

**TECHNOLOGY, SKILLS AND THE TRANSFORMATION OF WORK:
IMPLICATIONS FOR THE TRAINING PROVISION FOR BRAZILIAN
OFFICE WORKERS**

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Abstract

This thesis is concerned with the process of office automation in Brazil and its skills and training outcomes. The thesis combines a theoretical analysis with an empirical study undertaken in Brazil.

Following an introductory chapter, Chapter 2 discusses and analyses two existing theoretical perspectives which address the relationship between technology, work organisation and skills. These are: the labour process approach with reference to the 'deskilling thesis' developed by Harry Braverman (1974) and the 'flexible specialisation thesis' based on Michael Piore and Charles Sabel (1984). They focus on technological changes on the shopfloor, in advanced industrialised countries.

Chapter 3 applies the main arguments put forward by these two approaches to the office environment in advanced industrialised countries. Based on the discussion of a number of empirical studies concerned with the skill outcomes of new technology in the office, the chapter also develops two models of office automation: the 'technology-driven' and the 'informational' models. These models are used as a framework for the discussion of the empirical research undertaken in Brazilian offices.

Chapter 4 discusses the recent economic developments in Brazil in order to provide a context for understanding the empirical findings. The chapter describes the country's process of industrialisation, the current economic context and its implications for the adoption of new technology in the Brazilian office environment.

Chapter 5 focuses on the empirical research conducted in Brazilian offices and training agencies. It describes the perspectives of managers, office workers and deputy directors of training agencies with regard to technology, skills and training. The chapter then analyses these perspectives in the light of the two theoretical models of office automation developed in Chapter 3.

Chapter 6 summarises the main conclusions of this thesis, and draws some implications for training policies in Brazil.

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Chapter 1: Introduction

The rapid technological change of the last three decades has stimulated a debate about the relationship between 'new technology'¹ and skill requirements, training needs, work organisation and labour relations. The literature on the issue almost entirely refers to advanced industrialised countries in spite of the fact that less developed nations are likely to be drawn into processes of technological innovation in the workplace, albeit with considerably slower rates of technological diffusion. It also tends to concentrate on technological changes and its implications for the work process on the shopfloor, and limited attention is given to the office environment.

This thesis, in contrast, is concerned with the implications of new technology for skills and training in the office, with reference to a newly industrialised country - Brazil. There are various reasons for studying the relationship between new technology and work process in the office in general, and in the Brazilian office environment in particular.

This thesis focuses on the office environment because, as is noted by various commentators (Forrester, 1980, 1985; Long, 1987; Guiliano, 1985;

¹ 'New technology' or 'new information technology' is a general term used in the literature which reflects the convergence of several streams of technical developments, including microelectronics, computer science, telecommunications, software engineering and system analysis. For more detail see Forrester (1985).

Castells, 1989; Lieberman et al, 1982), the office has become a major area for the application of new technology for two reasons. On the one hand, the recession and the need to remain competitive in domestic and world markets have increased the pressure on firms in advanced industrialised countries to search for more efficient forms of production in the office. The use of technology is seen as a possible way of increasing the productivity of managers and office workers as well as the overall quality of office and administrative activities. On the other hand, technological developments in microelectronics have enhanced the potential application of new technology in offices. For instance, the last two decades have seen the introduction of network on-line micro- and minicomputer systems and of standalone or 'desktop' personal computers into offices and administrative operations, where computerisation was previously impossible². The electronic transmission of information between offices is facilitated by new technologies such as PABX exchanges and local area networks (LANs), and by the introduction of electronic public switching and transmission systems. These

² The computer-based automation of the office work is a recent phenomenon compared to manufacturing automation. According to Guiliano (1985) and Castells (1989) the first computer information systems, used in offices and administrative functions since the 1950s, were off-line systems for the routine bulk processing of data in batches. The information that managers received provided a retrospective view of the performance and status of work operations. The next development was in on-line information systems, which provided managers with real-time data on performance and operational conditions. Both these types of systems were based on large mainframe installations, and typically they were administered by central data processing departments. This meant that computers were quite often regarded as an interesting but not essential tool by line managers, who were too busy to digest the volume of information they produced, since it was presented in long and difficult to read and understand print-outs. Recent developments in microelectronics enabled computers to be used as a far more flexible means of accessing and retrieving management information from computer databases. Personal computers, for instance, have had their processing power increased, and now can provide managers and employees with powerful desk-top systems that can be used for a variety of diagnostic and decision-support tasks.

technologies enable access to a wide range of other services like electronic mail, facsimile, on-line databases and interactive view data and information retrieval services (Forrester, 1980, 1985; Long, 1987; Guiliano, 1985; Castells, 1989).

These technological developments have improved the potential power of new technology to process increasing amounts of textual and numerical information at increased speed, for instance, through the use of word processing and spreadsheet software. It has increased the ability to record, store, analyse and transmit information in ways that permit flexibility, accuracy, immediacy, volume and complexity. The new technology has the capability to restructure operations that depend upon information for the purposes of transaction, record keeping, analysis, control and communication. These are enabling characteristics that can have different influences on the work process in the office. These influences, however, depend largely on the form in which new technology is used and the objectives according to which it is applied in this environment (Buchanan and Boddy, 1983; Hirschheim, 1985; Immel, 1985; Bates and Burgess, 1985, Kleinschrod, 1986).

It follows that the introduction of new technology in the office opens up new possibilities for the organisation of work as well as raising questions regarding skill requirements and training. These issues are addressed in the research literature by two existing theoretical perspectives. These are: the labour process and the flexible specialisation approaches. These perspectives are concerned, with varying degrees, of the social and economic factors determining organisational behaviour, and the processes through which the various actors

attempt, within certain constraints, to shape organisational structure, the nature of work and skill requirements on both the shopfloor and in the office environment.

The labour process approach draws on Marxist perspectives and it aims to explain processes of technological change in historical terms by which capital seeks to control the labour force. It suggests that new technology is being adopted in the office with the intention of reducing skill requirements so as to increase management control over the labour process and, thereby, secure higher profits. The goal is to limit worker skills and reduce the role of human knowledge and judgement in the production process. This goal is achieved by the design of self-regulating computer-based systems that require little input from the human operators who work with them. Thus, new technology is employed in the office in a way that pre-empts the content and the job-related discretion previously enjoyed by skilled office workers. Such an usage is seen as leading to a process of deskilling the labour force in the office (Crompton and Reid, 1982; Feldberg, 1979; Braverman, 1974). The implication for training is that employees are trained in a limited number of narrow activities in order to reproduce the same tasks with more continuity and at higher speed. In other words, training aims to develop task-specific skills so that office workers can perform their tasks with increased efficiency, but within their limited roles (Braverman, 1974).

In contrast, the flexible specialisation approach locates the analysis of technological changes in a wider context. It argues that economic and technological conditions have the potential to influence managers to use new

technology as a means of developing a new kind of flexibility of the labour process and a new type of flexibility of the labour force. These conditions are seen as creating new possibilities for managers to combine new technology with a skilled labour force. Managers can employ new technology in ways that increase the skill content of some office jobs, and by doing so, create conditions for the process of reskilling the office workers (Zuboff, 1988; Castells, 1989; Attewell, 1992).

Some commentators (Zuboff, 1988) with this approach argue that new technology can be used by managers to complement rather than replace human skills that had previously been fragmented by computerisation in the office. This usage is seen by Zuboff (1988) as being related to managers' perception of the dual effect of new technology on the nature of work tasks, the skill required to perform them and the subjective experience of work. This point is encapsulated in the author's distinction between the 'automating' and the 'informating' capabilities of new technology. She explains this duality of new technology in the following way:

'On the one hand, the technology can be applied to automating operations according to a logic that hardly differs from that of nineteenth-century machine system - replace the human body with a technology that enables the same process to be performed with more continuity and control. On the other, the same technology simultaneously generates information about the underlying productive and administrative processes through which an organisation accomplishes its work. It provides a deeper level of transparency to activities that had been either partially or completely opaque. In this way information

technology supersedes the traditional logic of automation. The word that I have coined to describe this unique capacity is informate. Activities, events, and objects are translated into and made visible by information when a technology informates as well as automates (Zuboff, 1988, p.9-10).

This duality implies that new technology has the potential to be used as a means of conferring a new kind of flexibility to the labour force, which creates the need for the development of new skills. Therefore, on the one hand, technology automates the work and reduces the need for certain manual skills. But on the other hand, it can also generate new and deeper levels of understanding about the work process because information is potentially accessible to office workers and not just to their managers. It is argued that this greater accessibility and the possibility for office workers to input information into the system requires the development of what Zuboff (1988) calls 'intellective skills'. That is, problem-solving and interpretative skills which involve mental rather than concrete physical activity. Training becomes, within this context, an important strategy because the improvement of the abilities of employees to interpret information, make decisions and solve problems can allow a greater exploitation of the capabilities of new technology.

This dual effect of new technology on skill requirements implies that technology can be used to increase management control and replace labour input, but it can also be used to expand the role of employees in the work process by develop most of their intellective rather than task-specific skills. It can be argued,

however, that which of these two effects is present or dominates will depend on managers' perception of the potential of new technology to improve productivity and efficiency, and the way they intend to exploit this potential in the office. The actual approach to technology taken by managers will also determine the type and the aims of the training provided to office workers. The adoption of new technology raises two additional questions about the role played by agents like office workers and training agencies regarding the skill and training outcomes of technological change. What role do office workers play in decisions regarding the type of training made available? How do training agencies respond to the skill requirements of new technology? What type of training is provided by training agencies? What is the nature of the skills developed by this training? To what extent does agency training complement a firm's in-house training?

This thesis focuses on the Brazilian office environment for two reasons. On the one hand, Brazil is a newly industrialised country which has been troubled by low growth rates and high inflation during the 1980s and 1990s³. In this context, the adoption of new technology could be seen as a way of improving the country's economic performance in the long-run, and the competitive advantage of Brazilian firms in particular. It can be argued that firms that participate in international markets and those whose attention is focused on the domestic market pressures are likely to seek more efficient forms of production in the

³ National data provided by FIBGE (FIBGE, 1991) indicates that during the 1970s the average GDP annual growth rate was 7.5 per cent, and that this rate declined to -0.4 per cent in 1990. In regard to inflation, Longo (1991) points out that during the period between 1990-93 the inflation rate was around 80 per cent a month.

office through the use of new technology. These firms have been exposed to a number of pressures caused by recession, inflation, currency restrictions and the opening up of the Brazilian internal market to international competition,

On the other hand, according to a national report published by the Special Secretariat of Informatics (SEI, 1988), Brazilian firms have had limited experience with technological change in the office, and have only recently started to introduce the new technology in the hope of increasing the productivity and efficiency of office and administrative activities. It can be suggested that the concern with productivity gains result from the recent trade liberalisation measures adopted by the government. These measures were aimed at opening up the formally protected internal market to foreign competition. This 'opening-up' of the internal market could be seen as a factor that can put pressure on Brazilian firms to become more competitive in order to respond to economic and market changes.

Therefore, any analysis of the implications resulting from new technology requires an understanding of both the way in which new technology has been introduced into the office and the approach to technology, skills and training taken by the various agents involved in the process of technological change in the Brazilian office environment (i.e. firms and training agencies). In addition, this analysis needs to take into consideration some of the main features of the current economic context in Brazil, and their implications for the adoption of new technology in the office environment.

This thesis aims to contribute to this understanding by analysing the reasons for adopting new technology in Brazilian office. In particular, it analyses the way in which new technology is introduced, whether new skills are being developed, and if so, what type of skills. It also focuses on the types and goals of the training provision made available for office workers - either firm in-house training or training provided by private training agencies.

The thesis addresses these issues by combining a theoretical analysis with an empirical study undertaken in Brazil. The theoretical analysis is broken down into three levels. Firstly, it draws on two theoretical perspectives existing in the literature about technological change within the organisation, in particular on the shopfloor. These are: the labour process approach based on the 'deskilling thesis' developed by Harry Braverman (1974), and the flexible specialisation perspective, with regard to the 'flexible specialisation thesis' of Michael Piore and Charles Sabel (1984). Secondly, the thesis applies the main arguments developed by these two general approaches to the office in order to analyse the relationship between new technology, work organisation, skills and training in this environment. This application allows the development of two models of office automation based on the two theoretical perspectives. These models are used as analytical tools for discussing the data from interviews undertaken in Brazilian firms and private training agencies. This theoretical framework is complemented by a discussion of the current economic development in Brazil in order to provide a framework for understanding the empirical findings.

The empirical study looks at ten firms and ten private training agencies located in the South of Brazil. In total, twenty managers, one hundred office workers and ten directors of training agencies were interviewed. Given the small sample and the geographical concentration of the firms and agencies, the empirical findings may not be representative for the process of office automation in the whole of Brazil. But the interviews do provide an indication of the approach taken by managers, office workers and deputy directors of training agencies vis a vis technological changes and the resulting skill outcomes and training provision in Brazil. Therefore, the findings represent a starting point for understanding the process of office automation in the country, which is especially important considering the lack of both national data and published empirical studies in this area. The empirical analysis also provides an indication of whether the skill and training outcomes could be understood in terms of the deskilling or the flexible specialisation thesis. In other words, it gives an indication of whether the deskilling and the flexible specialisation thesis are applicable to the Brazilian office environment.

The thesis is structured as follows. Chapter 2 describes and analyses two general theoretical perspectives: the labour process and the flexible specialisation approaches. The chapter explores the contrasting perspectives on technological change and its skills and training implications provided by these approaches in reference to the shopfloor, in advanced industrialised countries. In the case of the labour process approach, the chapter focuses on the 'deskilling thesis' developed

by Harry Braverman (1974) and its training implications. Although variants of flexible specialisation have been developed in various advanced industrialised countries⁴, this thesis concentrates on the contribution made by Piore and Sabel (1984).

Chapter 3 moves the focus from the shopfloor to the office environment. It applies the main arguments developed by the deskilling and the flexible specialisation thesis to this workplace, in advanced industrialised countries. The chapter analyses two groups of case studies. The first group of studies is based on Braverman's contribution as applied to office work. The second group applies to the office some of the ideas put forward by the flexible specialisation approach. Finally, the chapter develops two theoretical models of office automation which reflect the main arguments discussed by the labour process and the flexible specialisation approaches. These models convey the resulting and alternative skill and training implications discussed by these two theoretical approaches. They are termed in the thesis: the 'technology-driven' and the 'informational' models of office automation. They are used as a framework for discussing the empirical study undertaken in Brazil, which is addressed in Chapter 5.

⁴ The origins of the 'flexible specialisation' debate lie in the work of a group of French social theorists known as the 'Regulation School' (see Smith 1989, for more detail). However, the precise form of this debate varies depending on the various countries. For instance, in Britain attention has been given to the notion of the flexible firm developed at the Institute of Manpower Studies, principally by Atkinson (Wood, 1992). For the Germans Kern and Schumann (1987), the new kind of flexibility refers to new concepts of production based on an understanding of the qualitative importance of qualified labour to productivity gains (see Berggren, 1992, for detail). However, as noted by Macloughlin and Clark (1992), the basic ideas embodied in this debate were applied and considerably extended for an English-speaking audience in the early 1980s by the work of Piore and Sabel (1984).

Chapter 4 discusses the Brazilian economic development in order to provide a perspective for understanding the findings of the empirical research in Brazilian offices. The chapter reviews the Brazilian process of industrialisation along the lines of the import-substitution model of economic development. It then discusses the current economic conditions and their implications for the adoption of new technology in Brazilian offices.

Chapter 5 explores the extent to which the two models of office automation previously developed can explain the findings of an empirical research based on Brazilian firms and training agencies. The chapter begins by discussing the perceptions of managers with regard to: the reasons behind the adoption of new technology in the office, the implications for the organisation of the office work, the implications for the skill formation of office workers and for the type of training adopted. It then analyses the office workers' perception of the implications of new technology to their work and to their skills. It also discusses their perceptions of the type of training made available vis a vis the skills required by the use of new technology. The chapter also discusses the type and aims of training provided by training agencies based on the approach to technology and skills embraced by their deputy directors.

Chapter 6 discusses the main findings of this thesis, and draws some implications for training policies in Brazil.

CHAPTER 2: Two Theoretical Approaches to Technology, Work, Skills and Training

1. Introduction

The existing academic discussion on technological change and its skill and training implications has been polarised by two main theoretical perspectives. These are: the labour process and the flexible specialisation approaches. These perspectives tend to focus on the adoption of new technology and its outcomes in the shopfloor, and in particular in advanced industrialised countries.

This chapter discusses and analyses the labour process approach, in particular the 'deskilling thesis' developed by Harry Braverman (1974), and the flexible specialisation perspective, with regard to the work of Michael Piore and Charles Sabel (1984).

Harry Braverman argues that a distinctive feature of the capitalist mode of production is the gradual process of deskilling of the labour force. He sees deskilling as resulting from a managerial concern with increased forms of labour control as a means of increasing the productivity of the labour force. Hence, for him, technology has no influence on work organisation and labour deployment other than embodying management's need to control the production processes in the shopfloor. The deskilling of the content of jobs

influences the adoption of training strategies aimed at providing the workers with task-specific skills so that they can perform routinised and fragmented activities within their limited roles.

Piore and Sabel argue that the current economic difficulties in advanced industrialised countries reflect a crisis in the production system that dominated the economies of most of these countries throughout the twentieth century. They identify this system as mass production. They assert that mass production is giving way to a new basis of production. For them, this basis refers to a new system of craft production or what they term 'flexible specialisation'. The key element in this system of production is the new flexibility that organisations acquire by combining new technology with a skilled labour force. Thus, contrary to the deskilling thesis, the flexible specialisation approach offers an alternative basis for the analysis of skill and training implications as it stresses the potential of the new technology to increase the flexibility of production processes by creating ways of skill-enhancing forms of work organisation.

This chapter makes two arguments. It argues that these two approaches advocate alternative models of technological change which imply particular implications for both the skill composition and the training of the workforce in the shopfloor. It also suggests that both perspectives present an oversimplistic understanding about the relationship between technology and skills. By focusing on particular elements informing the actions of the various agents involved in a process of technological change, they tend to neglect that other factors can also influence this change in different ways.

The chapter is divided as follows. Section 2 focuses on the labour process approach. It begins by reviewing some ideas developed by Karl Marx in order to provide a framework for understanding the main arguments advocated by deskilling thesis. Sub-section 2.1 discusses the work of Harry Braverman, and sub-section 2.2 reviews his approach to skills and training in the shopfloor. Sub-section 2.3 presents a critical review of the deskilling thesis, and sub-section 2.4 summarises the arguments developed. Section 3 concentrates on the flexible specialisation thesis of Piore and Sabel. Sub-section 3.1 describes the factors influencing the crisis in mass production, sub-section 3.2 addresses the different strategies used by organisations in order to counteract this crisis, and sub-section 3.3 discusses the alternative strategy to mass production. Sub-section 3.6 summarises the arguments developed in this chapter.

2. The Labour Process Approach

Much of the discussion on technology, work and skills has been devoted to the analysis of the labour process within the capitalist mode of production, or more specifically, the means by which raw materials are transformed by human labour by acting on the objects with tools and machinery (Thompson, 1983). The labour process approach seeks to uncover the social and economic interests that lie behind technological change within the capitalist mode of production. It aims to explain this changes and their implications for work in historical terms as a means by which management pursues increased forms of control over the labour process and over the labour

force. The approach thus locates the discussion on technology and work inside a wider system of capitalist production and class relations in which

'Work is not just something which a society organises to meet social needs, or which people carry out in order to survive. It is a framework within which those who own and control the economic resources seek to ensure the appropriation of the surplus. The ways that surplus are appropriated will shape and condition those arrangements.' (Thompson 1983, pp. 4)

Central to the labour process approach is the early work developed by Karl Marx, who locates his analysis about the nature of work relationship within an specific economic and historical context - the evolution of the capitalist mode of production. According to Marx (1976), work has always been necessary to satisfy the various social needs that exist in human society. In production, the purpose is to create goods that serve these needs, for instance, commodities that have a use value. The labour process is, in this sense, an activity between human labour and various components of nature, that have the following elements:

- a) It is a purposeful activity of man that is directed to work
- b) It involves objects on which the work is performed in the form of natural or raw materials
- c) It encompasses instruments of work, most often tools or more complex technology.

Marx notes that from the simple hunting to the complex industrial state, production is a social activity, which involves a technical component that he terms 'forces of production'. These include land, technology, raw materials,

scientific and technical knowledge, the technical organisation of production processes and the labour power of workers. He argues that each major stage in the development of the forces of production correspond with a particular set of social relationships of production. The 'relations of production' are seen by Marx as the social relationships which people enter into in order to produce goods, and which involve the relationship of social groups to the means and forces of production. The 'means of production' consist of those parts of the forces of production which can be legally owned. They thus include land, raw materials, machinery, buildings and tools, but not technical knowledge or the organisation of the production process.

Marx argues that in slave societies, labour power could be considered as one of the means of production since the workforce was actually owned by the social group in power. In feudal society, land, the major means of production, was owned by the lord whereas the serfs had the right to use the land in return for services or payment to the lord. Under capitalism, labour power is not one of the means of the production since the workers are free to sell their labour. The means of production are owned by the capitalists whereas the workers own only their labour, which they hire to the employer in return for wages.

Marx maintains that, with the possible exception of the societies of prehistory, all historical societies contain basic contradictions which suggest that they cannot survive forever in their existing form. These contradictions involve the exploitation of one social group by another. For instance, in the feudal society, lords exploited their serfs, and in capitalist societies,

employers exploit their workers. This creates a fundamental conflict of interests between social groups since one gains at the expense of another.

The idea of this conflict between forces of production and relations of production is explained by Marx in terms of the infrastructure of the capitalist industrial society. He notes that wealth in this society is produced by the labour power of the workers. However, much of this wealth is appropriated in the form of profits by employers, the owners of the means of production. The wages of the workers are well below the value of the wealth they produce. There is thus a contradiction between the forces of production, in particular the labour power of the workers which produce wealth, and the relations of production which involve the appropriation of much of that wealth by the capitalist.

Marx sees history as divided into a number of periods, each being characterised by a particular mode of production and relations of production. For him, major changes are the result of new forces of production. For example, the change from feudal to capitalist society stemmed from the emergence, during the feudal period, of the forces of production of industrial society. This resulted in a contradiction between the new forces of production and the old feudal relations of production, particularly because the former required relations based on wage labour rather than the traditional ties of lord and vassal. When they reached a certain point in their development, the new forces of production led to the creation of a new set of relations of production.

Marx detects a number of specific features of the capitalist mode of production. One specific characteristic derives from the capitalist purchasing

of the various components of the labour process - the means of production and the labour power - and setting one to work on the other. Marx uses the term 'labour power' to indicate that the worker's physical and mental capabilities exist in a relationship to capital. The capacity that the worker has to produce is thus transformed into a means of producing value for the capitalist production.

He identifies another feature of capitalism as the necessity to exchange commodities for a price greater in value than the costs incurred in production. The process of capitalist production seeks to combine the labour process with the creation of value, and by doing so, links the labour process to the struggle for profitable production. In purchasing its components, the capitalist not only provides the right materials, but also aims to exert control over the conditions under which the speed, skill, and dexterity of the worker operates. Labour power, according to Marx, becomes a 'variable capital' in a sense that only living labour is able to create value. Surplus, therefore, varies according to the relative capacities of workers in the production process.

Capitalism has another important goal that is, for Marx, the need to ensure profitability. For him, capitalism is not sufficient to create value that is an exact equivalent of the payment for labour power. Production also needs to be extended into surplus value, which although created by labour power, becomes the legal property of the employer. The labour process becomes, therefore, distinctively capitalist when it is combined with what Marx calls 'valorisation' - the process by which capitalism creates surplus value. In order to create surplus value it is important for capitalism to subordinate labour on

its own terms, and that is ensured by the introduction and use of machinery, science, and the expansion of scale of production.

For Marx, science and technology allow employers to create more effective and sophisticated methods of increasing surplus value and enhance the intensity and the control of labour, because they are used as a means of altering the technical organisation of work. He notes that the process of mechanisation of the factory during the second half of the nineteenth century enabled the development of enhanced forms of hierarchical control and supervision of production, which led the subordination of labour to capital. It also allowed greater specialisation of tasks that subordinated the knowledge and judgement of workers, leading to a reduction of skills. According to Marx, this period of capitalism constituted the phase of manufacture, characterised by the struggle to consolidate the division of labour. A hierarchy was thus created based on skill, training, and wages, including a substantial class of unskilled workers. The work began to be modified, resulting in a much greater specialisation of tasks that aimed to reduce the knowledge and will of workers.

Marx maintains that the shift from this phase of manufacture to large scale production further expanded the labour productivity. It also had immediate effects that altered the form and content of work in the capitalist pursuit of cheapening labour and increasing surplus value. A major consequence in the sphere of production was a further reduction in skills, followed by the development of enhanced forms of control and supervision of the workforce. He thus notes that this form of production involves a fundamental conflict of interest between the social groups involved in the

production process, which can lead to a disintegration of the capitalist system and the creation of a new society.

During the 1970s, the work of Harry Braverman (1974) played an important role in the revival of the debate about the labour process. Braverman combines a renewal of ideas developed by Marx with an explanation of the dominant trends in the labour process in the twentieth century. He follows Marx in arguing that there is a fundamental and structurally determined conflict underlying the relationship between capital and labour, and that relations between management and workforce, as well as the question of technological change, need to be seen in the light of this fact. Braverman thus brings the focus of analysis to the development of the labour process during the twentieth century and to what he considers as the structurally determined imperatives of managerial control, its effects upon the workers themselves, and the process of deskilling and degradation that underlies the progression towards monopoly capitalism.

Braverman (1974) states that the imperative of capital accumulation as the fundamental dynamic determining the increasing degradation and deskilling of labour which characterises the phase of monopoly capital. That is, the rise of oligopolistic competition among giant corporations, the process of rationalisation of production, the elaboration of the administrative apparatus of corporate capital, the encroachment of capitalist commodity production into enclaves of non-capitalist production, and the consequent relationship between the modes of organisation of the labour process in different sectors. For him, technological developments during this phase have not changed the nature of capitalist relations of production. He argues that the

main transformation of work under capitalism took place with the advent of mass production and the expansion of Taylorist methods of work organisation and labour deployment, both geared to the creation of profit rather than the satisfaction of workers' needs.

The primacy, in Braverman's account of the capitalist relations during the twentieth century, is given to Taylorism. Taylorism is, for him, concerned with the capitalist control of the labour force at any given level of technology. The consequence for the labour force, is a gradual process of deskilling and further division of labour within different work places. For him, deskilling results from the separation of conception from execution, in such a way that management becomes totally responsible for the planning and design of work tasks while workers become restricted to simple manual operation.

However, it is important to note that Braverman does not see the use of automation to deskill the labour process as an expression of the inevitable impact of technology itself. For him, deskilling is a product of the need to control the labour process in order to increase profit. Thus, technology is perceived by Braverman as having no influence on work organisation and labour deployment independently of management's need to control the workforce. In other words, as a managerial strategy within a capitalist labour process, technology constitutes an instrument used to further control and deskill the labour force.

2.1 The Deskilling Thesis: The Work of Harry Braverman

In his work *'Labour and Monopoly Capital: The Degradation of Work in the Twentieth Century'* (Braverman, 1974), Braverman argues that the critical area for explaining social conflict and control is the labour process itself; the place where commodities are constructed and developed by combining human labour and raw materials. He argues that in the nineteenth century, craft workers combined a wide range of knowledge and skills so that their levels of discretion, autonomy and control were high. He explains this in the following way:

'From the earliest times to the Industrial Revolution the craft or skilled trade was the basic unit, the elementary cell of the labour process. In each craft, the worker was presumed to be the master of a body of traditional knowledge, and methods and procedures were left to his or her discretion. In each such worker reposed the accumulated knowledge of materials and processes by which production was accomplished in the craft...The worker combined, in mind and body, the concepts and physical dexterities of the speciality: technique, understood in this way, is, as has often been observed, the predecessor and progenitor of science.'
(Braverman, 1974, pp. 109)

Braverman claims that the twentieth century experienced a particularly rapid process of degradation of work, followed by the deskilling of the labour force. He argues that in advanced capitalist societies, the pressure for capital accumulation compels management to develop forms of full control over the labour process in order to reduce costs and increase profit. He emphasises three aspects of such a process:

a) The necessity of capital to realise the potential of purchased labour power by transforming it into labour under its own control, thereby creating the basis for alienation of the workforce.

b) The origins of management lay in the struggle to devise the most effective means of imposing employers' control within a capitalist social relation of production, different in the kind and scope to the craft production.

c) The development within the capitalist mode of production of a division of labour based on a systematic subdivision of work, rather than simple distribution of crafts. This division provides the basis for the subsequent fragmentation of all-round craft skills.

Focusing on both the origins of management and the capitalist need for accumulation and control, rather than the imperatives of technology and efficiency, Braverman sees the process of automation as a strategy that seeks to increase managerial control over the labour process. For the capitalist the problem of work is the problem of managerial control - how can managers ensure the maximum degree of effort for the minimum amount of reward? For Braverman, the solution for the problem relates to the development at the turn of twentieth century of a theory and practice of 'scientific management' based on the ideas of Frederick Winslow Taylor.

Braverman explains that Taylorism advocates the pursuit of industrial efficiency by a complete separation of conception (the mental labour of planning and decision-making) from execution (the exercise of manual labour)

in the accomplishment of work tasks. The objectives of Taylorism are twofold. Firstly, job content is progressively deskilled as work is broken down into fragmented tasks requiring little mental ability and only physical effort to execute them. Secondly, the functions of planning and decision-making required to direct and control the execution of work are increasingly concentrated in the various ranks of management and managerial functions. Braverman notes that the division of labour, this separation of conception of work from its execution, and the deskilling of the work force provide not only for higher levels of productivity and cheaper labour, but also for a more submissive workforce.

The author maintains that initially, the enforcement of the rigid division of labour advocated by Taylorism relied on organisational and disciplinary mechanisms. However, as the twentieth century developed, automation allowed increased levels of productivity and offered management a more effective means of control over the labour process (which reduced managers' reliance on direct personal supervision of labour normally required by Taylorist methods). Thus for Braverman, while technological changes enable improvements in productive efficiency, they also facilitate the progressive elimination of the control functions of workers, and their transfer to devices which are controlled by management from outside the direct production process. In other words, technology is used as a means of replacing human labour, while management becomes the receptacle of workers displaced knowledge and skill.

Braverman argues that this progressive elimination of workers' input reduces *'at any given level of production, the need for workers engaged*

directly in production, since it divests them of time-consuming mental functions and assigns these functions elsewhere.' (Braverman, 1974, pp. 124)

Therefore, for him, in the capitalist mode of production, new methods and new technologies are incorporated within a management effort to dissolve the labour process as a process conducted by the worker, and reconstitute it as a process conducted by management.

However, the use of automation to control and deskill labour are not seen by the author as an expression of the inevitable impact of technology itself. Rather, for Braverman, managers use technology to achieve specific goals, and consequently, the forms of its utilisation - the manner in which labour is organised and deployed around it - are dictated by the capitalist effort to increase productivity and its control over labour. He points in this respect that:

'It is not the productive strength of machinery that weakens the human race, but the manner in which it is employed in capitalist social relations... In reality, machinery embraces a host of possibilities, many of which are systematically thwarted, rather than developed, by capital.' (Braverman, 1974, pp. 229)

Braverman understands that technological advances, enforced by the threats of national and international competition, have been leading to the adoption of advanced production methods that break down operations into an even larger number of smaller and simpler steps. This process of automation, according to Braverman, places the production processes under the control of management and engineers which further destroys the need for workers' knowledge or the need for a broadly trained workforce. However, as he argues, under a different production system, advanced technologies would

open up the possibility of different forms of job design and work organisation which would benefit the workforce. The author points out that this would involve employees possessing the technical knowledge required to operate and maintain the technology, and a rotation of tasks to make sure everyone had the opportunity to work on both highly complex and routine jobs. In other words, rather than being deskilled, employees would retain autonomy and control over the labour process, and technology would be used as a complement to, rather than a substitute for human skills.

2.2 Braverman's Approach to Skills and Training

The basic thrust of Braverman's argument about the organisation of the labour process under the capitalist mode of production is the extensive process of deskilling which has accompanied the development of monopoly capitalism. The rationale behind the 'deskilling thesis' arises, for Braverman, from the fundamental conflict of interests between workers and capitalists that reduces the capacity of labour to resist against managerial control strategies. The Taylorist 'principles' of work organisation constitute, within this conflicting context, the best strategy for management to control the labour force for it destroys the craft skill by separating conception from execution. Management becomes, in this way, totally responsible for the planning and design of work tasks while workers are restricted to simple manual operations. The work becomes progressively degraded as all elements of knowledge, responsibility and judgement are taken away as workers' tasks become totally programmed, routinised, and specialised.

The benchmark by which deskilling is measured by Braverman is the skilled artisan who is associated with the pre-capitalist form of industrial production overseen by craft and guilds. The concept of skill is bound up, for Braverman, with the craft mastery that involves both the manual and the conceptual knowledge according to which an individual is able to perform a job . That is to say, in the authors words, '*the combination of knowledge of materials and processes with the practised manual dexterities required to carry on a specific branch of production.*' (pp. 443)

However, according to Braverman, the development of monopoly capitalism transformed craft workers in its search for both lower production costs and greater control over a potentially unmanageable labour force. The craft form of work, through the adoption of Taylorism, was reduced to a body of principles and practices which progressively took away all elements of knowledge, responsibility and judgement from the labour force and gave it to managers.

For Braverman, the break-up of craft skills and the reorganisation of production under capitalism destroyed the traditional concept of skill. He states, in this respect, that the extreme concentration of scientific and technical knowledge in the hands of management reduced the concept of skill to a specific dexterity, a limited and repetitious operation. Thus, the content of skills only falls, according to him, in an absolute sense, in that the worker loses the craft and the traditional abilities without gaining new abilities adequate to compensate the loss. But it also falls in a relative sense, in that the more knowledge is incorporated into management the less workers understand

about the whole production process in the shopfloor. Braverman explains this idea in the following way:

'With the development of the capitalist mode of production, the very concept of skills becomes degraded along with the degradation of labour and the yardstick by which it is measured shrinks to such a point that today the worker is considered to possess a 'skill' if his or her job requires a few days or weeks training, several months of training is regarded as unusually demanding, and the job that calls for a learning period of six months or a year - such as computer programming - inspires a paroxysm of awe.'
(Braverman, 1974, pp. 444)

Braverman, therefore, strongly criticises the socio-economic occupational categories used by statisticians to identify the various portions of the 'manual' working class in the United States. He explains that the first occupational classification grouped workers into four categories: proprietors, clerical employees, skilled workers, and labourers. A revision of such classification divided the former group of labourers into two parts: the operatives (those who tended or operated machines) and the labourers (those non-farm workers who were neither craftsmen nor machine operatives). The classification was taken to correspond to different levels of skills. Craftsmen continued to be called skilled workers, operatives were called 'semi-skilled', and labourers 'unskilled'. The creation of 'semi-skilled' brought about, according to Braverman, a massive 'upgrading' of the skills of the working population.

He argues, however, that the entire concept of 'semi-skilled', as applied to operatives, is a delusion for it implies that a level of training and ability to perform a particular job lies somewhere between skill and the total lack of it.

For operatives, he explains, training requirements and the demands of the job upon the abilities of the worker are so diminished under the capitalist mode of production that *'one can hardly imagine jobs that lie significantly below them on any scale of skill.'* (pp. 430) Training for semi-skilled workers, within this context, has its conceptual content reduced for workers' have, on the one hand, their knowledge absorbed by the machines and, on the other hand, have their activities controlled by management and engineers. Training, therefore, conforms to a brief on-the-job form of learning in which workers are told exactly what to do and how to do it. They learn repetitive and task-specific skills through practice on-the-job, and managerial emphasis is placed on such characteristics as good co-ordination, steady pace, and adaptability to the work process.

Having in mind the process of apprenticeship required in traditional crafts (in which the craftsmen was required to master a specialty and become the best judge of the manner of its application to specific production problems), Braverman argues that Taylorism, under the capitalist mode of production, simplifies tasks through the separation of conception from execution in such a way that these can be learned in a few days of on-the-job training. The worker, it follows, is considered to possess a 'skill' if his or her job requires a few days or weeks training. Training a worker means, in this context, merely enabling him or her to carry out, through the development of narrow skills, the directions of his or her work schedule in the factory, in the office or in the service sector.

In regard to the education of labour, Braverman points to the possibility of some form of integration between schooling and training in so far as it

reflects the interest of workers that come to be the masters of the industry. However, the conditions for such a form of integration are seen by Braverman as involving the end of antagonisms in the labour process between controllers and workers, conception and execution, mental and manual labour within a mode of production different from capitalism¹. The author argues that the prerequisites for workers to re-acquire craft skills involves, on the one hand, the demystification of the role of technology as a capitalist instrument of control and, on the other hand, the reorganisation of the mode of production in a different way from capitalism. The worker can regain mastery over the collective and socialised production only by assuming the prerogatives of modern engineering. Short of this, he points out, there is no mastery over the labour process. The content of training is further emptied by the divorce of conception from execution while formal education provides workers with skills that are irrelevant due to the limited and repetitive forms of work subject to constant surveillance and supervision.

2.3 A Critical Review of the Deskilling Thesis

The arguments developed by Braverman stimulated an extensive debate on the nature of work in capitalist societies. There are in very broad terms two existing kinds of criticism of Braverman's analysis. On the one hand, there are those who are sympathetic to his general approach but who see his version of the labour process theory as oversimplified and in need of further

¹ Braverman sees, within capitalism, the existence of an ever emptier 'education' that, combined with the reduction of labour to simple and ignorant tasks, represents a waste of educational years.

refinement (Friedman, 1978; Burawoy, 1979; Wood and Kelly, 1982; Elger, 1982; Beechey, 1982; Wilkinson, 1983). On the other hand, there are those who recognise the value of some of Braverman's insights, but do not accept them as an adequate or complete explanatory framework (Litter, 1982; Knights, 1985; Knights and Willmott, 1990). This chapter focuses on four main criticisms considered to be relevant to the argument of this thesis. These criticisms refer to:

- a) Braverman's over emphasis on Taylorism as a managerial strategy
- b) The author's tendency to see the implementation of management as unproblematic
- c) Braverman's perception of deskilling as a unilinear tendency

Firstly, the most common criticism refers to Braverman's assumption that the imperatives of capital accumulation (that is the drive for profit) require management to wrest control over the labour process from the workforce, and that one particular strategy, Taylorism, is the most appropriate way of achieving this. Thus, as argued by Wood (1992), Braverman takes the logic of Taylorism to be the logic of capitalism based on the assumption that it guarantees effective capitalist control by ensuring that all knowledge over the labour process is transferred into the hands of management. Elger (1982) and Wood and Kelly (1982) note that by understanding Taylorism and its significance as part of a law-governed system whose laws inevitably work themselves out without contradiction, Braverman does not treat the capitalist mode of production itself nor the practices derived from it as potentially contradictory.

Wood and Kelly (1984), Burawoy (1979) and Friedman (1978) suggest that because Braverman perceives Taylorism as incapable of being transcended without the end of the capitalist mode of production, he does not recognise the existence of different forms of managerial control in production processes in the shopfloor. For instance, Friedman (1978) argues that there are other strategies available to management in their quest to control labour, and that these may not involve deskilling of jobs and reduction in worker autonomy. He maintains that management strategies involve choices which depend on prevailing product and labour market conditions. Furthermore he argues that worker resistance to management can do more than change the type of control used over them; it can also reduce the amount of control that managers have over some sections of the labour force.

Secondly, as suggested by Elbaum and Wilkinson (1979), Burawoy (1979), and Adler and Borys (1989), Braverman presents an oversimplified conceptualisation of control by exaggerating the extent to which Taylorism has been adopted both within firms and unilaterally across firms. They argue that Braverman minimises the role of class struggle in the forming of the labour process for he assumes that, having consciously designed the organisation of work to further capital accumulation, managers inevitably achieve their own goals. It follows that for Braverman the process of degradation of work is seen as producing a virtually inert working class, unable to pose any substantial problems for capital either within production or beyond it.

Wood (1982) and Elger (1982) argue, in this respect, that Braverman assumes a cohesiveness within the dominant capitalist and managerial classes

while denying that workers understand that their work has been degraded. He minimises the workers' potential to resist as he sees the reorganisation of the labour process as the outcome of a conscious design, rather than a product of the struggle of contending groups. Therefore, the only possible way for workers to acquire autonomy and the control over their own work can be achieved, according to him, on the day that the capitalist mode of production ends.

The issue of managerial control over the labour force, as it is put by Braverman, has been confronted by a number of empirical studies (Kelly, 1986; Wilkinson, 1983) that demonstrate that workers have the ability to develop different ways of resisting initiatives to control the labour process in the shopfloor. Wilkinson (1983), for example, maintains that Braverman gives insufficient consideration to the conditions to which capitalist strategies for control are implemented, in particular to the effectiveness of the workers' resistance to changes in the labour process. He bases this argument on the analysis of the adoption of numerically controlled machine tools² (NC) in a sample of firms. He suggests that the introduction of new technology in these firms was followed by different forms of work organisation. He describes how, in one plant, management tended to see workers as unwilling and unreliable, and thus sought to prevent workers from interfering with the system by locking the control panel of the machines. In contrast, in another

² Computer-Aided Manufacture (CAM) refers to the application of programmable computing power to manufacturing processes. CAM systems are currently available in the manufacturing of plastics and metal in the form of Computer Numerically Controlled - CNC or NC - extrusion machines. The essential feature that separates the NC machine tools from the previous forms of automation is their 'programmability'. Whereas previous forms of automatic tools needed to be changed when a new job was ordered, the CNC is reprogrammed; at its simplest, this means slotting in a new tape; at its most sophisticated, it means reconfiguring commands at keyboard or console machine that turn out a variety of cut metal parts, for instance.

plant, managers purchased NC machine tools with manual data input facilities, which allowed skilled craftsmen operators to write their own programs and to control the machine through their computers.

The study conducted by Wilkinson indicated that the introduction of NC caused what he calls a 'battle of control' or a conflict of interests not only between workers and management, but also between groups of managers and among programmers and mechanics. Programmers, for example, argued that they should have management-backed authority for all activities involving the programming of the machine tools. However, the machinists felt that, as their traditional skills would be embodied in the programme of the CNC, they should also retain some say over the process of programming. During this 'battle', the machinists developed, according to the author, different ways of resisting the loss of their skills. The machinists resistance indicated that (a) they were aware about the outcomes of automation, and (b) they were also able to find ways to counteract management control.

Adler and Borys (1987) contend, in this respect, that machinists, like other workers, especially unionised ones, often resist subordination and loss of autonomy in their jobs. Zeitlin (1989) adds that the struggle for control is not simply a battle between the autonomous and free-floating policies of management over workers. These policies themselves are forged out of the changing technological and market opportunities available to companies at particular times. For Zeitlin, the balance of forces between capital and labour constitutes a process which is conditioned by market forces that create, in turn, pressure for changes and set limits to the relationship between management and labour.

Wood (1992) argues that another criticism of Braverman's analysis is his tendency to see deskilling as an inevitable outcome of technological change in the shopfloor. Wood (1992) and Elger (1982) assert that Braverman sees as inevitable the link between automation and deskilling, and by doing so, he does not recognise the possibility for alternative skill outcomes. Braverman thus underestimates two factors. On the one hand, he obscures the idea that specific exigencies of automation can require expertise and responsibility from the labour force. On the other hand, the importance of analysing the ways in which automation, as a capitalist strategy of accumulation, affords (in conjunction with changes in the labour force) opportunities for relatively effective worker organisation and struggle.

