownership			Production Knowledge			Strategic Beliefs		
		Hierarchical Results		Final Results	Hierarchical Results		Final Results	Hierarchical Results		Final Results
Block No	**Variable entered into the equation**	R	R^2 Change	Beta's	R	R^2 Change	Beta's	R	R^2 Change	Beta's
1.	Time 1 Role Measure	.66***	.44***	- .67***	.58***	.34***	-.72***	.49**	.24**	-.33+
2.	Dummy Variables	.67***	.01	-.13	.59**	.00	.07	.58**	.10	.25
				.02			.06			.41*
3.	Team-working			.17			.10			.09
	Co-worker Support	.71***	.05	-.15	.74***	.20*	.28+	.67***	.11	.22
	Mgt Consultation			-.18			-.23			.13
	Communication			.19			.42*			.17

*** p < .001, ** p < .01, * p < .05, + p < .10

Note: Sample Sizes for all analyses range from 35 to 40