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CAPITALISM AND NEW TECHNOLOGY

- material submitted for discussion by McInnes

Capitalism & Technology

Introduction

The long economic boom that began after the second world war ended in 1974. This was partly overshadowed at the time in Britain by the dramatic events of that year. Conservative attempts to curb working-class power had culminated in an election based on the clear-cut class issue, 'Who Rules?'. The incoming Labour government only contained this level of militancy by conceding massive wage increases, several major new pieces of employment legislation, and the admission of a host of trade union officials onto existing and newly-created state institutions.

However, 1974 was a turning point for all the Western capitalist economies. Among the members of the Organisation of Economic Co-operation and Development (the organisation that represents all the main capitalist nations), industrial production grew continuously with only minor fluctuations throughout the post-war period, but between July 1974 and April 1975 it declined by 10% and unemployment leaped from a low of eight million during the boom to 15 million by the spring of 1975.

In Britain the value of shares on the London stock market slumped by 50% in 1974 – even more than during the celebrated crash of 1929. Industrial production declined for two successive years. All over the country workers were being laid off and made redundant, and unemployment reached its highest level since the 1930s. Although money wages did continue to rise, the real wage – what that money could actually buy – fell for the first time since the war. As the gap between the state's income and expenditure widened, it was faced with a fiscal crisis and for the first time since the welfare state was established after the war, plans were announced to cut its services.

This is the background against which microelectronic technology has been developed. This is a new technology that replaces transistor based electronics. Whereas in the past, complete electronic circuits

were constructed from thousands of separate transistors, now they are etched onto tiny 'chips' of silicon. A complete central processor for a computer can be produced on a single chip. Equally important, memory chips can be used in place of the extremely bulky units that were used to store the instructions and data that are fed into the central processor. And because microelectronic circuits eliminate the need for wiring, they are far more reliable than transistor based circuits.

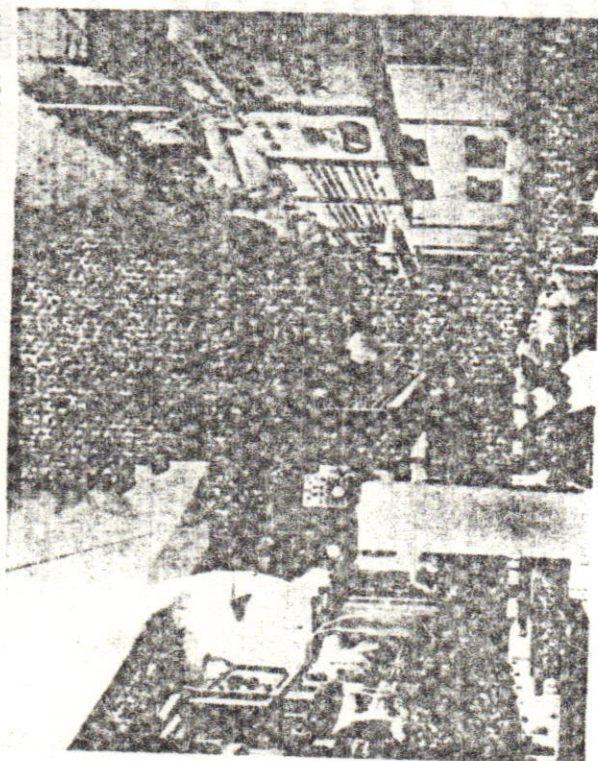
Microprocessors and micromemories can be mass produced at very low unit cost. This will have a major effect on future economic development. Computers will become smaller and cheaper and so are likely to be used far more widely than at present. Big computers will become more powerful, and so it will be possible to use them for much broader applications than at present. Microelectronic technology will also give rise to a whole range of new consumer products and provide the basis for redesigning many existing ones. But the main impact will be on the nature of work.

Microelectronics is being used to develop technology that will revolutionise factories, offices and many other working environments. Such technology could provide a powerful means of reducing the mind-numbing drudgery to which most workers are condemned for over half their waking lives. It could be used to end the appallingly dangerous and unhealthy conditions that so many workers are still forced to endure in the final quarter of the twentieth century. However, the studies in this book indicate that this is not why companies either produce or use microelectronic technology, whatever their public claims.