Kelly's (1984) analysis of 221 manufacturing plants, for instance, shows that in these firms no operators tended to program their NC machine tools, and that relatively few were responsible for their set up. This would suggest that operators were effectively deskilled. But, as the author indicates, operators used override buttons on NC machines to gain control over a series of stages of production, and thus learned to read punch tape and edit programs that improved the performance of the machines. Programs written in the back office, in turn, rarely performed adequately, they often had to be edited and operators seemed best positioned to do this. The author argues, therefore, that the separation of conception from execution envisioned by the designers was, in this case, misleading. The knowledge and initiative of skilled machinists proved to be more important for firms because they enabled operators to exploit the full potential of the technology, which contradicts

Braverman's argument that managers seek to control the labour force through further deskilling.

A study undertaken by Noble (1990) details the ways in which large firms in the United States implemented NC in the shopfloor. He argues that some firms offered, in the first place, lower pay rates for NC operators, and kept setting up and programming as separated jobs. This strategy caused great friction with unionised labour, as well as managerial dissatisfaction over the low productivity of NC. However, other firms experimented with a different form of work organisation which involved the design of jobs combining set-up, programming, and other conceptual skills with the manual aspects of the machining. Noble characterises the second approach to technological change as the result of technical and economic factors that proved, in the end, to be problematic for some managers because it bolstered the skills and leverage of some union labours. He notes, in this respect, that although the need for manual craft skills in operating NC machine tools is eroded, experiential and intuitive abilities based on years of experience of, for example, variations in raw materials, are still required so that workers can deal with operating contingencies which are not anticipated by the programs controlling the machines.

Cavestro also provides evidence that Braverman underestimates the idea that processes of technological change can create a new context in which the optimal use of the new technology involves a skilled labour force. In a sample of French firms, as argued by Cavestro (1992), the introduction of new technology did not restrict the scope of the action of some workers. On the contrary, the growing complexity and variety of technologies created the need

for permanent human intervention in order to improve the operation of automated installations. He explains that workers had to cope with technological systems that demand, in order to work properly, the formalisation of their practical knowledge. However, the formal procedures involved, for instance, in programming, did not ensure alone the successful operation of automatic control systems. Various unpredictable problems often crop up, and the handling of these problems became part of the worker's exercise of skills - that, in this particular case, involved the anticipation and the handling of different problems.

Cavestro notes, therefore, that as a result of the adoption of new technology, work becomes increasingly characterised by data gathering and by the construction of strategies to resolve malfunctions of the systems. The level of abstraction of the tasks tends to increase due to the fact that, within automation, the operator works with information in a symbolic form. Codes and computer languages constitute the basis of his/her intervention. The coding and de-coding of information and instructions contained in the programme of certain technologies are complex intellectual activities which involve substantial intellectual competencies, capacity to adapt, training, and work experience. Within such a framework, incidents and malfunctions combined with experience and training practices play an important part in the learning process and in the successful handling of technologies.

Therefore, as argued by Elger (1982), the development of the capitalist mode of production associated with technological advances does not create a simple homogeneous mass of deskilled workers on the shopfloor, but involves the elaboration of a complex and internally differentiated apparatus

of collective labour which contains a variety of skills and specific dexterities. In this sense, the relations between the advantages and disadvantages to capital of a specific form of the labour process can be related to the significance of such aspects as skilled labour, labour struggle, technological advances or increased competitiveness. It can also be influenced by both the specific manner in which skills are lodged within the labour process, and by the broader context of political, economic, and ideological pressures.

2.4 Summary

The deskilling thesis asserts that the adoption of technology in the shopfloor is part of a managerial strategy to increase their control over the labour force. This is achieved by using technology in such a way that jobs are fragmented and deskilled. Thus training practices focus on the development of firm- and task-specific skills required by fragmented jobs.

A critical analysis of this thesis suggests that it overlooks a host of possibilities and factors influencing the way in which technology is introduced, as well as its skill outcomes. Two arguments can be made.

Firstly, it can be argued that technological change can take on different forms in different contexts that allow adaptations, modifications and developments within production processes which do not necessarily lead to an unilinear process of deskilling. Managers can use technology as a means of

enhancing their control over both the labour process and the labour force, as shown by Noble (1990), Kelly (1984) and Wilkinson (1983). But this usage can prove to be not appropriate under certain conditions or may reach the limits of its effectiveness in different circumstances. As noted by Cavestro (1992), the effective employment of technology can require a more skilled labour force, especially where the technology demonstrates to be complex and less error free. In these instances, it creates a need for the development of new skills so that workers are able to anticipate and handle problems. Training practices, within this context, are likely to be seen by managers and workers as an important means of developing broad-based skills rather than task-specific skills.

Secondly, it can be suggested that the skill implications of computer-based technologies are more complex and varied than argued by the deskilling thesis. These implications are influenced, for instance, as implied by Kelly (1984), Noble (1990) and Wilkinson (1983), by a number of factors which have been underestimated by Braverman. Factors like different managerial strategies with regard to labour control, managers' objectives concerning technology, the capabilities of technology to achieve managers' expectations, and the role of labour during processes of technological innovation indicate the possibility of different patterns of technological change with varied skill outcomes.

3. The Flexible Specialisation Thesis: The Work of Piore and Sabel

The flexible specialisation thesis argues, according to Hirst (1989), that the new forms of work organisation and labour deployment in the manufacturing sector that emerged in advanced industrialised countries during the 1970s and 1980s resulted from a number of factors other than the need to control the labour force and reduce costs as supported by Braverman. This approach thus attempts to understand these new forms of work organisation and their implications to the labour process as influenced by a combination of such factors as increased international competition, saturation of the mass consumption markets and the development of new flexible computer-based technologies. The concept of 'flexible specialisation thesis' could be best defined, therefore, as suggested by Hirst and Zeitlin (1989), as a technological paradigm or an ideal-typical model of industrial efficiency. In other words, it refers to a shift from a system based on mass production, specialised machinery and semi-skilled labour to produce standardised goods to a modern version of craft production³ founded on the manufacture of a range of specialised goods for particular and changing markets using flexible general-purpose machinery and multiskilled labour.

Michael Piore and Charles Sabel analyse, in their book *'The Second Industrial Divide: Possibilities for Prosperity'* (Piore and Sabel, 1984), the major economic changes during the last decades in the light of the historical

³ This new version of craft production is based, according to Piore and Sabel, on the idea that technologies and processes enhance workers' skills, allowing them to apply his or her knowledge in ever more varied production processes. The more flexibility the machine has, the more widely applicable the process, the more it expands the workers' capacity for productive expression.

evolution of two types of systems of industrial production. The first was based on craft production and the second on mass production. They argue that the transition to mass production as the dominant form of industrial organisation took place during the late nineteenth and early twenty centuries. This is termed by the authors 'the first industrial divide'.

By presenting a macroeconomic account of the existing economic difficulties in advanced industrialised countries, Piore and Sabel suggest that the deterioration in the economic performance in these countries results from the limits of the model of industrial development that has been predominant during the last decades - that is, the mode founded on mass production. Such a model of industrial development involves, for the authors, the use of special-purpose (or product-specific) machines and the use of semi-skilled workers to produce standardised goods. Its guiding principle is the substitution of skilled labour by machinery in order to reduce the production costs of any particular good. Its aim is to decompose every handwork task into simple steps, each of which could be performed faster and more accurately by a machine dedicated to that purpose than by the human hand. Thus, the more specialised the machine - the faster it works and the less specialised its operator needs to be - the greater its contribution to cutting production costs.

Piore and Sabel see two possible strategies for the crisis of mass production. The first one, involves a process of restructuring of capitalism through the adoption of economic mechanisms aimed at giving support to the system of mass production - that is, the co-ordination of mass production among industrialised and developing countries so as to maintain and create new mass markets able to absorb the production of standardised consumer

durable goods. The second strategy, that is called by them 'flexible specialisation', involves a modern system of craft production which, through the use of flexible computer technology, constitutes an attempt to break away from the system of mass production. It makes use of the new flexible technology so that the production of specialised products can be easily adapted to changing market demands. It relies, contrary to mass production, on a multi-skilled labour force able to adapt to exploit the capabilities of new production technologies, and thus adapt to constant changes in production and market demand. For them, flexible specialisation is a new form of industrial organisation, which offers the possibility to what they call 'the second industrial divide'.

The authors thus present a distinct account of what they perceive as the deterioration in the performance of advanced countries in terms of a crisis in their system of industrial production. They drawn their analysis from the historical development of the system of mass production and its outcomes in the United States. They argue that the successful establishment of mass production required two important elements. On the one hand, it involved large investments in highly specialised equipment and narrowly trained workers, which contributed to the reduction of production costs. On the other hand, it involved the creation and expansion of mass production markets able to consume the mass production of standardised goods. As they put it:

'In the language of manufacturing, these resources were 'dedicated': that is, suited to the manufacture of a particular product - often, in fact, to just one make or model. Mass production was therefore profitable only with markets that were large enough to absorb an enormous output of a single, standardised commodity, and stable enough to keep the resources involved in the production of that commodity continuously

employed. Markets of this kind, like the market in general, did not occur naturally. They had to be created. In the United States, the modern corporation was organised for this purpose.' (Piore and Sabel 1984, pp. 49)

Thus mass production was supported by the development, in the United States, during the late nineteenth century, of a mass production national economy which established ways of using technology, organising corporations, deploying labour, and controlling macroeconomics' fluctuations that defined standards of industrial efficiency. Such^a mass production economy relied partly on the creation of corporations that asserted control over the market for its own products and for its immediate supplies of resources input. The first generation of corporations aimed to organise and create a market sized to fit pre-existing technologies. Other corporations, like the automobile corporation, aimed not only to create a market for new products, but also wanted to insure its continual expansion. The authors give the example of the Henry Ford's development of the Model T, which involved both the stabilisation and the expansion of a market for the consumption of this car. According to the authors, Ford sought to produce a reliable car at a price accessible to the average consumer. In order to do so, he introduced, on the one hand, the first automated automobile assembly line based on interchangeable parts and an extreme division of labour. On the other hand, Ford created a sales network aimed to organise the market for this single standardised product.

Piore and Sabel argue that Ford's efforts did drive the price of his product low enough to make it accessible to many people that could not afford his competitors' automobiles. But, his success was also dependent on his

product innovations, such as the Ford clutch and gearshift, which transformed what was initially something of a toy into a simple, reliable, useful vehicle. The authors point out that Ford relied on what he saw as infinite economies of scale to expand the market for his product. Nevertheless, he soon realised that the context he had envisioned, of lower costs-increased demand-lower costs-increased could not be self sustained. He thus raised his workers' wages as an attempt to increase the aggregate purchasing power of the consumers through redistribution of income, rather than the reduction of production costs. In this sense, he not only created a market for his product, but also ensured its expansion which in turn, permitted the realisation of the economy of mass production.

These markets, according to Piore and Sabel, were also dependent on the prosperity of a national mass production economy. Producers required assurances that the consumption market would expand to absorb the enlarged output called forth by their investments. Mass production became, within this context, increasingly concentrated in consumer durable goods (most notably automobiles) and in industries linked to consumer durables, such as steel, rubber, and plate glass that needed growing markets. As this occurred the whole economic system became dependent on the level of consumer purchasing power. The system, in this sense, '*became a mass-consumption as well as a mass production economy.*' (pp. 77) In order to maintain such mass consumption and mass production economy, economic adjustments were introduced, according to which, wage-setting mechanisms maintained consumer purchasing power, despite the fact that wages and prices became so rigid that they could no longer serve as an effective means of allocating

resources⁴. The national production economy and its mechanisms achieved such a success in the United States, that they were later imitated, with some degree of variations, by other countries in the post-1945 period - like France, Germany and Italy, thereby establishing an international 'mass production economy'.

The authors argue that for the first two decades after the World War II, the mass production economy produced great prosperity and social stability among advanced industrialised countries. The economy of advanced industrialised countries thus grew rapidly and, compared to other periods, steadily. Inflation was moderate and unemployment was generally low. However, during the late 1960s, these countries started to experience economic disruptions which characterised, according to Piore and Sabel, a '*general crisis of the industrial system*' (pp. 165) founded on mass production. For them this crisis can be explained by two ways. The first one focuses on external shocks to the economic system, the way they further disrupted economic activities, how the political responses to these disruptions undermined the macroeconomic stability and aggravated the crisis. The second way concentrates on what the authors perceive as the incapacity of the late-1960s institutional structures to accommodate the spread of mass production technology which is, for them, a consequence consistent with

⁴ They explain that within the mass-production industries, each of the industries - and within them, most companies - conducted separated negotiations with unions. But the negotiations were tied together in 'orbits of coercive comparison' (pp. 80), which forced all unions to follow similar patterns. However, at the bottom of the labour market, the pay rate was governed by a nationally legislated minimum wage. The authors assert that, at macroeconomics level, the unions saw the periodically wage adjustments as a means to maintain consumer purchasing power. At the microeconomics level, those unions whose wages were relatively low saw the minimum wage as a means to use extensive power in order to ensure that it was raised in step with the contract settlements that they felt compelled to follow.

implications derived from the former way of understanding and reacting to the crisis within mass production.

3.1 The Crisis in Mass Production: The Five Critical Episodes

According to Piore and Sabel, five overlapping episodes disrupted both the economic activities based on mass production, and the political responses to these disruptions. The first episode was the social unrest of the late 1960s and early 1970s that provoked a debate about the ends and means of the industrial society as well as the position of workers within such society. In the United States it was associated with students protests against the war in Vietnam and with the civil right movement. The latter was primarily a protest movement of blacks that demanded equal treatment on and off the job. It was eventually adopted by other disadvantaged groups. In Western Europe, the social unrest was more diffuse because it included: students, immigrant workers, native-born blue-collar workers, and some white-collar workers in France and Italy.

For Piore and Sabel the social unrest could be better explained as a result of changes in the attitude of workers. They explain that the rigid wage structure in the United States and the labour shortages in Europe, as the economy moved towards mass production in the early post-war decades,

created the need for reserves of labour⁵ available on call at the prevailing wage. The system thus depended on the willingness of these low-skilled reserves to move in and out of the factory on demand. Such conditions of employment were acceptable, for the authors, so long as these groups '*saw themselves as outsiders to industrial society, and their industrial income as a means of establishing or defending their place in the extra-industrial world...Given this situation, these workers were not interested in acquiring factory skills - skills that were irrelevant to their long-range plans. Nor were they determined to win job security - during downturns, farmers could go back to the farm, women to the home, young people to their parents.*' (pp. 168)

Nevertheless, such workers were drawn into full participation in the industry which brought about consequences for their self-perception and, hence, to their labour market behaviour. The more these people saw themselves as permanent members of the industrial workforce - and thus dependent on factory jobs - the more they started to demand stable, high-status, well-paying factory jobs. In the United States the effects of the protests generated reforms that levelled the wages of the rural labour reserve to the national wage structure, and also extended the system of income maintenance to such workers - this was done through some changes in the unemployment and social-security systems. In Europe, the reforms were seen, by Piore and Sabel, as an accelerated process of the modernisation of the society in the light of the American economic system. In France, for instance, wages were indexed to the cost of living, and job security and employment-insurance benefits increased. Italy introduced reforms that also included wage indexing,

¹ In the United States, these reserves consisted largely of blacks, woman and youths. In Europe, they were made up of agricultural workers, woman, youths, and immigrants.

that made pay levels and purchasing power independent of the situation in the labour market.

However, as a result, each national economy of mass production became more vulnerable to wage inflation, which arose from either labour shortages or trade union demands. The situation gave way to the adoption, during the 1970s, of employers' countermeasures to avoid the new employment guarantees. These involved, in the United States, the employment of unskilled young people, illegal immigrants, and an increased number of women - none of whom demanded inflated wages. In France, companies started to hire workers from temporary-help agencies and introduced short-term employment contracts. In Italy, large corporations subcontracted work to small firms. The authors argue, in this respect, that:

'The protests had indeed scotched the belief that economic progress made protest obsolete; but the persistence of the institutions and the direction of the reform suggested that further progress down familiar paths might vindicate that earlier belief. Even as this hope gathered strength, however, in the early 1970s, other changes in the system forestalled its realisation.'
(Piore and Sabel, 1984, pp. 170)

In the wake of the social unrest of the 1960s in the United States and Europe, the second critical episode emerged; that is, the international monetary system abandoned fixed exchange rates and shifted to a system of floating currencies which, in effect, meant the end of the dollar supremacy. The immediate cause of the shift was the rapid deterioration in the United States' competitive position in international markets due to both domestic inflation and the unwillingness of the government to raise taxes to pay for the Vietnam war. The change to a system of floating exchange rates solved the

immediate problems for the United States and its major trading partners. But its long-term effect was to increase the confusion and instability of world markets. The variation of the price of the dollar was impossible to predict for it started to fluctuate widely with respect to other major currencies, and in a way that could not be explained by trade flows, or differences in interest and inflation rates. As the authors explain:

'..The shift to floating exchanges rates made the price of goods in international trade hostage to forces only distantly connected to national economic performance - and almost impossible to forecast and control. These unpredictable exchange-rate fluctuations, in turn, wreaked havoc with mass production economy; they also produced political reactions that threatened the whole operating system. In mass production, as we have emphasised, producers make long-term commitments to certain production techniques. Once these commitments are made, it is difficult, if not impossible, to shift to different techniques.' (Piore and Sabel, 1984, pp. 174)

Thus, according to Piore and Sabel, the unexpected variation of the exchange rates - that was especially marked in the early 1980s - created two obstacles to a return to 'business-as-usual' under the existing regulatory regime - it discouraged investment in mass production, and it also encouraged the formation of major trade blocs, like the European Economic Community, that was motivated by the desire to obtain in Europe markets comparable in size and scope to those of the United States. *'Although it is difficult to assess its effects on economic activity, it is clear that this variation (like the two changes in the post-war order that are discussed next) weakened the stability on which mass production was based.'* (Piore and Sabel, 1984, pp. 174)

The third episode, the first OPEC oil price rise in 1974, caused a severe shock in the financial systems which had irreversible effects on the pattern of world industrial development and trade. The first consequence of the oil shock was to move the centre of economic expansion from the advanced industrialised countries to the developing countries in which the impact of the crisis was less severe. In Southeast Asia, for instance, growth was maintained by capturing a share of the advanced industrialised market for the low-wage mass production of consumer goods - especially textiles, garments, and electronic components. In countries like Brazil, the authors argue, the continuing economic growth was supported by extensive foreign borrowing which made possible the expansion of particular industries⁶. Brazil and Mexico, for instance, despite the crisis, together accounted for 4.2 per cent of new vehicle (cars, trucks, and buses) sales world-wide in 1980. Their output was almost equal to 15 percent of the new vehicles sold in the whole US market during the same period. As Piore and Sabel put it:

'The upshot of this shift in the epicentre of economic growth was that from 1971 to 1974, manufactured exports from the developing countries increased at an average annual rate of 25.6 per cent; in the developed countries, the rate was 11.2 per cent. The developing countries' share in the growing world market rose from 5.8 percent in 1968 to 8 percent in 1976; and the share of three of the newly industrialised economies - Hong Kong, Korea, and Singapore - doubled during the period, from 1.5 to 3 percent of world exports.'
(Piore and Sabel, 1984, pp. 178)

⁶ The extensive foreign borrowing was possible, as it is explained by Piore and Sabel, by the fact that the large revenues accumulated by the oil-exporting countries were deposited in the banks of the advanced industrial nations. Because of these petrodollar reserves, interest rates were relatively low, and the banks were thus willing to lend large sums of money.

The fourth episode, the second oil shock in 1979, created a wash of billions of dollars that had to be accommodated within an inflexible economic system. This situation generated inflation, unemployment, and a decline in productivity in advanced industrialised countries. The recession of the industrial world combined with the huge OPEC earnings - recycled through the world banking system - made real interest rates low if not negative. Such low interest rates produced, in turn, the fifth episode in the economic crisis - a prolonged recession that also affected the developing countries⁷. Advanced industrialised countries adopted austerity programs in order to control inflation and to enhance price and wage flexibility. However, such programs aggravated even further the world depression by reducing the world trade, which meant that mass markets for mass produced goods could no longer be guaranteed in these countries. The consequences were slow growth, low productivity gains, and rising unemployment.

For the authors, the consequences above, were also produced by a crisis of demand in advanced industrialised countries. They explain this crisis of demand in the following way:

'The demand crisis had both a familiar and a novel aspect. It was familiar in that it was a classic deficiency of aggregate demand: restraints produced recessions in 1974, 1980, and 1982-3. The novel aspect of the demand crisis was its association (part cause, part effect) with growing confusion about the

⁷ The low interest rates encouraged further borrowing in developing countries. But, after the second oil shock, Brazil, for instance, had to refinance - at higher interest rates - the debts contracted at relatively low interest rates in the 1970s within a context of depressed world trade, which limited its ability to earn foreign exchange. In addition, it has contracted debts to finance development programs on the assumption that world markets would expand as they had done in the previous periods. However, the changed economic environment made many of these plans unworkable and thus jeopardised the debtor's ability to pay off its loans.

level and composition of demand in individual markets, and about the price and availability of resources inputs.' (pp. 183)

According to Piore and Sabel changes regarding demand led to the break-up of mass markets for standardised products by reducing the portion of demand that employers saw as sufficiently long-term to justify the long-term fixed-cost investments of mass production. Because mass production was the motor of growth in the post-war period, the break-up of mass markets led to a decline in the rate of productivity, and thus to slower growth. The authors also relate, at this point, the break-up of mass markets to two factors. The first one refers to a process of saturation of consumer goods markets in the industrial countries. They argue that, by the late 1960s, domestic consumption of goods that had led the post-war expansion began to reach its limits. They give the example of the United States market for many mass-produced consumer goods that reached a saturation point, with more than 99 percent of households owning television sets and a refrigerator, while over 90 percent had an automatic clothes washer and a vacuum cleaner. Because of this consumer saturation, Piore and Sabel argue, it became more difficult to increase economies of mass production through the expansion of domestic markets alone. The further development along the trajectory of mass production thus brought the major economies into direct competition for one another's markets and for those of the developing world.

The saturation of the market for consumer goods in the advanced industrialised countries was accelerated by the interpenetration - through trade - of the developing economies. These economies formed two main groups made up of third-world countries that pursued different development strategies

than the ones adopted in United States and Europe. The first group consisted, according to the authors, of the East and Southeast Asian producers: South Korea, Taiwan, Hong Kong, and Singapore. These economies, poorly endowed with natural resources, imitated the Japanese model of export-led development. The countries thus began with labour-intensive, low-technology goods, and then, started a process in which they trained the unskilled labour, perfected technology and marketing techniques, and moved into mass-production of consumer durables for the international market. They also invested a much larger percentage of national income than do their Western trading partners. This means that:

'A disproportionately large share of their export revenues are spent on specialised producers' goods, rather than on mass consumption articles; and their international successes thus divert income from mass markets in general, even while intensifying competition in some of them.' (Piore and Sabel, 1984, pp. 188)

The second major group of industrialised countries that pursued a different development strategy, but one that has also added to the saturation of markets in the industrial world included, according to Piore and Sabel, were nations of Latin America, like Brazil and Argentina. The authors explain that these countries had large domestic markets characterised by a growing consumption-minded middle-class. They also had an abundance of natural resources, which made them less dependent on industrial exports for the foreign-currency earnings necessary to import capital equipment. The countries thus created domestically oriented mass-production industries. To do so, they restricted imports of competing goods from more advanced economies and required local subsidiaries of multinationals to produce an increasing

percentage of the final product domestically. At the same time, whenever the capacity of a competitively efficient plant exceeded the absorptive capacity of the domestic market, they exported the surplus output and used the foreign exchange earnings to purchase specialised producers' goods in the advanced countries.

Piore and Sabel assert that the spread of mass production beyond its original homeland exacerbated the problems derived from the saturation of mass markets. As a consequence, mass production corporations struggled in their own markets to meet the performance standards that had been set during the period of stability. Advanced countries, therefore, adopted strategies aimed to respond to the context of uncertainty; these strategies were, according to the authors, conglomeration and 'multinationalisation'. However, as they note, such efforts brought about limited benefits because the adoption of broader structural reforms required for success were rarely defined in international debate, let alone implemented.

3.2 The Corporate Response: Conglomeration and Multinationalisation

Piore and Sabel note that through the strategy of conglomeration, large corporations tried to compensate risks in their original market through diversification into other markets. However, as they point out, the strategy failed because it sought to reduce risks through diversification without

considering the shocks that disrupted the economies of mass production. As they explain:

'The risks arose not from business accidents, randomly distributed across markets, but from shocks to the economy as a whole. The result was strong correlation among the problems of not offsetting...In short, to reduce the economic risk in the environment of the 1970s, corporations would have had to insulate their markets from macroeconomics shocks that disrupted the economy in each of its parts. And some mass-production firms tried to do just that.' (Piore and Sabel, 1984, pp. 197)

The strategy of multinationalisation had, for Piore and Sabel, a major effect for it sought to achieve economies of scale no longer obtainable through the extension of the domestic market by producing a good that could be sold in many national markets simultaneously. They assert that the world-car strategy adopted by American automobile firms was a typical example of the projection of a mass-production paradigm from a national to a multinational scale. For them, this strategy,

'...required the corporations to extend their operations into at least some parts of the developing world, while defending their position in metropolitan markets. The developing countries would provide the expanding margin of demand necessary to achieve further economies of scale, but the new demand would only do this if the level of demand already created in the advanced countries was sustained.' (pp. 198)

According to them, these firms were encouraged to apply the world-car strategy because of the oil crisis, and because the newly industrialised countries offered low-labour costs and an '*apparent docility of the workers*' (pp. 198), which could guarantee low-cost production. For instance, Brazil, which had a growing automobile market, imposed regulations to foster

domestic production of consumer goods and to discourage their importation, For American companies, these regulations, the potential size of the market and the low-labour cost were perceived as factors stimulating the establishment of their labour-intensive production in this country. The host country, in this case, earned foreign exchange by exporting these components, which compensated the country for the fact that only part of the automobile was produced there. This arrangement thus served both parties, but only on the condition that cars sold throughout the world were built largely of the same components, as dictated by the world-car strategy.

Although the world-car and similar strategies were adopted by other countries - like France and Japan, they involved, for Piore and Sabel, four hidden costs that failed to create the international co-ordination necessary for their success. The first hidden cost was caused by the dispersion of production in the developing countries which seemed, at the beginning, a benefit rather than a cost; it aimed to avoid both the labour unrest and the higher wages of the developed countries. In the course of the decade, however, as the authors suggest, labour upheavals emerged in these countries⁸. The second hidden cost was the fact that the inventory and quality-control costs of the world-car strategy proved extraordinarily high when compared with the Japanese Kaban, or just-in-time. The third cost refers to the idea that world-car strategists underestimated the difficulties to consolidate a market around a standard, transactional design for a car. Demand, in this sense, fluctuated between small

⁸ Piore and Sabel note that in Brazil, for instance, the state made a number of promises to attract foreigner automobile partners. However, assembly-line workers in this sector organised themselves and started to make demands involving wage and work conditions. The corporations defended themselves by building identical plants in different countries and playing one off against another. However, this strategy proved, for the authors, to be costly because the more the corporation multiplied its sources, the less it was able to take advantage of the economies of scale of global production.

and large cars according to the price of gasoline and the general economic conditions. The last cost refers to the fluctuations in the exchange rate and the general international stability that made the level of world demand for this product hard to predict.

Piore and Sabel assert thus that if the crisis is a crisis of under consumption, rooted in the saturation of core markets for consumer durables, an alternative recovery strategy would be to increase demand for those products by raising the aggregate purchasing power of at least some nations not currently able to afford them. In other words, the continuing dominance of mass production requires a system of macroeconomics regulation that balances growth of supply and demand. Such a system would involve the construction of an international economic order based on multinational Keynesianism; that is, an international version of the Keynesian order that governed the economies of the industrial countries earlier in the post-war period. The system, according to the authors, would be built of at least three institutional mechanisms.

The first is an arrangement to ensure that international demand expands at a rate equal to the productive capacity. This would require integration of the developed economies with those developing economies whose markets, properly encouraged, could expand fast enough to provide the margin of growth for the system as a whole. The second institutional mechanism involves a series of mechanisms for stabilising the environment of business decisions. These mechanisms would reduce the uncertainty that paralyses investment in long-term and product-specific technologies. It would require a system of 'managed' currency exchanges, which would limit short-term

fluctuations in the relative values of key currencies. The third one would be a system to distribute the expansion of productive capacity among the advanced industrial countries, and between them as a group and the newly industrialised countries. Thus a general program of expansion could appeal to each firm to expand its capacity so as not to cause saturation of the market.

However, Piore and Sabel assert that certain firms and products based on a system of production different from mass production - the system of craft production - not only found market niches, but also grew during the economic crisis. Some of these firms are located, as they point out, in industrial areas like the 'Third Italy' (Tuscany, Umbria, Marche, Emilia-Romagna, Veneto, Friuli, and Trentino-Alto Adige), Austria (in the area around Salzburg), and West Germany (in parts of Baden-Wurttemberg). These regional economies created new products and processes to build markets in speciality steel, precision machine tools, especially chemicals, luxury shoes, medium priced textiles, motorbikes, ceramic building materials, furniture, and industrial instrumentation. The authors argue that the key of the success of these firms relies on the adoption of a craft mode of production or flexible specialisation rather than the mass production of standardised goods. As they put it:

'What is distinctive about the current crisis is that the shift toward greater flexibility is provoking technological sophistication - rather than regression to simple techniques. As firms have faced the need to redesign products and methods to address rising costs and growing competition, they have found new ways to cut the costs of customised production. And the more they have narrowed the gap in cost between mass and craft production, the easier it has become to draw customers away from the formerly cheaper mass-produced goods. Technological dynamism has thus allowed a shift from a purely reactive strategy, aimed at survival, to an expansive strategy, which has threatened to cut ground away from mass production.'

In short, craft has challenged mass production as a paradigm.' (Piore and Sabel, 1984, pp. 207)

Piore and Sabel thus explain that the difficulties to control a market characterised by uncertainties makes economically feasible the adoption of another alternative strategy for the economic crisis in advanced industrialised countries. They assert that such an alternative strategy relies on the revival of craft production which, through the use of multi-use low cost flexible technology, has the potential to adapt more easily to new market demands. The flexibility to adapt turns out to be especially important when shifts in market demand are too small or too costly to justify mass production and the special-purpose machinery required. Thus, to meet the changing market demands there is no necessity to replace the machines or to manually change tools and fixtures, as in mass production. The craft production or flexible specialisation makes use of computer based-technology which has the capacity to re-program equipment that are able to perform new tasks without physical adjustments or high production costs. Contrary to mass production, it combines this technology with a broadly skilled workforce able to deal with changes in production.

3.3 The Alternative Strategy: Flexible Specialisation

Piore and Sabel argue that the nineteenth century saw the collision of two forms of technological developments: the mass production and the craft production. They explain that the 'first industrial divide' occurred when industrialised societies chose mass production over craft production. Such a

'divide' was settled by the exercise of political power and the commitment of large investments in equipment and know how which reflected the interest of those who controlled these resources. The success of mass production technology was not, in this sense, because of its superior economic efficiency in prevailing conditions, but rather due to the resources thrown behind those engaged in promoting and using mass production techniques.

The authors suggest, however, that mass production has always co-existed alongside elements of craft production, especially because giant manufacturing plants filled with dedicated machinery and semi-skilled labour were, in many cases, ill-suited to meet the needs of such specialised markets. Craft production was, in these cases, more adequate because it relied, on the one hand, on general purpose technology and, on the other hand, on a skilled labour force able to work on multi-purpose machines to make specialised products, in limited quantities, for a variety of customers. It follows that the skills of these craftsmen involved not only the knowledge of a sequence of specialised procedures, but also the ability to respond with an appropriate set of tools and techniques to a novel job or circumstance.

For Piore and Sabel, this flexibility of response is the secret not only for the survival of specialised craft production during the nineteenth century, but also for the emergence of a new form of craft production based on computerised equipment, that has the potential to lead to a radical break with mass production. They state, in this respect, that flexible specialisation,

'... is a strategy of permanent innovation: accommodation to ceaseless change, rather than effort to control it. This strategy is based on flexible - multi-use - equipment; skilled workers; and the creation,

through politics, of an industrial community that restricts the forms of competition to those favouring innovation. For these reasons, the spread of flexible specialisation amounts to a revival of craft forms of production that were emarginated at the first industrial divide.' (pp. 17)

For Piore and Sabel the 'second industrial divide' constitutes thus the revival of a new form of craft production, which is perceived by them, as the alternative way to overcome the limits of the system of mass production. The craft production relies on the flexibility of the new information technology which allows the economic production of small batches of goods directed to specialised sections of the market. The flexibility of the technology makes possible speedy changes of output, in response to new opportunities and new needs. New products thus do not require new tools, nor the expensive and lengthy readjustment or reassembling of old ones. Such technology is non-specialised so that new designs and new products are the result of relatively simple changes in the computer controlled programmes that direct the tools.

Flexible specialisation involves the search for permanent innovation; that is, it allows new ideas to be quickly turned into new products. Production is customised, geared to highly specific needs and wants in a constant state of flux. In this sense, Piore and Sabel note that since the division of labour is limited by the extent of the market, the segmentation of markets and their rapidly shifting patterns toward flexible specialisation can lead to a lowering of the division of labour in firms founded on craft production. Customised and short-run production requires neither the large-scale plant and technology necessary to achieve economies of scale (which can be justified only by production in long series), nor does it depend on the unskilled or semi-skilled

detailed worker common in the mass production. Flexible specialisation thus calls for skill and flexibility in the worker as much as for the new technology.

Piore and Sabel give as an example of a flexible specialisation strategy at work, the networks of technologically sophisticated and flexible small manufacturing firms in the central and north-western Italy. They explain that the social upheaval of the 1960s generated a radical decentralisation of production in Italy, that constituted a short-term expedient for employers to regain control of production: '*once the militancy has passed, operations were to be regrouped in the large factories.*' (pp. 226) However, according to them, dependent subcontractors began to federate and started to use their collective capacities to devise innovative products and processes that gave them increasingly independent access to markets. They started to develop sophisticated and design-conscious products, enabling them to penetrate international as well as national markets.

The authors add that this transformation also generated changes in the Italian machine-tool industry due to a growing demand for flexible equipment by small shops. Turin became the centre of small industrial automation and robotics firms, often focusing on the needs of the small-shop sector. Large-firm technologies were adapted in order to automate the artisanal processes (such as firing ceramics and annealing metals), and thus allowed for subsequent modification of product and processes according to changes in the market demand. Leading American equipment makers began, for instance, according to the authors, to market Italian shoe machinery because of its flexibility and adaptability to the increasingly changing market demand.

Piore and Sabel argue, at this point, that flexible specialisation requires the development of a specific form of work organisation and labour deployment. They explain that a firm cannot afford repeated trials to perfect each production run in small-batch production, and thus workers play a critical role in debugging programs or intervening when production goes awry. It follows that skilled worker knowledge is essential for this type of production, particular because employees with broad skills are better equipped to master new responsibilities when firms change product line. Flexible specialisation also requires constant collaboration between management and workers to solve problems that often arise in the execution of the work. Thus the qualification of workers, under an organisation of work based on collaboration between management and workers, involves, on the one hand, the acquisition of craft skill - which is understood as multiskilling - and, on the other hand, the integration between formal technical education and work experience through flexible forms of training. The latter is partly the responsibility of the community institutions, that is, the craft community itself rather than the firm, as in mass production.

3.4 Flexible Specialisation: Skills and Training Implications

Piore and Sabel note that mass production makes use of semi-skilled labour able to operate special-purpose machinery. Many of the skills of such workers *'are trivial - much of what they do can be learned on the job through repetition of their assignment and tips from more experienced co-workers.'* (pp. 85) Workers are organised around an authoritarian system of control over

the work process which embodies narrow job definitions. *'Jobs are broken down into their component tasks: each task is rated on the basis of a list of underlying characteristics - reflecting the required level of dexterity, exposure to hazards, degree of responsibility, and so on.'* (pp. 113) Mass production involves, in this sense, a strict separation between management and workers, which is reflected in both *'the break between conception and execution of tasks, and the highly specialised character of almost all production jobs.'* (pp. 273)

According to Piore and Sabel, this extensive division of labour in mass production made possible the development of two separate institutions for the training of employees: the formal educational system and the firm itself. The authors explain that this separation has not constitute a problem for the development of the skills required by mass production. Rather, as they explain:

'The formal educational system is well adapted to providing potential employees with an abstract understanding of products and production; on the job, their lack of practical experience results in mistakes that are not costly when distributed over the long mass production runs.' (Piore and Sabel, 1984, pp. 273)

The firms, in turn, provide a specialised type of training for the majority of employees. The firms favour this type of in-house training because their production system is based on narrow job definitions which requires firm specific skills. The firms invest on a specialised type of training only for the fraction of employees who require skills which cannot be developed inside the plant. The authors note that, even when firms invest on training for these employees:

'They (the firms) do not fear that workers will take knowledge acquired at the firm's expense and apply it elsewhere. Put the other way around, there is a small danger of the firm's failing to capture the return the return on its investment in plant-specific knowledge.' (Piore and Sabel, 1984, pp. 273)

The authors argue that flexible specialisation, by contrast, cannot rely on what they see as this limited and job-specific training mechanisms. They explain that, as opposed to mass production, flexible specialisation has production runs that are too short and involve inexperienced designers and workers. Designers, on the one hand, must be broadly qualified so that they can envision product and production together. *'Book learning alone does not teach this ability.'* (Piore and Sabel, 1984, pp. 273) Production workers, on the other hand, must also be multiskilled so that they can shift rapidly from one job to another, and can also collaborate with designers to solve problems that inevitably arise in execution. *'With their technical knowledge, the workers are an integral part in the drawing up of a plan, just as they are essential for solving the inevitable problems that arise in its execution.'* (Piore and Sabel, 1984, pp. 117)

Skills are understood, by Piore and Sabel, as craft skills which involve intellectual knowledge as well as participation and collaboration within the whole production process. The authors put it this way:

'Flexible specialisation is predicted in collaboration. And the frequent changes in the production processes put a premium on craft skills. Thus the production worker's intellectual participation in the work process is enhanced - and his or her role revitalised. Moreover, craft production depends on solidarity and communitarianism. Given these conditions of working life in craft production, there is a case for preferring it

to mass production, regardless of the place accorded to unions within craft production.' (Piore and Sabel, 1984, pp. 278)

Piore and Sabel point out, however, that the more broadly skilled the work force, the greater the danger that firms would economise in training costs either because they expect to employ individuals who learned their craft at another firm's expenses, or out of fear that their competitors would do just that to them. As firms' incentives to invest in training decline, it could be expected, as they suggest, that incentives for institutions and individuals outside the firm to invest increase. In theory, as skills become more generally useful, more and more employers would compete to hire well-rounded or multi-skilled workers. This competition has the potential to increase the latter's wage, creating thus an incentive for other less skilled workers to pay for more training for themselves.

Organisations based on flexible specialisation solve this problem by linking the acquisition of skill to the acquisition of a membership in a community of craft workers. Becoming skilled is thus part of a larger process of taking on a certain identity. The identity of craft workers, according to this line of argument, is bound up with their admittance into a group of producers, on the one hand, and with their mastery of productive knowledge, on the other. Piore and Sabel explain that in northern Italy, for example, the family has been used to solve the problem of skill transmission and socialisation. In contrast, countries such as Japan and Germany have institutional methods for providing the combination of education and experience that in Italy is provided by the family-firm. In Japan, they note, the large companies employ highly educated managerial trainees and give them extensive on-the-job

training in production which not always provides enough shop floor experience to anticipate practical problems in design and innovation.

Piore and Sabel also give the example of the German system which uses a highly specialised apprenticeship system. The system supplies a skilled blue-collar labour force with enough conceptual understanding of their work either to progress via formal education into managerial positions, or to communicate easily with managers who come directly from the university. It is the pride in the craft as a collectivity that, for the authors, underlies collaboration among skilled workers and their self-confidence in collaborating with others in this country. They thus resume the issue in the following way:

'Both in the informal family training system of Italy and in the formal enterprise-based training system of Japan and Germany, versatile labour is trained through participation in the production process. In this way, incentives signalled by the market are of secondary importance...The common solution is the fusion of productive activity, in the narrow sense, with the larger life of the community. The same experiences that teach people who they are, teach them which skills to acquire; how to collaborate; and what they may not do in their competition for honour in the community.'
(Piore and Sabel, 1984, pp. 275)

Piore and Sabel assume, in this sense, that flexible specialisation involves no separation between formal education and the productive sector. Education does not constitute an institution detached from the requirements of the economy whereas the firms are not independent entities. Thus educational institutions are perceived as being linked to the requirements of firms, and vice-versa. Based on the example of the Austrian trade union movement, the authors argue that local community structures under flexible specialisation, would be co-ordinated by national social-welfare regulations on which formal

education would provide the technical knowledge necessary to understand the production processes. Training, in turn, would be partly a public responsibility and partly a firm responsibility. As an integral part of the craft production, training would focus on the integration of such technical knowledge within the production processes themselves.

3.5 A Critical Review of the Flexible Specialisation Thesis

The flexible specialisation thesis (FS) prompted a wide debate and discussion. In broad terms, the various critiques (Williams et al., 1987; Murray, 1987, Pollert, 1988) focus on five key premises developed by Piore and Sabel. These are:

- a) The conceptual status of the 'technological paradigm' based on the equation made between a 'system of industrial technology' and a dominant system of production.
- b) The alleged decline of mass production
- c) The alleged decline of mass market
- d) The alleged new skill opportunities created by new technologies.
- e) The extent of the spread of a skill-upgrading strategy of flexible specialisation in firms

This section comments on the papers by Pollert (1988), Williams et al (1987) and Hyman (1988). Pollert argues, in her paper *'Dismantling*

Flexibility' (Pollert, 1988), that the key premises of flexible specialisation (FS) are couched in a complex form of 'post-industrial'⁹ perspective which asserts that the current period of economic uncertainty characterises a radical break from mass production, and brings about the possibility of a 'new industrial divide'. She criticises FS for embracing a radical break. For her, the capitalist search for labour flexibility is far from new. Such flexibility, as she explains, has always been essential to capital accumulation; it creates the elastic commodity of labour power, and allows its extension and intensification in the capitalist extract of surplus value. Capital, therefore, has continuously required flexibility of labour, and the struggle for its control has become part of an historical class conflict.

Today, Pollert argues, labour flexibility remains an area of struggle socially negotiated. Piore and Sabel, according to her, reject an analysis of capitalism as a system based on contradictory class interests, and wholeheartedly support the restructuring of capital by the restructuring of both production and labour. FS thesis reveals, for Pollert, an uncritical and strong convergence in practice between management policies for labour fragmentation and neo-classical policies for labour market deregulation, which place major responsibility for economic recovery on changes in capital and in labour. This focus on labour forecloses perspectives on international

⁹ Pollert (1988) refers, in this context, to the post-industrial perspectives that, inspired by the post-war boom, advocated a radical break from the 'industrial society', rooted on the assumptions of guaranteed growth, general affluence, and satisfaction of material needs. The most influential exponent of these projections, Daniel Bell (1974), held that the break consisted in a fundamental employment shift from manufacturing to the provision of services within a new 'service society', founded on a 'knowledge elite'. Pollert thus argues that the 'post-industrial' emphasis on a shift towards a service society as a radical break, is paralleled by Piore and Sabel's recasting of craft production as the way out for economic recovery not only because it constitutes an economically dynamic production system (opposed to mass production), but also because it is more beneficial for labour.

movements of capital, capital concentration, money markets, the social distribution of wealth, and class conflict.

Pollert criticises another important idea developed by Piore and Sabel which reflects, according to her, a false dichotomy between mass production and craft production. For her, the lack of conceptual clarity of the concepts above enables Piore and Sabel to defend the idea of the decline of mass production, and that the only way to achieve economic recovery involves a process of restructuring of capital and labour within craft production. The adoption of mass production as the dominant system of 'industrial technology' in the 20th-century does not consider, according to Pollert, the different types of technology, their organisation into different systems of production, and different types of labour processes which cannot be confounded into a single paradigm. She argues that large and technologically advanced firms (that Piore and Sabel often identify with mass production) embody a variety of technologies and forms of production that exist depending on the nature of the product market. Pollert points out that differences in productive systems cannot be related to the size of firms or to technologies employed. These differences depend on the nature of the products and the type of customers, which influence in turn the way in which technology is applied - either to mass production or to unit and small-batch production.

Pollert argues that there is no clear opposition between mass and craft production as stated by the flexible specialisation thesis. For her, the existence of empirical evidence indicates that even within some forms of assembly-line production, product diversification takes place without prolonged delays or increased skills. Multi-model and mixed-model lines of production can be

used either to change the products or vary basic models. She thus stresses the capacity of mass production to achieve greater product diversity and responsiveness to market demands that indicate the complexity and contrary directions of production organisation.

Pollert also criticises Piore and Sabel for underplaying the female gendering of most semi-skilled assembly workers. The main focus of FS, she explains, has been on the car industry, and thus neglects the consumer durable industries and the assembly lines in them. Drawing on a number of empirical studies (Glucksman, 1986; Westwood, 1984; Cockburn, 1983; Pollert, 1981), Pollert asserts that the sexual division of labour in manufacturing constitutes a cheaper and more reliable option than machinery for it enables the location of semi-skilled women workers in the labour-intensive production, assembly and packing jobs of the mass production industries. The impact of technology, within this context, is likely to displace and further deskill the work taken by women. Besides, where restructuring takes the form of upgrading to flexible specialisation, she concludes, the labour gains in control over the labour process are also likely to be gendered.

Arguing that product markets have always been a mixture of standardised and differentiated goods, Pollert puts into question another fundamental idea that gives support to the FS thesis - the decline of mass markets and the expansion of fragmented markets for the specialised goods of flexible specialisation production. She stresses that the focus on fragmentation of demand as the root of a mass production crisis, as defended by Piore and Sabel, mistakes cause for effect. That is to say, the search of some industries, i.e. the clothing industry, for new markets by the deliberate cultivation of

finely-tuned consumer tastes is the evidence of a more sophisticated manipulation of mass markets in the face of increased competition, rather than the evidence of a decline in mass production. Fragmentation, according to her, is part of a capitalist marketing strategy to deal with problems of over accumulation which cannot simply be reduced to a crisis in mass production markets.

Pollert asserts that the labour process debate over the skill implications under technological innovation challenges any assertion of dominant trajectory towards the revitalisation of craft skills in flexible specialisation. Piore and Sabel's view of existing changes in manufacturing can be contrasted, according to her, by evidence provided by Shaiken et al. (in Pollert, 1987) that demonstrates that new technology has been used to wrest control from production workers and to further centralise management control. Based on the study conducted by Rubery et al. (in Pollert, 1987) on consumer goods industries, Pollert notes that flexible production is not always achieved through the use of new technology, and where it is, it does not necessarily lead to the creation of a polyvalent craft labour force. The outcomes for labour of shifts to more flexible production, according to her, indicate no clear development towards an upgraded craft revival - they vary, in reality, between continuing dependence on traditional skill, deskilling, skill increases, and skill polarisation.

Pollert also notes that the strength of flexible specialisation lies in its capacity to adapt to changing product markets. This capacity is seen to rest, above all, on multi-skilled labour. The 'flexible specialisation thesis', according to her, tends to neglect the issue of 'numerically flexibility', which

refers to the idea that workers may be insecurely or irregularly employed or may have no formal relationship with the firm at all, as in the case of clandestine homeworkers. She refers to Murray (in Pollert, 1987)) who suggests, for example, that even in Third Italy the artisan sector contains a wide variety of working conditions. Differentials thus exist in skill levels, stability and wages with a pronounced division along gender lines. Casual, low paid, often female labour seems, in these cases, to remain important to achieve numerical flexibility. Flexible specialisation, therefore, overlooks the complexity of capital and labour relationship.

Williams et al, in their article '*The End of Mass Production?*' (Williams et al., 1987), claim that Piore and Sabel employ a notion of mass production that is too monolithic, and thus fail to detect important distinctions and differences. They criticise Piore and Sabel for asserting that the success of mass production over craft production was settled by the exercise of political and financial power that implies that the balance of economic advantage is fairly even. They give the example of the success of the Ford T which was achieved without political and financial sponsorship. The Ford T, according to the critics, combined a number of technological innovations with reduced production costs that offered greater advantage over craft methods, and were used hitherto to produce high priced luxury cars for a specific social class. This case suggests that there never was a choice between mass production and craft production because there was not a viable craft alternative to mass production of complex consumer durables. This explains, according to them, why Piore and Sabel are unable to provide examples of successfully surviving craft production in key industrial areas where mass production developed.

Williams et al dismiss the existence of a dominant paradigm of mass production. They argue that Piore and Sabel fail to recognise crucial variations within mass production that have important implications for the organisation of production in a number of assembly industries, and that create new opportunities for large, medium, and small scale firms. They argue, for instance, that the innovations introduced by Ford were hardly responsible for the spread of mass production in advanced economies. Ford's successors did not generally imitate his product strategy of relying on one long lived model; most assemblers succeeded by making families of inter-related models which were changed fairly regularly.

Williams et al, like Pollert (1988), criticise the argument about the saturation of mass markets by stating that Piore and Sabel, on the one hand, fail to draw a distinction between simple product differentiation and market fragmentation and, on the other hand, provide no empirical evidence to support the argument. They explain that Piore and Sabel's argument focuses on older consumer durables (cars, washing machines, refrigerators) which are mature products with high levels of market penetration. The market for colour TVs in Britain, however, has more than doubled in size over the past ten years because households now buy small screen TVs as second sets. Piore and Sabel ignore, according to Williams et al, that existing mass producers can offer differentiated output by producing families of inter-related products that provide substantial growth in volume and value sales. Producers thus introduce such new products as video cassette recorders, new format cassette players (the 'walkman'), compact disc players, food processors, and so on.

The authors also criticise the optimism with which Piore and Sabel greet the role of the new technology within the flexible specialisation strategy. They argue, like Pollert (1988), that Piore and Sabel overlook the costs and the output potential of specific items of new technology in particular industrial sectors which influence, according to the critics, whether or not to use flexible technology. Based on the case of Flexible Manufacturing Systems (FMS), Williams et al say that evidence shows that the adoption of such a system is expensive, it delivers a limited variety of products, and also needs to be utilised at high volume. The adoption of FMS, therefore, constitutes a sensible strategy if a firm has a substantial workload that offers both the variety necessary to use the technical capabilities of the system and the volume necessary to secure high levels of capacity utilisation. This is, on the one hand, a constraint to their adoption by medium and small size firms, which find themselves at a disadvantage due to the lack of necessary in-house expertise to develop and run a sophisticated custom built system. On the other hand, it indicates that the choice of technology is much more complex than supposed by Piore and Sabel; it depends on the costs of available process technologies, the product strategy of the enterprise, and the markets which are available within the limits of investment in distribution.

Finally, Williams et al criticise the potential that Piore and Sabel place on the new technology to restore an economic system based on craft production. The impact of technological change, contrary to the perspective developed by the 'flexible specialisation thesis', is almost always uneven and, in many cases, the new technology is not used to create a skilled labour force. If technology has one general effect, it is, according to the critics, to reduce the relative importance of semi-skilled direct workers in the manufacturing

labour force. They argue, for example, that the intentions of British managers tend to be disclosed by their interest in a model of labour control according to which an elite of multi-skilled workers, whose training and skills are enterprise or plant specific, and whose privileges as 'core workers' are granted and can be taken away by the company.

Hyman argues, in his the paper *'Flexible Specialisation: Miracle or Myth'* (Hyman, 1988), that the flexible specialisation thesis advocates a route to a new form of accommodation between labour and capital without critically considering the existing conflict of interests between management and workers. Flexible specialisation, for him, embodies a number of contradictions that reinforce, rather than lose, the dominance of capitalism over the labour process. This thesis is based, according to the author, on two contradictory key issues: the restructuring of the relationship between capital and labour, and the consolidation of an internal labour market. As a managerial strategy, flexible specialisation neglects, according to Hyman, the contradictions within the managerial process itself. Conflict and division between capitalist management reflect, on the one hand, diverse ideologies and interests of marketing, production, and personnel staff. On the other hand, they reflect different elements in the production and realisation of surplus value that are in principle incompatible. That is to say, *'for individuals - as for capital in general - there is no "best way" of managing these contradictions, only different routes to partial failure. It is on this basis that managerial strategy can best be conceptualised as the programmatic choice among alternatives none of which can prove satisfactory.'* (Hyman, 1988, pp. 51)

Hyman suggests that advocates of flexible specialisation often portray a polyvalent labour force who, through their willingness to move between jobs and train for new ones, enjoy more secure employment prospects within their company, as well as more challenging and responsible work. The argument above disregards, according to him, the fact that labour control involves both the direction, surveillance and discipline of subordinates whose enthusiastic commitment to corporate objectives cannot be taken for granted. Hyman argues, in this respect, that the discretionary exercise of some form of special expertise can be found in virtually every labour process because it can be valuable for management. But conversely, there are few workers whose voluntary commitment requires no external reinforcement. Within management itself, therefore, conceding greater autonomy (whether individually or collectively), particularly against a background of oppositional relationships, inevitably carries high risks. Shifts in labour management, under flexible specialisation, it follows, stem from this inherent contradiction; solutions to problem of labour discipline aggravate the management problem of consent, and vice versa.

Hyman argues that the delegation to the immediate work group of detailed decisions on organisation and scheduling of production, and responsibility for initial monitoring of product quality, do not negate the overall directive control of management: *'a control which can be applied coercively if self-disciplining fails to yield the required outcomes...delegated management does not equal self-management; nor does an expanded portfolio of competencies necessarily equal enhanced skill.'* (Hyman, 1988, pp. 54) Employees who can perform a variety of routine functions, it follows, are of greater value to capital, but also their own sense of meaning, dignity and

control in work is subject to reveal, contrary to the flexible specialisation predictions, no significant improvement.

Hyman concludes that flexible specialisation underplays the conflict of interests between managers and employers. Increased flexibility in the internal division of labour through the qualification of the labour force reduces, according to him, the general marketability of the worker's skills within the external labour market. In the short term, he explains, the consequence of qualification may be a mutual dependence of employer and worker. Replacement costs of experienced workers may be high precisely because substitutes cannot be obtained from the external labour market without further training. In the long term, however, the relationship is asymmetrical for it is subject to a number of factors, for instance, new products are developed and old lines are deleted, new factories are open and old ones closed. Within this context, the antagonism of interest between managers and workers emerges.

3.6 Summary

A critical review suggests that the deskilling and the flexible specialisation thesis present two alternative perspectives on technological change in the shopfloor which imply specific skill and training outcomes. The deskilling thesis predicts a gradual process of deskilling and fragmentation of the production processes as a result of the adoption of technology. Training practices thus are seen as concentrating on one-time provision of narrow and job-specific skills demanded by the narrowly defined jobs. In contrast, the

flexible specialisation thesis predicts a shift from mass production to a new production system combining multi-purpose flexible technologies with a multiskilled labour force, within a context characterised by greater co-operation, responsibility and knowledge about the production process. Managers are likely to perceive training as an important strategy which enables workers to constantly up-date their skills in the light of both technological innovations and production changes caused by market demand.

Critics (Pollert, 1988; Williams et al, 1987; Hyman, 1988) of the flexible specialisation thesis suggest that this approach is too deterministic for it forecasts a particular form of capitalist development (a shift towards flexible specialisation) without taking into account that both different systems of production and different labour processes cannot be confounded into a single paradigm. These critics indicate that the complexity of the current transformations on work processes cannot only be explained by a dichotomy between mass production and flexible specialisation. Pollert (1987) and Williams et al (1987) suggest that by seeing changes only in terms of a shift from mass production to craft production, Piore and Sabel neglect instances in which these two systems of production can co-exist.

Pollert (1988) and Williams et al (1987) argue, contrary to Piore and Sabel, that some mass production firms can embody a variety of technologies and production systems that offer great product diversity and response to changing market demands. Such product differentiation is achieved, in some circumstances, by the employment of new flexible technologies within large-batch production lines that acquire sufficient flexibility to respond quickly to changing market demands (Pollert, 1988). They argue that even when new

technologies allow this great product differentiation, they do not necessarily lead to the creation of a multiskilled labour force, as advocated by the flexible specialisation thesis. The outcomes for labour can vary between a continuing dependence on traditional skills, deskilling, skill increases and skill polarisation (Williams et al., 1987; Pollert, 1988).

The discussion involving the labour process and the flexible specialisation thesis has shown, so far, that both perspectives tend to underestimate a number of important factors when analysing the technological changes and their skill outcomes in the manufacturing sector. It can be argued that they overlook the fact that capitalism is an inherently dynamic and fragmented process within which forms of work organisation based on mass production and flexible specialisation can exist side by side, and sometimes within the same product market. For instance, as argued by Walker (1992), mass production has not been applied, in some circumstances, as rigidly as suggested by both the flexible specialisation and the labour process thesis. In addition, mass production can demonstrate considerable flexibility through the use of computer-based technologies and different combinations of labour, and still represents an important mode of production at the level of the factory, with continuing relevance to certain kinds of mass production sectors.

In addition, mass production can also combine highly fragmented and deskilled jobs with integrated and skilled ones according to particular factors such as managerial strategies, changing market demands and technological innovations. Wood argues (1992) that mass production, in this sense, is neither Taylorism 'writ large' nor an obvious strategy for problems of work control as assumed by Braverman. It is neither a rigid mode of production

unable to respond to changing consumer demands nor is it basically founded on a semiskilled labour force producing standardised consumer goods through the use of not flexible forms of technology as advocated by the 'flexible specialisation thesis' (Wood, 1992; Walker, 1992).

Thus it can be argued that both the flexible specialisation thesis and the deskilling thesis imply particular patterns of technological change and skill outcomes without exploring the number of conflicting factors informing the actions of managers and workers in any given production process. There might be cases in which managers are in favour of certain technological innovations to reduce and control human input. But, contrary to the deskilling thesis, the combination of factors such as labour resistance and the limitations of technology can lead to the development of new skills, especially when one considers that new technology is not error free. Alternatively, the adoption of new forms of work organisation founded on flexible technology, as reported by Murray (1987) in reference to the artisan sector in Third Italy, does not necessarily imply a move towards flexible specialisation followed by the qualification of the labour force, but can reflect a context which contains a wide variety of working conditions and skill differentials with a pronounced division along gender lines.

It can be suggested, in this sense, that the outcomes that arise from technological changes cannot be taken as clear-cut - either leading to deskilling or multiskilling - mainly because they are influenced by factors like different managerial strategies, market demands, technological advances and labour struggle. Changes in different forms of work organisation can be followed, in some cases, by less skilled and more tightly controlled forms of

work. In other situations, the potential of new technology to require new skills in order to be efficiently used and the role of the workforce in processes of technological change make it possible for some forms of work to retain or even increase their skill content.

It follows that technological changes and their skill outcomes in the shopfloor might be more varied than supposed by both the deskilling and the flexible specialisation thesis. The introduction of the new technology within any production paradigm can lead to some degree of deskilling within some jobs and/or some level of multiskilling within others. Technology, it follows, needs to be seen as a social phenomenon which is influenced by broader corporate goals, managerial strategies, labour struggle and technological advances that can lead to a variety of expected or unexpected outcomes to both managers and workers.

However, it can be suggested that the two theoretical perspectives reflect a number of distinctive features that can also be used in order to analyse technological changes and their skill and training outcomes in the office environment, and in particular, Brazilian offices. The relevance of these two approaches to the main concern of this thesis, that is, the adoption of new technology in Brazilian offices and its skill and training implications, arises from the following facts:

(a) Although both approaches have focused their attention on changes in manufacturing production, they have also stimulated the development of empirical studies which seek to understand the relationship between technology and skills in the office environment.

(b) Although these approaches concentrate on advanced industrialised countries, they provide alternative models of technological change that can provide a theoretical framework for analysing the process of automation in Brazilian offices. More specifically, this thesis aims to explore the extent to which the main arguments presented by these two perspectives can explain whether skills are developed as a result of the introduction of new technology in Brazilian offices, and if so, the type of training provided to office workers.

However, before considering the relevance of these approaches to the Brazilian context, the next chapter discusses a number of case studies that shifted the focus of analysis from the shopfloor to the office environment. These studies apply some of the main arguments put forward by the deskilling and flexible specialisation thesis to the office in advanced industrialised countries. Based on the analysis of these studies, this following chapter aims to develop two alternative models of office automation. These models are used in Chapter 5 as a theoretical framework for the analysis of the process of technological change in the Brazilian office environment.

CHAPTER 3: Two Theoretical Approaches to Work, Technology and Skills in the Office Environment

1. Introduction

The previous chapter described the deskilling and the flexible specialisation theses. It also analysed the main arguments put forward by these two theoretical approaches with regard to technological changes and their skill and training implications on the shopfloor. This chapter applies the main arguments developed by these two perspectives to the office environment. In order to do this, the chapter discusses two groups of case studies which reflect the labour process and the flexible specialisation approaches in advanced industrialised countries.

The first group of studies (Glenn and Feldberg, 1979; Zmroczek and Henwood, 1983; Ahlin and Svensson, 1980; Dy, 1985; Bjorn-Andersen, 1983; Murphree, 1982; Crompton and Reid, 1982; Webster, 1990) is based on the labour process approach. These studies focus on the office as an expression of the capitalist social relations. They are influenced by the historical account of the development of clerical occupations presented by Harry Braverman (1974). They see the current adoption of new technology in various office environments as a managerial strategy aimed to deskill the labour force, and by doing so, enabling managers to increase their control over the office work.

The second group of studies (Attewell, 1992; Appelbaum and Albin, 1992; Zuboff, 1988) reflects the flexible specialisation approach. These studies do not explicitly employ terms such as flexible specialisation or craft production, but they seek to locate the analysis of technological changes in the office and their skill implications into a wider context. They argue that the skill outcomes of new technology are more varied than supposed by the deskilling thesis. These outcomes are thus seen as being influenced by environmental conditions, market pressures, and managerial strategies with regard to both new technology and labour deployment.

This chapter argues that the main arguments developed by both groups of studies point to two alternative models of office automation. These models imply specific patterns of technology, skills and training. They will be used as analytical tools for understanding the process of office automation and its outcomes in the Brazilian context. These models are called in this thesis: the 'technology-driven' and the 'informational' models of office automation.

The 'technology-driven' model draws on the deskilling thesis. It suggests that the adoption of computer-based technology leads to a gradual process of deskilling of the labour process in the office. Training in this context is focused on the development of task-specific skills which allow office workers to use new technology within their limited roles. The 'informational' model reflects the flexible specialisation perspective. It argues that economic, technological and environmental conditions can influence managers to employ new technology as a means of conferring a new kind of flexibility on office workers. This new kind of flexibility requires the

development of new skills. Thus managers are likely to place great emphasis on training strategies aimed at developing what Zuboff (1988) calls 'intellective' skills rather than task-specific skills.

This chapter is divided into two sections. Section 2 focuses on the labour process approach. It begins by describing Harry Braverman's (1974) contribution to the analysis of the labour process in the office environment. Sub-section 2.1 reviews a number of case studies that, influenced by the deskilling thesis, seek to understand the process of office automation and its outcomes within the context of the capitalist social relations. Sub-section 2.2 presents a critical review of these studies, and sub-section 2.3 summarises the discussion. Section 3 reviews three case studies which reflect the flexible specialisation perspective. Two case studies presents evidence of reskilling of office workers, and the third one focuses on the significance of different managerial strategies for skill outcomes in this area. This section begins by describing some of the main features of these studies. Sub-section 3.1 describes one case study undertaken in factory offices which . Sub-section 3.2 focuses on a case study undertaken in the insurance sector, and sub-section 3.3 reviews a study concerned with processes of technological change in the service sector. Sub-section 3.4 develops two alternative models of office automation based on the two theoretical approaches addressed in this chapter, and in chapter 2.

2. The Labour Process Approach

Braverman argues, in *'Labour and Monopoly Capital: The Degradation of Work in the Twentieth Century'* (Braverman, 1974), that the development of the capitalist mode of production during the twentieth century led to a process of degradation of the labour process in the office environment. For him, this process parallels the fragmentation and deskilling of the labour process that took place on the shopfloor because, like manual workers, clerical workers also possessed the craft form of social production. These clerical workers constituted an intermediate stratum, and they carried out aspects of the capitalist function by performing what Braverman calls 'semi-managerial' functions. According to the author:

'Clerical work in its earlier stages has been likened to a craft. Although the tools of the craft consisted only of pen, ink, and writing paper, envelopes and ledgers, it represented a total occupation, the object of which was to keep current the records of the financial and operating condition of the enterprise, as well as its relations with the central world. Master craftsmen, such as bookkeepers, maintained control over the process in its totality, and apprentices learned their crafts in the office apprenticeships.' (Braverman, 1974, pp. 298)

Braverman notes that at the turn of the eighteenth century, the industrial revolution transferred the basis of production from fields and cottages to towns and factories. The expansion of the production of goods and trade stimulated the establishment of more formal administrative offices in order to deal with the increasing amount of clerical and legal work. The office work was thus moved from houses to larger offices which contained only a few

desks separated by a railing from the employer. Clerks had their own desks, and they shared a rudimentary organisation of work which was channelled from points of input through various hands to a checkout for quality, and then output. The work was, most of the time, self-supervising in a sense that employer control was more personal and dependent on workers' personal motivation. This motivation was based on the direct bonds between employers and clerks, and the latter was often encouraged to identify with the former. Such relationships typically involved loyalty and obligation from the clerical staff which, in return, was afforded a measure of leniency and protection from the employer.

Braverman notes that the expansion of the capitalist mode of production during the last decades of the nineteenth century stimulated the establishment of larger companies. These companies adopted a different form of office organisation because of an increase in the number of clerical workers¹ employed. He argues that the atmosphere of mutual obligation that characterised the office of the previous decades was substituted by an impersonal form of managerial control over the labour force in the form of a hierarchy headed by office managers and staffed by unit supervisors and assistants. The all-purpose clerk was thus replaced by a more specialised one concentrating on only one or a few office tasks. Braverman explains such transformation within the office environment in the following way:

¹ The employment of more clerical staff created new occupations which were soon taken by a vast number of low-paid female workers, who needed far less knowledge and training than previous clerks in order to perform their tasks. Thus during 1890 and 1930 there was a large increase of typists and stenographers that was paralleled by a growth in the numbers of bookkeepers, cashiers, and accountants - all higher-status male clerical positions compared to female positions (Delgado, 1979).

'The characteristic feature of this era was the ending of the reign of the bookkeeper and the rise of the office manager as the prime functionary and representative of higher management. Office manager developed as a specialised branch of management, with its own schools, professional associations, textbooks, and methods.'
(Braverman, 1974, pp. 305)

For Braverman, this process of re-organisation in the form of a clear division between the managerial and the clerical staff was possible because managers applied Taylorist methods and procedures of work organisation to the office work. The outcomes were twofold; on the one hand, the adoption of a Taylorist form of office organisation led to a process of fragmentation of tasks and, on the other hand, increased managerial control over the production process in the office. The author asserts that the application of Taylorism to the office was stimulated by William Leffingwell, who published in 1917 the work entitled *'Scientific Office Management'*. In this work, Leffingwell advocated the application of the Taylorist 'principles of scientific management' to the standardisation and rationalisation of the office work. He argued, according to Braverman, that the growth in the size of the office was a major factor demanding new and increased forms of managerial control. These forms of control were thus seen by Leffingwell as the major tool against an expansion of inefficiency and chaos expected to be caused by the enlargement of the various offices.

Braverman explains that the fragmentation and rationalisation of the office work advocated by Leffingwell aimed both to fill the clerical workday with activities linked to pre-determined tasks and to eliminate managerial time spent on co-ordination and communication within the various levels in the

office. In order to achieve these goals, Leffingwell proposed the break-up of the arrangements under which each clerk used to perform his/her own work according to the previous traditional methods, independent judgement, and light general supervision. Work was, henceforth, to be carried on as prescribed by the office manager, and its methods and time duration were to be verified and controlled by management on the basis of studies of each job. According to Braverman, Leffingwell compared the rationalisation of the office work to the same process in the factory by arguing that:

'Time and motion studies reveal just as startling in the ordinary details of clerical work as they do in the factory. And after all, since every motion of the hand or body, every thought, no matter how simple, involves the consumption of physical energy, why should not the study and analysis of these motions result in the discovery of a mass of useless effort in clerical work just as it does in the factory?' (in Braverman, 1974, pp. 307)

Braverman asserts that this Taylorist approach to the office work was reinforced by Lee Galloway who published at the beginning of this century the work entitled '*Office Management: Its Principles and Practice*'. In this book, Galloway stressed that the purpose of the office was the control over the enterprise, and the purpose of the office management was the control over the office; as large companies grow, he advocated, the greater the importance of managerial control over the execution of clerical activities. For Braverman, Galloway best expressed his ideas in favour of managerial control over clerical workers by saying that

'Execution implies control - control of the factory organisation - control of the financial organisation - control of the marketing organisation. It is the work of the office

organisation, under the supervision of the office manager, to devise records, methods, and systems for carrying out the function of control and for co-ordinating the activities of one department with those of another....Orders must be given to employees by managers, and reports of work performed must be recorded...As a means of knowing the capacity of every clerk, and also as a means of spurring him to even better efforts, the planning department keeps daily records of the amount of work performed by each clerk and his relative efficiency. The keeping of such records alone has been known to greatly increase the efficiency of many offices.' (in Braverman 1974, pp. 306, 308)

Braverman thus argues that both the adoption of some multiple-function machines (like typewriter, calculating machines and telephone) and the adoption of the 'principles of scientific management' led to a process of reorganisation of the office work within which clerical work was to be carried on as prescribed by the manager, and its methods and time duration were to be verified and controlled by supervisors on the basis of detailed job studies. Office tasks were thus broken up into sets of routine tasks that were distributed among specialist workers separated by location and status. Physical rearrangements eliminated wasted motion. Managers took over the 'semi-managerial' activities of clerks, leaving the detailed work for the office staff while performing activities of supervision and control of the work.

According to Braverman, the clerical labour process parallels, in this way, that of the skilled manual workers - conception is separated from execution through rationalisation and fragmentation of the office work according to which clerical workers lose control over their own sphere of work without any exercise of discretion or independent judgement. Clerical workers were prevented from gaining an overview of the total work process,

thus necessitating an external co-ordination which was supplied by managers. The latter devised a work plan to be implemented by supervisors, who divided the work load and saw that the production requirements were fulfilled. The clerical work became a set of routines and procedures less and less dependent on a skilled clerical staff. As a result, two distinct occupational hierarchies evolved in the office - the managerial staff involved with both control and conceptualisation of work or mental work, and an increasingly deskilled clerical staff formed by file clerks, typists, stenographers and secretaries performing manual work.

Braverman explains this process of reorganisation of the clerical work based on Taylorism in the following way:

'From the beginning, office managers held that all forms of clerical work, not just routine or repetitive ones, could be standardised and 'rationalised'. For this purpose they undertook elaborate studies of even those occupations which involved little routine, scores of different operations each day, and the exercise of judgement. The essential feature of this effort was to make the clerical worker, of whatever sort, account for the entire working day. Its effect was to make the work of every office employee, no matter how experienced, the subject of management interference. In this way, management began to assert in the office its hitherto unused or sporadically exercised right of control over the labour process.' (Braverman, 1974, pp. 309)

According to Braverman, the development of computer-based technologies allowed computers to be used for large-scale routine and repetitive operations which were to some extent already performed mechanically (for instance, payrolls, billing, accounts, inventory control). He

notes that this technology was later applied in new tasks like sales reports, market research information, and sales commissions, which further stimulated the technical division of labour in the office. He argues, therefore, that as in manufacturing, technology itself was not responsible for the fragmentation of tasks, routinisation of work and deskilling that took place in the office. For him, technology was used as part of a managerial strategy seeking new forms of labour control and increased profits. Its introduction, therefore, was paralleled by the development of a new division of labour that reduced even more the craft component of the clerical worker. He explains this process by arguing that:

'Each aspect of computer operations was graded to a different level of pay frozen into a hierarchy: systems managers, systems analysts, programmers, computer console operators, key punch operators, tape librarians, stock room attendants, etc. It soon became characteristic that entry into higher jobs was at the higher level of the hierarchy, rather than through an all-round training. And the concentration of knowledge in a very small portion of the hierarchy became the key here, as with automatic machines in the factory, to have control over the process.' (Braverman 1974, pp. 329)

Braverman makes explicit that during this process of degradation of clerical work, technology was used in conjunction with, and as a supplement to, a Taylorist form of work organisation. He thus discusses the introduction of technologies in the office not in terms of a technological breakthrough because he sees technology as being subordinated to the capitalist mode of production. He perceives technology as an important part of organisational rearrangement of the office work which allows further degradation of the clerical work according to the principles of scientific management, that is, the

maximum possible control of labour through: fragmentation of tasks, routinisation of jobs, and loss of the craft skills among clerical workers. The capitalist mode of production, therefore, is able to achieve its main goals:

- (a) Reduce labour costs² through the substitution of skilled by semi-skilled clerical workers.
- (b) Increase of managerial control with a parallel loss of clerical workers' skills and autonomy, which indicates to a process of deskilling of office workers in the long-run.

2.1 Labour Process Studies of the Office Work

The historical account of the development of clerical occupations presented by Braverman stimulated a number of studies largely concerned with the capitalist social relations in the office environment in advanced industrialised countries. These studies focus on the introduction of computer-based technologies like word processors, electronic data-processing systems or on-line systems and its implications for office workers in various sectors. In broad terms, there are two kinds of studies.

Some of these studies (Glenn and Feldberg, 1979; Ahlin and Svensson, 1980; Zm rozek and Henwood, 1983; Bjorn-Andersen, 1983; Murphree,

² Braverman explains that computer technology also has the effect of reversing the traditional profile of office costs in favour of capitalism in the sense that costs of operating an office shift from salaries paid to clerical workers to purchase of new equipment.

1982) seek to counteract the criticisms raised against the work of Braverman by providing evidence that supports his analysis. Other studies (Crompton and Reid, 1982; Downing, 1982; Webster, 1990) are supportive of his work, but argue that some of Braverman's ideas could be further refined, in particular the argument which points to a gradual process of deskilling of clerical workers. These studies argue that deskilling, although a powerful trend, is not an unilinear process as stated by Braverman because it is subject to factors such as workers' resistance, as well as the differences regarding the various roles performed by clerical workers. All the studies, however, share the same basic argument developed by Braverman; that is, technology is subordinated to capitalist goals. It is seen as being used by managers as a means of deskilling and fragmenting the labour process in the office, and thus both enhancing managerial control over the labour process and increasing the productivity of the labour force.

The empirical study undertaken by Glenn and Feldberg (1979) represents the first attempt to analyse technological changes and their implications to the labour process based on the deskilling thesis (Wood, 1982). The authors conducted a study in five different insurance companies in order to explore two issues:

- a) whether or not more routine and fragmented jobs had been created as the result of the introduction of new technology
- b) the skill outcomes of new technology

The authors conclude that almost the entire staff and much of the managerial and professional staff had their work affected by the introduction

of computers, and the degree of changes varied according different occupations. They suggest that automation, as far as the clerical staff was concerned, brought about further fragmentation, routinisation and deskilling of the content of the clerical work. This process was accompanied, in turn, by organisational changes towards more rationalised forms of managerial control over the labour force.

In regard to some office workers, Glenn and Feldberg argue that before the introduction of the on-line system in some firms, each clerk used to provide customers with information on a specific area, such as sales, bills, and so on. Each job was specialised and a customer call had to be referred to several clerks before a complete answer was given. The authors note that the new computer-based system involved a process which centralised information into computer terminals, and that this centralisation made possible access to all aspects of the work to certain clerks. However, they argue that although the job content of these workers became broader in scope, their work also became more closely monitored because the system could provide a tally of all information that they processed to managers. In regard to other office workers, the adoption of new technology allowed the reorganisation of some jobs around the capabilities of computers to capture, process and store data. As a result, specific jobs for capturing, processing and storing data were created. For the authors, the performance of these activities precluded the use and maintenance of a full range of skills previously acquired. They argue that the on-line system required workers with task-specific skills, which suggests that clerical workers' old skills were made trivial and opportunities to develop new skills were reduced. They explain this process of deskilling of the office work by arguing that:

'Such traditional specialities as stenography and book-keeping, which required extensive training, have been displaced or simplified beyond recognition. The skills now required are more mechanical, as in the operation of a machine, lower level, as in typing addresses on automatically typed correspondence, and/or more technically narrow, as in the administrative support centre.' (Glenn and Feldberg ,1979, pp. 61)

Glenn and Feldberg also argue that the specificity of the jobs created, allowed managers to reorganise the work according to standardised procedures and within a specific time. For the authors, this rationalisation of jobs combined with the absence of mental activity made their performance more physically and psychologically demanding. Thus clerical workers started to experience greater pressure to work quickly, accurately, and to maintain the pace set by the machines. Managers, in turn, focused on such behavioural qualities as office workers' 'patience' to deal with the increased pressure, rather than concentrating on the development of new skills that could allow these workers to deal with difficulties caused by the system. The authors assert that forms of personal control were thus created by managers and implemented by supervisors. Supervisors, according to the Taylorist principles of work organisation, devised the work load of each employee in order to guarantee that production requirements were fulfilled by the clerical staff.

The authors also argue that changes in the work process and in the forms of managerial control transformed the relationship between supervisors and office workers, and between those among lower levels. Supervisors started to become distant from workers due to their activities aimed at controlling and enforcing rules set up by managers. Workers, in turn, did not

identify themselves with supervisors. In addition, the physical separation of the office into units increased the separation between individual workers, and communication between them was established through clerical units. As a result, it became difficult for individual workers to know what those in different units were doing, and whether they shared the common conditions and occupied comparable positions in the hierarchy.

The authors also note this process of rationalisation of the office work led to what they call the 'feminisation' of certain jobs. Glenn and Feldbeg argue that certain jobs changed from being classified as suitable for men to be more appropriate for woman. They thus anticipate a polarisation of skills between a highly trained group of professional workers performing jobs involved with capturing, processing and storing data - predominantly male workers - and a less skilled group of workers performing lower-level jobs like stenography, typing and bookkeeping - mainly female workers. The authors argue that this polarisation results from a tendency among managers to see that the technical knowledge involved in the activities considered to be most 'suitable' for woman is no longer required since this knowledge is absorbed or transferred to the computer. Opportunities for upward mobility for these female workers are, according to them, further curtailed by the establishment of this skill differential.

Glenn and Feldberg conclude that the introduction of computers in the firms studied was used as a managerial strategy to increased control over the labour process. Such control was achieved through further rationalisation and deskilling among clerical workers, in particular female workers. The authors explain this process in the following way:

'Remove the very feature that once made clerical work interesting, attractive, and of higher status. At a more abstract level, the changes alter the relationship of the workers to their work, to each other, and to management. As managerial decisions are substituted for workers' decisions, the work force becomes an 'inert' collection of bodies mechanically related to a set of materials and sustained in motion by external force. Managers' greater control is control over the transformed work force: less knowledge, less involved, less committed, and therefore, less able and willing to respond to variation.' (Glenn and Feldberg, 1979, pp. 71)

An empirical study conducted by Zmroczek and Henwood (1983) also suggests that further methods of fragmentation and rationalisation of work are developed as a result of the introduction of new information technology in the banking sector. They argue that such a process of rationalisation and fragmentation reduced the intellectual content of jobs and left clerical workers with less knowledge about the overall production processes than before. They thus anticipate, like Braverman, that most advanced stages of office automation will have the following implications:

- (a) They are expected to generate further loss of skills among office workers since their knowledge is transferred to the technology.
- (b) They are expected to further standardise and routinise the clerical labour process, which is likely to increase monotony and boredom in the office environment.

A similar argument is presented by Ahlin and Svensson (1980). Based on a case study conducted in three different insurance companies the authors suggest that deskilling often follows the current application of new technology

in that much of the expertise of clerical workers tends to be transferred to the technology. They argue that the knowledge and work experience are, in this sense, extracted from the worker and stored in the computer. For them, '*when a computer enters an office it creates a direct threat to the position and skills of many clerical workers.*' (Ahlin and Svensson, 1980, pp.4) They also point out that this process of deskilling tends to be paralleled by further fragmentation of tasks and routinisation of the office work which has been generally performed by female clerical workers. A study conducted by Dy (1985) also indicates that the deskilling of female clerical workers through the transfer of their skills and expertise to the computer within commercial firms is a long-term trend. She suggests that the content of lower-stratum jobs held by women is unlikely to be enriched by the introduction of new technology in the future. Rather, she argues that because managers tend to assume that the most effective way to assure a depth of skill in one area is to restrict the overall range of skills, they design jobs that favour a process of fragmentation of tasks characteristic of the Taylorist 'principles' of work organisation.

According to a study conducted by Bjorn-Andersen (1983) about secretaries and clerks in the baking sector, the introduction of new technology in the office environment allowed managers to design increasingly inflexible jobs so that the various aspects of a task fit together. They argue that in order to achieve this goal, the adoption of technology in the firms studied was followed by the fragmentation and rationalisation of the work of secretaries and clerks, and thus created a context in which less and less knowledge, autonomy and judgement was required by managers from clerical workers. The result of this process of rationalisation led, for Greve (1987), to the creation of boring jobs with limited scope for further learning and clerical

worker's initiative. For her, the introduction of new information technology characterises a labour process in which clerical workers lack understanding of the overall production processes, and thus lose operational efficiency and job satisfaction.

Murphree (1982), analysing the effect of word processing (WP) on secretarial jobs, affirms that secretaries had their jobs broken down into component parts when computers were first brought into the offices studied. As a result, according to the author, '*one woman does electronic filing all day, another handles correspondence all day, another types all day, one answers the phone all day, and so on.*' (Murphree, 1982, pp. 45) The re-organisation of work also led to the creation of special departments within which the work-flow became centrally monitored and co-ordinated by managers. The rationalisation of jobs combined with a new form of centralised control reduced, for Murphree, the level of such secretarial skills as speed stenography and typing, as well as increasing managerial control over their activities which could be constantly monitored.

Crompton and Reid (1982), following Braverman's argument, contend that the constraints and requirements of the capitalist mode of production result in a tendency to further deskill the clerical work. However, they suggest that Braverman's concept of deskilling is capable of more refinement. They argue that deskilling involves not only the fragmentation and routinization of the clerical labour process, as Braverman implies, but also the progressive elimination of elements of the 'semi-managerial' forms of clerical control. The loss of control refers, according to the authors, to the earlier generation of clerical workers that used to perform 'semi-managerial' functions, and thus not

only incorporated the clerical labour process, but also aspects of the function of capitalism as managers.

Analysing the impact of the introduction of electronic data-processing (EDP) on the tasks of clerks working on a local authority payroll, the authors note that such technology had a substantial deskilling effect on the craft nature of clerical workers at two levels: as craft workers and as clerks performing capitalist functions. They argue that although rationalisation and fragmentation began well before the first introduction of computers, these imposed further fragmentation and new forms of internal control on operations which had once depended on the experience and knowledge of clerical workers. For them, technology absorbed both the clerk's knowledge of the work process and his/her ability to exercise discretion to make decisions and control the performance of the work (the 'semi-managerial' functions). Crompton and Reid explain, in this respect, that:

'Previously, the clerks had specialised knowledge and had dealt with a particular area of work in its totality, which ensured both interest and individual expertise. The central role of the computer seemed to deny employees the chance to see the work process through from the beginning to the end...The clerks at the lower levels of the hierarchy saw these new jobs, accurately enough as dead-end. There was limited prospect of promotion, especially for female workers, and no strong link between clerical workers and the managerial staff in the higher strata, the latter being increasingly recruited on the basis of qualifications rather than seniority or acquired knowledge and experience.'
(Crompton and Reid, 1982, pp. 170)

Computerisation coupled to recruitment policies favouring unqualified staff (since the clerk's knowledge was absorbed by the computer) created, according to the authors, a large stratum of low-grade workers - predominantly

women - working mostly to a pace and procedures that extended the division between those executing the work and those making decisions. The authors argue, therefore, that the use of EDP made possible a process of skill polarisation among clerical workers. As they explain,

'The "feminisation" of clerical employment has marked a recognition of the creation of posts which consists of tasks overwhelmingly bound to the performance of machinery. The basis for career mobility has further marked the separation of a trained, qualified and relatively privileged stratum of managers, professional and technical experts from the mass of clerks performing repetitive and highly restricted tasks as "servants" to the computer.' (Crompton and Reid, 1982, pp. 173)

The authors also argue that Braverman considers in insufficient detail the possibility of any clerical workers' counterbalance or reaction to managers strategy of deskilling. For Crompton and Reid, the reduction of motivation among the clerical staff in the office studied was seen as a means to counteract the process of deskilling of this work place. They explain that the lack of motivation poses negative consequences for the improvement of clerical productivity that has, in turn, the potential to undermine the managerial strategy of labour control through rationalisation and fragmentation. They conclude that, contrary to Braverman's assumption that deskilling occurs despite technological advances; different technologies can open various possibilities for work organisation in the office that may even lead to a process of reskilling. As they explain:

'The introduction of on-line...may provide the opportunity or impetus to reverse the deskilling of clerical work to interact with the machine at his or her own discretion rather than being tied

to unvarying deadlines, as is the case with batch systems. It also revives the possibility that the clerk may be able to follow through the total work process by regaining direct and immediate control of the data during all parts of its processing. As yet it is too early to judge what this second phase of automation will mean to the clerical worker.' (Crompton and Reid, 1982, pp. 177-8)

Following this line of argument, Downing (1982) reports, based on a study on the use of word processors in a bank, that technology is used as a means of extending and reinforcing the gradual process of deskilling. However, contrary to Braverman's idea that managerial strategies regarding technology are likely to succeed, she argues that effects of centralised forms of work organisation aimed to reduce the skill content of jobs and increase labour control, may prove to be counterproductive for managers. She explains that in the firms studied, a central wordprocessing centre was established, workstations were laid out in rows with about two square feet of space between each of the 110 mainly female operators, and a system of labour control was developed. For instance, operators' movements in and out of the room became strictly controlled by supervisors, and maximum productivity was sought by specifying the amount of work to be accomplished by each worker. The bank management combined this discipline on the movements and actions of operators with a systematic monitoring of their productivity through devices in the equipment.