There are two broad approaches to explaining the development of new technology. One is basically technological, the other identifies the social forces that are involved. The first concentrates on simply describing the *technical* aspects of innovations. There certainly are scientific and technical limits to what can be developed at a particular time, but an explanation that confines itself to technical factors will fail to grasp the social framework within which the tasks of any technology are set. For example, any record of technological change that failed to document the impact of war on the timing and shaping of innovations would be very incomplete. In this chapter it will be suggested that there is an even more important influence on the development of new technology in a capitalist society.

Capitalism depends on the existence of a class of waged workers that produces a surplus over and beyond the goods that it receives for its own consumption. This surplus is the source of capitalists' profit. Part of the profit will be used by the capitalists to keep them-

selves in the style to which they are accustomed, part will be reinvested to expand production and produce even more profit. However periods of profitable growth become blocked as workers develop ways of resisting management discipline at work, and of building their strength in the related struggle over the size of their wage. It is this situation that provokes an urgent search by capitalists for new technologies that can be used to overcome such bottlenecks. The extent to which capitalists can impose this technology on the working class will be crucial in determining the basis for any subsequent period of profitable growth.



Britain, 1946: 30 ton, 18,000 valve; hand built by scientists.

The cycles of capitalist growth

Because our memories were dominated for many years by the experience of the post-war boom, there was a tendency for many people, including most economists, to take continual economic growth for granted. This has obviously been shaken by what has happened in the last few years, especially as the seriousness of the present situation is now being emphasised to justify large cuts in state services and the need for stringent wage restraint. Even so, the

present recession is still usually presented as a deviation from a normal pattern of expansion.

In fact, all the Western capitalist economies have developed through the cycles that have lasted for about 50 years. Since the rise of industrial capitalism in Britain nearly 200 years ago, long booms that have lasted for about 25 years have been followed by long depressions of roughly the same duration. These cycles were documented in the 1920s by the Soviet economist, N. D. Kondratieff. He recorded the movement of wages, selected prices and the rate of interest, first for Britain and then for other countries as capitalist production developed in them. The existence of such long cycles has clearly been borne out since the 1920s by the way the inter-war depression was followed by the post-war boom that has now also come to an end.

Each long boom has been closely associated with the growth of one or more particular industries, as is illustrated for Britain in Figure 1.1. In the depressions that followed, it was these industries

Figure 1.1: Long Booms and Associated Industries

Dates	Industry
1790-1815	Cotton
1848-1873	Textiles
	Engineering
1896-1921	Engineering
	Electrical
	Chemical
	Steel
1945-1974	Motor Cars
	Mechanical and Electrical
	Consumer durables
	Petro chemicals

Mechanisation of spinning
Mechanisation of spinning and weaving
Production by machine of textile machinery, steam engines and locomotives
Batch production semi-automatic machinery using of machines; marine engineering; motor car

Rise of science based industries
Bulk production

Assembly-line mass production

Continuous-flow process production

that generally suffered most markedly from decline and low profitability, whereas, at the same time, the industries that would play a leading role in the next boom were already developing. This was true in the 1930s of the motor and consumer durable industries: Coventry and the new industrial estates in West London were growing rapidly in contrast to the old centres of heavy engineering and shipbuilding in Scotland and the North East of England which bore the brunt of the depression. A similar situation exists at present, as sectors of the economy based on microelectronics are growing, while much of the motor industry is undergoing a protracted crisis.

Production for profit

This cyclical pattern of development is undoubtedly the outcome of many factors. It is noticeable, for instance, that the cycles correspond broadly with major shifts in the structure of the world economy and the development of the state. More research is necessary to explain the duration of the cycles, but the key to their cause seems to lie in the class relations of a capitalist economy.

In a capitalist economy, the means of production — the factories, machinery and raw materials that provide the basis of material life — are nearly all owned by a small part of the population, the capitalist class. The existence of this capitalist class depends on the creation and maintenance of a class of workers who must sell their ability to work, their labour-power, for a wage.