The author notes that this intensification of the work process increased the tension among operators as they pushed themselves to increase output. The operators thus developed forms to resist the pressure caused by the technology by, for example, erasing computer tapes, and by doing so, preventing certain

bank deadlines being met. She argues that a consequence was that managers soon became aware that productivity could decline, and that there was a need for them to rethink their approach to the organisation of work around the word processing system. However, according to Downing, the managerial search for solutions regarding the attitude of office workers is likely to involve no change to job content but even tighter forms of supervision of the operators' work.

Based on a study about the use of word processing technology in a variety of organisational settings, Webster (1990) criticises Braverman for asserting that the adoption of technology is automatically followed by a process of work reorganisation characterised by further fragmentation of tasks, routinisation of jobs and deskilling. She argues, however, that by seeing Taylorism as an incipient and inevitable managerial strategy following the introduction of technology, Braverman oversimplifies the technical division of labour that, for instance, differentiates the secretarial from the typist labour process.

Based on her study, Webster argues that technology was associated with a variety of changes in job content and work organisation, which reflected a managerial concern with costs regarding the reorganisation of the work in the offices studied. According to her, this reorganisation of the office work was seen by managers as a time-consuming and a costly process which could only be justified if it could provide significant savings in production costs. As a consequence, the introduction of word processors in the companies surveyed caused no reorganisation of office procedures as far as secretaries and typists were concerned.

In the case of secretaries, she observes that the functioning of the office remained substantially the same, and the introduction of word processors (WP) generated no alteration in the content of the jobs performed by secretaries. She explains that in these firms, technology was introduced into an existing pattern of work organisation that involved a relatively wide range of tasks, and thus allowed for the exercise of secretaries' discretion over when and how tasks were to be executed. Here job content remained the same. Secretaries continued to perform such tasks as answering the phone, dealing with queries of staff and customers, elaborating letters and reports, and organising the boss's diary. The major effect caused by WP was that it increased the workload of secretaries mainly because managers started repeatedly to send work back for minor alterations.

Referring to the work of the typists, the author contends that the use of WP increased the rate of repetition by eliminating the waiting time associated with the magnetic card machines and the handling of papers (as it was done before the WP). Clearly, however, *'it did not institute the work fragmentation initially though and therefore represented no qualitative change. In fact, it merely replaced one form of monotony with another - that of constant keying in.'* (Webster, 1990, pp. 56) According to Webster, technology was introduced into an existing pattern of work organisation that already involved a deskilled job content. It follows that, in this case, no restructuring or organisational change took place upon the shift to WP. She also notes that the lack of organisational changes following the adoption of technology was reinforced by a managerial concern with costs.

The key point for Webster is the degree of complexity of the tasks accomplished by the different workers. Where tasks were complex, the introduction of new technology was unlikely to result in a deskilling of job content. Where tasks were already routinised then word processing jobs required no more skills than the typing skills that they had replaced. Webster differentiates the secretarial from the typist labour process by pointing out that the former has responsibility for the entire process of text production, like printing, collating, filing and distributing typed copy.

She argues that the content of the work of a typist is more narrow than the content of a secretarial job. By definition, the author suggests, typists are both restricted to the output of a text, and are often physically restricted in the typing pools. Therefore, they do not have built into their job, the gamut of administrative tasks that secretaries have. It follows that, in the case of the typists, the word processing technology aimed to capitalise on processes already set in motion, or in other words, it was introduced without parallel changes in an already fragmented and routinised typing process. The author also points out that in order to cope with the boredom of the work, typists developed practices like making endless shopping lists, stopping work every few minutes for chats with work mates, or constantly going to the canteen to get a 'decent cup of tea'. Webster concludes that:

'These case studies suggest that, far from WP having one uniform impact on all categories of typing-related office work, several different labour processes result, from highly integrated jobs containing a variety of whole tasks to tightly fragmented ones made up of partial operations. Many of the women who I interviewed recognised the point that the impact of the machinery was inextricably bound up with the structure and content of their own jobs...It seems misleading to

make blank pronouncements about the impact of this technology without considering the divisions of labour within which it is embedded. The distinction between secretarial and typing work, and also the different degrees of the technical division of labour applied to the latter category, seem crucial for an understanding of technological change.' (Webster, 1990, mpp. 57-8)

2.2 A Critical Review of the Labour Process Studies

The labour process studies discussed in the previous sub-section constitute an important starting point for the analysis of the technological changes and their skill implication within the office environment. By moving the focus of analysis from the shopfloor, they do provide evidence that the adoption of new technology in some offices is followed by a process of fragmentation of tasks, rationalisation of work and deskilling of office workers.

However, it can be argued that these studies suffer from some of the same weaknesses embodied in the deskilling thesis. These are:

- a) They imply an over deterministic perception about the office and its activities.

b) They overemphasise the managerial capacity to achieve its own goals, and thus minimise the potential for office workers to counteract deskilling in the office.

c) They see deskilling as an unilinear tendency in the office.

Firstly, the labour process studies (Glenn and Feldberg, 1979; Crompton and Reid, 1982; Zm rozek and Henwood, 1983; Webster, 1992) assume that work in the office is similar to work in the shopfloor, and by doing so, they perceive the outcomes of office automation as similar to those in the manufacturing. These studies see the office and its activities as being homogeneous, and hence being completely subject to routinisation through the adoption of a set of pre-determined rules. Office activities are discussed as the inevitable product of a permanent and inflexible Taylorist work organisation based on procedures that need to be followed, as on the shopfloor, so that interruptions in the work process do not occur.

However, as noted by Hirschheim (1985), labour process studies neglect the fact that offices are not isolated entities, but bodies that interact within a larger organisational context through procedures, contact between individuals and co-ordination of different functions within such an organisation. He notes that the office is not a static structure shaped by the rigidities of a Taylorist work organisation. But is an environment that embodies interpersonal and, to a certain extent, flexible interactions that can supersede divisions among departments, sub-units and different individuals. It follows that office activities or tasks are largely the product of social interaction between the different individuals within the this environment. Office work, unlike the

shopfloor, denotes a wider assortment of functions in which office workers perform different activities that can, in some circumstances, supersede the specific functions designated to each employee. Office workers can perform structured and pre-determined activities, but these can also be subject to modification as managerial strategies change or unexpected problems arise. For instance, Bullen, Bennett and Carlson (1982) whose arguments are based on research about secretaries and their activities, say that although secretaries have specified activities, they also perform unstructured tasks which require discretion and initiative. They argue, in this respect, that:

'It is clear that much of the secretarial workload consists of tasks initiated by the secretary, contrary to the conventional stereotype that secretaries carry out highly structured tasks at the direction of the persons supported. We found that secretaries typically spend more than half their time working on self-initiated tasks, and department secretaries spend from 10 per cent to 50 per cent of their time in such activities.'
(Bullen, Bennett and Carlson, 1982, pp. 359)

Secondly, it can be argued that the labour process studies minimise the role of office workers in processes of office automation. The studies conducted by Zmoroczek and Henwood (1983), Bjorn-Andersen (1983) and Ahlin and Svensson (1980) do not consider the possibility of office workers to resist the automation and deskilling of their activities. The case studies presented by Crompton and Reid (1982), Downing (1982) and Webster (1992) imply that some office workers understand that their work has been degraded, and hence develop ways of resisting the effects of automation (such as taking long breaks, erasing work). However, these authors do not explicitly consider this resistance as a means of counteracting the process of deskilling in the office, because they assume that managers inevitably achieve their own goals -

that is greater productivity in an area which, by comparison to the shopfloor, has often been characterised by low productivity increases.

Studies on office automation undertaken by Knights and Sturdy (1987) and Cox (1989) contradict this assumption about the inevitability of managerial intents. These studies suggest that in many firms studied, managers sought to increase the productivity of office workers by adopting a set of rules and procedures, and thus limit workers' input. They note that in some firms, the adoption of new technology required managers to adopt strategies aimed to develop new skills so that technology could be used efficiently by employees. Bowen (in Long, 1987), in a similar research, also shows that unlike factory automation, the gains that managers expect to achieve through the use of new technology in this environment, are difficult to realise because the automation of office activities often requires investments on training in order to develop a skilled workforce.

The major problem, as far as productivity is concerned, as argued by Hirschheim (1985), is the fact that managers and systems designers often focus their attention upon the hardware rather than on the human input necessary to utilise the new technology sensibly. These managers and designers constantly overlook the fact that office automation also requires a more qualified labour force, especially because the use of new technology can create more complex jobs, -which require skilled individuals to handle unexpected problems or situations. Hirschheim argues that, in some cases, companies soon realise that the efficient use of the new technology requires skilled office workers, and that broader forms of training need to be developed.

Thirdly, by assuming that management always achieve its goals, the labour process studies see the introduction of new technology as leading to only one skill outcome - the gradual deskilling of office workers. However, as argued by Attewell (1992), the adoption of new technology has different implications for the various types of office workers. For him, skill outcomes in the office are influenced by two factors, On the one hand, they depend, to a considerable extent, on the politics within the office environment. On the other hand, they are also influenced by unexpected difficulties or events during and/or after the process of implementation of new technology which point to a need for skilled employees. He thus see the generation and distribution of skills under a process of office automation as being a much more dynamic process than supposed by the labour process approach. As it is put by Attewell:

'The implications of these criticisms of the deskilling thesis is that new production technologies do not have a single, across-the-board effect on skills. Different production technologies will have very different impacts on skills. And, most importantly, identical technologies can be and are implemented in a variety of ways, some of which enhance skill, whereas others deskill. Tasks may be grouped to make simpler or more complex jobs; workers may be given discretion.' (Attewell, 1992, pp. 54-5)

Castells (1989) makes a similar argument by suggesting that the skill implications of new technology are more varied than supposed by the deskilling thesis. He argues that office automation has a varied effect among the range of office workers that largely depends on the product of the industry as well as on the management of an industry at a particular time. It can have

the following effects: it can automate and deskill the lower end of clerical jobs while higher-level operations become concentrated in the hands of clerical workers who acquire a number of new skills and have their autonomy increased. Based on the discussion of a number of empirical studies focused on the insurance sector, the authors explain the skill outcomes in the office in the following way:

'While at the bottom of the process there is increasing routinisation and automation of data entry, at the middle-level, there is reintegration of several tasks into an informed decision-making operation, generally processed, evaluated, and performed by a team made up of clerical workers with some level of autonomy in reaching their decisions...Thus office automation instead of simply rationalising the tasks (which was characteristic of the first phase of batch-processing automation), actually rationalises the process, because the technology allows the integration of information from many different sources and its redistribution, once processed, to different decentralised units of execution.' (Castells, 1989, pp. 140)

A similar trend with regard to skill outcomes has been observed in a study conducted by Hirschhorn (in Castells, 1989) in banks. He notes that the introduction of new technologies in the organisations studied led to the upgrading of the work content of a small number of office workers, who were retrained into the business of selling services to customers. A study undertaken by Baran and Teegarden (in Castells, 1989) on the insurance sector also provides evidence that contradicts the idea that the use of new technology leads to an unilinear deskilling tendency. The authors argue that the first stage of automation in this sector tended to increase office fragmentation, centralise production by narrow functions and made many routine keyboarding functions

disperse into the organisation. More recently, as they point out, the greater sophistication of the new technology and the transformed market conditions in this sector dictated a new form of work organisation that reversed many of the earlier trends. In many cases, office automation led to the reintegration of many occupations; workers became integrated into divisions which served a particular subset of customers. Such integration caused the qualification of office workers who became responsible for all transactions involving particular customers.

Also analysing the case of the insurance industry, Appelbaum (in Castells, 1989) argues that the introduction of new technologies in offices located in this sector generated varied skill outcomes. According to her, on the one hand, unskilled data entry jobs were eliminated as a result of automation. On the other hand, the remaining clerical positions were reskilled by integrating their tasks into multidimensional jobs susceptible of greater flexibility and adaptability. The skills needed for such positions required no specific form of training, but they required high general literacy, verbal communication skills, and an aptitude for arithmetic. Other professional jobs also upgraded clerical workers who became involved in highly specialised tasks that required formal education, generally on the basis of a college degree. She explains that this process in the following way:

'The resulting configuration of jobs vary from firm to firm... The gap between the skills of clerical workers and those of professionals has widened despite the elimination of unskilled clerical work such as coding and sorting mail and much filing, and the reduction of routine keyboarding. Skill requirements for clerical workers have increased at the same time that jobs have become overwhelmingly dead-end... Office automation has wiped out thousands of

low skilled clerical workers, created new jobs for skilled clerical workers, and eliminated many professional jobs that comprised the middle of the occupational distribution.' (in Castell, 1989, pp. 196)

2.3 Summary

Labour process studies assume that the same process that has degraded labour in the shopfloor also rationalises and deskills labour in the office. They suggest that technological changes in the office environment result in a steady degradation and simplification of work, which leads to an unilinear erosion of office workers' skills. Thus for the majority of office workers, work becomes limited to executing a set of pre-determined routines and procedures laid down by systems analysts and managers.

It can be argued, based on the critical analysis of these studies, that the labour process approach implies a specific model according to which to the automation of the office is seen in terms of deskilling of office workers. This approach thus implies a specific pattern of technology, work and skills, without considering the complexity of the office environment. It does not take into account the possibility for alternative forms of work organisation and labour deployment, which could involve the development of new skills as well as the reintegrating some jobs previously fragmented.

Critics (Castells, 1989; Attewell, 1992) have argued that technology has no uniform skill outcome across the whole range of office activities as

advocated by the labour process. Office automation allows the integration of certain activities which demand new skills while decreasing the content of others, and thus cause deskilling in certain occupations. Office workers, in some circumstances, also have the possibility to access information (through computer-integrated systems) that was previously associated only with certain occupations, and thus can acquire knowledge about the whole production process, as far as some client are concerned.

3. Flexible Specialisation Approach

Most of the studies reflecting the flexible specialisation approach tend to focus on processes of technological change on the shopfloor (Kern and Schumann, 1987; Piore and Sabel, 1984; Streeck, 1987; Tolliday and Zeitlin, 1987) and, as Appelbaum and Albin (1992) note, the office environment has been somewhat neglected in this literature. However, a few studies (Attewell, 1992; Appelbaum and Albin, 1992; Zuboff, 1988) concerned with the adoption of new technology in the office and its implications to work organisation and skills have been developed during the last decade.

These studies do not explicitly use such terms as flexible specialisation or craft production, but they could be seen as reflecting some of the ideas advocated by the flexible specialisation approach. They seek to analyse the process of office automation and its outcomes within a wider context characterised by competitive pressures, environmental conditions, technological advances and new managerial strategies regarding technology

and human labour. The studies point to the emphasis that managers place on office workers and their skills as a means of increasing the flexibility of the office work. According to this line of argument, office workers have an important role within a process of reorganisation of the office work, which aims to provide firms with higher levels of flexibility and adaptability to various conditions. It can thus be argued that they constitute an alternative approach to the labour process perspective. They see skill outcomes in the office not as reflecting a net deskilling trend as argued by the deskilling thesis, but as being subject to various factors.

These studies recognise that the use of new technology has gradually fragmented tasks, rationalised the work and reduced the level of skills within some occupations in the office. But, contrary to the labour process approach, they argue that a growing concern with increasing levels of competition and changing market demands have the potential to put pressure on managers to combine the use of new technology with a skilled work force in the office. The studies imply that this concern can influence managers to employ new technology as a means of developing the flexibility of office workers. Thus, rather than leading to a unilinear process of deskilling, new technology can be used to develop new skills. For managers, these skills are seen as being of great importance because they enable employees to fully exploit the processing capabilities of new technology as a means of creating new knowledge.

The studies reflecting the flexible specialisation approach suggest that the introduction of new technology in the office has the potential to bring

about varied skill outcomes, and that these outcomes are influenced by four interrelated factors:

a) Competitive pressures from particular markets that force firms to look for new combinations between technology and labour.

b) Environmental regulations that drive firms to the search for more flexible forms of work processes aimed to enable them to quickly adapt to changing conditions.

c) The potential of new technology to be used as a means of creating alternative forms of work organisation and labour deployment in order to allow firms to quickly respond to new environmental and market conditions, as well as to increase the productivity of office workers and reduce costs in the office.

d) Managerial understanding about the way in which this potential of new technology is to be used in order to achieve particular goals. Technology can be used, as noted by Appelbaum and Albin (1992) and Zuboff (1988), to further rationalise, fragment and deskill jobs or it can be employed to both reintegrate tasks that have been previously fragmented and increase the level of skills and responsibility of office workers.

This approach suggests, according to Appelbaum and Albin (1992), that although new technology is part of a managerial strategy aimed to increase productivity of the work force and reduce costs in the office, the means to achieve these goals can be varied. New technology can be employed to further

deskill and reduce office workers' decision-making to a possible set of algorithms. Alternatively, it can be used enhance employees' capacity to interpret and process information, and thus improve the flexibility of the office work. The new information technology has a central role, but it is not perceived as directly leading to deskilling or reskilling³ largely because it is seen as a social phenomenon which is subject to various factors. For instance, these factors refer to managerial strategies regarding the way in which technology is to be used in order to achieve the goals above, and management understanding of its skill requirements. It can be employed to deskill or to create new combinations regarding the labour process in the office.

In addition, Zuboff (1988) argues that the possibility for different combinations between technology and labour also relates to the capabilities of new technology itself to generate a context in which information is potentially accessible by all employees and not just their managers. She notes, in this respect, that new technology supersedes the traditional logic of automation because it is characterised by a fundamental duality that does not yet seem to be fully appreciated by managers, and thus can lead to the adoption of managerial strategies aimed at further deskilling. For her, the duality of the new technology refers to its potential to what she calls 'automate' as well as to 'informate' the office environment. The former transfers the office workers' know-how acquired through experience to a computer-mediated environment, and the latter has the potential to put pressure on managers for a process of restructuring of labour that involves higher levels of skills.

³ Reskilling means the learning of new skills in place of old ones so that the ability to handle the same level of uncertainty is retained and applied to a new specialisation (Ainley, 1993).

The flexible specialisation approach envisages, therefore, the possibility for the creation of new forms of co-operation between managers and office workers which can require the development of new skills. Managers understand, according to this line of argument, that the efficient use of the new technology can involve a more skilled and responsible work force able to make decisions based on their knowledge about the whole production process. Office workers and their skills, therefore, become a central component in a process of office automation. Skilled workers are seen as being both able to create new knowledge regarding office and administrative activities, and able to handle uncertainties caused by environmental and market changes. Thus managers are likely to concentrate both on the potential of the new technology and the capacity of skilled office workers to use it intelligently.

The following sub-section reviews three case studies undertaken in offices located in the manufacturing, insurance and banking sectors. The first study was conducted by Attewell (1992) in factory offices. He points to a process of reskilling of the office work. The second study refers to a research undertaken by Appelbaum and Albin in the insurance sector. The authors argue that a combination of factors shape alternative forms of office automation, which can lead to reskilling of some occupations. The third study is based on a research undertaken by Zuboff (1988) in the insurance and bank sectors. She focuses on two aspects of a process of office automation. The author analyses the new technology and its potential to create new forms of work organisation and labour deployment. She also explores the extent to which managers perceive what she calls the 'duality' of new technology, or its potential to 'automate' or 'informatize' the office environment. She thus argues

that skill outcomes are partly related to the potential of the new technology to be used as a means of automating or informing the work of office workers, and partly related to managerial discretion in choosing among particular strategies of office automation. Introduced to eliminate as much as possible the human input so that the possibilities of errors are further reduced, and to increase the speed according to which office workers perform their tasks.

3.1 The Case of Office Automation in the Manufacturing Sector

In a study conducted on factory offices, Attewell (1992) notes that the shift from batch production to interactive computing in the offices studied made possible the integration of tasks of some low-level office workers, that had been previously fragmented according to the 'principles of scientific management'. He explains that under batch production, work processes were separated into various stages. For instance, paper was typically carried from one person to another. Inventory had first to be checked before a decision was made to produce more of a product. Then the raw materials inventory had to be studied by an employee, and then perhaps a purchase order authorised for more materials. These practices tended to result in an organisation of paper flow and decision processes into long sequences, each stage of which was the responsibility of a different person. Attewell argues that this characteristic of the office work reflected a Taylorist approach to the labour process because it involved the rationalisation and fragmentation of clerical jobs. In his words:

'These properties of manual paperwork tended toward or were enhanced by Tayloristic designs that involved sequencing, simplifying, and fragmenting white-collar work. This fragmentation was carried over into computer batch processing.' (Attewell, 1999, pp. 72)

However, as Attewell explains, the introduction of a new form of computer-based technology in the offices studied, reintegrated tasks that had previously been fragmented, and not only allowed clerical workers to have a comprehension of the whole production process, but also led to a process of reskilling followed by office workers' greater autonomy and responsibility. He argues thus that the computing system changed the clerical jobs in two ways. Firstly, under interactive computing, work became distributed more evenly throughout the day or month. Office workers had no longer to rush to meet monthly or other deadlines for calculating receivable and preparing drafts, as was the case under most batch systems. Secondly, jobs that were very narrow and repetitious under most batch systems became somewhat broader. In other words, some workers started to move easily from one task to another via software, which also allowed information to be moved from one database to another. Thus, for example, a customer order entry could interface with an inventory, and generate a production order, possibly resulting in a purchase order for more raw materials, and so on.

Attewell argues that the capacity of interactive computing to link, update, and transfer calculations from multiple databases in a fraction of a second made it possible and more efficient to integrate diverse tasks into one job in such a way that would not be feasible with the manual or batch processing. It enabled a clerk, for instance, to do order entry, check inventory,

and monitor customer credit from one terminal to another, whereas batch processing would probably have involved different clerks consulting different printouts in different physical locations. It follows, that the integration of tasks increased the complexity of some jobs. In other words, technology allowed up-to-date information about many of the firm's main activities to be accessed by the various employees. Consequently, it required office workers to make a greater number of choices and decisions based upon the information provided. For Attewell, this process of reintegration of tasks involved the learning of new skills in place of the old ones so that office workers' ability to handle uncertainties was retained and applied to a new occupation.

The potential of new technology, for the author, encouraged managers to design new jobs that combined retrieving information from the system with clerical-like data entry into the system. Such jobs involved a new type of clerical work that required more knowledge and greater degree of care and responsibility. This process thus led to the upskilling of some clerical workers which was, nonetheless, followed by the shrinkage of the most routine levels of clerical jobs in some of the firms studied. Attewell explains the changes following the adoption of new technology in the sample by pointing out that he:

'(I) found many clerical jobs that had assumed these characteristics. For example, some accounts-receivable clerks, who had previously spent almost the entire work day typing bills or invoices, were alternating among three tasks: entering billing data, posting cheques as they were received, and telephoning customers to increase the collections of past-due bills. Clerks whose previous duties had consisted primarily of typing order information received from salespeople were now able to enter orders into

the computer, check the inventory, give an estimated delivery date, and sometimes also check the customer's credit or payment history...In these examples, interactive computing has modified many low-level clerical functions primarily by enabling previously separated tasks to be joined.' (Attewell, 1992, pp. 73)

Attewell thus suggests that the skill outcomes of new technology can be more varied than supposed by the deskilling thesis. He argues that instead of simply rationalising and deskilling the office work (which was characterised by the first phase of batch-processing information), the adoption of new technology in the offices surveyed actually opened the possibility for altering the content of some clerical jobs. It allowed previously fragmented tasks to be integrated into a single job which, in turn, required the development of a new knowledge about the whole production process in the office, and demanded a greater degree of responsibility from office workers. He gives two reasons for such a process:

a) On the one hand, new technology has the potential to make information more available for employees in different levels in the organisation. This potential allows them to develop new knowledge on the basis of the services provided by the organisation.

b) On the other hand, in order to exploit the potential of new technology, managers have to adopt strategies that see labour as a capital investment rather than a cost. By doing so, they have to devise work designs that bring together previously fragmented tasks into one single function. He thus points to a *'trend that seems clearly to be toward a higher-skill, high-commitment work force.'* (Attewell, 1992, pp. 83)

3.2 The Case of the Insurance Sector

Based on an empirical study about office automation in insurance companies, Appelbaum and Albin (1992) argue that the enhanced flexibility of the new technology to process information and control operations has the potential to: alter the balance of work tasks, change the decision-making process between people and machines, as well as to increase the scope managers have to redesign jobs so that the skill content of work can be increased or decreased. As a result, organisations face a wide range of choices in implementing automated production systems in the office. For the authors, these choices are shaped by managerial discretion in choosing among alternative forms of work organisation. This suggests that skill outcomes can be more complex than supposed by the deskilling thesis.

The authors explain that the automation of the office work in the insurance industry in the United States was stimulated by the deregulation of financial markets, the need to fight inflation and the wide variation of interest rates during the 1970s. Increasing mobility of capital was the main objective, leading the emphasis on cash-flow management rather than on returns from premiums. Flexibility thus became crucial for competitiveness. Instead of the standardised rationalisation and mainframe-dependent data entry processes characteristic of the first stage of office automation (that took place during the 1960s), insurance companies started to rely on the automation of routine paperwork in order to increase their decision-making capacity. The enhancement of flexibility was achieved by both decentralising networks of agents, and increasing the control of the work performed by relatively skilled

clerical workers on the basis of the full computerisation of underwriting and rating operations.

Appelbaum and Albin note that this introduction of computers led to productivity gains considered by managers to be substantial in comparison, for example, with the manual processing of applications used during the 1960s. However, the authors argue that these gains were realised in the period immediately following computer rationalisation and then exhausted. Since then insurance companies have been searching for new ways of combining new technology with labour in order to increase their productivity and their flexibility *vis a vis* services provided to customers and changes in the market.

The authors argue that both this concern with productivity gains and the need to become more competitive has influenced managers in the firms studied to design jobs in different ways. They note that although nearly identical computer hardware was utilised by these firms, two different forms of work organisation could be identified.

In some firms, the adoption of new technology reflected what they call an 'algorithmic' form of work organisation and labour deployment. This form of work organisation suggests that new technology was used in order to standardise the various services provided to customers. It thus eliminated some jobs performed by semi-skilled worker by pushing their conceptual skills and decision-making responsibilities down the hierarchy. In contrast, in other firms, managers adopted what the authors term a 'robust' form of work organisation. Technology was used in these firms to increase the amount of information about products, procedures and clients. This information was

made available to workers at every level within the organisation. The decision-making capacities of all employees, including office workers, were enhanced. For instance, these capacities were decentralised and moved down the organisational hierarchy. But, as the authors note, this change was followed by a certain loss of workers' autonomy largely because the computer-based systems allowed managers to monitor their work-time and their decision-making abilities.

Appelbaum and Albin argue that in the firms that adopted an algorithmic approach, managers sought to increase the productivity of office workers by adopting new forms of surveillance through the use of computers to monitor the clerical work. Such firms favoured, in this sense, a process of office automation that replaced workers' old skills and knowledge in decision-making processes with pre-programmed decision rules and procedures. The goal of this process was to limit workers' skills and reduce the role of human knowledge and judgement in the production process by designing self-regulating systems requiring little entry input from the human operators who worked with them. Technology was introduced to separate the entry of data from the processing of applications which was, in turn, removed to locations outside the organisation. For the authors such reorganisation of the office work constituted an extension of the Taylorist organisation of work that was already prevalent in the insurance industry when computer rationalisation was first introduced a decade ago.

The authors suggest, therefore, that this routinisation of clerical work typical of an algorithmic organisation relies on the fragmentation of work that requires no knowledge of insurance products or claims adjusting procedures.

The skills that remain - routine keyboarding and word processing skills - are related to the use of computers to perform narrow tasks and not to the firms' business line. In addition, this organisation of production facilitates the use of part-time or temporary workers as a strategy for increasing productivity gains, as well as allowing managers to reduce labour costs. The authors note that high turnover among these part-time workers holds down wage growth while narrow and job specific forms of training are whenever possible to be accomplished in few days. Thus, technology is used to reorganise the clerical work so that it is done by lower-paid part-time workers (mostly female) who require very few skills beyond the typing accuracy required, and who have limited access to training for other positions.

In contrast, as Appelbaum and Albin argue, firms that opted for a robust approach to the use of technology did not seem to have their productivity gains limited by the higher levels of sickness, absenteeism and turnover characteristics of the algorithmic organisations. They suggest that firms following a robust strategy increased the amount of information about products, procedures and clients by making it available to workers at every level within the organisation. The decision-making capacities of all workers, including clerical workers, were thus enhanced. Decision-making was centralised and moved down to the organisational hierarchy which was often streamlined or simplified in the previous processes of automation. New technology was used to process and transmit data on various operations to workers at all levels. The associated work organisation was designed to promote value learning, flexibility and adaptive behaviour on the part of employees.

According to the authors, a robust organisation differs fundamentally from an organisation that proceeds by standardising and reducing information inputs by applying 'algorithmic' decision rules to fully anticipated situations. For them, a robust organisation places great value on workers' responsibility, skills and flexibility to use the new technology. However, Appelbaum and Albin note that in robust firms, office workers can also suffer certain loss of autonomy and increased stress due to the more stringent regulations of working time. For instance, clerical workers in the firms studied were often required to handle clients in a given number of minutes, and nominally independent sales agents became monitored by company employees. The authors argue, therefore, that 'robustness' has implications for the work setting that cannot be characterised simply in terms of it. 'Robustness' thus involves, according to them:

'A degree of organisational adaptiveness and, as such, is a systems property describing how the firm, or a significant subset of its production activities, is organised. The defining characteristics of robust forms of organisation have to do with relationships among the employees at different levels within the firm. Workers at higher levels are familiar with the work done at lower levels as well as with the people doing it. Confidence in workers at lower levels allows managers to delegate problems with current products or services to lower levels for solution while freeing those at the upper levels to develop new products and markets. Workers at each level have some knowledge of the whole production system, though the extent of this knowledge increases at higher levels.'
(Appelbaum and Albin, 1992, pp. 261)

The authors explain that investment is necessarily high in such firms, and they can be justified if a company seeks to take advantage of the increased.

adaptiveness that such a form of work organisation provides. Thus, according to Appelbaum and Albin, in firms facing a changing environment, the costs associated with a robust organisation can become less important to profitability than the productivity gains associated with the ability to move rapidly up the learning curve or to adapt easily and flexibly to new conditions. The authors note that the choice of any organisational structure reflects, in this sense, management's evaluation of the 'trade-off' between higher costs in the present and the potential for higher productivity, higher quality or greater flexibility in the future.

However, for the authors, despite the advantages offered by a robust organisation, the managers' resistance to provide training for clerical workers is one of the major factors favouring the more algorithmic forms of work organisation in the insurance industry. Appelbaum and Albin note that in the firms favouring an algorithmic approach, many jobs were low in what they call 'contextual knowledge' requirements. These refer to knowledge of the firm's products, production processes, customers, clients, procedures and regulatory environment. Job skills in these firms were related solely to the sophistication of the software employed in the firm. The valued skill, from word processing to graphic designs or programming, was not firm specific, but related instead with the technology itself. Training, in this context, was limited to the provision of narrow and job-specific keyboard skills.

In contrast, in robust organisations, the increased level of communication among different workers led to the development of a highly skilled administrative support staff knowledgeable about the firm's operations. Thus, jobs were filled by workers with substantial training and contextual

knowledge, which allowed them to performed their tasks in an integrated form (or integrated with other related tasks) and with a minimum degree of supervision.

Appelbaum and Albin suggest that, in addition to contextual knowledge skills, the various jobs within robust organisations can also create a need for the requirement of what they term 'transferable skills'. These skills include:

- (a) social and communication skills.
- (b) skills related to planning, organisation of time, and thinking more comprehensively about the firm.
- (c) general skills related to computer technology - how to use the computer and its facilities.

3.3 The Case of the Service Sector

Zuboff (1988) presents a study undertaken in three different organisational settings: an insurance company, a stock and bond transfer firm and a bank. Based on this study, she suggests that even where control and deskilling are the intent of managerial strategies with respect to new technology, managers themselves are also captive to a wide range of impulses and pressures. Thus to fully understand the way in which new technology can change the office work, she argues that it is necessary to consider two factors. On the one hand, the manner in which new technology creates intrinsically new qualities of experience for both office workers and managers. On the

other hand, the way in which new possibilities for work organisation and labour deployment are engaged by the often conflicting demands of political and economic interests involved in decision-making processes.

Zuboff (1988) argues that a computer-mediated⁴ environment involves a more abstract form of clerical work within which the new technology can be introduced in two different ways. It can be used, on the one hand, to 'automate' the office environment. That is, according to her, new technology is used as a means of absorbing the skills and experience of office workers. These skills are translated into explicit data and displayed in the medium of an electronic text. The new information technology, within this context, depersonalises supervision, modifies social relations, and absorbs much of the judgement and skills that clerical jobs used to entail. Office automation conforms, in this case, to the typical pattern of craft deskilling, as discussed by Braverman. It thus leads to a further process of rationalisation and deskilling with the following outcomes:

- a) Clerical workers lose the skills previously acquired
- b) Workers are less able to handle uncertainties and the various problems that arise from the use of new technology
- c) They also become less capable of exploiting the electronic text for more complex value-adding activities

⁴ As Zuboff (1988) explains, a computer-mediated work involves the electronic manipulation of symbols rather than the manual activity. Through the computer-mediated work, the clerk gets feedback about the task object in the form of a symbol which is transmitted through a medium of information. From the point of view of the clerk, she explains, the elements of the task seem to disappear 'behind the screen' and into the information system.

- d) They often develop physical symptoms that demonstrate their resistance to the process of rationalisation of work.
- e) Managers create new forms of labour control which reinforce their supervisory role.

She argues that, on the other hand, the new technology can be used to 'informate' the office environment. In this case, technology is introduced in such a way that it provides the basis for a more comprehensive understanding of the work. It creates new possibilities for clerical workers to make choices and changes that can lead to innovations regarding the various production processes in the office. In other words, the 'informating' character of the new technology provides, according to Zuboff, an increased level of transparency to the firms activities. Such a level of transparency allows information to become available both to managers and to all clerical workers for improved organisational planning and efficiency. Thus, office automation, according to this line of argument, involves a reorganisation of the previous forms of managerial control, as well as the development of a committed approach to clerical workers skills. Office automation places, in this sense, a premium on office workers 'intellective' ability to master events, processes and procedures, in particular because new technology increases the content of clerical tasks. Zuboff explains that this ability involves new conceptual skills or what she calls 'intellective skills'. These skills involve both the competence to handle uncertainties and the collaboration between individuals to achieve the best interpretation of shared information in an informed workplace. Office automation, within this context, implies a serious and continual organisational commitment to the development, requirement and nurturing of these new skills.

According to Zuboff, two firms studied introduced new technology in order to automate the office environment. For one of these companies, an insurance dental firm, this introduction aimed to '*achieve a more attractive price/value relationship in customers services.*' (Zuboff, 1988, pp. 127) As the author explains, it sought reduction of costs and increased productivity among benefit analysts through the development of an 'on-line' system⁵. The system was aimed at simplifying transactions processing while substantially increasing the volume of work that could be completed by one benefit analyst. It involved, on the one hand, the elimination of all tasks requiring such elements of interpersonal co-ordination as collecting mail or answering the telephone in order to maximise the productivity of such clerk. It implicated, on the other hand, the reduction of knowledge demands on tasks performed by this clerk in order to increase his/her speed to process claims.

Zuboff notes that for the other company, a stock and bond transfer firm, the goals of office automation were more complex. There was a driven intention to automate the tasks of data-entry clerks and transfer assistants (who were considered part of management although at a lower stratum) in order to:

- (a) Reduce labour costs and increase productivity.
- (b) Improve the service to shareholders by providing more information in less time.

⁵ On-line means, in this case, that at the moment a transaction is completed, the clerk presses the key marked ENTER, the transaction is recorded instantly in the central computer, and appropriate follow-up functions start. For example, cheques mailed, accounts debited or credited, and so on, are set into motion.

(c) Organise the processing of information so as to conform to new regulations set by an external regulatory body.

(d) Direct the work as much as possible into computers so that clerical workers would have minimal possibilities to make errors while processing information.

The author argues that in both companies, managers aimed to change the nature of the office so that the clerks' knowledge could be translated to computers, and by doing so, they could eliminate the '*...unspecified information collaboration, based upon the proximity of individuals and their accessibility in face-to-face communication.*' (Zuboff, 1988, pp. 136-7) These firms shared the following three common goals:

- a) Locate all resources for doing a transaction within the computer to the maximum extent possible to reduce errors.
- b) Physically locate office workers' activities around computers so that most of the work could be done without even rising from the chair.
- c) Reorganise the office work to, on the one hand, reduce the knowledge of methods and procedures with which tasks were usually performed by office workers and, on the other hand, eliminate the informal contact with peers and supervisors.

Zuboff argues that in these firms, the introduction of a computer-mediated environment simplified clerical jobs because it allowed, for instance, transactions to be broken down into a series of simple steps. Thus the managerial aim was to locate the resources for accomplishing a transaction within the computer system to the maximum extent possible. This meant,

according to the author, that much of workers' knowledge was absorbed or transferred to the technology. For Zuboff, clerical workers perceived this process of rationalisation of work as preventing them from using much of the knowledge acquired through years of experience. It follows that for these workers, their skills were seen as being less important than the typing skills and the 'sheer stamina' needed to meet daily production quotas set by managers and supervisors. For instance, in the case of benefit analysts and transfer assistants, the outcomes were twofold. New technology reduced opportunities for these workers to exercise their knowledge. It also reduced their opportunities to exercise judgement, in particular because the system was designed to break down the transactions, and thus eliminate the possibility of mistakes.

The author argues that the adoption of a computer-based system in these companies also allowed managers to reorganise the office work in order to reduce the social exchange among clerical workers, and hence increase their productivity. These managers physically replaced people and furniture in order to enforce new patterns of communication and behaviour among employees. Zuboff asserts that the consequences of this process imposed an additional measure of tension and purpose upon the attentional efforts of the clerical staff. On the one hand, the knowledge that their input would be inscribed immediately into the computer, and thus initiate a series of interdependent organisational operations, increased the pressure among office workers. Clerks, it follows, needed only manual skills and higher levels of concentration in order to understand the programmed logic that controlled their interaction with the electronic text. On the other hand, the increased interaction with the computer imposed new attentional demands that caused a

number of immediate sensations of physical discomfort like eye strain, nervous exhaustion, irritability, and so on.

The author argues, therefore, that office automation in these firms resulted in a process of deskilling followed by loss of control and autonomy of clerical staff. In both firms, managers and designers decided to emphasise the automating rather than the informing capacity of the new technology and as a consequence:

'The clerk was absorbed into the machine system, and the managerial process became anchored in the supervisory role. In the context of managerial choices that emphasise cost reduction, productivity, and increased volume, the clerical experience became one of labouring bodies engrossed in the demands for ongoing physical and attentional stamina, and removed from the forms of social exchange that once signified their integration with the managerial hierarchy.'
(Zuboff, 1988, p. 171)

For the third company, an international bank, office automation reflected, according to Zuboff, a move towards the exploitation of the informing character of the new technology. The author explains that the bank introduced a computer-mediated system to improve their internal operating need for information. It aimed to develop a data infrastructure that could be explored by office workers in order to create new value-added information-based products and services. Office automation represented a technological strategy in direct support of the bank's more aggressive competitive strategy.

She notes that during the first phase of the project, managers directed almost all efforts towards the automation of the banks' transactions. Having accomplished this phase, they initiated a second part which involved the creation of a database environment. Such an environment was expected to provide both value-added information and an anticipation of new product discoveries based on the ability of workers to explore a variety of financial possibilities. Managers, according to Zuboff, aimed to '*...transpose data from people's head or personal files into a unified, visible, accessible medium.*' (Zuboff 1988, pp. 163)

However, as the project developed, managers and clerks alike, according to Zuboff, began to consider the likely implications of the new information technology for their tasks, especially for the nature of the office workers' skills required by such an environment. These agents thus anticipated two ways in which skills were likely to be challenged and transformed by the informing character of the new technology.

Firstly, some managers feared that the system would absorb or transform such traditional skills as the ones involved in the relationship between a banker and his/her customers. They identified the importance of what Zuboff calls 'action-centred' skills to activities of clerical workers. Action-centred skills, as Zuboff notes, characterise work which has been subject to high levels of automation. Its performance is based upon sentient information derived from physical cues from the work environment. The work involves the physical performance of tasks, and the skills used are context-dependent and highly personalised. That is, they only have meaning within the context in which associated physical activities can occur and through the act

of physically performing their tasks. In the case of the bank, action-centred skills would involve:

- a) the banker's bodily presence
- b) his/her personal knowledge about the banks's activities
- c) his/her knowledge about particular clients in a face-to-face situation with a customer.

Secondly, Zuboff argues that the process of office automation eliminated a number of skills and failed to replace them with new forms of knowledge that could become the basis for new competencies. It follows that the database environment was seen by managers as a black box into which a great deal of knowledge or intelligence about banking procedures was loaded. They understood that individuals at all levels became both dependent on that box and poorly acquainted with much of the financial logic fundamental to the banking business. It was then that both managers and workers realised that the skills eliminated by the system needed to be replaced by a new set of what Zuboff terms 'intellective skills'. The generation and distribution of such skills at each level of the organisation would encompass, according to Zuboff,

'...a shift away from physical cues, toward sense-making based more exclusively upon abstract cues; explicit inferential reasoning used both inductively and deductively; and procedural, systemic thinking...A theoretical conception of the total process is essential if intellective skill is to be successfully applied to the problem of meaning in this way.' (pp. 95-6)

According to Zuboff, some managers started to perceive the need for developing a set of new skills through training *vis à vis* the anticipated

changes in the role of clerks. This set of skills would involve intellectual skills based on database inferential reasoning in order to enable clerks to analyse and conceptualise innovations within an information-rich environment⁶. More specifically, these intellectual skills involve a qualitative new experience for office workers because they require problem-solving and interpretative abilities rather than concrete physical activity. Instead of cues from the immediate physical environment, the employees' responses are based on abstract cues provided by the data interface⁷. These responses involve thought processes, whereby the office worker is able to understand the procedures according to which abstract cues can be manipulated to result in the desired effects.

Zuboff concludes by arguing that an informing strategy requires managers to understand the unique duality of new technology. Managers also need to understand that in order to exploit the capacities of new technology there is a need to develop a different form of work organisation. This strategy implies, in other words, a managerial approach to the office work which relies on the human ability for learning and using new skills. For instance, in the insurance company, technology was introduced in order to defend and reproduce the legitimacy of managerial authority. Managers thus put emphasis on machine intelligence at the expense of developing new skills in the

⁶ Information environment refers, for the author, to the quality of organisational life that emerges when the computer mediates jobs and begins to influence both horizontal and vertical relationships. In this environment, people generally have greater access to data and, in particular, data relevant to their own decision-making. The capacity for following-up and reorganising increases as information is retrieved and communication can occur with greater ease and convenience than before.

⁷ For Zuboff (1988), 'data interface' refers to the means by which information is provided to the employee by computing and information systems, and the means by which this information can be input to the system by the employee.

operating workforce. They used technology as a 'fail-system' to increase their sense of certainty and control over both production and organisational functions.

In contrast, in the bank, an informing strategy seemed to put pressure on managers to recognise the emergent demands for intellectual skills and to create a learning environment in which these skills could be developed. She notes that this recognition contains a threat to managerial authority because it affects the managerial control over the organisation's knowledge base. The adoption of an informing approach to the use of technology involves, in other words, a different conception of authority which largely depends on a new relationship between managers and employees with regard to the development of new skills, such as intellectual skills. Zuboff notes, however, that although these new skills could be seen as a vital requirement by some managers, it does not mean that this requirement is going to be fulfilled. The author points out, in this respect, that:

'As some members of the bank feared, institutions may be unable to respond to the technological presence other than as an occasion for decreasing their dependence on human talent, ignoring the opportunities to gain value from the technology in a qualitatively way. However, one thing seems clear - the informing potential of the technology cannot be exploited without human skills in ways of thinking that are conceptual, inferential, procedural, and systemic.' (Zuboff, 1988, pp. 172)

3.3 Summary

The flexible specialisation studies locate the discussion of the process of office automation within a broader context in which environmental conditions, market forces and managerial strategies are seen as influencing the way in which technology and skills are combined within the organisation of the office work. It can be argued that these studies are aware of different skill outcomes in the office, and thus are less deterministic than the labour process studies. However, by over emphasising the likelihood of a process of reskilling of office workers as a result of the adoption of new technology, they neglect some important factors informing the actions of the various agents involved in a process of office automation.

Firstly, like the flexible specialisation thesis, these studies see skill outcomes in the office as a result of a high degree of collaboration between managers and office workers in the pursuit of common objectives. By doing so, it can be argued that these studies advocate a route to a new form of accommodation between capital and labour without critically considering the existing conflict of interests between managers and employees. As Noble (1991) notes, by perceiving the development of new skills in the office as resulting from a new partnership between managers and office workers, Zuboff (1991) neglects that automation strategies are also characterised by a struggle for power. It follows that Zuboff, as well as Appelbaum and Albin (1992), see reskilling in the office as the outcome of a conscious design implemented by managers, rather than a product of a struggle of contending

groups. These authors thus ignore that this collaboration between management and labour can reflect new forms of control in the office environment.

Secondly, it can be suggested that the flexible specialisation studies underestimate the role of office workers in two ways. On the one hand, the studies presented by Zuboff, Attewell and Appelbaum and Albin assume that office workers' commitment to managerial strategies with regard to technological change is unproblematic. It can be argued, in this respect, that the adoption of new technology to automate or informate the office environment requires direction, surveillance and discipline of office workers, that cannot be taken from granted. As argued by Noble (1991), there are workers who recognise that more complex activities mean a more stressful and undefined work, which does not necessarily lead to an upward mobility within the organisation. These workers are less likely to see this new form of collaboration as an advantage. On the other hand, by seeing a cohesiveness between managerial strategies and office workers, the studies minimise employees' potential to resist organisational changes caused by the adoption of new technology. The studies thus underestimate the importance of analysing the ways in which technological change can create opportunities for an effective workers' organisation and struggle in the office.

Based on the application of both the labour process and the flexible specialisation approaches to the office, it can be argued that these theoretical perspectives allow the development of two alternative models of office automation. These theoretical models are called in this thesis: the 'technology-driven' and the 'informational' models of office automation.

The theoretical models do not represent the whole range of processes of office automation, but they are 'ideal types'⁸ developed in order to provide a framework for analysing the process of technological change on offices in Brazil and its skill and training outcomes. The models reflect the main arguments on technology, skills and training implications advocated by the two theoretical perspectives discussed in this chapter and in Chapter 2. These are alternative models which perceive office automation as a process leading to different skill and training outcomes. They thus are used as analytical tools for exploring the extent to which the theoretical arguments put forward by the deskilling thesis and the flexible specialisation approach can explain the empirical findings of the study undertaken in Brazilian offices. These findings are analysed in Chapter 5.

Four main variables distinguish these two models:

- a) The managers' perception of the potential of new technology to achieve particular goals.
- b) The managers' perception of the way in which technology is to be used in order to meet these goals.
- c) The managers' perception of the skill requirements of new technology.

⁸ The term 'ideal-type' was first introduced by Weber. According to him, ideal types are theoretical models which are used as a kind of yardstick against which to compare and evaluate empirical cases. The discrepancies between the ideal-type and the factual form of the institution or behaviour pattern being investigated, enable to understand and explain the complexities of this empirical investigation.

d) The type of training adopted in order to meet these skill requirements.

The 'technology-driven' model of office automation draws on the labour process approach, in particular the deskilling thesis of Braverman. This model implies that the new technology has no independent influence beyond the aims and objectives that are built in by managers. These aims are - the managerial desire to reduce costs, increase the productivity of employees, and enhance their control over the workforce in the office. The model suggests that, in the case of the office, managers achieve the goals above by using new technology in such a way that it reduces human input, and thus decreases their dependence on old office workers' skills. More specifically, the deskilling of office workers takes place because the adoption of new technology allows jobs to be broken down into a series of simple steps, which require minimal human intervention. The model thus argues that as old skills are transferred into the technology, office workers with task-specific skills are expected to perform routine activities. The deskilling of the workforce is supported by a process of reorganisation of the office work characterised by further fragmentation and rationalisation of office jobs.

The model also indicates that new technology is used by managers to replace rather than complement office workers' skills. These skills become routinised, fragmented and task-specific. As a consequence, managers are likely to provide a limited type of training aimed to develop these narrow skills, or what is also called in this thesis - keyboard skills. Keyboard or task-specific skills are thus related to the use of the machine rather than related to a knowledge of the various activities of the organisation. They are seen by

managers as allowing office workers to use the basic 'commands' of specific software programs so that they can type, store, retrieve and distribute standard information within their limited roles.

The 'informational' model of office automation draws on the flexible specialisation approach. In particular, it reflects Zuboff's perspective on the potential of new technology to informate the office environment. This model implies that economic, technological and environmental conditions create new possibilities for using new technology in ways that can lead to an increase in the skill content of jobs in the office environment. It argues that a growing concern with changing market demands and increasing levels of competitiveness have the potential to put pressure on managers to adopt new technology in a way different from that suggested by the technology-driven model.

According to the informational model, managers seek to increase the flexibility of the office work by combining new technology to a skilled labour force. This combination leads to a new kind of flexibility in the office environment. Drawing on Zuboff, the model indicates that this combination flexibility derives from the potential of new technology to create new levels of information about work processes by enabling data to be accessed and fed back into the system by both managers and office workers. In other words, the office work becomes mediated by an information system which not only provides information to workers, but also allows this information to be input to the system by the employees. This mediation through what Zuboff calls 'data interface' has the potential to require new skills of office workers with intellectual skills.

According to this model, in order to increase this new flexibility of the labour process, managers are likely to place great emphasis on the provision of a type of training aimed to develop office workers' knowledge. More specifically, training strategies are likely to focus on intellectual skills. These skills allow employees to understand the procedures according to those abstract cues provided by the system which can be manipulated to result in desired effects, as well as can be used to create a basis for new services or procedures. Training would thus focus on the development of the following abilities:

- a) The ability to understand the internal structure of a computer-based system and its functional capabilities.
- b) The ability to make a correspondence between abstract cues and actual processes and their systemic relations.
- c) The ability to understand what actions mediated by the system lead to appropriate outcomes.
- d) The ability to interpret new data as feedback on the results of their responses

As argued earlier, these models reflect two alternative patterns of technology, work, skills and training with regard to the office environment. The technology-driven model sees the adoption of new technology as a means of enhancing managerial forms of control through deskilling. Hence, training strategies are likely to be limited to the provision of task-specific or keyboard skills. In contrast, the informational model suggests that new technology can be potentially used as a means of conferring a new kind of flexibility to office

workers. This flexibility requires the adoption of a type of training aimed at providing employees with intellectual rather than task-specific skills. Thus managers are likely to consider training as an important strategy if office workers are to create new knowledge through the exploitation of the informing capabilities of new technology.

Chapter 5 explores the extent to which the arguments implied by these two models can explain the skill and training outcomes in the Brazilian context. It does so by discussing the findings of a field work undertaken in Brazilian offices. It describes and analyses the perspectives of managers, office workers and deputy directors of training agencies with regard to technology, skills and training. However, prior to focusing on this field work, the next chapter addresses some of the main features of economic development in Brazil. Chapter 4 aims to provide a context for understanding the empirical findings by describing the Brazilian process of industrialisation, the country's current economic situation and its implications for the adoption of new technology in the office environment.

Chapter 4: The Brazilian Economic Development: From Import-Substitution to Trade Liberalisation

1. Introduction

The previous two chapters addressed two theoretical approaches on technological change and its skill and training implications on both the shopfloor and the office, in advanced industrialised countries. However, the main concern of this thesis is the analysis of the specific context of current technological changes in office work in the Brazilian context. Therefore, prior to narrowing such analysis to the relationship between new technology and skill formation in Brazilian offices, this chapter discusses the Brazilian model of economic development, the current economic conditions and their implications for the adoption of new technology in offices. In the absence of both national data and empirical research regarding the process of office automation in Brazil, the historical analysis of the country's mode of economic development will provide a perspective for interpreting the empirical research undertaken in Brazilian offices, that is discussed in the next chapter.

The chapter argues that the specificity of the Brazilian economic development relied on the adoption, during the 1950s, of a particular economic model aimed to promote a shift from an economy based on the export of primary products to an urban economy engaged on the development of an industrial complex. Such an economic model, was termed the import-

substitution model (Cardoso, 1970, 1980; Baer, 1987; Becker and Egler, 1992). It sought to develop a national industry through the adoption of measures protecting the internal market from foreign competition. Brazilian firms relied on the importing of capital-intensive technology. The use of this technology was combined with semi- and unskilled labour.

However, in the mid-1980s, Brazilian policy makers initiated a process aimed to gradually move away from the import-substitution model. This process has involved the adoption of trade liberalisation. These policies are seen as exposing many Brazilian firms to increased levels of competition due to the opening up of the internal market to foreign goods. The chapter suggests that this shift from the previous economic model implies the development of a new combination between technology and labour, which involves great emphasis on human skills in the office.

Section 2 describes the factors that influenced the adoption of the import-substitution model in the 1950s. Sub-section 2.1 reviews the main features of the import-substitution model during the period that has been described as the 'Brazilian miracle'. Sub-section 2.2 discusses the current economic conditions, in particular the adoption of trade liberalisation policies and their implications for Brazilian firms in the internal market. Section 3 draws, based on the analysis of the existing economic and market pressures, some tentative conclusions with regard to the adoption of new technology in Brazilian offices.

2. The Import-Substitution Model

During the 1950s, Brazil's development strategy envisaged a shift from an agro-export to an urban economy through the creation of an industrial complex¹. This process of industrialisation was supported by the adoption of an economic model based on import-substitution policies. According to Cardoso (1975), the import-substitution model involved the establishment of a national industry for the production of goods which until then had been imported. The state played a strong role as the main promoter of industrial development in this phase. It adopted economic measures aimed to protect the emergent internal market, as well as enabling the transfer of national capital accumulated by the agro-export and urban-mercantile sectors to the productive sectors connected to this internal market. As a result, the internal market became the main focus of economic and social development.

The import-substitution economic model² sought to create conditions for the incorporation of Brazil into the international division of labour as an industrial rather than an agro-export society. Such an economic model enabled

¹ During the 1930s and 1940s Brazil was still an essentially agricultural country with approximately 66 per cent of its economically active population working in the primary sector, and about 70 per cent of its inhabitants living in rural areas (Becker and Elger, 1992).

² The import-substitution model of economic development was adopted in other Latin American countries like Mexico and Argentina. However, in Brazil, the process of industrialisation along the lines of such an economic model, assumed certain characteristics that made it different from these countries. For instance, the Brazilian State played a very strong role as promoter of economic development than in Argentina or Mexico. In addition, the process of internationalisation of the economy was more extensive in Brazil, which allowed the country to achieve greater economic growth during the 1970s when compared to Argentina and Mexico. Moreover, while the Argentine government stimulated the expansion of both the export sector and the industrial sector, the Brazilian government focused much more on the development of the consumer good sector (Belluzzo and Mello, 1982).

the transfer of parts of the system of production characteristic of advanced industrialised nations, thereby creating conditions for the expansion of the Brazilian industrial complex. Cardoso (1975) explains this process of industrialisation in the following way:

'Involved the transfer to developing economies of a system of production 'already formed'; it imported complete companies that during a few years started to produce consumer goods characteristic of the 'modern lifestyle' in developed countries, and it also brought techniques (not only technology) necessary for the functioning of mass consumption economies: advertising, constant production of new products, the generation of new consumption needs and a complete financial support (credit to consumers and producers), etc.' (Cardoso, 1975, pp. 74)

The adoption of this model of import-substitution was influenced by a crisis within the coffee agro-export complex during the 1940s and 1950s. This crisis resulted from a decline of the world demand for Brazilian products, particularly coffee, after the second world war. It was accentuated by both the rising prices of imported manufactured goods and a slow increase of the consumption of raw materials by industrialised countries during the same period. Baer (1987) argues that during the 1950s it became clear to Brazilian policy makers that there was a need for changing the structure of the economy, which was until then largely based on the export of primary products. The adoption of import-substitution strategies thus were seen as a viable long-run development strategy. Baer explains the decision to adopt a different form of economic development in the following way:

'The evidence seemed to indicate to Brazilian policy makers that the country found itself not only among the group of nations whose exports steadily lost in the share of world trade, but also among those countries

whose exports had little chance of regaining their former pre-eminence. It is in this context that one should view the gradual decision of the Brazilian government to change the structure of the economy through the promotion of import-substitution industrialisation.' (Baer, 1987, pp. 51)

Another factor of importance for the adoption of an economic model based on import-substitution strategies were the ideas originated in the work of the Economic Commission for Latin America (ECLA) in the 1950s (Cardoso, 1975, Baer, 1987). This Commission³ outlined a number of arguments about causes, conditions and obstacles to socio-economic development in Latin American countries such as Brazil and Argentina. In broad terms, the ECLA argument was based on the idea that the world economy was composed by two poles - the centre made up countries with a homogeneous and diversified economy and the periphery involving nations with an heterogeneous and specialised economy⁴. It suggested that the main obstacle for economic growth in the peripheral countries, such as Brazil, was their reliance on the agricultural export-sector, which furnished the foreign exchange necessary to import manufacturing goods. It argued that this export activity was subject to extreme demand fluctuations originated in the centre, which affected the terms of trade faced by the peripheral countries.

³ The Commission for Latin America stimulated the development of different versions of what has been called 'dependency theories' within Latin America. See Cardoso (1975) for more detail.

⁴ Cardoso explains (1975) that the periphery is heterogeneous because economic activities with significant differences as to productivity exist side by side, with the two extremes being provided by an export sector with relatively high productivity of labour and a low agricultural sector of subsistence level productivity. The periphery is also specialised because its export economy is geared toward the export of primary products, with production confined to an enclave within the periphery economy which has almost no linkages with the rest of the economy.

According to the Commission there existed a tendency for these terms of trade to deteriorate, leading to continued underdevelopment rather than development in the periphery. In this context, the absence of a dynamic home-grown industrial sector in peripheral nations implied an increased dependence on the centre for the import of manufacturing goods, as well as a dependence on fluctuations with regard to the demand for primary products. The Commission thus concluded that economic development in Latin America countries would require a move away from an agro-export economy through a process of import-substituting industrialisation. Industrialisation was seen as increasing the productivity per capita, enabling capital accumulation, and, simultaneously, raising the socio-economic well-being of the majority of the population. This process was perceived as requiring both a significant degree of state intervention in economic life, and a significant contribution of foreign technological and financial resources (Cardoso, 1975).

Therefore, influenced by both the crisis within the agro-export sector and the ideas developed by ECLA, the Brazilian government adopted, during the 1950s, an import-substitution economic model. This model brought about economic development and certain social mobility, at least in the urban-industrial sectors of the Brazilian society (Cardoso, 1977). It favoured a process of politically direct industrialisation based on a strict partnership between the state, the national and the foreign capital - and thus inaugurated the so-called 'tripod-based model' (Baer, 1987; Becker and Egler, 1992). Belluzzo and Coutinho (1982) note that this model involved the redefinition of the expansion of the industrial sector which, under State control, favoured the establishment of industries concerned with the production of consumer durable goods over the production of non-durable goods. It required the

development of new consumption patterns aimed to expand both Brazil's internal mass production and the consumption power of the urban middle and upper classes. Finally, it also involved the adoption of economic policies that created credit facilities for the import of machinery and equipment for the establishment of the industrial complex.

However, in the early 1960s, the Brazilian economy went through an economic crisis characterised, for instance, by a yearly inflation of 100 per cent (Baer, 1985). The economic difficulties associated with a political crisis led to a military coup d'état in 1964. The following military governments consolidated and extended the import-substitution model previously introduced. Under the military rule, the period between 1968-1974 became described as the so-called 'Brazilian Miracle' (Becker and Egler, 1992). During this period, the process of socio-economic development rested on the consolidation of the 'triple alliance' between state, private and foreign capital (Becker and Egler, 1992; Evans, 1979).

2.1 The 'Brazilian Miracle'

During the period characterised as 'Brazilian Miracle', the country experienced a vigorous acceleration and strong expansion of its economic activities with both lower levels of inflation and foreign indebtedness. Annual real growth of the GDP, which averaged only 3.7 per cent in the period 1962-67, surged to yearly rates averaging 11.3 per cent in the years 1968-74. The industry was the leading sector through an yearly expansion of 12.6 per cent

(Serra, 1982) propelled by the expansion of the consumer durable and capital goods industry in this period (Baer, 1987; Dinsmoor, 1990; World Bank, 1984). Brazil's industrial development represented, during the 1970s, around 26% of total GDP, a figure similar to the Japanese (30%) and South Korean (28%) economies (CEPAL/UNIDO, 1992).

The process of industrialisation between 1964-85 brought about an economic development which led to four fundamental structural changes:

(a) Brazil ceased to be an essentially agrarian country and its industrial share of GDP grew from 25 per cent to 38 per cent between 1960 and 1980 (Evans, 1979).

(b) The agricultural export sector became somewhat less important for economic growth. Exports of primary products continued to increase but at a slower rate. For instance, between 1947 and 1979 the ratio of exports to GDP declined from 14.8 to 6.7 per cent (Serra, 1982).

(c) Brazilian productive base came to depend even more upon both the consumer durable goods sector and the expansion of the internal market for the consumption of national products (Serra, 1982).

(d) The social structure was altered. The economically active population in the secondary and tertiary sector grew, the middle-class diversified and a substratum of a mobile working population was formed to attend to the needs of the new investment poles (Becker and Egler, 1992).

The Brazilian industrialisation process, along the lines of the import-strategies, became characterised by five main features. Firstly, the state extended its role as the main promoter of industrial development. It defined, articulated and financially supported large blocks of investment which determined the principal modification in the Brazilian economic structure. It created an infrastructure which integrated the highway, energy, urban and telecommunication systems. The state directly produced intermediate inputs which were indispensable for heavy industrialisation, and it also provided services such as energy and telecommunications (Ferraz et al., 1992).

Secondly, the process of industrialisation relied on institutional arrangements which combined the industrial concerns of national, multinational and state-owned firms. The state co-ordinated the interests of national, multinational and state firms. According to this arrangement, as suggested by Ferraz et al. (1992), the Brazilian industrialisation varied greatly compared to the pattern of industrial development in advanced countries in terms of sectoral distribution and ownership structure. For instance, in the Brazilian context, the State combined foreign and local interests according to branches of industry. The foreign capital dominated the production of durable goods, the private national capital produced non-durable goods, and the state capital operated in the sphere of production of services.

Thirdly, the import-substitution strategies implied an inward orientation which favoured the establishment and diversification of the manufacturing sector, particularly the expansion of firms located in the consumer-durable sector. This process of industrialisation, on the one hand, involved the adopting of policies which protected this home-grown sector from foreign

competition. On the other hand, it was accompanied by the expansion of an internal consumption market through the adoption of a number of measures like wage concession and credit facilities offered to consumers (Cardoso, 1975, 1980).

Fourthly, the process of industrialisation led to the so-called 'internationalisation of the internal market' (Cardoso, 1975). The 'internationalisation' resulted from the lack of domestic capital and the impossibility of alleviating this through wage compression. The latter was seen as restraining the middle-classes' consumption power, and hence inhibiting the expansion of the consumer durable sector. Therefore, in order to accumulate capital for industrial growth without retraining the consumption power of the population, the government encouraged direct investment to the establishment of foreign subsidiaries. During this period, industrialisation became even more dependent on foreign investment and extensive foreign borrowing.

Fifthly, the Brazilian industrialisation process, along the lines of the import-substitution model, relied on the importing of foreign technology, in particular capital-intensive technologies. These technological imports were actively encouraged by the government⁵ with the help of special credit facilities for firms located in the manufacturing sector (Aragao and Vanneman, 1990; Baer, 1987). Ferraz et al (1992) and Becker and Elger (1992) note that this reliance on import technology led to great technological

⁵ Ferraz et al (1992) note that the primary aim of industrial policies during this period was the establishment of production units, with the key parameter for Brazilian policy makers being the 'nationalisation' index of locally produced industrial goods.

heterogeneity across sectors and across firms within sectors⁶. In other words, even though Brazilian firms benefited from economic measures that made easier the acquisition of foreign technology, this acquisition led to a very diverse technical base due to differences between firms in terms of size, geographical location, ownership structure and particular technological strategies

However, despite achieving economic growth, Longo (1991) notes that, far from being a 'miracle', the emphasis on import-substitution strategies led to an economic crisis in the 1980s. For the author, after the first (1973) and second (1978) oil shocks, instead of engaging in an austerity adjustment program to reduce the non-oil import bill and temporally accept low rates of economic growth, the government continued to press on with the development program initiated in the previous decades. Thus, despite the slow-down in growth of exports, the rising oil prices, the growing internal inflation and the rising international debt, the military government opted for a growth policy that resulted in a resurgence of internal inflation and in a rapid expansion of the country's international debt. Longo (1991) explains this governmental choice in the beginning of the 1980s in the following way:

The fatal mistake of the Figueiredo administration (1979-85) was to press on with the now outdated development programme initiated in the previous decade. The argument used was that Brazil was different, that through public investment, subsidies to import-substituting industries (Proalcool, coal and petroleum prospecting) and preferential treatment for

⁶ Ferraz et al (1992) argue that the uneven adoption of technology in the Brazilian economy is characterised by the fact that, in 1982, the largest firms were responsible for more than half of the total expenditure on technology in Brazil. For instance, in the telecommunication industry, six firms were responsible for more than 80 per cent of expenditure and, in the machine tool industry, one firm alone accounted for more than 90 per cent of expenditure on technology.

exports of natural resources (such as soybeans and orange juice) it would be possible to go on growing despite the new external constraints and international distortions inherited from previous governments. Brazil began the 1980s, in fact, without any planning framework at all.' (Longo, 1991, pp. 5)

2.2 The Current Economic Context

Brazil entered the 1980s with high rates of economic growth that lasted until 1982. For instance, in 1980s real gross domestic product grew by 7.2 per cent, industry by 7.9 per cent, agriculture by 6.3 per cent and commerce by 7.2 per cent (Baer, 1987). According to Baer (1987), this growth achieved in the 1980 was partly due to the recovery of agricultural production in the previous years, and partly due to a strong consumer demand for consumer durable goods, which resulted from further inflationary expectations. However, as noted by Dinsmoor (1990), an inflation rate of 110.3 per cent in 1983 together with an increased difficulty in financing the external debt indicated that the Brazilian economy was suffering serious imbalances. In this year, there was a sharp decline in trade by 8 per cent and in manufacturing output by 5.8 per cent, leading to an overall fall in GDP of 3.4 (Longo, 1991; Dinsmoor; 1990).

During the mid-1980s, the civilian government of President Jose Sarney (1985-90) made three attempts⁷ to fight inflation, but all three attempts were unsuccessful after an average period of four months. During this period, the

⁷ These attempts were the following. The Cruzado Plan in 1985, the Bresser Plan in 1987, the Summer Plan in 1989. These constituted heterodox plans which attempted to freeze prices and wages in order to achieve 'zero inflation' (Longo, 1992).

real value of income declined by 11 per cent, and employment in industry fell by 25 per cent. The costs of such failures were high: the international reserve loss led to a moratorium, inflation increased even more, labour purchasing power decreased sharply leading to a context of recession that became apparent in the first half of 1987. It was during this period that the government started to gradually move away from the import substitution model through the adoption of some trade liberalisation policies, in the hope that this would support attempts to fight the inflation. These policies promoted the first changes concerning the previous trade measures which protected the internal market from foreign competition. These policies aimed, in other words, to progressively open up this market to international firms (Longo, 1992).

In the beginning of the 1990s, the government adopted a number of measures which aimed to fight high inflation rates. For instance, during the beginning of the decade, inflation rates were at around 80 per cent per month (Longo, 1991). One of the measures introduced involved an adjustment programme aimed to stimulate trade reform and privatisation. In regard to trade reform, in June 1990, the government announced a new industrial and trade policy (PICE). According to Longo (1992), this new trade policy was aimed to open up the once protected internal market for foreign competition, and thus promote economic stability and growth.

A number of measures were taken in order to make trade policy more open. For instance, special import-schemes and international agreements were eliminated, the existing crawling-peg devaluation system was replaced by a more market-oriented system of floating exchange rates, and more credit

facilities were provided to exporters. The adoption of these measures was followed by a regional agreement between Brazil, Argentina, Paraguay and Uruguay - The Southern Common Market (Mercosul). This agreement aims to consolidate cooperation with neighbours through the creation of regional blocs, in the hope that strategic partnerships could spread to other countries in the continent (Longo, 1991; Coes, 1994). Meanwhile, concessions are being made between Brazil and other trading partners in the framework of the GATT⁸ round. These concessions seek to eliminate disputes with advanced industrialised nations (The World Economy, 1994). For example, according to Longo (1991), there are efforts to introduce stricter laws on intellectual property, and the commitment not to resort to policies which permit the use of import restriction measures.

Commentators (Longo, 1991; Coes, 1994) argue that Brazil's integration into regional blocs like Mercosul, as well as the adoption of trade liberalisation policies, can be seen as representing a move away from the import-substitution model of economic development. Longo (1991) explains this move in the following way:

'Changes made to industrial and trade policy since 1988 were designed to alter the development model that prevailed in the 1980s - a closed, uncompetitive, inefficient model that helped to undermine the economic and technological dynamism of this decade.'
(Longo, 1991, pp. 23)

It can be argued that the shift away from the import-substitution model raises questions as to whether the existing strategies with regard to technology

⁸ The General Agreement on Tariffs and Trade (GATT) is a multilateral international treaty aimed to promote trade through the reduction and elimination of tariffs and import quotas.

and labour can enable Brazilian firms to become more competitive, and thus increase their responsiveness in the long-run to market changes in the internal and external markets. As explained by Ferraz et al (1992), the Brazilian process of industrialisation has relied on the importing of capital-intensive technology. However, as they note, the protection of the internal market from foreign competition has not created pressure on Brazilian firms to improve the quality and competitiveness of their products. It follows that firms have traditionally combined the use of this foreign technology with semi- and unskilled labour as a means of obtaining competitive advantage in a protected market. For instance, this argument is supported by data from Senai (1988) which indicates that in the state of São Paulo, the most industrialised one in Brazil, 69 per cent of the labour force had not completed primary education in 1987, only 18 per cent had completed it, 9 per cent had secondary education, and 4 per cent had higher education.

Ferraz et al (1992) and Salm and Fogaca (1990) argue, in this respect, that Brazilian firms' reliance on low labour costs, cheap labour with low educational level, has not constituted a barrier to the expansion of the industrial sector nor to the economic growth achieved during the 1970s and beginning of the 1980s. As Ferraz et al (1992) explain, firms in the various sectors favoured the adoption of in-house training strategies aimed to develop the narrow firm-specific skills required by the specialised machinery. Training practices, as noted by Roesch (1989), have become limited to the development of narrow-based skills acquired at the workplace by the majority of the labour force.

As noted by Ferraz et al (1992), the move towards trade liberalisation implies an increase in competition between Brazilian and foreign products in the internal market. The opening-up of this market creates a need for Brazilian firms to become more competitive by improving the quality of their products and the efficiency of their services. This search for greater quality and efficiency requires Brazilian firms to develop a different approach to technology and human skills. Therefore, rather than relying on low labour costs as a means of obtaining competitive advantage, the current economic climate requires firms to adopt a new combination of technology and labour which recognises the importance of human skills.

The development of new skills is particularly important given the technological developments in microelectronics during the last decades and their applicability to production processes in the shopfloor and in the office environment. These developments have enhanced the potential power of new technology to process increased amounts of textual and numerical information in ways that permit greater flexibility, accuracy, immediacy and complexity (Forrest, 1975; Buchanan and Boddy, 1983). As noted by Castells, the exploitation of these enhanced capabilities of new technology relies on the development of 'intellective skills'. Rather than narrow-based skills, these 'intellective skills' allow workers to exploit the flexibility of the new technology in a productive way, or in other words, as a means of creating new knowledge which can be applied in different contexts.

It can thus be argued that the improvement of Brazilian firms' market responsiveness vis à vis foreign competition cannot rely on training strategies that perceive labour as a cost rather than an investment. A context

characterised by increased market pressure associated with computer-based technological developments points to the importance of combining the use of new technology with the development of a skilled labour force. Within this context, and contrary to the previous phase in which training efforts have been limited to the development of narrow firm-specific skills, it becomes important to adopt new training strategies focusing on workers' capacity to understand and interpret information. It is this capacity that enables workers to both handle uncertainties derived from the use of a more flexible technology, and apply his/her knowledge into the production of new services, for instance, in the office environment. In other words, it is workers' ability to process, interpret as well as generate new knowledge on the basis of the information provided which confers a higher degree of quality and competitiveness to the goods produced and the services provided.

3. Some Implications for the Adoption of New Technology in Brazilian Offices

This chapter has discussed the main features of the Brazilian economic development in the last decades. It has suggested that the process of industrialisation, along the import-substitution model, has largely relied on two factors. On the one hand, the protection of the internal market has enabled the establishment and diversification of the country's industrial complex. On the other hand, Brazilian firms have set up production capabilities in which the use of technology has been combined with unqualified labour. Firms have

thus favoured in-house training strategies aimed at developing the narrow and firm-specific skills required by the technology.

The chapter has also argued that the gradual adoption of trade liberalisation policies suggests a move away from the previous model of economic development. This shift involves the adoption of a different approach to technology and labour, in which greater emphasis is placed on the development of workers' 'intellective skills'. These skills become a key element in the search for enhanced quality, efficiency and productivity because they enable workers not only to use technology to perform their immediate tasks, but also to generate new knowledge. This new knowledge can be used as a means of creating new products as well as new services.

Given that the main concern of this thesis is the nature of the technological changes and their skill and training implications in the office, it is important to consider the extent to which the current economic conditions have been affecting this environment. A review of the Brazilian literature on the issue indicates that any attempt at evaluating the nature of technological change in Brazilian offices faces two major limitations. Firstly, there is a lack of empirical research concerning office automation in Brazil. Articles (Costa Filho, 1985; Morgado, 1992; Wright, 1992) published in Brazilian journals do not include any detailed and rigorous studies on office automation in Brazilian offices. They rather discuss this process in terms of the experiences of advanced industrialised countries.

Secondly, there are only two reports about the diffusion of new technology in Brazilian offices. The first one is a national report which has

been published by the Especial Secretariat of Informatics⁹ (SEI, 1988). The second one has been elaborated by the Society of Users of Computer-based Equipments (SUCESU-SP, 1985), and it focuses on the diffusion of new technology in offices located in the state of Sao Paulo. These two reports indicate that the great expansion of the use of new technology in offices took place at the beginning of the 1980s. This diffusion was partly influenced by the development of the national computing industry¹⁰, and partly stimulated by the economic growth achieved during the 1970s, which allowed firms to invest in new technology.

These reports suggest that although there has been a general slow uptake of new technology due to the existing recession, Brazilian firms in various sectors (such as finance, industry, commerce, government and services sectors) are likely to continue to invest in office automation. The reports estimate that the gradual automation of Brazilian offices reflects a concern with enhanced levels of efficiency and productivity in this area. However, both reports point to two barriers to the adoption and use of new technology in Brazilian office as a means of achieving the goals above:

⁹ The Especial Secretariat of Informatics (SEI) is a governmental body created during the 1970s in order to develop policies aimed to protect and stimulate the development of a national computing industry. The Secretariat, along the lines of the import-substitution model, was responsible for the design and implementation of a national policy the aim of which was to reserve the internal computing market for domestically controlled firms. Policies were thus adopted in order to restrict the importing of new technologies (particularly computers), and control this importing as a means of securing the production of these technologies for Brazilian firms (Tigre, 1987).

¹⁰ Data provided by SEI (1988) indicates that due to the expansion of the national computing industry, the number of computers in the various sectors grew from 3,843 in 1975 to 153,202 in 1984.

a) The existing economic uncertainty caused by recession and high inflation rates which makes it difficult for firms to undertake long-term investments regarding the acquisition of new technology and the provision of appropriate training for office workers.

b) The limited managerial awareness of the capabilities of new technology, as well as their limited understanding of the skill requirements of this technology, which are likely to inhibit the development of the necessary skills in the office environment.

To sum up, the discussion of both the current economic conditions and the available information about office automation in Brazil, allow the development of two tentative conclusions:

a) Economic factors such as the recession and the opening-up of the internal market are likely to influence the adoption of new technology in Brazilian offices.

b) Managers' understanding of both the capabilities of new technology and the way in which these capabilities are to be exploited is also likely to influence the nature of the skill and training outcomes in Brazilian offices.

The extent to which these tentative conclusions are present in the Brazilian office environment is explored in an empirical study undertaken in a sample of ten Brazilian firms. This study explores whether existing economic conditions have been influencing the introduction of new technology in the offices surveyed, and if so, in what direction. It explores whether the adoption

of new technology in these offices created a need for the development of new skills, and if so, the nature of these skills. It explores whether the new technology influenced the adoption of training strategies aimed at developing new office workers' skills. The study not only focuses on firms, but also on the way in which Brazilian training bodies have been responding to the skill requirements resulting from the introduction of new technology in Brazilian offices.

Therefore, the next chapter, based on the two theoretical models of office automation developed in Chapter 3, analyses the evidence provided by managers, office workers and deputy directors of private training agencies. The chapter discusses the managers' perceptions about the reasons for introducing new technology in the office, and their understanding of the skill and training requirements of new technology. It analyses office workers' perceptions about new technology and its skills implications, as well as their perceptions about the appropriateness of the type of training made available. The chapter also considers the approaches to technology and training taken by deputy directors of training agencies, who operate outside the production processes in the office environment.

Chapter 5: The Introduction of New Technology in Offices in Brazil: The Empirical Research

1. Introduction

This chapter discusses the main findings of an empirical research undertaken in Brazilian offices. The discussion of the empirical findings aims to explore the extent to which the key theoretical arguments that have been developed in the previous chapters, are relevant to explain the skills and training outcomes of the adoption of new technology in offices located in Curitiba, Brazil. The chapter analyses, based on the two alternative models of office automation developed in Chapter 3, three groups of interviewees and their approach to both technology, skills and training. These interviewees are managers, office workers and deputy directors of private training agencies.

The evidence analysed in this chapter was gathered through informal and semi-structured interviews with three groups of interviewees. One group was made up by human resource and systems analyst managers working in a sample of ten firms. This chapter uses the general term 'manager' to refer to these interviewees¹. The second group involved interviews with office

¹ The managerial structure in all firms studied was divided into two levels. One level was made up by senior managers who were responsible for decisions concerning the whole organisation. The second level was made up by middle-level managers like human resources, systems analyst, marketing, stock control, product development and public relations managers. These managers were responsible by specific department within the various organisations.

workers who were personal secretaries, financial clerks and general clerks working in the same organisations as the managers interviewed. The third group was made up by deputy directors of training agencies. The interviews with deputy directors aimed to provide an insight into the approach to skills and training taken by individuals providing training outside firms. Further details concerning the methodology employed are described in Appendix 1.

Prior to discussing the evidence provided by the three groups interviewees, it is important to briefly review the main arguments developed in the previous chapters. Chapter 2 analysed two theoretical perspectives which put forward alternative arguments about the relationship between technology, skills and training on the shopfloor. These were: the deskilling thesis developed by Harry Braverman (1974) and the flexible specialisation thesis of Michael Piore and Charles Sabel (1984). Two arguments have been made.

Firstly, it was suggested that these perspectives reflect two alternative models of technological change which imply particular implications for the skill composition of the labour force and the type of training adopted. The deskilling thesis argues that technology is adopted as part of a managerial strategy to control the labour force, which leads to a process of deskilling and degradation of the labour force. Training, within this context, focuses on the provision of task-specific skills, which allow workers to perform their tasks within their limited roles. Contrary to this position, the flexible specialisation thesis suggests that economic and technological conditions have the potential to create a need for a new combination between new technology and workers'

skills. This combination is seen as having the potential to promote the reskilling of the work force. Training thus becomes an important means by which workers develop new interpretative and problem-solving skills. These skills allow them to generate new knowledge, and thus innovate by applying this knowledge under changing conditions.

Secondly, it was argued that both theoretical perspectives put forward an over-simplistic understanding about the relationship between technology and skills. In other words, by over-emphasising particular factors which influence processes of technological change on the shopfloor, these approaches fail to recognise the existence of alternative patterns in which the combination between new technology and labour cannot be simply explained in terms of deskilling or reskilling. They neglect that the skill outcomes of new technology are influenced by complex and often contradictory factors, such as managerial strategies and labour struggle.

Chapter 3 applied the main arguments developed by the deskilling and the flexible specialisation theses to the office environment. It discussed two groups of studies considered to be representatives of these two theoretical perspectives. Two arguments have been made. Firstly, it was suggested that the two groups of studies reflect some of the same weaknesses of the main theoretical perspectives. By over-estimating the influence of specific factors on processes of technological change on the office, these studies discuss the skill implications of new technology as reflecting a trend towards deskilling or reskilling. Labour process studies underestimate the extent to which managerial strategies seek to use new technology to control and deskill office

workers. As argued in the chapter, the employment of new technology can lead to the deskilling of low-level jobs while increasing the skill content of middle-level occupations. In turn, by over-emphasising the likelihood of a process of reskilling of office workers, flexible specialisation studies neglect the fact that this process can reflect new forms of managerial control in the office.

Secondly, it was argued that the case studies reflect two contrasting theoretical perspectives with regard to technology, skills and training in the office environment. The contrast between these perspectives allowed the development of two theoretical models of office automation to be used as analytical tools for the discussion of the findings of the empirical research in Brazilian offices. The models were termed: the 'technology-driven' and the 'informational' models of office automation. It was also suggested that four main variables distinguish these two models:

- a) The managers' perception of the potential of new technology to achieve particular goals.
- b) The managers' perception of the way in which technology is to be used in order to meet these goals.
- c) The managers' perception of the skill requirements of new technology.
- d) The type of training adopted in order to meet these skill requirements.

The technology-driven model of office automation implies that new technology has no independent influence beyond the aims and objectives that are built into it by management. It identifies, therefore, three driving forces behind the introduction of new technology in the office environment. These are: the managerial desire to reduce costs, increase the productivity of workers, and enhance their control over the labour process. The model suggests that, in the case of the office work, managers employ new technology in order to reduce their dependence on the skills of office workers, and consequently, increase both the productivity of office workers and their own control over the labour process. In other words, skill requirements in the office are reduced because managers use the new technology in such a way that it displaces office workers' skills. This usage is seen as leading to the deskilling of the content of jobs and the generation of routinised, fragmented and task-specific skills. Given the nature of the skills required by new technology, the model implies that managers are likely to adopt training practices limited to the development of task-specific skills or keyboard skills. The development of these narrow skills are seen by managers as enabling office workers to carry on routinised and fragmented activities within their limited roles.

The informational model suggests that current economic and technological conditions create new possibilities for employing new technology in ways that can lead to an increase in the skill content of jobs in the office. The model points out that a growing concern with increasing levels of competitiveness and changing market demands has the potential to put pressure on managers to use new technology in a different way than suggested

by the technology-driven model. The model implies that such a concern can influence managers' decisions to combine the use new technology with the development of office workers' skills. This new combination is seen by managers as a means of enhancing both the flexibility of the labour process and the flexibility of the labour force. The model implies that this new flexibility requires the development of new skills so that office workers are able to explore the full potential of new technology. Managers thus are likely to adopt training strategies aimed to develop new skills or what Zuboff (1988) calls 'intellective skills'. These skills are perceived by managers as being important because they allow workers to understand and interpret information in ways that enable them not only to generate new knowledge, but also apply this knowledge as a means of improving and/or producing new services.

Chapter 4 discussed the Brazilian economic development in order to provide a perspective for understanding the empirical research undertaken in Brazilian offices. Two arguments have been made. Firstly, the adoption of the import-substitution model of economic development promoted the expansion of a national industry protected from foreign competition. During this period, Brazilian firms set up their production capabilities by combining capital-intensive technology with low skilled labour.

Secondly, two existing factors suggest a shift away from the previous model of economic development - the adoption of trade liberalisation policies during the last decade and the country's great participation into regional blocs, such as Mercosul. These two factors are aimed at improving the Brazilian firms' capacity to compete in the internal and external markets, with

implications to the way in which new technology is introduced into the office environment. This shift has the potential to involve a new combination of new technology with labour, which recognises the importance of office workers' skills as a means of enhancing the quality and efficiency of office and administrative activities.

The empirical research suggests that the adoption of new technology and its implications for the skill formation of office workers seem to be more complex than it would be expected from either of the two models of office automation discussed in Chapter 3. The research provides evidence that elements of both the technology-driven and the informational models of office automation can be found in the firms and training agencies surveyed. The evidence indicated the following three findings.

In regard to managers, the findings suggest that they tended to have a technology-driven approach to both technology and training. This approach was influenced by their limited understanding of the potential of new technology and its skills requirements. New technology was introduced without parallel changes to the organisation to the office work in all firms studied. It was accommodated within, rather than used as a means of changing existing organisational structures. Two types of training were adopted - one group of firms surveyed favoured on-the-job training whereas the other group adopted in-house training courses. Both types of training reflected the same goals - they focused on the development of task-specific or keyboard skills so that workers would be able to use new technology within their limited roles.

In the case of office workers interviewed, these employees tended to have a view of technology and training which reflected a mixture of the technology-driven and the informational models of office automation. Forty per cent of office workers interviewed seemed to see new technology as simplifying their tasks, and generating a context in which these tasks could be performed only with task-specific skills. For these interviewees, the type of on-the-job training provided was seen as appropriate. In contrast, for sixty per cent of office workers interviewed, technology was perceived as creating more complex tasks which required skills other than task-specific skills. For these office workers, on-the-job training was not seen as appropriate to the development of the skills which could allow them to overcome the difficulties created by the use of new technology. They thus put pressure on managers to adopt a different type of training.

In the case of private training agencies, the findings indicate that deputy directors seemed to assume a technology-driven approach to training. The courses offered by the agencies also focused on the development of task-specific because these were the skills perceived by deputy directors as being demanded by the market. Thus deputy directors tended to see the skill requirements of new technology in terms of keyboard skills associated with specific software packages. In other words, for these interviewees, new technology was perceived as requiring individuals only with the basic 'keyboard commands', such as the ability to type, store, retrieve and distribute information related to a particular package. Courses focusing on these skills were provided to both private individuals and office workers sponsored by firms. The courses provided by agencies implied, in this sense, no

differentiation between the various clients (individuals and firms). These courses and the training provided by firms should be seen as substitutes in that both focused on the same type of skills.