Capitalists employ workers to transform raw materials into finished commodities that can then be sold at a profit. The value of the commodities is determined by the average labour-time that is necessary to produce them in a particular society. The value of the means of production that are used up in the production process is transferred to the commodity and new value is added by labour. Part of the new value will pay for the workers' wages, the other part is surplus value which is the source of the capitalists' profit. Effectively, workers just work part of the time (necessary labour-time) for themselves, during the rest of the time (surplus labour-time) they perform unpaid labour for the capitalist. However, because the wage appears to be paid for all the time spent at work, the source of profit is obscured.

The aim of capitalist production is to produce as much surplus value as possible, and until the second quarter of the nineteenth century the main way capitalists did this was by compelling their workers to work longer hours so as to prolong surplus labour-time.

But this had its limits. The day has only 24 hours and workers must spend at least some time eating and sleeping if they are to work the next day. More important, workers' opposition to this super-exploitation became so militant and widespread that legal limits had to be imposed on the length of the working day before the continued existence of the whole system was threatened.

Increasingly, those capitalists who could afford the necessary investment relied on transforming the labour process in which their workers were employed. By increasing workers' productivity, capitalists could reduce the quantity of labour needed to produce each commodity and so cut their costs. The real breakthrough was the introduction of machinery.

Machinery was first applied to cotton spinning at the end of the eighteenth century, and the extraordinary increase in productivity that resulted was the basis of the first long boom. The long booms that have occurred since then have each been based on the application of fundamentally new production techniques in other parts of the economy.

The capitalists who pioneer a new technique can initially achieve much higher profits, although such super-profits will become less marked as other capitalists are forced to adopt the new method too if they want to stay in business, and prices will fall to reflect the new, lower value. But there is also a further advantage which accrues to all capitalists as a result of a general increase in productivity. If wage goods can be produced more cheaply, then the same working-class standard of living will be associated with less necessary labour-time. Out of the total number of hours of work, more time will be spent on surplus labour. Even if workers succeed in winning a wage increase or shorter hours, it is still possible for the amount of surplus value that is produced to increase.

However, the success of this process tends to undermine itself. During a boom, profits will be re-invested to expand production. Additional machinery is generally similar to that already in use, rather than of a fundamentally new design. But the machinery is likely to incorporate a steady stream of improvements, and so less labour will be required to produce the same level of output. If production grows even more rapidly than productivity, then the total number of workers employed could still increase. However, capitalists will be investing a larger and larger proportion of their capital in machinery and raw materials and a smaller and smaller proportion in value-creating living labour. The outcome is that in the course of a long boom there is a tendency for the rate of profit (the amount of profit divided by the amount of capital invested) to fall.

Workers' resistance

Capitalists experience the tendency of the rate of profit to fall as a need to rationalise and cut their costs. They therefore attempt to increase the intensity and productivity of the work of their employees. However, in attempting to do this capitalists are forced to confront the organised strength of the working class and in the course of a boom, conditions become more favourable for workers to resist capitalist demands.

Capitalists employ workers because they are necessary to produce a profit. As with any other commodity that they pay for, capitalists would like to be able to do as they choose with labour-power. What they want from workers is continuous work of the greatest possible intensity. But capitalist management has to find some way of enforcing this.

As far as workers are concerned, they go to work for a capitalist because it's the only way they can get the money that is necessary to live. There is therefore economic pressure on workers to conform to the demands of management, since insubordination might lead to the sack. This is particularly true when there is a large pool of unemployed. However, as capitalists employ a growing number of workers in a boom, the prospect of unemployment becomes less threatening.

In any job that depends on workers' skills, workers have to exercise some control over the labour process and this is a source of power that can be used against management. If only workers understand how a job is done, then management is not in a position to exercise detailed control over it.

The development of new technology has been one of the most important means that management has used to break workers' strength. When a machine incorporates the skills that were previously exercised by a worker, then the worker is deprived of this source of power, and management can use the machine to regulate the speed and intensity of its operators' work.

However, subordination is never established once and for all. Although management introduces technology to increase its control over the labour process, when workers find their feet in the new situation they set about rebuilding their strength. If workers are necessary for a capitalist labour process, they cannot be completely powerless. Since they observe the operation of any new technology at close quarters, day in and day out, they soon discover the weak points in a system. Any vulnerability is a source of strength that can be used to develop new forms of struggle.