The discussion of the empirical findings is divided into six sections. Section 2 explores managers' understanding of the factors influencing the adoption of new technology and their implications for the organisation of the office work. Sub-section 2.1 analyses managers' perceptions about the reasons behind the introduction of new technology in the firms studied. Sub-section 2.2 discusses managers' perceptions about the implications of new technology to the organisation of the office work. Section 3 focuses on managers' perceptions about the skill requirements of new technology by exploring their approaches to training. Sub-section 3.1 analyses managers' perceptions about the appropriateness of on-the-job training, and sub-section 3.2 discusses managers' perceptions about the reasons that led to the adoption of in-house training courses. Section 4 explores office workers' approaches to technology and training. Sub-section 4.1 analyses evidence regarding office workers who seemed to have expressed an informational view of both technology and training, and sub-section 4.2 discusses evidence concerning those office workers who tended to take a technology-driven approach to the issue. Section 5 discusses the approach to training implied by deputy directors of private training. Section 6 presents a summary of the evidence discussed in the previous sections.

2. Managers' Approaches to New Technology

Chapter 3 has made reference to two models of office automation which put forward contrasting perspectives on the role of management regarding the introduction of new technology, and its implications for the organisation of the office work.

The technology-driven model rests on the assumption that new technology is adopted in order to increase managerial control over the labour process in the office. In order to achieve this goal, the introduction of technology is followed by a process of re-organisation of the office work which involves a process of fragmentation and routinisation of tasks. For the informational model, economic and technological conditions have the potential to influence managers to combine the use of new technology with the development of office workers' skills. It follows that a process of reorganisation of office work is required in order to support this new combination. Managers are likely to create flexible organisation structures in which great emphasis is placed on the development of flatter hierarchies, the improvement of internal communication, and the development of knowledge among office workers.

Therefore, taken into consideration these two alternative forms of office automation, did the introduction of new technology in the offices studied reflect a managerial desire to control and deskill the workforce in the manner suggested by the technology-driven model; or were aims such as

greater organisational flexibility as well as labour reskilling more evident? In particular, were managerial decisions regarding the employment of new technology influenced by an explicit objective to increase managerial control over the office work? Alternatively, were they driven by a concern to counteract competitive pressures by creating more flexible structures in which office workers and their skills have an important role?

Evidence from the interviews with human resources and systems analyst managers suggested that the reasons for adopting new technology and its implications for the work organisation were more complex than implied by these two models. The evidence indicated two main findings:

- a) On the one hand, the adoption of new technology in all firms surveyed was influenced by two economic factors. These conditions were: the recession and the opening-up of the internal market.
- b) On the other hand, it was also shaped by managers' perceptions about: the potential of new technology to achieve particular goals and the way in which it was to be used to meet these goals.

The analysis of the evidence regarding human resources and systems analyst managers is broken down into two sub-sections. Sub-section 2.1 explores managers perception about the reasons behind the introduction of new technology in the offices surveyed. Sub-section 2.2 discusses managerial perception about the organisational changes that followed the implementation of technology in the office environment.

2.1 Reasons Behind the Introduction of New Technology

Evidence from the interviews with both human resources and systems analyst managers suggested that reasons behind the introduction of new technology in the firms surveyed were the product of processes of managerial choice, and that managerial concern with labour control was not necessarily central to the overall decision-making process. Two factors influenced managers decision over why and how to use the new technology in the offices studied.

a) On the one hand, the introduction of new technology was influenced by managers' perceptions about economic conditions, such as the need to become more competitive due the adoption of trade liberalisation policies.

b) On the other hand, it was influenced by managers' perceptions and expectations about the potential of new technology in providing ways to counteract problems resulting from particular economic circumstances. The adoption of new technology aimed to achieve the following goals: increase the productivity of office workers and managers, reduce administrative costs, and enhance the overall efficiency of the office in order to provide better services for customers.

Managers interviewed indicated that the need to counteract competitive pressures derived from the opening up of the internal market to foreign competition was one of the main reasons for introducing new technology in

the office. According to these interviewees, the process of liberalisation of the internal market created new competitive pressures in the market in which their firms operated. For them, this market pressure stimulated the search for more competitive forms of production through the employment of new technology in the office environment. For instance, a system analyst manager pointed to competitive pressures in the market as one of the main reasons for the introduction of new technology in the office. He argued in the following way:

'Our firm has been affected by competition which has increased in the last seven years. The market in which we operate is not so 'closed' as it used to be. Office automation is one strategy that we have adopted in order to face this problem and become more competitive.' (food sector)

Another systems analyst manager made the same argument by saying that:

'The economic policies issued by the Sarney government and the Collor government increased the competition in our sector. We decided to introduce computers in the office as a means to counteract this competition. We believe that we can become more competitive, more advanced in technological terms, if we automate the work in our offices.' (food sector)

Yet another systems analyst manager related the search for more competitiveness to the introduction of computers in the office by stating that:

'We have detected changes regarding competition in the market in which we operate. The necessity to become more competitive was one important factor

that influenced our decision to introduce computers and automate the office work.' (capital goods sector)

A similar idea was implied by a human resource manager. He said that:

'The competition has caused some problems for our firm. In order to face these problems, we decided that it would be very important to become technologically advanced. We then introduced computers and attempted to modernise our office. Computers are important tools that are available and that can be used so as to give a more competitive edge for firms.' (metal/mechanics)

Many human resources managers acknowledged that the need to become more competitive was one of the driving-forces behind the introduction of computer-based technology in offices studied. These interviewees stated that:

'The need to become more competitive was an important factor for the automation of our office. There is no doubt that computers can be used so as to provide new services for our customers, and provide better support for our managers. In other words, we are looking for technological superiority because that is the only way to survive in the present economic situation.' (metal/mechanics)

'Many things have changed during the years, and the degree of competition is one of these things. We have to think about new ways of becoming more competitive or we 'go bust'. We introduced computers in the office because we wanted to increase our competitiveness. I think that computer-based technology provides services which are not only better for us, but also better for our customers.' (footwear)

The evidence from the interviews with managers suggested that managers interviewed perceived new technology as conferring competitive advantage over competitors. However, how did these managers expect to achieve such a goal through the employment of new technology in the office? For these interviewees, their firms' competitive positions could be improved by employing new technology as a means to improve the performance of the production process in the office. This improvement of performance was expected, according to the interviewees' perception, to be achieved by the employment of new technology in such a way that it would increase the productivity of both management and office workers, enhance the quality of the services provided to customers as well as reduce administrative costs in the office environment. A human resources manager explained that new technology could provide competitive advantage because it could, according to his perception, increase the productivity of office workers and reduce costs in the office environment. He put this in the following way:

'It has been proved that firms that use new computer technology are better placed to meet the increased levels of competition. We know that in order to become more competitive it is necessary to generate a process of technological modernisation of the office environment. It follows that we introduced computers in the office in order to increase our productivity, our efficiency, reduce our costs, as well as to improve our competitive advantage.' (transport)

A systems analyst manager made a similar argument:

'In our firm, office automation is part of a process of technological modernisation in the office. This process aims to increase the productivity of managers and employees, reduce costs in the office and,

consequently, increase the overall competitive capacity of the firm.' (paper and pulp)

This same argument appeared to be accounted in the observations of various managers interviewed. They stated that:

'The automation of the office reflects the decision that senior managers took concerning the modernisation of the work in the office. These senior managers followed the example of other firms and introduced computers in order to increase the productivity and reduce costs. I think that we can become more competitive if we provide a more productive and efficient service to the various departments as well as for our customers.' (paper and pulp)

'We moved towards office automation for three reasons. We had to search for more modern ways to face competition. We followed the experience that other firms had with office automation. We can see that office automation can increase the productivity of managers and employees. Besides, we also want to reduce costs.' (metal/mechanics)

'We have followed experiences involving the process of office automation in other firms. We saw the positive results and we could understand the advantages offered by the use of computers in the office. We believe that we can become more competitive if we increase the productivity and reduce the costs in the office. In doing so, we also become more competitive. I think these are the reasons for the automation of our offices.' (capital goods)

'Our firm decided to use computers and automate the office because we wanted to increase our productivity and improve our position in the market. The reduction of costs was another important factor.' (energy)

'Every modern firm requires a more efficient and productive office. This efficiency and productivity can easily be achieved through the employment of computers in the office. Moreover, the use of computers has another important consequence - it reduces costs.' (energy)

Evidence from the interviews suggested that the desire to enhance productivity through the introduction of new technology reflected a managerial concern with the improvement of the production process itself, rather than a strict intent to increase managerial control over the workforce. This desire to improve the overall performance of the production process in the offices studied was expressed, according to information provided by managers interviewed, in terms of enhanced efficiency and reliability in the work of office workers, on the one hand, and reduction in uncertainty regarding managerial decisions, on the other hand. The enhancement of the efficiency and the reliability in the tasks performed by office workers was reflected in a managerial concern with increased speed, orderliness, consistency in work operations and error reduction. A human resources manager described his firms' intentions regarding the productivity among office workers in this way:

'There is no doubt that computers have the potential to increase the performance of managers and employees. The computer allows different tasks to be done in less time and with much more efficiency. Employees provide information in a more reliable, precise and organised way. Managers are better equipped to make faster and better decisions.'

A systems analyst manager made a similar relation between the employment of new technology and the achievement of such as goals as increased productivity, enhanced efficiency and reliability concerning the production and distribution of information in the office. He argued that:

'Office automation improves the productivity of all employees. Office workers become not only more efficient, but the information that they produce is more reliable. There is no need for all that paper. The work is more organised, clean and reliable. It follows that managers have information which is more reliable and can take better decisions, in less time and with more confidence.'

A human resources manager provided a similar argument. He stated the following:

'I think that computers make the work of our employees more reliable and efficient. This work is done in half of the time, and there is no need to carry large amounts of paper from one place to another. Another consequence is that managers don't have to wait for any information. They have all the information that they need right in front of them, on the screen.'

According to evidence provided by the majority of managers interviewed, the introduction of new technology was also aimed at improving the productivity of the managerial staff in general. For these interviewees, new technology was perceived not only as providing the managerial staff with information considered to be more reliable or error free, but also reducing uncertainty in decision-making processes. One human resources manager described such a goal in the following way:

'Technology has the potential to increase the productivity of managers as well. Manager can do a better job because they can easily locate the information necessary. All information is displayed in front of them. They just need to make sense of it.'
(food)

This argument was supported by a systems analyst manager:

'Technology has positive effects on both office workers and managers. We have to think about both of them. I believe that the productivity of managers can be increased due to the potential of the technology to store, retrieve and distribute information. It follows that managers can make better decisions because they have all the necessary information.'
(metal/mechanics)

Evidence from these interviews implies that for many managers interviewed competitive advantage could be achieved not only through the enhancement of productivity and reduction of costs, but also through the improvement of the quality of the services provided to customers. A human resources manager argued in this respect that:

'We automated the office because we also wanted to provide better services to our clients. I think that offering a better service not only maintains our lead over competitors, but also offers the opportunity for expanding our share in the market. We learnt this lesson from other firms.'

A systems analyst manager implied that one of the aims of office automation was the search for quality services in the office. He said that:

'I think that office automation is a good strategy because it enables the provision of better services to our clients. They (the clients) can ask for any information, and we can easily provided it . '

A human resources manager identified the same aim as far as the introduction of new technology in the office surveyed was concerned. He stated the following:

'We have to consider two things. Firstly, we need to find ways of making the work of managers and employees more efficient, reliable and fast. Secondly, we need to think about our clients. We have to find ways of providing a service which is better than our competitors. I think that these are the reasons that have influenced our decision to invest in office automation.'

Evidence from the survey suggested that another driving-force behind the introduction of new technology in the office environment was the managerial desire to reduce costs. This information indicates that the employment of new technology was perceived by managers as a means of reducing administrative costs in two ways - by allowing operating procedures such as accounting procedures to be quickly adjusted vis a vis changes in the economy, and by improving the reliability in work operations like payroll. According to the majority of managers interviewed, new technology was perceived as reducing administrative costs in a particular department: the finance department. For these interviewees, this reduction of costs was achieved because new technology improved the reliability of the work process by reducing errors as well as enhancing the adaptability of the whole production process to constant changes caused by the fluctuation of the

Brazilian currency. One systems analyst manager referred to the use of new technology in terms of cost benefits by saying that:

'The changes in the economy have always caused us a lot of work. Every month we have to change things, such as the payroll, inventory costs. We still do, but with the computer we can easily adapt ourselves to these changes as well as reduce costs. The payroll department is a good example. The payroll had to be altered every month due to inflation and index changes. Financial clerks used to have a lot of difficulties to elaborate the payroll in time for the payment. Computers made their life easier because all information is already updated in the screen. We are also able to reduce a lot of costs.' (food)

Other human resources managers made the same argument. They said the following:

'Before the introduction of the computer in the payroll department, it was very difficult for employees to keep up with the changes that had to be made almost every week. Every change had to be made by hand and with the use of a calculator. They don't have to do that anymore; we have developed a program which does all the changes. Today they need to put all the information into the computer, and the computer does all the calculations. It is not only their work which becomes less problematic, but we are also able to reduce costs in this department.' (paper/pulp)

'I think that the payroll department is one of the departments that benefited most from the introduction of computers. The work has become much more efficient because employees don't have to do all the work by hand. Besides, there has been a reduction of administrative costs considering that there is no need for all that paper.' (capital goods)

'Work in the payroll department used to be very stressful. The employees had to run from one place to another with lots of paper and without knowing if they would finish the work in time. The computer changed this picture because it gave more reliability and efficiency to this department. Financial clerks do not become so stressed about the work and the manager has been able to reduce some of the costs in his department.' (footwear)

Managers interviewed rejected the idea that the desire to reduce costs could be justified in terms of staff reduction. Those interviewees acknowledged that many senior managers as well as managers from different departments believed, during the stage in which the new technology was implemented, that computers could be introduced so as to substitute human labour. However, as noted by these interviewees, the adoption of new technology was not followed by any staff reduction because the deepening of the economic recession had already led, in the beginning of the 1980s, to a process termed by managers interviewed as 'draining' - a process by which the number of office workers was reduced to a minimum. Therefore, according to one human resource manager interviewed, by the time computers were introduced in the office, there was no need to further staff reduction. This interviewee described the situation in the following way:

'When computers started to be introduced, senior managers and managers from other departments expected to reduce the number of employees. I think that they believed in all that stuff about the 'paperless office' and so on. However, office automation did not cause any unemployment because we already had a limited number of employees.' (metal/mechanics)

A systems analyst manager presented the same argument. He said that:

'I don't believe that computers can replace human labour. I agree that many senior managers expected it, and even wanted to reduce the staff. But, as I told you, there was a process of 'draining' in the beginning of the 1980s which caused the dismissal of many employees. The introduction of computers did not lead to any dismissal because the whole office work was already done by a small number of employees.'
(energy)

Another systems analyst manager explained that:

'I can tell you that, from my experience, there is no such thing as technology causing unemployment. Two of our employees lost their jobs for reasons other than the introduction of computers. Our staff was considerably reduced more than ten years ago when senior managers decided to cut costs as a result of the recession. We call this a process of 'draining'. Today we have practically the same number of employees.'
(paper and pulp)

The evidence that has been discussed in this section indicated that the adoption of new technology in the offices studied was shaped by two factors. On the one hand, economic conditions such as the opening-up of the internal market put pressure on managers to adopt new technology in the hope of enhancing the firms' capacity to compete. On the other hand, managers' perceptions about the potential of technology to achieve objectives such as the improvement of competitive capabilities, as well as the enhancement of productivity, efficiency and reliability of the work process. The evidence suggested that labour control did not seem to be a decisive factor in the managerial decision to introduce new technology in the office environment. It can be argued that management attempts to increase their control over the

labour force may be in fact an intended consequence of pursuing objectives concerned with the overall performance of the production process in the office. The search for enhanced performance seemed to be linked to a managerial concern with the improvement of the productivity and performance of both office workers and managers by increasing the speed at which information could be allocated and analysed, as well as improving the quality of the office work - all aimed at increasing the firms' ability to address new competitive pressures in their respective markets. The next subsection aims to provide evidence as to whether the adoption of new technology was followed by organisational changes leading to fragmentation of office work or followed by changes seeking to enhance the firms' capacity to respond to competitive pressures by creating more flexible structures.

2.2 Organisational Changes Following the Adoption of New Technology

It has been argued in Chapter 3 that decisions to adopt new technology open up choices with regard to its implementation as well as raise organisational issues of how the work is organised once technology is implemented (Zuboff 1988; Appelbaum and Albin, 1992).

The findings of the empirical research have suggested, so far, that labour control did not seem to be a decisive factor in the managerial decision to introduce new technology in the organisations surveyed. In other words,

the management decision to employ new technology was not driven by a concern to control labour *per se*, but rather a desire to improve the performance of the production processes in the office. However, was the work organisation in the offices studied changed in order to create flatter hierarchies, decentralise decision-making processes and enhance office workers' autonomy as implied by the informational model of office automation? Or did the re-organisation of the office work involve job fragmentation and task routinisation by replacing decision-making processes with pre-programmed decision rules as suggested by the technology-driven model of office automation ?

Evidence from the interviews with systems analyst and human resources managers suggested that the nature of organisational changes that followed the introduction of new technology in the offices studied, cannot be explained by a dichotomy between these two models of office automation. This evidence indicated that the new technology was accommodated within, rather than used as a means for changing the existing work organisations. In other words, when asked whether any organisational change had followed the adoption of new technology, all managers interviewed responded that no such changes had occurred. According to these interviewees, due to the limited number of computers² made available in all offices studied, office workers continued to undertake tasks such as typing letters and elaborating reports or tables with the help of calculators or typing machines. New technology

² Based on the information given by managers, on average, five office workers shared one computer in the sampled firms.

tended to be used by employees in the final stage of their work, and according to a timetable organised by office workers themselves. A system analyst manager answered the question above in the following way:

'I don't think that the work in our offices was changed. Our employees continue to perform the same tasks. In reality, we have a limited number of machines in the various departments, and there aren't enough computers for all employees. It follows that these employees perform their tasks like typing letters, reports or tables manually or with a typewriter or a calculator. They use computers only in the final stage of their work.' (paper and pulp)

A human resource manager made a similar point when referring to the work of financial clerks. He argued that :

'I don't think that there have been any considerable changes from the way the work used to be organised. Employees still do the same things. For instance, financial clerks use computers in the final stage of their work because it reduces errors. It does all the calculations. The rest of the work is done by hand. You see, we have a limited number of computers available to office workers, and they cannot use the machine to do all their work.' (energy)

The need for organising the work of office workers based on timetables was explained by a human resource manager in the following way:

'The introduction of computers caused some confusion. All employees in the office wanted to use the computer, but it was not possible because we had, and still have, a limited number of computers. In order to solve this problem, they decided to make a timetable and they use the computer according to this timetable. There is some confusion from time to time, particularly at the end of every month when everybody has a lot of work

to do. In this sense, I don't think that the work has been changed a lot.' (capital goods)

Another systems analyst manager made a similar argument:

'There have been changes regarding the quality and speed of the work of our employees, but no changes in the way their work is organised. The only change refers to the fact that they use the computers available according to a timetable that they organised. Sometimes they have to fight to use the machines, but in the end all the work is done.' (footwear)

For managers interviewed, the limited acquisition of new technology throughout the offices studied was perceived as resulting from economic uncertainty caused by recession and high inflation rates. The uncertain economic environment tended to be seen by the interviewees as generating what they called a 'wait and see' attitude regarding new investment projects - in the case of the firms studied, the acquisition of new technology. One human resources manager explained the adoption of this 'wait and see' attitude in the following way:

'We don't have enough computers for the majority of our employees. This problem is very much the result of our economic mess. You have to understand that the recession and the inflation create difficulties for long term investment. Therefore, the automation of our offices has to be done step by step.' (Paper and pulp)

A systems analyst manager made a similar point and added that investments regarding new technology were likely to continue in the future. He said the following way:

'The recession and the inflation created some difficulties for the diffusion of computers in our office. There is the recession, the inflation and the high price of equipment. It is very difficult to make investment within this context. We decided that the best strategy would be a 'wait and see' attitude to the acquisition of more computers.' (metal/mechanics)

A human resources manager also argue that the recession was a barrier to the introduction of new technology, but that his firms would continue the process of office automation. He said that:

'In my opinion, the recession, the fact that we have to buy technology which is made in this country, have delayed the process of office automation in this firm. But we have plans and we will continue to invest on computers in the future. We have to go step-by-step.' (paper and pulp)

A human resources manager made a similar point when asked about problems surrounding the process of office automation in his firm:

'I think that the problems that we have are related to the economic situation in this country. It is very difficult to allocate more resources for the acquisition of more equipment. In addition, this equipment is very expensive in Brazil. Therefore, we decided that the automation the office will be done in various stages. But we will continue in the future.' (food)

Managers were asked whether they saw a need for organisational changes in the future given the diffusion of new technology. The majority of managers took the view that the existing organisational structures were capable of meeting the original objectives regarding the adoption of new

technology. These goals were: improvement of productivity of office workers, reduction of costs and enhancement of the overall competitive capacity of the firms studied. Thus for these managers, there was no need for changing the organisation of the work of office workers and managers as a result of new technology. Although some managers interviewed acknowledged the need for more technology, they did not seem to see the limited number of computers as a barrier for the improvement of productivity. Rather, for them, new technology was seen as having already enhanced the efficiency, reliability and speed of the work performed by personal secretaries, financial and general clerks. It follows that for them, future investment on new technology would improve this level of productivity even more. A human resources manager answered the question above in the following way:

'I don't see a need for changes in the way we work. The organisation has been, and will continue to respond very well as the result of the adoption of more technology. I think that everything is fine, we just need more computers. But even if we don't have, we are doing fine because we can see that the productivity of secretaries, financial and general clerks has improved. Their work is more efficient and reliable, and may be there is no need for drastic changes, at least in the short-term.' (food)

This argument is also implied in the quotations below:

'We don't have the ideal situation in terms of computers. But we can see that despite the difficulties, the productivity of employees has increased. The work of financial clerks, for instance, is more reliable and fast. The same for secretaries. I don't think that we need to changes the way their work is organised

because I think that the whole organisation is responding very well.' (metal/mechanics)

'As a systems analyst manager, I would like to have more money to introduce more computers, but our reality is very difficult. The point is that it is possible to see that office workers can have their productivity improved without too many changes.' (footwear)

The evidence discussed in this sub-section suggested that none of the changes regarding the organisation of the office work could be associated with technology-driven nor with the informational models of office automation. Evidence from the interviews with managers indicated that managerial strategies aimed to automate the office were being applied in a half-hearted and inconsistent form. More specifically, a general indifference to the issue of work organisation seemed to be a more suitable typification. The introduction of new technology was not followed by organisational changes aimed at rationalise the office work nor to create flatter hierarchies within which office workers have more autonomy and responsibility. New technology was not used to complement or replace human skills. Rather, it tended to be seen as an additional device ~~for~~ the work of employees.

It can be argued that two factors influenced the way in which new technology was introduced in the firms surveyed. On the one hand, the opening-up of the internal seemed to have pushed managers to adopt new technology as a means of becoming more competitive. But, at the same time, the recession made them more cautious with regard to investment projects, such as the acquisition of a number of computers that could promote a process of technological change in the offices studied.

On the other hand, the interviews with managers suggested that these could understand the capabilities of new technology, but could not relate these capabilities to a need for promoting changes in the office work. Thus they tended to focus on the potential of the new technology on its own to achieve particular goals, rather than considering the need for developing organisational structures aimed to support the effective use of new technology. Their limited understanding about the relationship between technology and work organisation suggested that managers interviewed tended to view new technology as a neutral input to a production process. The effects of which were seen as being largely incidental. In other words, it seemed that according to management's perception, new technology arises somehow from scientific and technical research, and it so happens to confer such a competitive advantage that firms must adapt or, as mentioned by a manager interviewed, they 'go bust'.

However, as argued by Boddy and Buchanam (1988), the general lack of a consideration of how work is to be organised can frustrate, in some circumstances, the achievement of the overall managerial objectives behind the introduction of new technology in the office, namely increased productivity and efficiency. It can also result in outcomes which might allow workers to exercise considerable influence over job content, work organisation and training. Thus, the next section extends the discussion on the adoption of new technology and work organisation, and looks at managers' perceptions about the skill requirements of new technology. It does

so by analysing the types of training made available to office workers in the firms studied.

3. Managers' Approaches to Training

It has been pointed out in Chapters 2 and 3 that the employment of new technology influences skill requirements in different workplaces. It was argued that these skill requirements are shaped by managerial decisions regarding the way in which human resources are to be deployed in order to use new technology, and thus achieve specific corporate goals. These decisions are shaped, in turn, by their perception about both the nature of the skill implications derived from the use of technology in the workplace, and the ways in which these implications are to be met by different organisations (Zuboff, 1988; Appelbaum and Albin, 1992). It follows that, within this context, the managerial approach to training becomes an important variable that distinguishes the two models of office automation proposed in Chapter 3. The emphasis - or lack of emphasis - that management places on training as well as the nature of the training provision for office workers indicate the extent to which the introduction of new technology in the firms surveyed could be explained in terms of a technology-driven or an informational model of office automation.

The technology-driven model implies that in order to decrease managerial dependence on human skills, new technology is adopted to reduce

the skill requirements of tasks, and which ultimately minimise job-learning times. In other words, management replaces human intervention with a technology that enables the same work process to be performed with more continuity and control. By doing so, new technology reduces the range and complexity of tasks, which deskills the labour force by making redundant requirements for office workers to execute task-based skills other than task-specific skills. In the case of the office work, managers employ new technology in such a way that old office worker's skills are displaced by the technology. As a consequence, managers are likely to adopt training strategies aimed at providing narrow and task-specific skills, or, as it is termed in this thesis, keyboard skills such as the basic 'commands' of specific software programs. These skills enable office workers to type, store, retrieve and distribute standard information under normal circumstances, but do not enable them to have both their tasks range and discretion increased.

The informational model suggests that in order to improve the overall flexibility of the labour process, management can^{use} what Zuboff (1988) calls the 'informating' capabilities of the new technology. By doing so, managers employ new technology to complement rather than replace old office workers' skills. The 'information' of the office environment leads to more complex tasks which require what Zuboff (1988) terms intellectual skill requirements. These requirements involve mental rather than concrete physical activity or, in other words, employees' responses are based on abstract cues provided by the data interface rather than cues from the immediate physical environment. These responses involve problem-solving and interpretative dexterities, for example, in deciding upon corrective action when problems occur.

Thus, in order to exploit the informing capability of the new technology, management would tend to place great emphasis on training strategies focusing on the development of problem-solving and interpretative skills. These intellectual skills allow office workers to develop:

- a) An understanding of both the internal structure of the information system and its functional capabilities, and an understanding of what actions at the data interface lead to appropriate outcomes .
- b) The ability to make a correspondence between abstract cues and actual processes and their systemic relations, and to interpret new data as feedback on the results of responses.

These two models of office automation raise important issues regarding managerial decisions about the nature of the training strategies adopted as the result of the introduction of new technology in the organisations studied. To what extent did these organisations follow the informational or the technology-driven model of office automation as far as the managerial approach to training was concerned? Did managers seem to be committed to the adoption of training policies aimed at developing the skill and expertise of office workers in order to exploit the full potential of the new technology and increase the overall organisational flexibility? In particular, did the training practices adopted seek to provide these workers with the ability and creativity to make critical judgements and to develop alternative modes of thought as implied by the informational model? Or did managers place emphasis on

training strategies, the goal which was to develop tasks-specific skills aimed to provide office workers with keyboard skills necessary to use the technology in a basic fashion?

In regard to training, the evidence from the research suggested that the pattern of responses provided by both human resources and systems analyst managers tended to reflect an approach to training which could be explained in terms of the technology-driven model of office automation. This argument is supported by the following findings:

Firstly, evidence from the interviews with managers indicated the perception that they had about the potential of the new technology to increase productivity influenced their approach to training. These managers tended to take a view of technology replacing the need for training because they assumed that productivity could be improved by the new technology on its own. Therefore, they did not seem to relate the use of technology to a need to develop problem-solving and interpretative skills. Rather, for them, technology was perceived as requiring task-specific skills, which could be developed in-house rather than by a course provided by a private training agency.

Secondly, evidence from the interviews with managers indicated that all firms surveyed adopted a type of in-house training rather than training provided by private training agencies. However, there were differences concerning the nature of the training provision in the firms studied, which point to two groups of firms. One group adopted a type of on-the-job training

whereas the other introduced in-house training courses. The former involved firms located in the following sectors: energy, paper and pulp, footwear and transport. The latter involved firms that operated in sectors such as capital goods, metal/mechanics and food (see Table 1).

Thirdly, one half of the firms surveyed seemed to have adopted a *laissez-faire* approach to training. In other words, the adoption of new technology was not followed by any formal training strategy. In this group of firms, managers expected office workers to develop task-specific or keyboard skills through experience of using the technology or, as it is called in this thesis, through on-the-job training. Managers interviewed tended to place greater emphasis on the potential of the new technology on its own to achieve goals such as increased productivity, and not on the development of skills among office workers. Therefore, by assuming that office workers with task-specific skills could use new technology, and thus have their productivity increased, managers did not see a reason for investing in formal in-house and/or external training courses.

Fourthly, in the other half of the firms studied, managers tended to take a more formal view of training. These firms adopted a type of in-house training courses. These courses involved the existence of a program, an instructor and a structured environment in which training used to take place. Evidence from the interviews with human resources and system analyst managers suggested that three interrelated reasons influenced the decision to adopt in-house courses.

On the one hand, the lack of a structured type of training generated protests from office workers, who had difficulties in acquiring the skills necessary to incorporate the new technology into their daily work. These workers put pressure on managers to adopt a structured type of training, which would allow the development of skills, and consequently, would enable the incorporation of new technology into the office work. On the other hand, managers seemed to have realised that the lack of skills could prevent the use of new technology, and consequently, inhibit the improvement of productivity in the offices in question. For this group of managers the issue of productivity was very important for two reasons. On the one hand, these firms seemed to operate in more competitive sectors and, on the other hand, a large proportion of office workers were expected to use new technology.

Taking into consideration both the employees' pressure to be formally trained and the fact that this technology was being under-utilised, managers decide to invest on training. These managers could choose between training employees in private training agencies or in-house. However, as they tended to perceive courses given by training agencies as both expensive and providing office workers with general rather than firm and task-specific skills, they opted for in-house training courses - these course were perceived, therefore, as reflecting a cost-effective and a firm-specific strategy. The evidence suggests, nevertheless, that the aim of the in-house courses was also the development of narrow and task-specific skills so that office workers would be able to type, store, retrieve and distribute information within their limited roles, but with increased levels of productivity.

The evidence regarding training is broken down into two sub-sections. Sub-section 3.1 explores the managerial perception about the reasons for adopting on-the-job training, as well as the aims of this type of training. Sub-section 3.2 analyses both managers' perceptions about the reasons for introducing in-house training courses, and their perceptions about the goals of this type of in-house training.

3.1 On-the-Job Training

Information provided by systems analysts and human resources managers indicated that in half of the firms surveyed, new technology was introduced with a limited concern regarding the development of skills among office workers. This limited importance attached by management in regard to the development of office workers' skills was reflected in the fact that managers did not create training opportunities such as having employees externally trained in private agencies or trained in-house through a short-course or a formally structured form of on-the-job training. Rather, in these firms, managers adopted a *laissez-faire* approach to training. In other words, this approach was reflected in the adoption of forms of on-the-job training which did not involve any regular supervision. In fact, managers seemed to expect office workers to acquire by themselves task-specific skills, which they perceived as enabling employees to type, store, retrieve and distribute information within their limited roles. More specifically, office workers were

supposed to learn these skills through practice on-the-job, and under an irregular form of supervision from a colleague-instructor.

The evidence from the interviews with systems analysts and human resources managers implies that the adoption of this form of on-the-job training reflected a narrow managerial approach to technology and to training. In regard to the narrow approach to technology, the evidence suggests that managers interviewed seemed to put greater emphasis on the potential of the new technology itself to achieve goals such as increased productivity in the office. By having such a deterministic perception about the capabilities of the new technology, managers seemed to assume that, in order to be used, and thus increase productivity and efficiency, new technology would require office workers with tasks-specific skills - skills which could, according to their perception, be acquired through practice on-the-job. For instance, as argued by a human resource manager, on-the-job training was considered to be an optimal strategy because new technology demanded office workers with task-specific keyboard skills rather than what he termed a 'specialist knowledge'. As he said:

'It is not difficult to operate a computer, and I think that the best way to learn how to use it is through practice on-the-job. We need employees with practical skills rather than special knowledge about computers. They have to know the right commands - how to type, store and retrieve information. By the time they master these commands, they perform their tasks with more speed, reliability and efficiency.' (energy)

A systems analyst manager presented a similar argument when stating that, in his view, new technology required office workers with task-specific skills, which could be acquired on-the-job. He stated the following:

'We think that employees can learn how to use computers through practice. Computers do not require any special skills in order to be operated in an efficient and productive way. Therefore, we think that training on-the-job is a good solution. By doing so, they learn the skills that are important to their work, and when they have problems, they ask for advice from a colleague or an instructor. The result is that they realise that computers are not difficult to use, and that they can really improve the productivity and quality of the work.' (energy)

A similar argument was also expressed in various statements provided by other systems analyst managers. According to them:

'Computers do not require any specialised knowledge to be used and increase productivity and efficiency. We told that to our employees: 'you only need to know the right commands.' We expected that through practice they would learn the skills that were necessary for them. They did and they are using the computer with more familiarity, in a way that increases their efficiency and productivity.' (footwear)

'There is a lot of mystification about computers. Many employees think that they demand a technical knowledge. However, when they try to use it to do their work, they learn things that are relevant to their job. In my opinion, there is no need to train them in a different way because most important for them is that they learn the right skills, they feel confident and that their work becomes more efficient.' (energy)

'Office workers think that a computer requires a knowledge which is special. That is not true. We think

that they can learn the important commands on-the-job, by trying different combinations. I think that this is the best form of acquiring skills because employees learn skills which help them to do their job whereas other forms of training do not always meet the specific needs of an organisation. ' (transport)

'We need employees with practical skills which are relevant to the tasks that their perform. They need to know how to type, store and retrieve information because the computer does the rest. You see, in order to use computers, employees don't need to know more than that. They can learn these commands on-the-job, which is a more practical way.' (paper and pulp)

The evidence also indicates that the managerial decision to adopt such a form of on-the-job training was reinforced by their narrow approach to training itself. Managers interviewed tended to place a low value on training, which was perceived as a cost to be reduced rather than an investment in the development of knowledge among office workers. More specifically, although they acknowledged the importance of introducing new technology to increase productivity in the office, they could not relate the use of this technology to a need to invest on training. Therefore, managers tended to perceive on-the-job as a cost-effective training alternative, particularly when compared to other practices such as courses provided by private training agencies. Such a perception of on-the-job as a cost-effective alternative compared to courses offered by private agencies was implied by a human resources manager when he explained the reasons that led to its adoption in his firm. He stated the following:

'We invested in technology because we thought that it would be important for us, but we don't think that it is necessary to make a big investment on training. Therefore, when computers were introduced, it was decided that 'on-the-job' would be the best form of training for two reasons - it would be cheaper than sending all employees to a private training agency, and employees would learn task-specific skills.' (energy)

A human resources manager made a similar argument when justifying the adoption of on-the-job in terms of costs to be reduced:

'We don't see a need to invest on training as much as we thought when we introduced computers. Training costs money and this needs to be taken into consideration. On-the-job is cost effective, and it takes place while employees are actually working. Training outside the firm is expensive and it can be very disappointing because employees learn general things rather than task-specific skills.' (paper and pulp)

Another human resources manager described the same idea by pointing out that:

'The acquisition of computers consumed a lot of money, and it didn't leave much for training. So, the best solution has been on-the-job because it requires little investment when compared to courses offered by private training agencies, employees don't have to leave their work place, and they also learn the things that are relevant to their jobs.' (footwear)

Evidence from these interviews points out that on-the-job was not only seen as an optimal alternative in terms of costs, but it was also seen as meeting the specific needs of each organisation. In other words, managers interviewed tended to be critical about the courses offered by private training

agencies because these were perceived, on the one hand, as expensive, and, on the other hand, as not aimed at providing firm-specific skills. In fact, as argued by a system analyst manager, these courses were not considered to be an adequate strategy because they were seen as a time-consuming strategy as well as providing what he called 'general' rather than firm-specific skills. He said the following:

'A number of reasons influenced our decision to train our employees on-the-job. We think that the courses offered by training agencies are too expensive, they consume a lot of time of our employees and they don't meet our needs because they teach general things.'
(footwear)

A systems analyst manager provided a similar argument by stating that:

'One form of training employees to use computer is by using the services provided by private training agencies. We feel that this is not the best solution because these courses are expensive and too general. We need employees with skills which meet the needs of the firm. Besides, these courses last a week and we cannot release our employees for such a long period.'
(transport)

A human resource manager reinforced this argument by saying that:

'I think that by training employees to use computers on-the-job, these employees learn the things that are important for their jobs. We had some employees trained in private agencies and they came back with a general knowledge about computers. They find that it is very difficult to apply this knowledge into their daily activities, and they have to adapt themselves to a different context.' (transport)

According to evidence provided by managers interviewed, investment in training courses provided by private training agencies was justified only when referring to the formation of employee-instructors. These instructors were expected to create a 'cascade effect', as it was called by these interviewees. The 'cascade effect' involved a practice in which an office worker was supposed to help colleagues when they faced difficulties in using specific software programs related to word processing, if a personal secretary, or spreadsheet, if a financial clerical worker. The instructor was chosen to be externally trained in private training agencies according to both his/her interest and motivation to learn how to use a computer as well as his/her ability to communicate to other office workers. A system analyst manager described the role of the instructor in this way:

We decided that some of our employees should be sent to be trained in one of these training agencies in order to become instructors. We chose these employees based on their desire to use computers as well as their capacity to communicate with other employees. They learnt how to use programs such as word processors and spreadsheets, and they not only teach their colleagues when these have doubts, but they also compensate for errors made by others.' (paper and pulp)

A human resources manager made a similar argument:

'We decided to develop some instructors by having them trained in private training agencies. We wanted these instructors to acquire a general knowledge about various programs so that they would be able to create a 'cascade' effect. By that we mean the following - they learn how to use a program, they come back, and they help others when these are in trouble.' (footwear)

A human resources manager described the so-called cascade effect by saying that:

'Our goal is to create a 'cascade effect'. It is cheaper and firm-specific. We choose employees that seem able to learn how to use specific programs and have the ability to teach and communicate. They are externally trained. They learn how to use various programs, and they help others when is necessary.' (transport)

According to information provided by managers, the role of the instructor was to both support colleagues when they had difficulties or doubts regarding the use of a particular program, and compensate for any errors made by them. On-the-job training occurred, therefore, on an irregular basis in the sense that it did not involve any formal instruction of regular supervision from these instructors. Human resources managers described the role of the instructor in the following way:

'The instructor is there to help the colleagues when it is necessary. If a colleague has a doubt or makes an error, the instructor helps.' (transport)

'The training does not take place in a regular basis. The instructor gives tips when others have difficulties. He also helps when employees make mistakes.' (paper and pulp)

'The role of the instructor is to help the colleagues. When they don't know something, they can ask to the instructor and he is supposed to teach them the best way to do whatever they need to do.' (energy)

The evidence discussed in this sub-section suggested that, in the case of these firms studied, the narrow attitude that managers interviewed demonstrated towards technology and training influenced the adoption of a technology-driven approach to training. On the one hand, on-the-job training was considered to be an optimal alternative because managers took the view that the employment of new technology involved narrow task-specific skills which, according to their perception could be acquired through practice on-the-job. On the other hand, such a form of training was considered suitable to these firms because managers perceived it as a cost-effective alternative compared to courses offered by private training agencies. The use of the services provided by these private agencies was considered suitable only when the formation of instructors was concerned. Managers expected these instructors to train office workers on an irregular basis, and thus reduce training costs, minimise job-learning time (because office workers would not have to be released from work to be trained) and provide these employees with firm-specific skills.

Therefore, rather than concentrating on the development of office workers' new skills to increase their flexibility of response to various conditions, managers tended to place greater emphasis on the potential of the new technology on its own to both enhance the productivity of the office work, and reduce their reliance on human skills. Managers tended not only to assume that technology itself could enhance productivity, but they also presumed that office workers' skills could be taken over by the new technology - and, by doing so, they seemed to presume that task-specific skills would be sufficient to operate the new technology. Such a deterministic

perception of the capabilities of the new technology influenced the development of a *laissez-faire* attitude expressed in the adoption of a form of on-the-job training which involved no regular or formal supervision. Rather, managers seemed to expect office workers to acquire task-specific skills that would both enable the use of technology within their limited roles, and reduce their input to activities such as typing, storing and retrieving information.

By perceiving the skill requirements derived from the introduction of new technology in terms of task-specific skills, managers interviewed did not seem to consider training an important strategy but a cost to be reduced. Consequently, they did not tend to see training in terms of a 'trade-off', as suggested by Appelbaum and Albin (1994). In other words, managers did not perceive investment on training as having the potential to bring about long-term benefits to the organisation such as increasing the flexibility of response of both the labour process and the labour force. Rather, managers took the view that training in private training agencies, for instance, would not only be an expensive alternative, but would also develop what they believed to be 'general skills' instead of firm-specific skills. Consequently, these interviewees seemed to assume that on-the-job was cost-effective as well as directed towards the particular needs of each organisation and needs of the different types of office workers.

In the light of the evidence discussed, it could be argued that managers interviewed in these firms tended to concentrate on the automating rather than the informing capability of the new technology. By doing so, managers seemed to expect new technology to replace and not complement office

workers' skills or, in other words, they assumed that technology would enable the same work process to be done with more continuity and less human intervention. This perspective contrasts with an informational approach which assumes that a new combination between technology and skills can lead to more complex tasks demanding intellectual skills requirements, such as: an understanding of the internal structure of the information system, an understanding of what actions at the data interface lead to appropriate outcomes and an ability to interpret new data as feedback on results of responses. Managers assumed, therefore, that the automation of the office work would generate a need for task-specific skills which could be easily developed through experience on-the-job. In this sense, investing on training courses provided by private agencies was not consider a suitable strategy, except when the training of instructors was concerned - in this case, investment was justified because these instructors were expected to informally train colleagues on the use of new technology.

3.2 In-House Training Courses

Evidence from the interviews indicated that systems analysts and human resources managers in the other half of firms studied tended to express a more systematic approach to training than managers in the firms which adopted on-the-job training. The evidence indicated that firms in this group introduced a structured form of in-house training in the form of short training courses. These courses tended to have a duration of twenty hours, took place in an

structured environment, and were aimed at particular groups of office workers. For instance, specific courses were organised in order to train personal secretaries to use a word processor while financial clerks were trained how to use a spreadsheet. A systems analyst described the organisation of the in-house training courses in the following way:

'Senior managers decided that we had the knowledge to organise these training courses. These courses have a duration of twenty hours, which are broken down into four days, and a systems analyst is the instructor. We have two kinds of courses - one is for secretaries and clerks who need to use a word processor, and the other for financial clerks to use a spreadsheet.' (capital goods)

Another systems analyst manager explained such a form of in-house training course in the same way. He stated that:

'The courses are the responsibility of this department because senior managers believe that we are capable of dealing with this kind of training. These courses were organised in order to meet our needs - they are quick and firm-specific. Employees are trained in four days, five hours per day. The courses are given by a systems analyst who knows how to communicate with others - he has a lot of patience and he speaks in a language that everybody understands. We have one course which is for secretaries and clerks, and one course which is for financial clerks. These courses are different because these employees need to acquire skills that are relevant to their work.' (metal/mechanics)

A similar description was provided by a human resources manager:

'The courses are organised by the Informatics department. This department has the knowledge,

equipment and staff necessary to train our employees. There are two courses. One is for financial clerks on how to use a spreadsheet while the is for secretaries and some clerks on how to use a word processor. They have a duration of twenty hours, four hours per day.' (food)

The evidence from the interviews indicates that three interrelated factors influenced the adoption of in-house training courses. These were the following:

Firstly, the fact that office workers exerted pressure on managers in order to develop skills so that they would be able to use new technology into their work.