The capitalist use of technology and workers' attempts to rebuild their strength are illustrated by the history of the metal-working industry. During each long boom, production has been based on techniques which were developed in the previous depression. In the first boom (1790-1815), the spinning machines and steam engines were built by artisans. In the next boom (1848-73), basic machines were used although they still required quite skilled labour. By the boom at the beginning of the twentieth century (1896-1921), semi-automatic machines that needed less-skilled labour had been introduced. And in the post-war boom (1945-74), assembly-line techniques using labour with hardly any training at all gave management an unprecedented degree of control over the organisation and intensity of work.

The artisans in the first boom had complete control over their work. In the next boom, engineering workers built up the Amalgamated Society of Engineers (founded 1851) to control the supply of skilled workers and boycott employers who refused their demands on working conditions and pay, and by 1871 they were strong enough to win the nine-hour day. In the years before the first world war, the exclusive organisation used to restrict the supply of skilled workers had to be broadened to include the less-skilled who would otherwise be used to break the union's strength, and from status-conscious conservatives engineering workers became some of the most active members of a very militant working-class movement. During the most recent boom, assembly-line workers developed forms of struggle that were often based on informal organisation in the plant rather than the official union, and by the late 1960s and early 1970s, car workers in particular had become strong enough to seriously limit management control. Management began searching for a technological solution, and cheap microelectronics are now providing the basis for automatic devices that can be used either instead of workers at key bottlenecks, or selectively, to try and isolate workers from each other and prevent successful organisation within a plant.

Restructuring and the long depression

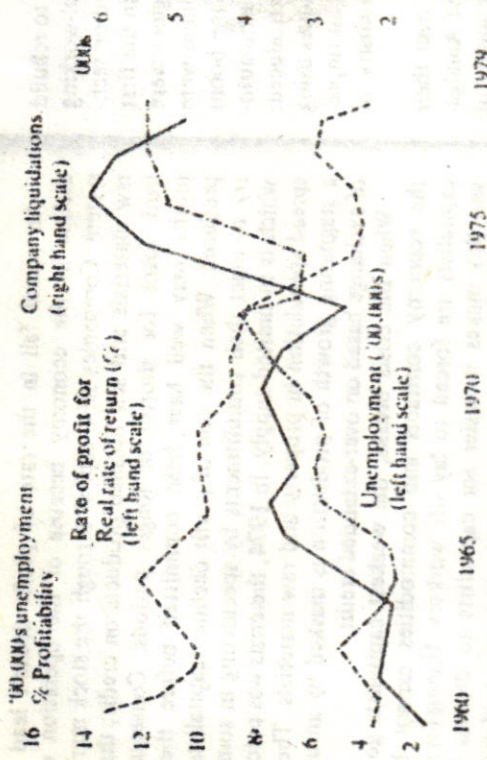
There is then on the one hand an underlying tendency for the rate of profit to fall in the course of a long boom. On the other hand, capitalist attempts to counteract this through rationalisation are likely to be blocked by the working class. The outcome will depend on how successful workers are in developing forms of organisation and struggle that are appropriate to the particular period of capitalist development.

An actual fall in the rate of profit doesn't lead to a gradual decline in the economy because of the operation of the credit system. Companies raise capital through the stock market; they buy raw materials and sell finished products on credit; they depend on bank loans for shorter or longer periods. Consequently, future profits may well have been committed before they have been produced. When the rate of profit declines, capitalists are likely to try to meet their commitments by speculating in some commodity which is in limited supply. In 1974, the crisis was preceded by widespread speculation in property and raw materials. The result is that a stagnating growth of production is masked by an illusory growth of exchange based on over-extended credit.

When the crisis breaks, the weakest capitalists go bankrupt. As the economy contracts and commodities cannot be sold, other capitalists are forced to lay off workers. Unemployment increases and this makes it easier for capitalists to depress wages and for management to strengthen its authority over workers. The crisis is a disaster for individual capitalists since sometimes the existence of even the biggest companies is threatened. British Leyland only survived after 1974 because it was nationalised. However, crises have an important function in a capitalist economy. The least efficient enterprises are purged, and rationalisation is imposed as the price of survival.

In the long depressions that follow the crises, capitalists are forced to withdraw from the least profitable sectors of the economy and attempt to lay the foundations for a new period of profitable growth. This means ensuring that workers spend less time on necessary labour and more time producing surplus value. It means revolutionising productivity in those sectors of the economy that produce machinery and raw materials so that they become cheaper and capitalists will only need to invest a smaller proportion of their capital in means of production. It also means speeding up the time that it takes for capital to complete a circuit, from being advanced for means of production and labour power, through the production process to being sold so that the profit is realised and the capital re-invested to produce yet more profit. This will affect offices, the distribution system, transport and communications and many other sectors of the economy.

During depressions, therefore, capitalists are impelled to search for new forms of technology that can be used to restructure the economy. Above all, they have to be able to overcome their dependence on those sectors of the working class who have used their position in the economy to build sufficient strength to act as a



bottleneck. Since the introduction of new technology is usually resisted by workers, depressions tend to be periods of intense struggle in which capitalists are by no means assured of success in implementing the technology that has been developed.

During the third quarter of the nineteenth century, for example, the production of pig-iron became a major bottleneck in the long boom based on the production by machine of machines made of iron. The production of iron depended on highly skilled puddlers who formed balls of pasty, half-molten iron on top of a puddling furnace and then drew it off. They were well organised in skilled unions and repeated attempts to break their control by mechanising the process failed. The capitalist solution finally lay in bypassing the problem entirely and producing steel. Previously steel could only be produced in tiny quantities, but now, with the invention of several new production processes, it could be produced in bulk. The giant US steel industry grew on the basis of these new techniques, though their introduction was resisted by the skilled-workers' union which was finally broken after a long, and at times armed, struggle. In Britain, by contrast, workers' organisation not only survived the transition to steel production, but it broadened its base in the ensuing struggle to include less-skilled workers and workers succeeded in maintaining control over the labour process.

Restructuring the working class

The composition of the working class that has been employed during each long boom has been different from that which was expelled

during the previous depression. There have been two main elements in this process of recomposition.

Firstly, skilled workers who have been the most highly organised have been displaced by workers who have less training and who do not usually have the same organisational traditions. During the post-war boom there was a massive expansion in the employment of women workers. A substantial black working class was also created.

Secondly, there has been a shift in employment away from the direct process of production. This has involved an expansion of technical and office work, and the growth of the state as a major employer.

When technology is used to remove control of a labour process from the immediate workers, someone must be able to design and understand the new system. A few highly-skilled jobs are created, but once these tasks expand to employ more than just a tiny elite, the new jobs are themselves subjected to a division of labour and the more routinised parts of the work are separated out leaving those parts that continue to require much initiative concentrated in the hands of a few individuals. This separation of the process of conception from that of execution, even within the most technologically advanced sectors of the economy, has resulted in a polarisation between a few key personnel and a mass of routinised technicians.

Office work has expanded for several reasons. One is the need to look after the commercial and financial affairs of big companies. The size of companies has continually increased as profits have been reinvested to expand the scale of production and as a result of mergers and takeovers. A large number of office staff are needed to organise the transactions of a big company which may involve different plants, or even different countries.

Office work has also expanded as a result of attempts to shift knowledge and control away from the factory floor. In addition to using technology to accomplish this, capitalists have developed sophisticated techniques of work-study. These were first systematised at the turn of the twentieth century by F.W. Taylor, who called his new discipline scientific management. Taylorism, as it has become known, involves systematically studying a job, no matter how complex, in order to identify each type of task that must be performed. Once management has appropriated complete knowledge of a job, by documenting every possible variation that can occur, it is in a position to take command. Each worker can now be allocated just a detail to work on under strict management supervision. But once the immediate workers have been deprived of knowledge of the labour process, then every stage has to be monitored and recorded

12 Microelectronics

by management and this has meant duplicating the production process with a flow of paper in the office.