Secondly, the fact that managers demonstrated a great concern with increased levels of productivity in the offices studied. Such a concern was an important factor determining the adoption of in-house training courses for two reasons. Firstly, in these group of firms, a large percentage of office workers were expected to use new technology. However, evidence indicates that large number of employees located in different departments were not able to use new technology due to their lack of skills. Secondly, as this group of firms seemed to operate in more competitive sectors than the firms which adopted on-the-job training, managers tended to perceive the under utilisation of new technology as a barrier to the achievement of increased levels of productivity in the office - a barrier which could be overcome, according to these interviewees, through a structured form of training.

Thirdly, the fact that managers tended to perceive in-house training courses both as a cost-effective and a firm-specific strategy compared to courses provided by private training agencies.

Evidence from the interviews indicates that managers in these organisations seemed to have taken into consideration office workers' reaction regarding the limited training provision made available when new technology was introduced. More specifically, like in the group of firms that adopted on-the-job training, managers in these organisations also expected office workers to develop keyboard skills through experience of using the new technology, and by doing so, being able to incorporate the technology into their daily work. However, office workers demonstrated difficulties in developing such skills through practice of using the new technology - a difficulty which managers perceived as causing a certain degree of frustration and stress because office workers found themselves not able to incorporate new technology into their work. Such a context of frustration regarding the use of technology, according to managers interviewed, led to office workers like personal secretaries, financial and general clerks to request the adoption of a structured and formal type of training. One human resources manager interviewed described the influence that office workers had over managers' decision to adopt in-house training courses in the following way:

'We believed that office workers could learn keyboard skills by practising with the computer. However, it didn't work as we expected. Our employees did not acquire such skills - they got frustrated because they didn't know how to use the computer, and they got stressed because they were losing a lot of time to solve their difficulties. They started to complain to their

managers, and asked for a more structured form of training. Then I think that we all realised that it would be important to train these workers in a different way.'
(capital goods)

A similar argument was made by another human resources manager:

'When computers were introduced, the majority of office workers started to complain because they didn't know how to use them, and because they believed that on-the-job training was not sufficient. The secretaries were the first to ask for training because they were having a lot of difficulties to learn by themselves. They had to use manuals, and sometimes manuals are not very helpful. We could see that it was necessary to provide some support in the form of a structured type of training not only for secretaries, but also for financial clerks.' (metal/mechanics)

A systems analyst provided the same argument regarding the adoption of in-house training courses *vis a vis* office workers' request for a structured form of training:

'Due to the limited resources available to training, we decided that on-the-job training was a good solution. However, as most of our employees didn't have the knowledge of how to use computers, they started wasting time in performing their tasks, and they also started to lose parts of their work by pressing the wrong keys. As they got frustrated, they put managers under pressure in the sense that they asked for a different form of training. I think that this pressure influenced the decision to invest on training courses.'
(food)

Evidence from the interviews also suggests that another element that influenced the adoption of in-house training courses was the fact that managers interviewed seemed to have realised that the difficulties experienced

by office workers regarding the use of new technology could constitute a barrier to the achievement of a goal such as increased levels of productivity. This barrier to the improvement of productivity was associated with two factors.

Firstly, according to information provided by managers, a large percentage of office workers were expected to employ new technology in this group of firms. However, the difficulties experienced by office workers did not allow them to use new technology. Managers interviewed perceived this situation as leading to what they called 'under-utilisation' of new technology. In other words, a large number of office workers who were supposed to use new technology, did not seem to be able to incorporate it into their work. Rather than employing new technology, the majority of office workers in these offices continued to use devices like typewriters and calculators in order to carry out their tasks. Managers interviewed tended to perceive the under utilisation of new technology as an obstacle to the achievement of greater productivity and efficiency in the office - an important goal considering that, according to them, these firms performed in a very competitive environment. Consequently, in the face of the possibility of both having a limited percentage of office workers using new technology, and therefore not achieving the expected levels of productivity in the office, managers in these organisations decided to introduce in-house training courses. A human resources manager related, in the following way, the under utilisation of new technology to the adoption of in-house courses:

'We expected to see most of our employees using computers. However, computers were introduced but not being employed because our employees didn't know how to use them. They carried out their activities as they used to - by using the calculator or the typewriter. As a consequence we had, on the one hand, a large percentage of office workers who were not able to use computers. On the other hand, we couldn't have our productivity increased because employees were not using the technology. We realised that it was necessary to provide another form of training otherwise computers would not be used at all, and productivity - which is very important in our sector - would not be increased.' (food)

A similar argument was presented by a systems analyst manager:

'Computers were not being used because the majority of office workers didn't know what to do with them, and they continued to perform their tasks as if computers were not there. Obviously, the productivity that we expected was not achieved. This constituted a problem because our sector has become very competitive, and one of the reasons for introducing computers was to become more competitive. We discussed the situation with other managers, we listened to our employees, and we decided that short-training courses could solve this problem.' (metal/mechanics)

A human resources manager reinforced the same idea by saying that:

'The problem with on-the-job training was that employees were not able to develop the skills necessary to use computers. In other words, just a few employees were able to use computers. Managers from different departments complained because they expected to increase their productivity and nothing was happening. The issue of productivity is very important for our firm because we work in a very competitive sector. So, we decided that it would be important to train our employees in a more structured way.' (metal/mechanics)

Secondly, managers interviewed noted that on-the-job training was a time-consuming alternative which could compromise the productivity in the office. More specifically, they realised that the development of skills through the experience of using new technology seemed to consume more time from the part of office workers than they expected. The interviewees explained, in this respect, that the performance of office workers' tasks was being delayed by the fact that these employees had spent a lot of time in activities such as learning commands or compensating for errors rather than actually performing their daily tasks. It follows that, for these interviewees, training courses turned out to be seen as a time-effective strategy because office workers would be able to acquire keyboard skills within a specific period, and, after such a training, they would be able to concentrate on their tasks. One human resources manager presents this argument in the following way:

'We realised that on-the-job training consumes a lot of time because employees have to read manuals or wait for help from a colleague. There is also the problem of losing files and deleting things that are important. In this sense, I believed that a training course is a good solution.' (food)

A similar argument was expressed by a systems analyst manager:

'The problem that we had with on-the-job training was the fact that office workers could not carry out their work without interruptions. They were not able to keep on with the work because they often had to ask for help. I think that training courses are more time-effective.' (metal/mechanics)

Evidence from the interviews indicates that the decision to adopt in-house training courses rather than courses provided by private training agencies was influenced by two factors. On the one hand, managers interviewed tended to perceive them as a cost-effective alternative compared to private training agencies. On the other hand, they argued that through a type of in-house training, office workers would be able to develop firm-specific skills rather than what they perceived as 'general' skills. In regard to costs, managers interviewed argued that their firms favoured in-house training based on the idea that the investments that it requires are typically lower than those in training centres. A systems analyst manager explained the adoption of in-house training courses as a more adequate alternative in terms of costs in the following way:

'One reason that influenced our decision to train our employees inside the plant was the costs involved. It is cheaper to have our office workers trained by the Informatics Department rather than having them sent to a training agency.' (metal/mechanics)

The view of in-house courses as a cost-effective training alternative was echoed by other human resources managers. They stated the following:

'The issue of cost is very important. Training outside is very expensive whereas training in the plant could be much more effective, at least in terms of costs.' (capital goods)

'Limited resources are allocated to training. So we considered that training office workers in the plant would be cheaper than training in a private agency.' (food)

In regard to private agencies, managers interviewed explained that these tended to provide what they perceived as 'training beyond the needs of the firm'. In other words, managers interviewed tended to take the view that whilst training courses offered by private training agencies provided what they termed 'general' skills or 'skills beyond the needs of the firm', in-house courses were more adequate because they focused on the development of firm-specific skills. A systems analyst manager justified the adoption of in-house courses rather than external training courses in the following way:

'I don't think that the courses offered by training agencies are adequate to our needs. They are too general, and they do not reflect our needs. The trainees learn general skills that cannot always be used in their daily activities. But, if we train our employees, they acquire the skills that are specific for the performance of their tasks.' (food)

A human resources manager provided a similar argument. He said that:

'We don't need office workers with skills that are beyond the needs of the firm, and, consequently, cannot be used here. Training needs to be concentrated on what is important and relevant for the firm. I don't think that the courses offered by training agencies can provide the skills that we need because they are too general, and they are not firm-specific. I think that in this sense we are better able to provide the necessary knowledge.' (capital goods)

Managers interviewed also criticised the courses provided by private agencies by arguing that office workers who had been trained in these agencies developed skills which were perceived as 'general' rather than task-

specific. One systems analyst manager stated the following in regard to private agencies:

'Some of our employees received training in a private agency, and they developed general skills or skills which were not task-specific. These employees faced difficulties when they tried to apply the knowledge that they had acquired in their work. We need to train office workers so they can use computers according to the needs imposed by their work.' (capital goods)

A similar critique regarding the courses provided by private agencies was made by a human resource manager:

'Our employees argued that the training provided by a private agency was too general, and that they didn't know how to use the knowledge acquired in order to carry out their activities. They added that they preferred to receive a more specific training, and we think the same. I think that in-house training is a better solution because it is organised in order to develop skills which are relevant to our employees.' (metal/mechanics)

Managers interviewed provided evidence that suggests that the in-house training courses were aimed at equipping groups of office workers with firm and task-specific skills rather than intellectual skills. This argument is supported by various statements in which managers seemed to imply that, through in-house training, office workers could develop skills relevant to the performance of their immediate tasks. These managers argue that:

'Through in-house training, our office workers can develop skills that are relevant to their work. If they know how to use a program which is related to their work, they feel confident, they know how to avoid

errors and their work becomes more efficient. By using a program, I mean knowing the right commands or the commands that are necessary to perform their tasks.' (capital goods)

'For instance, our personal secretaries are trained in order to use a particular program. There is no reason why they should learn something else because they are not going to use it. They learn the right commands so they can create, store and retrieve documents. I think that in knowing how to do that, secretaries become more productive and efficient.' (food)

'In the case of financial clerks, the in-house training aims to train them to use a spreadsheet. By knowing the right commands they can work with the program and accomplish their tasks.' (metal mechanics)

'The in-house courses are aimed at developing skills that are relevant to employees' work. They need to know practical things like commands and terms. If they do that, they feel more confident using the computer, and I do believe that their efficiency and productivity is improved.' (metal/mechanics)

The evidence in this sub-section suggested that the adoption of in-house training courses did not derive from a managerial concern to the development of a flexible labour force, as implied by the informational model of office automation. Managers decided to invest on this type of training because they seemed to have realised that the lack of training could constitute a barrier to the improvement of productivity of office workers. In-house training courses turned out to be, in this sense, a more cost-effective alternative compared to private training agencies. On the one hand, it was seen as a strategy that could enable office workers to incorporate the new technology into their daily activities by developing firm-specific skills. On the other hand, it was seen as

a more economical solution than training courses provided by private training agencies.

It can be argued that managers in this group of organisations seemed to be more concerned with the training of office workers because they realised that in order to increase productivity, it would be necessary to develop skilled office workers. However, such a concern expressed a narrow approach to both technology and training because it reflected a commitment to the development of keyboard skills rather than intellectual skills. In-house courses were expected, in this sense, to develop skills which would assure the improvement of productivity of the labour force without increasing the complexity of the tasks performed by office workers. They were also expected to reduce office workers' resistance by providing task-specific skills - skills which were seen as enabling these workers to cope with the changes caused by the introduction of new technology.

4. Office Workers' Approaches to Technology and Training

Evidence from the interviews with personal secretaries, financial clerks and general clerks indicated two main findings.

Firstly, it indicated that the two theoretical models of office automation discussed in Chapter 4 can also be applied to the analysis of office workers' approach to new technology and their approach to the nature and purposes of

training. The evidence suggested, therefore, that the attitude that office workers have, both to the skill requirements derived from the adoption of new technology and the type of training appropriate to meet these requirements, tended to be influenced by their perception about the potential of technology to change the content of their work (in terms of increasing or reducing the complexity of some of their tasks, and consequently, whether generating or not a need for narrow skills).

Secondly, evidence from the interviews suggested that office workers interviewed could be divided into two groups. One group of interviewees tended to express an approach to both technology and training which could be understood in terms of the informational model of office automation. The other group seemed to have taken a technology-driven approach to technology and training (see Table 2).

The informational model of office automation suggests that new technology can be used as a means of conferring a new kind of flexibility to the labour force. Such a flexibility is related to the idea that technology has the potential to create new and deeper levels of information about the work process by enabling data to be fed back to employees in new ways - a process which suggests that information becomes potentially accessible by all employees and not just their managers. This process occurs because the office work becomes mediated by an information system which not only provides information to office workers, but also allows this information to be input to the system by the employees.

The model implies that work mediated by such a system or what Zuboff (1988) calls 'data interface' has the potential to generate a qualitatively new experience for office workers - an experience which requires new and more abstract skills. More specifically, it suggests that work with data interface increases the complexity of the work process because it involves mental rather than concrete physical activity. The responses given by an employee become based on abstract cues provided by the data interface rather than cues from the immediate physical environment. These responses involve thought processes in which options for action are considered, and choices are made and translated into terms that can be fed back to employees via data interface. The model implies, therefore, that such responses require the development of intellectual skills. In other words, skills which refer to both the ability to solve problems - or problem-solving skills - and the ability to interpret situations - or interpretative skills.

In contrast, the technology-driven model of office automation implies that new technology allows the same work process to be performed with more continuity, control and reliability. The adoption of new technology decreases, in this sense, the complexity of the work process, which leads to a context in which informed human intervention is also reduced. The model implies that such a reduction of human intervention leads to a parallel decrease regarding skill requirements in the office environment. This decrease is reflected in the adoption of a type of training is aimed at the development of task-specific skills or keyboard skills so that office workers can type, store, retrieve and distribute information within their limited roles.

The discussion of the evidence regarding the two groups of office workers is broken down into two sub-sections. Sub-section 4.1 analyses the group of office workers who seemed to have taken an informational view to the issue. It discusses their approach to technology, skills and training. Sub-section 4.2 explores the evidence concerning office workers who tended to express a technology-driven approach to technology, skills and training.

4.1 A More Informational Approach to Technology and Training

Evidence from the interviews with office workers suggested that sixty per cent of office workers interviewed tended to express an approach to technology and training which could be understood in terms of the informational model of office automation. Thirty five per cent of these interviewees were personal secretaries, thirty five per cent were financial clerks and thirty per cent were general clerks. Sixty per cent worked in firms which favoured in-house courses (food, metal/mechanics, and capital goods), and forty per cent were in organisations that adopted on-the-job training (energy, paper and pulp, footwear and transport). In regard to this group of office workers, evidence pointed to three main findings.

Firstly, it indicated that for those interviewees, new technology increased the productivity and efficiency of their work due to three reasons:

- a) it allowed the reduction of a number of tasks requiring manual skills

- b) it improved the speed or the rate at which physical operations could be carried out
- c) it enhanced the consistency or reliability involved in the performance of tasks like typing letters and tables.

Secondly, it suggested that these interviewees tended to see the use of new technology as requiring informed human intervention. According to their perception, technology also enhanced the complexity of tasks such as elaborating letters, reports and tables. For them, the complexification of tasks was perceived as generating a context in which the performance of certain tasks required other skills rather than task-specific skills.

Thirdly, it also suggested that due to the perception of new technology as requiring informed human intervention, these office workers tended to express a great concern with the appropriateness of the type of training available in their organisation - in their case, on-the-job training. For them, on-the-job training constituted a limited type of training because it tended to focus on the development of task-specific skills rather than skills which would enable employees to cope with the increased level of complexification of certain tasks. It follows that, in order to develop such skills, these interviewees searched for different types of training in the form of courses provided by private training agencies or in-house training courses.

When asked about the changes caused by the new technology, a group of personal secretaries, financial clerks and general clerks expressed a positive attitude to its introduction based on the perception that technology increased

the overall productivity of their work. These interviewees related such an enhancement of productivity to the fact that new technology reduced a number of tasks that used to require manual skills like typing, and by doing so, improved the speed at which they could be operated. For instance, a secretary interviewed explained, in this respect, that the use of new technology improved the productivity involved in the performance of tasks such as typing letters. She pointed out that it allowed such a task to be done with more speed because it reduced the process of retyping a letter in full in order to make corrections. She expressed her view in the following way:

'I think that the decision to introduce computers was great. You see, when one of the managers wants to make changes to a letter, I don't have to retype it all over again. This not only saves a lot of my time, but it also allows me to do the work with more speed and I don't have that feeling that I have to do it all over again.' (metal/mechanics)

Another personal secretary expressed a similar view when she argued that new technology improved her productivity because it created the opportunity to correct letters without having to retype them in full. She said

'Before computers were introduced, I had to retype every single letter that needed to be corrected. It was very annoying, demanding and I tended to lose a lot of time because I had to type a letter twice, sometimes more. Nowadays, I just print it, I give it to my boss, he makes alterations, I make the correction in the computer and the letter is ready. I feel that my work has become more productive and efficient.' (transport)

A financial clerk presented a similar argument when he explained that prior to the use of new technology in his organisation, he had to type all information involved in a payroll list such as names of employees, their functions and their respective salaries. However, the introduction of new technology eliminated such a process of typing and retyping because all information concerning employees was kept on a disk, recalled and updated in the end of each month. He described such a change in the following way:

'I can say that computers made my life much easier because they eliminated a lot of the manual work that I had to do. In the beginning, I had to type names, occupations and salaries of each employee in order to have the payroll list done. It was very stressful, particularly at the end of each month, because it was a lot of work and it was always difficult to finish on time. But now, we have everything on disk and I just update the list. The whole process was speeded up and sometimes I have some time left to do other things.'
(food)

This financial clerk added that new technology also improved the consistency or reliability of his work in the sense that it reduced the possibility of making errors when elaborating a payroll list. He explained that errors were frequently made due to the fact that calculations used to be done manually with the use of a calculator. However, as he noted, new technology decreased the amount of errors because it allowed calculations to be done in what he perceived as a more consistent way. He explained the situation in the following way:

'My work was very stressful because I had to concentrate a lot when calculating the salary employees. A calculator was used to make all the

calculations, and I was under a lot of pressure in terms of not making mistakes. But it was very difficult not to make errors, and now, it is less stressful because the computer does all the calculations and the amount of errors have decreased.' (footwear)

A similar argument was presented by a general clerk working in the sales department. This interviewee explained that one of his tasks was to keep an updated list of prices in order to answer customers' queries - a list that according to him needed to be revised on a regular basis due to the fluctuation of the Brazilian currency. He argued that, prior to the introduction of new technology, such a revision involved calculations that were done with the use of a calculator, and that errors were made as a result of this. He noted, however, that the usage of new technology to make these calculations reduced the amount of errors involved in the elaboration of the list of prices - a change that he perceived as improving the consistency of his work. He said that:

'I have to keep an updated list of prices in order to answer customers' enquiries. As our currency changes every day, I have to update this list, and sometimes I made mistakes because I used a calculator to do the calculations. Nowadays, the computer is used and I feel that the errors have been reduced, and, in this sense, I also think that my work has become more reliable.' (capital goods)

However, evidence from the interviews indicates that these office workers interviewed did not perceived such an usage of new technology as simplifying or reducing the complexity of their work. These interviewees argued that one of the impacts of new technology on their work was one of making easy the performance of tasks like typing and calculating due to the fact that technology reduced the need to retype a document in full or decreased

the possibility of making errors. The interviewees suggested, nevertheless, that rather than having their work simplified, new technology improved its complexity because it made tasks such as elaborating tables as well as elaborating new letters more demanding activities. For example, a personal secretary interviewed argued that, according to her perception, new technology reduced the need to retype a document, but it did not simplify the performance of tasks like elaborating letters. She explained, in this respect, that although formats could be kept on a disk, recalled and filled in when necessary, she still had to create new letters which required the setting up of new formats. She perceived such an activity as being demanding because it involved decisions concerning, for instance, the appropriateness of a document layout. She presented her perception in the following way:

'I don't think that technology simplified my work. It simplified it in the sense that I don't have to retype a letter in full when I have to correct it or when I want to send the same letter to another person. I mean, a letter is formatted and kept on a disk and I recall it when its necessary. But in my work, I always need to create new formats for new letters and then I need to make decisions about a new layout. I decide about the way in which the headings, the footings and the centring are going to be done. I do think that in this sense, my work has become more complicated.' (paper and pulp)

A similar argument was presented by a financial clerk when referring to the elaboration of tables. For him, new technology made it easier to create a new table in the sense that it offered the possibility to work its final appearance on screen as well as to correct errors that had been made or typed. However, as he noted, the level of complexity increased because he had to

think and plan this task carefully in order, for instance, to fit all columns on a particular size of paper. According to him

'For instance, if you consider that I have to make tables. It is obvious that computers make it easier because everything is in front of me and I can correct my errors. But it doesn't mean that I don't have to think about it or that the computer does it all. I have to plan a table carefully before actually doing it otherwise I waste a lot of time. In this sense I believe that my work has become more complex.' (food)

A general clerk expressed the same view. He said that:

'I have to write small reports and I still need to plan them. For instance, how am I going to organise the text, how am I going to do the layout, and things like that. Well, the computer doesn't do that for me and I have to do it myself. You see, the computer makes it easier on one side, but it makes more difficult on the other.' (footwear)

According to the perception of some personal secretaries interviewed, new technology also increased the complexity of tasks such as answering enquiries from managers and clients. They related this complexification to the fact that as new technology allowed access to data from other departments, it became relevant for them to interpret this information in order to answer various enquiries. An interviewee working in the marketing department explained, in this regard, that due to the introduction of new technology, she acquired access to information concerning stock and prices from the sales department, and that she was expected to provide such information to managers and clients. She argued, however, that in order to do so, she had to

develop both the ability to retrieve information as well as the ability to interpret it. She described this process in the following way:

'I think that the computer simplifies things and makes other things more complex...The fact that I have more access to information from other departments makes some of my tasks more complex. I have to give information for my boss and also for clients who are related to the sales department. It's about prices and stock control. I have to know how to retrieve this information in order to provide it and also need to know its meaning. If I don't know that, I can't give the right information.' (metal/mechanics)

Another personal secretary presented the same argument. She said:

'I have more information now because computers are being linked to each other. So I have access to information from other departments, but still, I need to know how to find it. I feel that I also need to know its meaning otherwise I give the wrong information. You see, the work has become, in a way, more demanding, more complicated.' (energy)

Evidence from the interviewees suggests that by perceiving the use of new technology as increasing the complexity of their work, they tended to express a great concern with the appropriateness of the type of training received in their organisations - in their case, on-the-job training. For them, and as implied in the quotations above, new technology was not seen as reducing the need for human input, but rather as enhancing the complexity involved in tasks such as producing letters, tables and reports. It follows, therefore, that for these interviewees, on-the-job training reflected a limited type of training because its focus was on the development of what they

perceived as task-specific skills such as typing, storing and retrieving information. For them, these skills were not seen as allowing them to deal with the enhanced level of complexity involved in the performance of certain tasks. For instance, as argued by a personal secretary interviewed, on-the-job training constituted a narrow type of training. For her, it developed skills which enabled her to type, store and retrieve information, but it did not provide her with a general technical knowledge required to solve problems involved in the production of a table. She expressed herself in the following way:

'On-the-job training is very limited. I have learnt to type, store and retrieve documents but I haven't learnt how to do a table, for instance. It is much more than just typing and filling in. For instance, I have to solve problems like the position of columns, the size of characters, and in order to do this, I have to plan before actually doing it. So it is a lot of brain work, and it is very difficult when you don't have a general technical knowledge about the whole process.' (paper and pulp)

Such an argument was supported by another personal secretary interviewed. In regard to the production of letters, she said the following:

'Managers think that computers work by themselves so they have this idea that we can learn on-the-job. I don't agree because I think that this form of training is extremely poor...For instance, some letters are already formatted and I know how to retrieve them and fill them in, but it is different when I have to write a new one. I have to decide things about its layout that are more than just typing. I also have to paste, delete unwanted material, and I have to merge up documents. The problem is that it is very difficult to learn these things on-the-job.' (metal/mechanics)

A financial clerk expressed a similar view. He argued that:

'I think that is ridiculous the way in which managers expect us to learn how to use a computer. They think that computers don't need people so we better learn a few things by ourselves. I have to do a lot of brain work when I prepare a report. I have to plan ahead, decide the layout, see if tables fit in the pages, and so on. And I can't do all that just because I know to type, store and retrieve a document, and I think that is very hard to do that without learning it properly, without having technical knowledge.' (food)

The interviewees explained that on-the-job training constituted a barrier to the employment of new technology because it failed to provide what they termed 'general' skills. The interviewees argued, in this respect, that in order to overcome this barrier, they had to put pressure on their managers to create a type of in-house training - in the form of in-house short courses - aimed to develop a general technical knowledge about new technology so that they would develop both:

- a) an understanding of what actions at the data interface would lead to appropriate outcomes
- b) the ability to interpret new data as feedback on the results of responses.

A personal secretary interviewed described the concern with the type and aims of in-house training in the following way:

'I pointed out to my boss that I was not using the computer as I felt I could, and that sometimes, it was difficult to use it at all because I didn't know how to

solve certain problems. I argued that a type of formal in-house training would be a good solution for me. I mean, I wanted training in which I could learn technical things about computers so that I would be able to understand what leads to what, and solve problems as they occur. I think that another important thing is to know how to interpret new information as it arrives on the screen.' (metal/mechanics)

A similar argument was presented by a financial clerk:

'I think that training needs to be concerned with technical aspects of technology. If I understand how things happen, I can explain the meaning of information even if it is new or old. If I have this understanding, I know how to solve my problems. I know that if I press a sequence of commands I have a certain outcome. That is the reason I kept bothering my boss about having in-house training rather than learning by myself on-the-job.' (food)

A general clerk expresses the same point of view. He argued that:

'I complained about the way in which they expected us to learn how to use computers. I can learn commands by myself, but I don't know how to solve certain problems because I am not sure that when I do something, I get what I expected. It is more complicated because it involves knowing technical aspects. Now we have in-house courses because other employees felt the same way as I did.' (capital goods)

Evidence from the interviews also suggests that some office workers did not have their request for the provision of an alternative type of training met by managers. These interviewees explained, in this respect, that their managers tended to take the view that any type of training different from on-the-job training would constitute a cost to be avoided by the organisation due

to a context of economic uncertainty. However, as the interviewees tended to see their limited knowledge not only as a barrier to the use of new technology, but also as a cause of stress and frustration, they decided to invest on their own training - a training which took place in private training agencies. A financial clerk explained his decision to invest on training provided by a private agency in the following way:

'My boss replied that training was too expensive, and that it was necessary to keep costs down because of the recession, inflation and so on. Well, I decided to pay for my own training in a private agency because the pressure and the stress was too much. I felt that I was not able to use the computer in a proper way, wasting time and brain cells.' (paper and pulp)

A similar argument was provided by general clerk. He stated that:

'I financed my own training in a private agency because my boss didn't want to pay for it. He said that it was too expensive and the firm was supposed to make expenditure cuts. But as I didn't have the knowledge of how to use the computer properly, the whole situation became very stressful.' (energy)

A personal secretary presented the same view:

'You see, managers didn't want to spend money on training. They blamed the economy, and I had to keep up with all the stress because I didn't know how to use a computer in an efficient way. So I decided to attend one of these courses offered by private agencies.' (transport)

Finally, these office workers were asked to evaluate the type of training received. In regard to office workers who attended in-house training courses, sixty per cent tended to see them as a limited type of training because they focused on the development of task-specific skills that had already been developed through experience on-the-job. However, Forty per cent of the interviewees argued that their goals meet their expectations because they allowed them to establish a relation between the technology on their desk and their work. Among office workers who criticised in-house training courses, a personal secretary argued that:

'I don't think that it solved my problems. It was too general, and I didn't learn much because most of the things that were taught, well, I had already learnt by myself. It still is difficult to relate the machine which is on my desk and the things that I can do with it.'
(metal/mechanics)

A financial clerk presented a similar argument in regard to in-house training courses:

'It was very basic. The instructor taught us things like storing, saving, deleting, and retrieving documents. But the point is that I knew all that. I think that in this sense it could have been more detailed.' (capital goods)

The argument above was supported by a general clerk:

'I don't think that I benefited from the training. It focused on basic things such as basic commands. The problem was that I had already learnt all these commands through experience on-the-job, and I wanted to learn more technical things. I want to know

more about the different way by which I can do my work'

Office workers who took a positive view about in-house courses argued the following:

'I think that it was fine. I knew some of the things taught by the instructor. Other things were new.'
(personal secretary - food)

'I can say that in general terms, the training was good. Some things were new and helped me to understand some operations.' (financial clerk - metal/mechanics)

'The training was good. I learnt an easier way to do certain operations, and that was fine.'

In regard to office workers who attended courses in private agencies, it was argued that the training received tended to focus on the development of task-specific skills (such as storing, deleting, retrieving and distributing information) which had already been developed by using new technology on-the-job. However, in their opinion, compared to in-house training, this type of training had an advantage because it allowed them to make a relation between the capabilities of the new technology and their work. A personal secretary presented this argument in the following way:

'For me, the training was sort of basic. We had a small introduction about the historical development of computers, and then, the instructor started to teach us basic things - how to save, delete, retrieve and so on. Well, I knew almost all of that. I don't think that the training contributed for the development of new skills. I have still the same difficulties.' (transport)

A financial clerk expressed a similar view:

'The training was basic because it focused too much on commands. But it helped me to see the all the things that I can do with a computer in my work. I didn't have that general understanding. But I don't think that it addressed my problems, because it was too general. I think that the training should focus on more specific things so that I could improve my knowledge.'
(footwear)

The same argument was also supported by a general clerk:

'It helped me realise that I could use the computer to do a lot of things. I know that I can try new layouts, and so on. But I didn't learn much in terms of acquiring new abilities. I knew most of the material that was given to us. I expected the training to be more specific so that I could learnt things that I could later apply into my work' (paper and pulp)

The evidence discussed in this sub-section pointed to two main findings. Firstly, the training provision was not only shaped by managers' perceptions about the relationship between technology and skills, but was also influenced by office workers' approach to the potential of new technology to create a need for skills other than task-specific ones. Secondly, the evidence pointed to a contrasting approach to technology and training between managers interviewed and this group of office workers.

For systems analyst and human resources managers, new technology was seen as replacing rather than complementing office workers' skills. In their

view, skill requirements could be reduced to task-specific skills because technology could allow office tasks to be performed with more continuity, efficiency, speed and control. It follows that for them, in-house training constituted a cost-effective strategy as far as it could develop these task-specific skills, and consequently, enable office workers to adopt new technology within their limited roles but with increased levels of productivity. The aims of both types of in-house training were, in this sense, the development of keyboard skills such as commands of specific software packages rather than the development of new skills which could allow employees to exploit the informational potential of new technology.

However, being the user of new technology, this group of personal secretaries, financial and general clerks experienced new technology in a different way. Rather than concentrating only on the automating potential of new technology, office workers perceived it as informing the content of tasks like elaborating new formats for letters, producing new tables, as well as interpreting information from various departments. As implied in their statements, by enhancing the complexity required to operate these tasks, technology also changed their content. They were able to realise, therefore, that this process of complexification demanded skills other than task-specific skills, and that they could not be developed only through experience on-the-job.

It follows that for them, in-house courses or a type of external training became an important means by which they could develop what they perceived

as a 'general technical knowledge' about new technology. The evidence suggested that by 'general knowledge', office workers pointed to a need to:

a) Have a broader understanding of what actions at the data interface lead to appropriate outcomes.

b) Solve problems resulting from the use of new technology

c) Develop abilities to interpret new data.

Due to this approach to the nature of skill required by new technology, office workers rejected on-the-job and set out to look for what they considered to be a more appropriate type of training. A type of training by which they could develop an understanding of the capabilities of technology in relation to their work, and consequently, cope with difficulties regarding the performance of various tasks. This aim seemed to be implied particularly in the statements provided by office workers who financed their own training in private agencies. For them, although this type of training focused on task-specific skills that had already been developed, it tended to have an advantage over in-house training because it allowed them to make a relation between their work and the capabilities of technology.

4.2 A More Technology-Driven Approach to Technology and Training

Forty per cent of office workers interviewed tended to express an approach to technology and training which could be understood in terms of the technology-driven model of office automation. These interviewees were in organisations which favoured on-the-job training, and were comprised of personal secretaries, financial clerks and general clerks. Evidence from the interviews with office workers indicated two main findings:

Firstly, evidence indicated that these interviewees tended to see the impact of the introduction of new technology as one of simplifying their work by improving the consistency and speed at which tasks could be done, and consequently, reducing the need for informed human intervention to the performance of tasks.

Secondly, evidence suggested that the interviewees did not seem to express a great concern with the development of skills other than task-specific skills. Therefore, they tended to have a positive view of on-the-job training. For them, on-the-job training was an appropriate type of training because it allowed the development of task-specific skills. These skills were seen as enabling office workers to meet short-term needs regarding the performance of their work.

Evidence from the interviews with some personal secretaries and financial and general clerks suggests that, according to their perception, the introduction of new technology simplified their work because it improved both the consistency and the speed at which tasks like producing letters, reports and tables could be performed. A general clerk noted, in this respect, that the greatest change caused by new technology was one of simplifying tasks like producing letters. He argued that such a simplification took place because new technology allowed letters to be formatted on a disk, recalled and filled in when necessary, and thus, reduced the need to type or retype a document in full. For him, technology increased not only the speed involved in the production of a letter, but also improved reliability in the sense that it created the opportunity to make corrections on the screen without having to retype the whole document. He explained his perception about the changes derived from the introduction of new technology in the following way:

'For me, the great change caused is the fact that it simplified my work. I don't need to type a letter every time my boss asks. I know that it is formatted on a disk. I just retrieve it and I fill it in. It is much easier even to correct it because it is all there, on the screen. So my work, I think is more reliable.' (capital goods)

A similar argument was presented by a personal secretary in regard to the elaboration of reports. She said the following:

'It is all about making the work much simpler. For instance, when I have to write a report, I know that it is on a disk, I just update numbers and other things, and it is all done. I don't have to think too much about it, it is more automatic, error free.' (transport)

A financial clerk interviewed expressed a similar view in regard to the production of tables. He said:

'The computer makes my life much easier, for instance, when I need to prepare a table. The only thing that I have to do is to update the numbers because it is already done in the computer. I just type the information in, and the computer does the rest.'
(footwear)

Evidence from the interviews indicates that for these group of office workers, the adoption of new technology was not seen as enhancing nor reducing the content of their work. They argued that their tasks had not been altered due to a limited availability of new technology in their firms. It follows that these interviewees did not tend to perceive technology as increasing the complexity of tasks. Rather, for them, it was seen as simplifying tasks like producing letters, reports and tables, and by doing so, reducing the need for informed human intervention. For instance, when asked about his perception about the nature of changes caused by the use of new technology, a financial clerk said that:

'Computers didn't change my work. I don't use computers very often because there are few machines and lot of colleagues who want to use it. As I said before, I think that technology made my work easier because I don't have to think too much to do a table. The work is done by the computer.' (transport)

A similar view was expressed by a general clerk in regard to the production of letters. He stated the following:

'I really don't think that my work has become more complex. In reality, it became more simpler. I don't have to think too much about things like setting up columns because the computer does it for me. I don't have much time to think as well because there are other who also want to use computers. ' (paper and pulp)

A personal secretary supported such an argument when she stated that:

'The change is that I don't have to think too much about certain things. The work is more automated and, sometimes, the only thing that I have to do is to retrieve a document, change a few things, and the letter is done. In my opinion, it became less difficult and less demanding.' (metal/mechanics)

The interviews with office workers provided evidence that suggests that because they seemed to perceive new technology as reducing human intervention due to its potential to automate certain tasks, they did not tend to express a great concern with the development of skills like problem-solving and interpretative skills. In other words, as new technology tended to be seen as allowing tasks like elaborating letters, tables and reports to be performed with task-specific skills, these interviewees did not express a greater concern with the type of training available in their organisations - in their case, on-the-job training. Rather, they seemed to consider on-the-job training as an appropriate type of training because it allowed, according to their perception, the development of task-specific skills such typing, storing, retrieving and distributing information, and by doing so, enabled them to perform their tasks. For instance, when asked about the appropriateness of on-the-job training, a personal secretary gave the following answer:

'I think that it is okay because I can do my work. I need to know the things that are relevant to my work. In order to write a letter, I don't have to think too much because a lot of things are done by the computer. I need to know commands like retrieving, storing and printing, and I can learn them by myself on-the-job.'
(paper and pulp)

A similar view of on-the-job training was presented by a financial clerk.

He said that:

'As a lot of my tasks are automated, I don't need to know more than certain commands, and I can learn them by myself on-the-job. I think that this is fine, and when I have a problem, I ask a colleague for help. The important thing is that I do what I am suppose to do.'
(energy)

A general clerk expressed the same view:

'I think that it is better to learn on-the-job because then I learn the things that are important for me. I don't want to learn things that I am not going to use. I want to do my work, that is all. I need to know some commands and the rest is easy.' (transport)

Finally, these interviewees were asked if they would like to learn skills which would allow them to do tasks such as producing letters and tables in a different way. They implied that although they would like to have a general technical knowledge about new technology, they did not see such a knowledge as relevant to the performance of their everyday tasks. One financial clerk answered this question in the following way:

'Maybe I would like to have some technical knowledge, but I don't think that it is that important. I can do my

work with the knowledge that I have so, in this sense, learning new things is not very necessary.' (transport)

A personal secretary provided a similar answer. She said:

'I would like to know how computers work, I mean, on a general basis. However, I don't have time and I think that I can cope with my work with the skills that I have.' (footwear)

A general clerk presented the same view:

'The important thing is to do my work, and I can do that with the knowledge that I have acquired on-the-job. If I had the time, I would like to know general things about computers, but it is for the future.' (paper and pulp)

The evidence discussed in this sub-section indicated that both this group of office workers and managers interviewed seemed to express a technology-driven approach to both technology and training. However, based on evidence from their interviews, it can be suggested that one of the factors that influenced these office workers' approach to technology, skills and training, was their limited access to new technology. Office workers did not seem to perceive new technology as changing the content of their work, in other words, enhancing the complexity of their tasks. The systems analyst and human resources managers likewise, tended to focus only on the automating capabilities of the new technology, and by doing so, were not able to perceive it as increasing the need for informate human input. For them on-the-job training constituted, in this sense, an optimal type of training because it allowed the development of short-term skills such as the commands of

particular software programs. In addition, both by not seeming to be under pressure to adopt new technology and by not perceiving a need for skills other than the ones acquired on-the-job, these employees did not express a concern with the development of skills in the future.

5. Private Agencies: Deputy Directors' Approach to Training

The thesis not only focuses on the type of training provided to office workers by firms, but it also considers the type of training provided by bodies outside the office environment. It thus looks at training agencies in order to explore the way in which Brazilian training bodies have responded to changing skill requirements in offices located in Curitiba. The interviews with deputy directors of training agencies provide an insight into the approach to training and skill requirements of new technology taken by individuals who operate outside the production processes in the office. The agencies studied offered courses directed at private individuals, but also at office workers sponsored by firms. Evidence from the interview suggested that the design of these courses was influenced by deputy directors' perceptions of the skill implications of new technology. For them, individual (either office workers or private individuals) with task-specific or keyboard skills were seen as capable of using new technology to perform activities related to specific software packages, i.e. word-processing or spreadsheet.

Evidence from the interviews with deputy directors indicated that private training agencies studied have two main characteristics:

a) They are completely separated from the educational system, and maintain no relations with employers organisations or trade unions.

b) They are market-oriented organisations but they do not seem to tailor their courses to specific client, such as office workers sponsored by firms.

Directors interviewed made it clear that the agencies studied do not receive any funding from employers organisations, trade unions or state or federal bodies of the Ministry of Education, nor do they have to satisfy educational requirements or support training policies adopted by the Ministry or the other organisations. One principal interviewed described the functioning of his training agency in the following way:

'This is a private and independent organisation. We don't have links with any educational body or trade unions or association of employers. We are not funded by any of them. We don't need to follow any training guidelines laid down by the Ministry of Education or any other organisation.'

A similar description was presented by other interviewees. They stated that:

'This is a market-oriented organisation. We don't need to follow training policies adopted by the Ministry of Education nor do we have to meet specific requirements of the industrial sector or trade unions.'

We are independent, private and we function via consumer demand or according to needs detected in the market.'

'This is a private agency. We don't have to follow regulations or training requirements imposed by any educational body or industrial organisation. We are independent in the sense that we offer training courses according to consumer demand.'

Evidence from these interviews also suggested that the agencies ultimate aim is to make profit. In fact, according to directors interviewed, the agencies were set up to fill a gap in the training market, which had resulted from the diffusion of new technology across firms located in Curitiba. The interviewees argue that the courses that they provide have a competitive advantage over firm in-house training based on a greater understanding of the skill demands imposed on technology users. They pointed out, in this respect, that firm-managers tend to have a limited experience of new technology, are unaware of the general skill requirements related to its use, and hence, tend to provide inappropriate in-house training. In their view, such an in-house training only develops task-specific skills which do not enable office workers to adapt the technology to their particular work. According to them, office workers who have undergone this type of training still have great difficulties in using new technology. This reduces the productivity gains which were to result from the adoption of technology, and creates frustration within the office - among managers and office workers. A deputy director interviewed presented such a view in the following way:

'The agency was set up because we detected a gap in the training market caused by the growing diffusion of new technology in firms located in Curitiba. We aimed

at this market because we believe that the training courses that we provide meet the skill requirements imposed by computers. For instance, if you take a firms' in-house training, you can see that it develops very narrow and task-specific skills which do not allow employees to use technology. The point is that managers don't have experience of computers and don't know the type of skills that it requires. Thus, it is very common to find firms in which computers are hardly used, managers are frustrated because they don't see any improvement of productivity, and employees feel the same because they can't use computers.'

A similar argument was expressed by other directors interviewed. They said:

'We explore a gap that was created by the use of computers. We have been successful because our courses reflect the skill requirements derived from this technology. It is important to explore this gap because there is a growing demand for the individual with computing skills, particularly among office workers. Because they are usually trained in-house, they feel that they don't have sufficient knowledge to use computers. You see, managers don't have much knowledge or experience with computers. They think that employees need to learn basic commands, and productivity is increased. The result is frustration among managers and employees.'

'There is a demand for training in this area, and we just explore it. It is obvious that one of our aims is to make profit, but we also want to provide a type of training which reflects the skill demands imposed by technology. We provide training for firms because managers don't really understand that employees need more general skills to use computers. Managers provide in-house training but, as they soon realise, it is not sufficient and employees are not able to adapt to computers. This causes a lot of stress among employees and frustrates managers' expectations to increase productivity.'