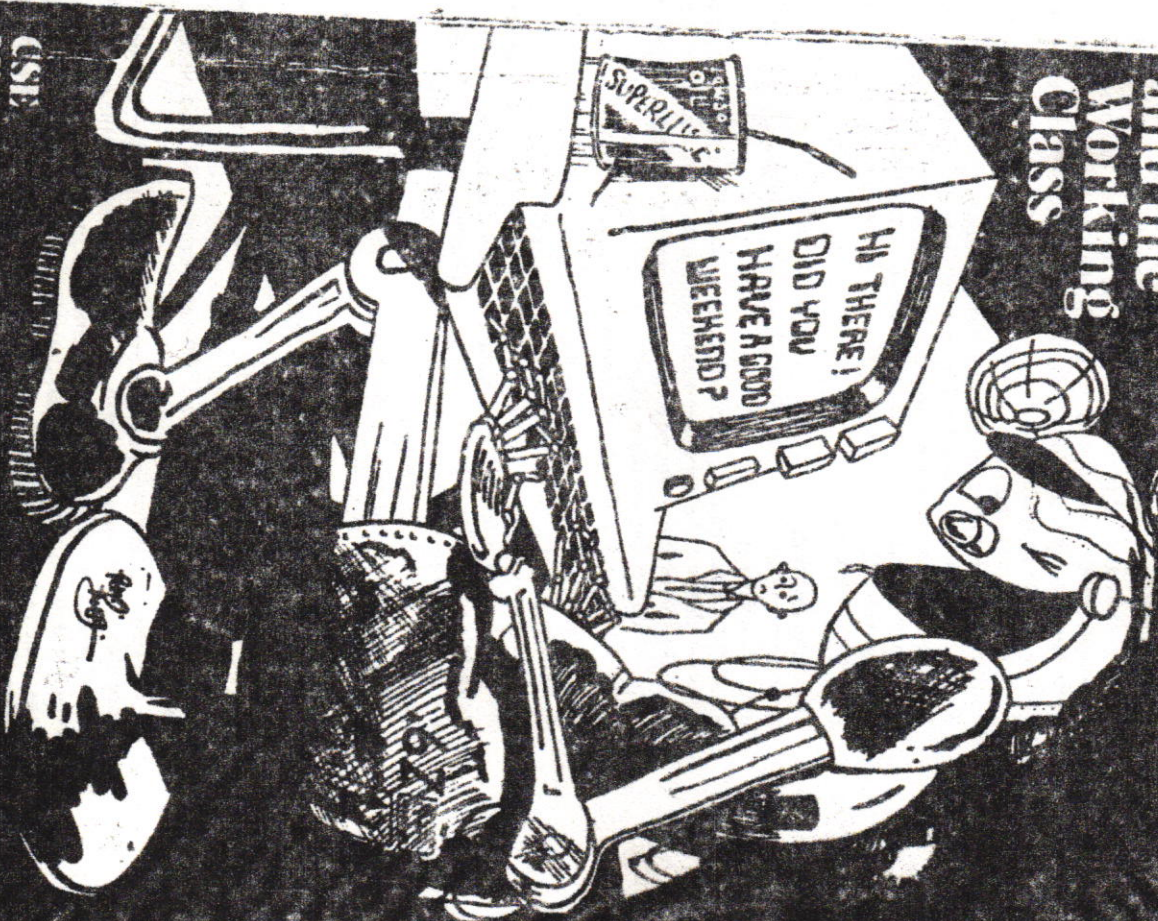
Office work has generally been organised on the basis of a division of labour in which managerial and executive work has been performed, predominantly by men, within a defined career structure, and the mass of routine clerical labour has been provided largely by women. Clerical work is labour intensive and much of the technology in use, like the typewriter, has remained basically unchanged for many years. This has caused a severe imbalance, because while office employment has grown and factory employment has declined, productivity has increased far more slowly in the office than in the factory. The office has become a bottleneck in the process of profitable growth and will therefore be a major target of restructuring in the current period of depression. Micro-electronic technology is being developed that will make it possible to begin the process of automating the office.