However, even though the agencies representatives tended to criticise firm in-house training for being too specific, the agencies themselves provide training courses which also focus on the development of task-specific skills rather than both problem-solving and interpretative skills. According to the interviewees, agencies offer two types of training courses, both to employees sponsored by client-firms and to private individuals: courses focusing on word-processing and courses focusing on spreadsheet. Both types of courses are designed to develop task-specific skills so that trainees can type, store, retrieve, delete information - i.e. basically, master the 'keyboard commands' of a certain software package. For the interviewees, the aim of this type of training is perceived as appropriate because, as they note, employees can learn what they call more 'specific' skills on their own in the office given that they have been taught the basic 'keyboard commands'. Such an argument is expressed by a deputy director when he explained the type of courses provided and their aims:

'We offer two types of courses for both firms and private individuals. Both aim to see trainees mastering the commands of word-processing or spreadsheet. We focus on the development of skills which enable trainees to use these software programs. If they learn these skills, they can adapt to computers and, by doing so, they can certainly develop other general skills through practice on-the-job.'

The same idea was expressed by other interviewees. They stated the following:

'We offer one course which focuses on the use of a word-processing and one course which focuses on a spreadsheet. At the end of the course, we expect trainees to learn the commands of these software programs. They are expected to know how to type, store, retrieve and so on. That is very simple. We believe that when they start using the computer to perform their activities, they can do so because they know the basic commands, they improve their knowledge and skills.'

'One course focuses on a spreadsheet and the other on word-processing. We teach the basic commands of these two packages, so that trainees have a general idea and can use computers in their workplace. Afterwards, the more they practice on-the-job, the more they improve their skills.'

To sum up, the above evidence indicated that agencies did not tend to differentiate between clients, or in other words, they did not seem to take into account the specific needs of individual-clients when designing their courses for three reasons. Firstly, given that there seemed to be a sufficient demand for courses from the individual market, there tended to be no pressure for agencies to tailor their courses to individual clients' needs, for instance, office workers sponsored by firms. In other words, as the demand from private individuals appeared to be greater than firms, deputy directors did not tend to see a need for providing courses directed at office workers and their specific skill requirements (as implied by office workers who attended these courses). Therefore, although criticising firms' in-house training for focusing on task-specific skills, deputy directors favoured courses aimed at developing the same type of skills. Deputy directors concentrated on the provision of this type of skills because, according to their perception, these were the skills demanded by the individual market. Therefore, as managers interviewed,

deputy directors interviewed also seemed to see skill requirements of new technology in terms of keyboard skills which could be learnt in a few days³.

The following quotations provided by interviewees support these ideas:

'We don't do any specific research in firms in order to know their needs in terms of skills. The experience that we have in this area allows us to design courses according to the skill requirements imposed by computers. The growing demand from private individuals for our courses is a proof that our courses reflect these needs. I think that we have to develop the skills that are required by this market, and these are keyboard skills. You see, if the trainee knows the basic commands of a program, he can use a computer without problems.'

'The feedback that we receive from trainees indicates that our courses provide the skills required by technology. The feedback that we have from the market is also positive, for instance, most of our courses are already booked up. We have experience in the area, an experience which allows us to organise an appropriate type of training without going into too much detail with firms. We look at the skills that are required by the individual market and these are keyboard skills. If the trainee learns these skills, he can apply the computers to different circumstances.'

'We started to function seven years ago, and I can say that the demand for our courses has increased. People seem to be more aware that computers are an important part of our lives and work, and because of that, they look for our courses. The feedback that we have indicates that our courses reflect the needs of our clients, firms or private individuals. Thus, there is no need to design a specific course for particular groups. Individuals with keyboard skills are capable of using computers without problems.'

³ According to information provided by deputy directors of training agencies, the courses offered (word-processing and spreadsheet) by half of the agencies studied had a duration of four days (three hours per day). The courses provided by the other half had a duration of five days (3 hours per day).

Secondly, given their independence, there did not seem to be pressure from the educational establishment for deputy directors to design their courses which focus on the development of skills such as both problem-solving and interpretative skills. Thirdly, the interviewees did not seem to perceive any need for these skills because they tended to take a technology-driven approach to both technology and training. Thus, they assumed that their clients only needed to be taught task-specific skills to enable them to use new technology in the office. This assumption resulted from seeing new technology as simplifying existing tasks rather than increasing their complexity. This view of the purposes of technology influenced the adoption of a type of training which focused on short-term skills such as task-specific or keyboard skills rather than skills which could allow office workers to think logically, and thus have flexibility to solve different problems.

The argument above is supported by office workers who underwent training provided by agencies. As discussed in sub-section 4.1, these office workers tended to criticise the training received because it concentrated on task-specific skills which had already been developed through experience on-the-job. For these workers thus agency training was not seen as appropriate for the development of skills which could allow them to solve the difficulties resulting from the use of new technology.

Given the evidence provided by deputy directors, it can be argued that training offered by agencies and training provided by firms should be seen as

substitutes in that both focus on exactly the same type of skills without meeting the more complex demands of new technology.

6. Summary

Of the three groups interviewed, two groups, managers and directors of private agencies tended to take a technology-driven approach to technology and training. In the case of both groups, this was partly due to a limited understanding of the potential of new technology, but also partly due to economic environment they operated in.

In the case of managers, the market liberalisation and the recession, on the one hand, pushed managers to adopt new technology to become more competitive but, on the other hand, made them more cautious regarding any investment project (investment in new machinery and investment in training). In the case of private training agencies, the independence from educational, employers and trade unions bodies and the sufficient market demand for training courses reduced any pressure on agencies to adopt an informational approach to both technology and training.

The third group of interviewees, office workers who were the users of new technology, appeared to have taken a more informational approach to both technology and training. Some office workers tended to see new technology as simplifying their tasks. Others, however, realised that new

technology had the potential to create more complex tasks which require skills that they did not possess. In many instances, these office workers put pressure on managers to provide training courses because they perceived on-the-job training as insufficient to develop those skills. But, at the same time, some of them seemed to be unaware of the exact nature of the skills they required. Due to this, they tended to accept a type of training based on a technology-driven approach. Therefore, the research suggested that office workers tended to have a view of technology which reflected a mixture of the technology-driven and the informational approaches.

Chapter 6: Conclusions

1. Introduction

This thesis set out to achieve two goals. Firstly, it aimed to analyse the impact of new technology in Brazilian offices on the skills of office workers. In particular, it tried to discover whether new skills were being developed as a result of the adoption of new technology, and if so, the nature of these skills. The thesis discussed the way in which new technology was introduced into the office, as well as being focused on both the types and goals of the training provision made available to office workers. Secondly, the thesis sought to explore whether existing theoretical approaches were appropriate to explain the relationship between technology, work and skills within the Brazilian office environment.

Given these two goals, the thesis combines a theoretical analysis and an empirical study undertaken in Brazil. The theoretical analysis is broken down into three levels. The first level involves a review and analysis of two existing theoretical approaches which address the relationship between technology, skills and training in advanced industrialised countries: the labour process and the flexible specialisation approach. These approaches were chosen because they provide two different perspectives of technology and its implications for work

organisation, skills and training. It should be noted, however, that they focus on advanced industrialised countries which have a longer experience with computer-based technology than Brazil, and that they concentrate on changes on the shopfloor rather than in the office. So the two approaches need to be specifically applied to the Brazilian office context.

The labour process approach, by drawing on Marxist perspectives, sees the management search for increased profitability and for increased control over the labour force as the driving forces behind technological change in the workplace. Harry Braverman (1974) argues that the way management achieves this increased control is by seeking the deskilling of the labour force. Deskilling results from a process of task-fragmentation and rationalisation which reduces human input to task-specific skills. These skills are developed by an one-off type of training which is narrow in content.

The flexible specialisation approach in contrast emphasises wider market, technical and historical forces as determining organisational and skill outcomes derived from the adoption of new technology in particular national contexts. Piore and Sabel (1984) argue that increasing levels of competition, changing products, market conditions and technological advances create new possibilities for restructuring work on the shopfloor. Such a restructuring can increase the control exercised by employees and increase the importance of skills in the production process, leading to a process of reskilling of the labour force. This

approach implies, therefore, that employees gain a wider scope for intervention, for which they need to be trained accordingly.

This thesis takes Braverman's and Piore and Sabel's contribution as representative of the two theoretical approaches to the skill implications of new technology. The second level of the theoretical analysis then applies the deskilling thesis and the flexible specialisation thesis to the office environment. The discussion of a number of case studies concerned with technology and skills in the office resulted in the development of two models of office automation: the technology-driven and the informational model. These later provide the framework of analysis for the discussion of an empirical study undertaken in Brazilian office organisations and training agencies.

The third level of the theoretical analysis focuses on the Brazilian model of economic development. It discusses the process of industrialisation along the lines of the import-substitution model of economic development, the current conditions and their implications for the adoption of new technology in Brazilian offices. This provides a background for understanding the empirical findings.

The empirical study was based on a research aimed to explore the way in which new technology was introduced in Brazilian offices, its implications for the skill composition of office workers, and the form training for these workers has taken in both firms and private training agencies. Four main findings can be identified:

a) Regarding the reasons for the adoption of new technology in the office, two economic factors appear to be relevant. On the one hand, the market liberalisation during the last decade has induced a search for more productive and competitive processes in the office. On the other hand, the recession accompanying the process of liberalisation has increased uncertainty in the economic environment influencing managers to adopt a 'wait and see' attitude with regard to investment projects - such as the acquisition of equipment and training provision.

b) Regarding the type of training adopted, all the firms studied used in-house training rather than training provided by private agencies. In-house training was seen by managers as more cost-effective and relevant to the specific skills required by the firms. Two types of in-house training emerged: on-the-job training and in-house courses. Both aimed to develop tasks-specific skills.

c) Regarding the role played by workers in the process of technological change and training, a significant proportion of the office workers interviewed had some influence over the type of in-house training adopted.

d) Regarding private training agencies, their approach to training appears to be very similar to that of firms. Their training courses concentrate on developing task-specific skills so that office workers are able to master the basic

commands of specific software programs, such as word-processing and spreadsheet.

1. Discussion of the Findings

The evidence discussed in Chapter 5 indicates that the skill and training outcomes of new technology in the firms studied cannot be understood as reflecting a managerial concern to deskill labour along Taylorist lines as argued by the deskilling thesis, nor as a move towards reskilling by combining new technology with a broadly skilled work force as implied by the flexible specialisation thesis. As argued in Chapter 3, by implying specific patterns between technology, work and skills, these two perspectives tend to neglect a number of conflicting factors informing the actions of the different agents involved in a process of technological change.

In the case of the firms studied, existing economic conditions, managers understanding the capabilities of new technology, their perception of the way in which these capabilities are to be exploited, their understanding of the nature of the skill required by technology, and the attitude of office workers vis a vis skill and training implications were factor which influenced the skill and training outcomes in these firms. New technology was adopted in order to increase the productivity of office workers and enhance the firms' response to economic

factors, such as recession and market pressure. However, this adoption did not seem to reflect a managerial pursuit of enhanced forms of control through the deskilling of the labour force. Nor a means of conferring a new kind of flexibility to both the labour process and the labour force by enhancing their responsibilities, discretion and skills.

The findings suggest that managerial strategies concerning new technology were applied in a half-hearted form. New technology was accommodated within existing work structures, rather than used as a means for changing the existing organisation of the office work and the skill composition of the labour force. Its adoption was followed by a limited managerial concern to decisions regarding the pattern of work organisation and the development of office workers' skills. Deskilling of the labour force did not seem to be the main concern among managers interviewed partly because organisational changes aimed to rationalise and fragment the office work did not appear to take place. Technology was introduced in a piecemeal fashion, which did not seem to allow managers to fully exploit the automating capabilities of computers as a means of replacing informed human intervention in the office environment. In addition, although both types of training (on-the-job training and in-house courses) made available for office workers sought to develop task-specific skills, it can be suggested that some office workers not only maintained their old skills, but they also had an opportunity to develop new ones. For instance, as some office workers explained in Chapter 5, the adoption of new technology created a need

for new skills which could enable office workers to solve problems and interpret information available by the new technology.

Evidence from the research points to three factors influencing these outcomes: existing economic conditions, managers approach to technology and training, and office workers understanding of skill requirements.

Firstly, the analysis of managers perception of the reasons behind office automation in the firms studied suggests that the introduction of new technology was influenced by two economic factors. On the one hand, the adoption of policies aimed to liberalise the internal market put pressure on these firms to introduce more productive processes in the office. As suggested in Chapter 5, managers tended to see new technology as a way of increasing the productivity, efficiency and reliability of office workers, and consequently, enhancing the firms' response to competitive pressures. But, on the other hand, the recession accompanying the process of liberalisation influenced managers to adopt what they termed a 'wait and see' attitude with regard to investment projects. For instance, evidence from the research indicates that investment such as acquisition of equipment were undertaken in a limited scale, i.e. managers purchased a small number of computers per office worker (usually one per ten employees), which were deployed in a piecemeal fashion by the various employees.

It can be suggested that these factors encouraged the introduction of new technology but, at the same time, they also created barriers to the exploitation of

the capabilities of new technology for two reasons. They partly inhibited the acquisition of equipment so that the majority of office workers could perform their tasks through the use of technology, and thus have the possibility to exploit the processing power of new technology. These economic factors also inhibited investment regarding the adoption of a formal type of training in half of the firms studied. This type of training was seen by managers in these firms as a cost to be reduced during periods of recession and high rates of inflation. Hence on-the-job training was perceived as a cost-effective alternative in two ways: it was seen as both a less costly and firm-specific type of training compared to courses provided by private agencies. Similarly, rather than seeking for a type of training aimed to develop broad-based skills, managers in the other half of firms studied adopted in-house courses also tended to search for more economical and firm-specific forms of training compared to training provided by these agencies.

Secondly, as argued in Chapter 4, the implications of new technology for the work organisation and skill requirements are shaped by managers perception of the potential of new technology to improve productivity in the office environment, as well as the way in which they intent to exploit this potential. In the case of the offices studied, managers adopted technology with a view to increasing productivity and efficiency, but with a limited concern for further development regarding work organisation and skills along Taylorist lines nor with a concern for combining the new technology with a skilled labour force able to fully exploit the processing capabilities of new technology.

The findings suggest that this limited regard to human resources issues could be related to managers own understanding of the new technology, its capabilities and the way in which these could be used. Evidence from the research suggests that managers tended to focus on the hardware and its expected capabilities as a means to increase productivity, rather than concentrating on the human input necessary to exploit sensibly these capabilities. It can be suggested that managers tended to see technology as a neutral input to the production process in the office, and its effects, a part from the improvement of productivity and efficiency, being largely incidental. Therefore, for them, information storage, manipulation and distribution was seen as taken place with high degrees of reliability and efficiency inside the equipment, the only human intervention needed being to activate procedures. Thus, for them, new technology was perceived as replacing the need for changes in the existing work structures as well as replacing the need for the development of office workers' skills.

Evidence from the research indicates that this limited concern to the development of skills was reflected in the adoption of a type of on-the-job training in half of the offices studied. In these firms, managers appeared to expect new technology on its own to improve the productivity of employees, and thus did not take into consideration the need for adopting a different type of training. In other words, they tended to largely associate the use of new technology to task-specific or keyboards skills which could be developed through experience on-the-job. Training did not seem to be evaluated, in this sense, as a long-term investment that could bring about future benefits to the organisation in terms of

enabling the development of a skilled labour force able to fully exploit the capabilities of new technology. Rather, on-the-job training was perceived as a cost-effective strategy compared to training provided by private agencies because it allowed the development of skills relevant to the immediate tasks of office workers.

It was only when managers perceived the under-utilisation of technology as a barrier to the realisation of productivity gains expected, that some firms situated in more competitive sectors (food, metal/mechanics, capital goods) decided to undertake a systematic approach to training in the form of in-house courses. However, the adoption of this type of training implied no change in both the existing skill composition and the role played by office workers in the production process, and hence did not seem to imply a move towards a more flexible way of labour deployment. The training courses were designed to develop mainly keyboard skills so that office workers could be able to use specific software packages with more efficiency, reliability and speed. However, these narrow skills were perceived by office workers as being of limited value for overcoming the problems created by the new technology. In addition, as argued by these employees in Chapter 5, the skills that they expected to acquire through in-house training had already been developed through experience on-the-job, and therefore did not allow them to overcome the enhanced level of complexity generated by the use of new technology.

Thirdly, two arguments have been made in Chapter 2 in regard to the deskilling thesis. It was argued that this approach disregards the possibility that new technology creates additional and more complex skill requirements in order to allow its effective use. It was also suggested that this approach underestimates the role played by office workers in the process of office automation because it assumes that skills and training outcomes are exclusively determined by managers in the pursuit of control over the labour process.

The empirical study suggests, contrary to the deskilling thesis, that some office workers had an active role in shaping skill and training outcomes in one group of firms. As the users of technology, these employees could see a need for the development of skills other than task-specific ones and requested a formal type of training. As implied by the interviews with some office workers, new technology had a dual effect on their skills. For example, in the case of some secretaries, the need for such manual skills as typing was eroded, but at the same time, computer codes for formatting and editing texts had to be learnt and their meaning when displayed on the screen understood. Similarly, an understanding of file management became essential to avoid unwittingly erasing work.

This dual effect was perceived by some office workers as creating a need for new and more complex skills rather than a simply piecemeal knowledge of what commands to press. Thus, for them new technology tended to be seen as requiring a more systematic approach to the development of skills, which demanded the adoption of a type of training other than on-the-job training.

However, the empirical study also indicates that although the duality of new technology was perceived by some office workers, it was not acknowledged by their managers - who were not technology-users. On the one hand, some managers adopted a formal approach to training, but failed to provide employees with the skills required. On the other hand, other managers simply disregarded the request for a type of training other than on-the-job training, which led some employees to look for a way of developing the necessary skills in training agencies.

It can be suggested, however, that although these employees influenced the adoption of firm in-house training, they did not appear to adopt a strategic approach to skills and training, i.e. put pressure on managers to provide training aimed to develop broad-based skills. It can be argued that their concern with the development of short-term skills was partly based on their limited experience as technology-users, and partly based on their concern to secure existing positions rather than increasing their bargaining power in the long-run by demanding a comprehensive skill development strategy.

To sum up, the labour process approach, in particular the deskilling thesis, cannot fully explain the adoption of new technology and its outcomes in the firms studied. This perspective presents three assumptions which are not consistent with the empirical findings. These assumptions refer to organisational changes following the adoption of new technology, the impact of technology on skills, and the role played by office workers in decision processes concerning training.

In turn, the flexible specialisation thesis also fails to provide an adequate framework to understand these same outcomes. The approach assumes that when managers introduce technological changes to become more competitive, they are likely to be concerned with developing work structures and the skills of employees so as to enable them to explore the full potential of new technology. In the Brazilian offices surveyed this did not happen. Managers in these organisations adopted new technology with a view to increase productivity, efficiency and competitiveness, but with a limited concern for further development of office workers' skills. The reason for this narrow approach implied by managers interviewed is partly to be found in (a) their limited experience and understanding of the technical and non-technical aspects of technology itself, and partly (b) their overriding concern with costs associated to organisational changes and training.

The adoption of forms of training considered by some office workers as not appropriate vis a vis skill requirements, the lack of changes on existing work structures and the limited availability of equipment raise questions about managerial strategies regarding the employment of new technology in the firms studied. The skills developed through training combined with the inconsistent way in which technology was introduced suggest that managers can have their expectation concerning productivity gains of technology frustrated.

It can be argued managers' half-hearted approach to the adoption of new technology and its skill requirements can limit the exploitation of the same processing capabilities which differentiate new technology from other technologies. This approach can, as suggested earlier, create barriers for office workers to employ technology sensibly, leading to sub-optimal or ineffective employment, and thus jeopardising existing organisational goals related to technological change in the office. One can argue, therefore, that both managers and office workers understanding of the duality of new technology, the need for a coherent infrastructure aimed to support its use, and the importance of developing necessary skills can be important factors determining the extent to which strategies seeking technological change can succeed in the office environment.

2. Considerations for Training in Brazil

The empirical findings suggest that a concern with the development of workers' new skills did not appear to be met either by the firms' in-house training or the private training agencies. The type of training provided in both contexts focused on the development of the minimal skills which seemed to allow office workers to use new technology in a piecemeal fashion, rather than enabling them to use their capacity to create and apply new knowledge. The types and goals of the training adopted by firms and agencies raise two questions. Firstly, can

managerial strategies regarding the exploitation of the potential power of new technology through the development of narrow skills enable Brazilian firms to respond to new economic and market pressures? Can the existing training bodies - that is, training agencies - effectively train skilled individuals for an economy which is likely to be increasingly influenced by technological change, as well as open to greater competition in the internal and external markets?

The discussion of the findings indicate that, in the case of the firms studied, there was rarely an explicit managerial concern to introduce new technology as part of an overall strategy in which its use was combined with the development of a skilled labour force. Managers' overriding concern with costs associated with their limited experience with new technology favoured the adoption of in-house training strategies limited to the development of task-specific rather than intellectual skills. As implied by some managers, the reasons for adopting new technology in the offices surveyed can be seen best as a managerial attempt to follow the example of other firms, rather than a conscious strategy in which managers fully understand the potential of new technology to provide competitive advantage by improving workers' skills. The limited managerial awareness of the potential of new technology to create new value-added information-based services favoured the adoption of training strategies which did not seem to take into account that the knowledge required by new technology tends to be of a more abstract nature. The in-house training strategies which were adopted focused on narrow skills. These skills proved to be, in some firms, not sufficient for office workers to overcome the complexities resulting

from new technology, and thus use it as a means of conferring greater efficiency and productivity with regard to office and administrative activities.

It can be argued, in the case of the sampled firms, that the process of trade liberalisation, the great increase in the potential for competition that goes with it, and the transformative potential of new technology have not yet been perceived by managers as requiring a high-skill system of production in the office. Although recognising the economic and market pressures resulting from the opening-up of the internal market, managers continued to rely on traditional strategies the aim of which is to obtain competitive advantage by combining new technology with labour requiring a low level of skills. Managers thus tended to put emphasis on machine intelligence at the expense of developing new skills in the operating workforce.

The findings indicate that, given the managers' narrow approach to new technology, skills and training, the achievement of goals such as enhanced efficiency and productivity in the office requires not only the development of employees' new skills, but also a managerial staff knowledgeable about new technology and the nature of the skills that it requires. Managers in the firms studied did not seem to have the necessary knowledge to fully understand the implications of new technology for the organisation of work, human resources requirements and training needs. For these managers, new technology tended to be seen as an artefact, and not as an integral part of a production process which

has the potential to require changes in the work of both managers and office workers, with profound implications to the skill composition of the labour force.

The development of a different attitude to these issues requires managers to be trained in the technical and non-technical aspects of new technology so that they can have a broader understanding not only of the skills required by new technology, but also understand that such a technology creates the possibility for restructuring work processes in which greater reliance on workers' skills can improve the firms' capacity to respond to various pressures. This greater awareness of the potential of new technology creates the possibility for managers to adopt a new combination of technology and labour which recognises the importance of workers' skills. This new combination involves not only investments in technology, but also training investments in the development of new skills. These new skills require training strategies focusing on the development of workers' abilities to both efficiently process information, and also to create new knowledge which can be applied to the improvement of office and administrative activities.

The adoption of an approach to new technology and labour which recognises the importance of workers' skills depends on a learning environment in which these skills could be developed. However, the development of this environment poses a problem for managerial authority and control over the organisation's knowledge base. As argued by Streeck (1988), managers can favour the development of firm and task-specific skills so as to protect their own

position of power and control. In this sense, it can be argued that the training of the labour force cannot only be the responsibility of firms, but it needs to involve educational and training bodies as a means of providing a changing economy with broad skills which can be put to many different and,

'...most importantly, as yet unknown future uses...Firms which want to be successful in today's changed economy, need not just the skills they need, but above all skills they do not yet need; they not only need what is functional in their present environment but, in a period of change, also what may become functional in uncertain and contingent future environments.' (Streeck, 1988, p. 97)

Given the role that new technology and workers' skills are likely to play in the country's development in the present and future economic environment, this thesis not only focused on the type of training provided by firms, but also on the training provided by bodies outside the production processes in the office. The findings indicate that the adoption of new technology in offices influenced the spread of private agencies aimed at providing training for private individuals and individuals sponsored by firms. These agencies are profit-oriented bodies which are not subject to any national guidelines regarding training in the context of office automation, and thus can provide any type of training. Their major concern did not seem to be with the development of new and broader skills which could be applied by individuals in different and changing contexts. They seemed to be more concerned with the provision of certificates to private individuals so that they could then have a better chance to get a job. These agencies thus tended to design courses the aim of which was the development of basic keyboard skills

related to particular software packages, and which could be easily developed in a short-period of time.

The evidence also indicates that the greater demand from private individuals compared to firms, did not put pressure on deputy directors to design specific courses directed at office workers sponsored by firms. The findings point out that there seemed to be no direct collaboration and co-ordination between agencies and firms in order to identify the skill requirements of new technology in the office. This lack of co-ordination was expressed by both managers and some of the office workers interviewed. Managers in the sampled firms criticised the courses offered by agencies for not being firm-specific, and thus not developing the skills which could be applied by their employees to their activities in the workplace. Similarly, some office workers demonstrated dissatisfaction with the content of the training courses for focusing on basic keyboard skills which had already been developed through experience on-the-job.

However, considering that the courses, offered by both the agencies and the firms studied, tended to focus on the development of basic skills related to specific software packages, it can be argued that these two types of training should be seen as substitutes in that both of them aim at exactly the same type of skills without meeting the more complex skill demands of new technology (as expressed by some office workers). The agencies' lack of concern with the development of broader skills (which could confer greater flexibility and adaptability on individuals) associated with the limited appropriateness of the

type of training provided by firms, can be seen as a challenge to a country whose aim is to shift towards a more competitive economy in the internal and external markets as a means of promoting economic growth.

The findings point out to the limitations of firms and training agencies to provide individuals with the skills necessary to process information and generate knowledge in a context characterised by technological change and increased levels of competition. The reduction of these limitations requires the Brazilian government to adopt a different approach with regard to the development of national training strategies. The government has so far assumed a limited role as co-ordinator of the various agents involved in the provision of training for the various sectors of the economy. Training thus has been largely the responsibility of the private sector. This sector includes firms and private training agencies determining the scale, scope and type of training in general.

Therefore, a greater involvement of the Brazilian government through the adoption of a comprehensive national training strategy, can ensure and stimulate an adequate amount and greater quality of the training provided by firms and agencies. The development of this strategy would involve an evaluation of the role of the government, as well as the suggestion and analysis of national strategies aimed to:

- a) Encourage the development of training which meets the skill requirements of new technology in the office environment.

b) Ensure greater co-ordination between the different training agencies and firms.

c) Promote the complementarity of the different types of training available as a means of providing office workers with skills which have not yet been developed in firms or agencies.

Suggestions for national training policies would also require an evaluation of the role played by managers and agencies from different regions in order to draw a broader picture of the process of office automation and its skill and training implications in today's technological and economic contexts. Another important factor which would need to be considered in future studies is the role of Brazilian trade unions with regard to technological change, labour deployment and training needs in this area.

However, the development of a labour force with the broader skills needed by a society which aims to become more competitive and integrated into the world economy cannot rely on firms and agencies as the only providers of training. The formation of the labour force also requires an educational system capable of meeting the skill demands of new technology, such as problem-solving and interpretative abilities. These demands pose a challenge to the Brazilian educational system for three reasons. Firstly, the system still faces great difficulties like the elimination of illiteracy and high rates of dropout, as well as

the improvement of the quality of education (particularly when considering the so-called 'repetition' trap in primary education)¹.

Secondly, there is need for greater integration between the formal education system and the skill requirements of a changing economy. The educational system has so far focused on the provision of academic or general education, while firms have concentrated on the provision of a narrow-based training of the labour force. Thirdly, considerations of the educational implications resulting from technological change have hardly begun in Brazil. The curriculum within the educational system has focused on subjects like Portuguese, Mathematics, History and Geography without taken into account issues relating technology, technological change and the world of work. It thus becomes important to develop programs of technological literacy as a means as enabling individuals to understand how technological changes are embodied in organisational, economic and political choices. Such a literacy can allow individuals not only to comprehend the essentials of technological design and the motives of change, but also allow them to play an important role in the future process ~~for~~ restructuring resulting from economic and technological changes. However, the development of such programs points to the need to rethink the

¹ Data from Senai (1988) shows that 27.1 per cent of the population between five and ten years old is illiterate, and less than 18 per cent of the population with more than ten years old has finished primary education. In regard to dropout, the data indicates that only 22 per cent of students finish the full eight years of study (that is, primary and secondary education). In regard to the repetition trap, those students who succeed in completing primary education spend approximately eleven years within the system.

strategic role of the educational system within this process of restructuring, as well as its links to existing and future needs of the economy.

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Appendix 1: Methodology

The empirical data discussed in Chapter 5 was generated in the course of a field work undertaken in Curitiba, Brazil, in 1992. The survey involved a sample made up by both private firms which were expected to have already introduced new technology in the office environment and private training agencies which provided training for office workers. It was carried out by means of semi-structured interviews with three groups of interviewees: deputy directors of private training agencies, middle-level managers and office workers both working in the firms studied. The aim of the field work was to provide evidence to the extent to which the skill implications derived from the introduction of new technology in offices situated in Curitiba, could be explained in terms of the two models of office automation developed in Chapter 3. It explored the various interviewees' perception about the relationship between new technology, office work, skills and training. In order to do so, the field work focused on the provision of data regarding the following issues:

- a) The reasons behind the introduction of new technology in the firms studied, and the organisational changes derived from such an introduction. In the field work, the term new technology refers specifically to computers.
- b) The skill implications caused by new technology, and the way in which both managers and office workers confronted these implications.

- c) The type and aims of training provided by private agencies, and their link with firms, educational bodies and trade unions.

1. Location of the Field Work

The field work was undertaken in Curitiba, capital of the state of Parana, for two reasons. Firstly, Curitiba is situated in what is considered to be one of the most industrialised Brazilian states¹. For instance, according to national data provided by IBGE (IBGE, 1990), Parana presented one of the highest rates of industrial growth during the period 1980-84. More specifically, it achieved an industrial growth of 16.7 percent whereas the state of Sao Paulo - which is considered to be the most industrialised state in Brazil - had a growth of 2.7 percent during such a period. Secondly, Curitiba is also considered to be the most industrialised city in Parana due to the fact that it encompasses 35 percent of all firms established in this state (IBGE, 1990). Therefore, the high share in the state's industrial activity, made it possible to obtain a list of enterprises in Curitiba which could meet the purposes of this research.

2. The Sampling Process

The sample consisted of ten private training agencies and ten private firms. The selection of training agencies reflected a purposive method of

¹ Parana is situated in the south of Brazil.

sampling. This method was chosen due to difficulties in obtaining a list of training agencies, particularly because they are not registered in any educational body nor employers organisation. It was known, because of previous knowledge about the area, that there were fifteen agencies at the time of the research. They all offered training courses for both private individuals and office workers sponsored by firms. A list of agencies was elaborated, and their deputy directors were contacted. Only ten agreed to participate in the research, and the other five refused to take part in the research arguing that they did not have time for interviews.

The firms were chosen according to two criteria. Firstly, they were selected according to information provided by a regional association of users of new technology called Sucesu-Parana (Society of Users of Computers and Equipment - Curitiba, Parana). The association provided a list of member-firms which had already introduced new technology in their offices. The firms were situated in the industrial sector because this sector was considered to be, according to the information given by Sucesu, the most advanced in terms of using new technology in the office, in Curitiba. The firms selected were expected, therefore, to have already acquired some experience concerning the use of new technology in such an environment which was considered to be relevant to the argument of the thesis. Secondly, they also were chosen because of their openness for research purposes.

The sample involved firms which had different goals and constraints, as well as operating in various environments. The firms developed activities in sectors such as energy, food, paper and pulp, footwear, metal and mechanics,

transport and capital goods. They were categorised into three sizes: very large firms (more than 1000 employees), large firms (between 500 and 999 employees) and medium firms (between 200 and 499 employees). And, in regard to ownership, the sample was made up by national firms (or firms which involved private national capital) and multinational organisations (or firms involving private foreign capital) (see Table 4).

3. The Data-Gathering

Semi-structured and individual interviews with the three groups of interviewees were used as the principal means of gathering information. Interviews were employed because they allow for greater depth than any other method of data collection, since they encompass the possibility of employing both quantitative and qualitative methods of data collection and data analysis (Cohen and Manion, 1989). For instance, such a method differs from questionnaires where fixed questions can sometimes inhibit or constrain interviewees responses (Cohen and Manion, 1989). The data was gathered, therefore, through semi-structured interviews in which a set of general questions were made in order to explore the various interviewees' perception about the issues in question. These questions followed an interview guideline elaborated according to both the different groups of interviewees and the issues to be explored in their interviews.

The interviews with middle-managers were aimed to gather information

about the following five issues (see Appendix 2):

- a) General information about the interviewees.
- b) The main characteristics of the firms surveyed, such as number of employees and office workers, ownership, sector and current situation within their respective markets.
- c) The interviewees' perception about: 1) the reasons for introducing new technology, 2) the implementation process, 3) the difficulties derived from such an introduction and 4) the implications for the office work caused by the use of new technology.
- d) The interviewees' perception about the skill requirements brought about by the use of new technology in the office.
- e) The interviewees' perception about the nature of the training provision for office workers: 1) the type of training adopted, 2) its content and objectives, and 3) the percentage of office workers trained.

The interviews with office workers aimed to explore the following five issues (see Appendix 3):

- a) The main characteristics of office workers like name, occupation, years of experience in the current occupation and educational background.

- b) Their perception about changes to their work caused by the introduction of new technology.
- c) Their perception about the skills implications generated by the use of such a technology.
- d) Their evaluation of the type of training provided.
- e) Their perception about future skill needs in their occupation.

Finally, interviews were made with ten deputy directors of private training agencies to gather information about the following issues (see Appendix 4):

- a) The main characteristics of private training agencies such as their aims, their organisation or functioning, the type and number of trainees to whom the courses are provided.
- b) The interviewee's perception about relationship between training agencies and educational bodies, employers organisations and trade unions.
- c) The interviewee's perception about the type, aims, content, and duration of the training courses provided to office workers.

4. The Interviewees

Interviews were made with deputy directors of private training agencies, middle-managers and office workers. Ten deputy directors from different training agencies were interviewed. They were chosen because they were, in all of the agencies surveyed, responsible for the organisation, administration and functioning of the agencies themselves.

In the firms studied, a number of twenty managers occupying middle-level positions² such as human resources managers and systems analyst managers were interviewed. Within each firm surveyed, one human resource manager and one systems analyst manager were individually interviewed for approximately two hours. These managers were selected because they were considered to be more knowledgeable (rather than for instance public relations, marketing or product development managers) about issues regarding the adoption, diffusion of new technology and its implications for the training of office workers. In this thesis, the term manager is used in reference to these interviewees.

Systems analyst managers were, in all the firms studied, the key technical participants involved in the acquisition, implementation and diffusion of new technology in the office. Human resources managers

² In the firms surveyed, management was broken down into two levels. One level was made up by senior managers or directors. The other level involved middle-level managers such as human resources, systems analyst, marketing, public relations and product development managers.

interviewed not only took part in the decision-making processes regarding the introduction of new technology, but were also responsible, alongside system analyst managers, for the organisation and functioning of the training provision for office workers.

Interviews of approximately one hour and a half were also made with fifty office workers who were personal secretaries, financial clerks and general clerks (see Table 5). Five office workers were interviewed in each of the firms surveyed. They were selected by human resources managers according to the following criteria:

- a) Office workers using new technology to perform their daily tasks.
- b) Office workers who had already been trained internally or externally.
- c) Office workers willing to be interviewed.

Personal secretaries interviewed performed a broad range of tasks for either senior managers or middle-managers of various departments. Their tasks included: typing, duplication, message distribution, handling mail/telephone, gathering information for reports or for answering questions, filing, keeping calendars and appointment schedules and composing correspondence or responses to correspondence. All financial clerks interviewed performed tasks such as calculations, typing, filing and production of payroll lists, correspondence and reports. General clerks interviewed were responsible for general clerical work in different

departments. Their tasks involved typing, filling, producing correspondence, updating documents/files, information gathering and answering enquiries. Table 5 provides information about percentage of office workers interviewed, their occupation and educational background.

5. The Data Analysis

The method used to analyse the data was inductive. Inductive means that, for most part, the data analysis relies on inductive reasoning over generalisations, concepts and relationships that emerge from an examination of the data gathered (Merriam, 1988). Therefore, rather than aiming to verify pre-determined hypothesis, the data was analysed in order to explore the different patterns that emerged from the field work, and by doing so, allow the formulation, reformulation and clarification of the relationship between technology, work, skills and training in the offices studied. The quotations included in the thesis represent the main trend of responses on the issues in question. They illustrate both the content of ~~the~~ thought and the style of expression of the individuals to which the information belongs.

Appendix 2: Guidelines for the Interviews with Managers

General information about the interviewees

1. Occupation
2. Years of Experience in the current occupation
3. Main activities in the occupation

General information about the firms

4. Which is the main economic activity of the firm?
5. What is the ownership composition of the firm?
6. What is the current position of the firm in its sector?
7. What is the total number of employees and number of office workers?

The introduction of new technology in the office

8. What are the reasons that influenced the decision to introduce new technology in the office? When was such a decision taken?
9. Who participated in the decision-making, selection and implementation processes?
10. Who is responsible for the operation of the system?
11. What goals are expected to be achieved by using new technology in the office? How important are these goals for the firm?

12. What are the technical, economic and human difficulties related to the use of new technology?

13. To what extent do such difficulties constitute a barrier to the achievement of organisational goals regarding the adoption of new technology?

14. What are the future plans regarding the use of new technology in the office?

The implications to the office work

15. What changes to structure, work content and work organisation were considered as a result of new technology and at what stages?

16. What changes to the work content and work organisation do you see as a result of the use of new technology in the office? What changes are still expected to take place?

17. Who are the office workers who had their work most affected by the use of new technology? Why and in what sense?

18. How well do you feel that managers in the various departments and office workers have accepted the introduction of new technology and adapted to using it?

The Skill Implications

19. What are the changes observed in the current skill levels of office workers? What changes in terms of skills do you anticipate in the future?

20. Do you see the current level of skills among office workers as constituting a barrier or facilitating the use of new technology in the office?

21. In your opinion, which are the skills necessary to operate new technology?

Training outcomes

22. Do you see the use of new technology and its skill implications as requiring a specific approach to training? Why?

23. What is the type of training adopted? Who participated in decisions regarding training and who is responsible for its organisation?

24. Which are the skills expected to be developed through the type of training adopted?

25. What is the content, objectives and organisation of the training provided to office workers?

26. Do you see such a type of training as being effective in terms of providing office workers with the skills necessary to use new technology? Why?

27. How many office workers have been trained?

28. Do you see a need for retraining these workers?

29. What future changes are expected to take place in regard to the current training provision?

30. Have you used the services provided by private training agencies? Why?

31. Would you use these services in the future? Why?

32. How do you evaluate the type of training provided by private agencies?

Appendix 3: Guidelines for the Interviews with Office Workers

General information

1. Current Occupation
2. Years of experience both in the firm and in the current occupation
3. Educational background
4. What are the future prospects in the firm and in the present occupation

The introduction of new technology

5. Why did managers in your firm decide to introduce new technology in the office?
6. What is your opinion about this decision?
7. Did you take part in the decision-making process?
8. What impacts the adoption of new technology had or are likely to have in the office environment?

Implications to the office work

9. What tasks did you perform prior to the introduction of new technology?
10. Do you think that these tasks have been changed as a result of new technology?
11. If yes, in what way do you think that they have been altered?
12. If not, why have they not been changed?

13. Do you feel confident and capable of coping with the changes caused by the new technology into your work? Why?

Implications to skills and training

14. What skills do you think that are required by the new technology? Why?

15. Do you think that the type of training adopted in your firm can enable you to develop such skills?

16. Do you see this type of training as an appropriate way of developing skills related to the use of computers? Why?

17. Would you like to be trained in a different way? How?

18. Do you think that it would be relevant for your work to develop other skills? Why? If so, what kind of skills?

Private training agencies

19. If you have been trained in a private training agency, why did you decide to take part in this type of training? If not, would you consider to take part in a training course provided by agencies?

20. What skills did you expect to develop?

21. Did the training taken meet your expectations? Why?

22. How do you evaluate the training provided?

Appendix 4: Guidelines for the Interviews with Deputy Directors of Training Agencies

General information about the agencies

1. What are the main objectives of the agency?
2. When and why did it start to function?
3. How is it organised? How is it funded?
4. The training courses are aimed at which section of the population?
5. How many trainees do you take? Who are these trainees?
6. What is the educational background and occupation of the trainees?

The training courses

7. What kinds of short courses are offered? What are their aims?
8. To whom they are directed to? Private individuals or office workers sponsored by firms?
9. How are they organised? What is their content and duration?
10. What kind of skills are the courses aimed to develop?
11. What certificate do the trainees acquire after completing the course?

Links with other bodies

12. Does the agency have links to regional or federal educational bodies? With employers organisation? With trade unions?

13. If yes, how is the relationship between the agency and these bodies?
14. If not, how is the relationship between the agency and firms established?
15. Do you see the establishment of these links as an important factor for the organisation of the content of the courses provided? Why?

Table 1: The type of training provided and the percentage office workers trained up to 1992

| Firms | Type of Training | Workers Trained | % |
|-----------------|-------------------------|------------------------|----------|
| Energy | On-the-job | - | - |
| Food | Course | 70 | 35 |
| Paper/Pulp | On-the-job | - | - |
| Paper/Pulp | On-the-job | - | - |
| Food | Course | 89 | 37 |
| Footwear | On-the-Job | - | - |
| Metal/Mechanics | Course | 36 | 60 |
| Transport | On-the-Job | - | - |
| Metal/Mechanics | Course | 25 | 15 |
| Capital Goods | Course | 25 | 15 |

Table 2: The division of office workers according to the two models of office automation

| Office Workers | Technology-Driven Model | % | Informational Model | % |
|-----------------------|------------------------------------|----------|--------------------------------|----------|
| Secretaries | 12 | 30 | 18 | 35 |
| Financial Clerks | 12 | 30 | 16 | 35 |
| General Clerks | 16 | 40 | 15 | 30 |
| Total | 40 | 40 | 60 | 60 |

Table 3: Some Characteristics of the Sample

| Firms | Sector | Ownership | Size | Office Automation (in years) |
|--|-----------------|------------------|-------------|--|
| A | Energy | N | Very Large | 7 |
| B | Food | N | Very Large | 5 |
| C | Paper/Pulp | M | Very Large | 7 |
| D | Paper/Pulp | N | Large | 7 |
| E | Food | M | Large | 5 |
| F | Footwear | N | Large | 7 |
| G | Metal/Mechanics | M | Medium | 7 |
| H | Transport | N | Medium | 5 |
| I | Metal/Mechanics | M | Medium | 5 |
| J | Capital Goods | M | Medium | 7 |
| <p>Note: National firms are identified by the letter N while multinational firms are identified by the letter M.</p> | | | | |

Table 4: Educational background of office workers interviewed

| Occupation | No. | % | Educational Background | | | |
|-----------------|-----|-----|------------------------|----|-------------|----|
| | | | 2a.Educ. | % | Higher Educ | % |
| Secretary | 30 | 30 | 15 | 50 | 15 | 50 |
| Financial Clerk | 30 | 30 | 18 | 60 | 12 | 40 |
| General Clerk | 40 | 40 | 24 | 60 | 16 | 40 |
| Total | 100 | 100 | 57 | 57 | 43 | 43 |