The largest employer in Britain is now the state, and many of its intensive work in which productivity has been fairly stagnant. State workers were for many years very poorly paid, but by the late-1960s of struggles these workers managed to win large wage increases. State workers now face cuts in the level of employment and attempts to increase their workload through rationalisation and increased management supervision. Arguments about the unproductive nature of state employment have been eagerly seized on to justify the cuts that are being made.

Such arguments illustrate how, in a period of restructuring like the present, there are not only attacks on the strength of the most well-organised sections of the working class, but also continued attempts to strengthen the divisions between different sections of the working class so as to undermine any possibility of collective struggle. The ideology of the male bread-winner is being revived to explain why women should bear the brunt of unemployment and there has been a growth of racist immigration legislation. Government economic policy is being used to divide employed from unemployed workers and to isolate those workers who do fight back by going on strike. It is in this atmosphere that anyone who does so much as pause to consider whether or not the introduction of new technology is in their best interest is immediately denounced as a Luddite.

MICROELECTRONICS

Capitalist Technology and the Working Class



GSE
Microelectronics

New Technology

Management's desire to achieve ever greater control has gathered new strength in the 1980s with the introduction of microprocessor technology. This works in two ways. First, gadgets based on the chip can capture and feed back to the management a mass of detail on how work is actually being done. This information helps management to keep tabs on things, but it also provides them with the knowledge which they can then use to reshape the production process. Second, microprocessor technology enables management to use this knowledge to install a more subtle and flexible version of automation. The skills of workers are now being embalmed in chip technology and programmed routines, where they are management's property.

A first priority, then, in any move to win back control over our working lives, is to find an effective answer to the inroads which New Technology is making into the skill-content of jobs. Practically speaking, this should be selective opposition rather than out-and-out rejection. There are a number of rules-of-thumb for recognising features of new systems which take control and skill away from the worker. The questions to ask are:

Does the new system:

- i) incorporate new provision for monitoring the speed or accuracy of individual workers?
- ii) permit the automatic collection of data on worker-controlled operations which would help management to automate them at a later stage?
- iii) make the worker respond to the system, rather than have the system respond to decisions by the worker?
- iv) abolish an old skill without creating a new equivalent skill?

Evidently most of these questions should be asked for any new technology, whether microprocessor-based or not.

If the answer to any of these questions is 'Yes', then workers should organise to resist these features of the proposed system. There is no technical reason why such features need appear in production systems and there *are* alternatives. They will be programmed if workers' opposition can be made effective.

In the process, not only quality but the quantity of jobs should be increased. But in cases where the application of new technology results in the need for less labour inputs, and reduction in jobs whether by redundancies, early retirement, or by natural wastage, it should be resisted. Demands should be rather for a shortened working week, longer holidays, and 'sabbaticals' for further training or study. Further, any time set free from the treadmill of work could well be absorbed by the demand for trade union use of 'liberated time' at the workplace, which will be set out below.

The demands are designed to provide a breathing-space, in which more effective means of improving workers' control over their own labour power can be worked out. Defensive demands protect individual workers' skill and control; but real control is only possible on a collective basis. One requirement for this is collective knowledge. This makes the call to 'Open the Books' a key demand. But it must not be interpreted narrowly as applying just to details of the firm's income and expenditures. Financial information of that kind is useful for pay bargaining. For

bargaining over control, what is needed is information about what use management is making of existing control systems, or plans to make of proposed new systems. One trade union demand should be the right to see the feasibility study report plus the system specification for any new scheme management proposes to introduce. Here we can learn from the extensive Scandinavian experience of trade union branches commissioning and controlling research by university computing and system staff into the effects of management proposals.

The worker's interest – in satisfying work and socially useful products – will in many or most cases run counter to that of management. For workers to be able to counter management effectively the issue is not only one of relative power; they will also need to match management's sophistication, a sophistication gained through management's long domination of decision making. Management plans. So trade unions will have to find ways of planning also. Without planning, workers will be like a chess player who does not think more than one or two moves ahead.

Since management plans on a company-wide basis, the multi-plant trade union combine will, for many purposes, be a more effective counter-planning unit than individual units or branches. (For subsidiaries of transnational corporations, good links with corresponding workers' organisations abroad will greatly increase workers' ability to respond to and anticipate management initiatives.) One inspiring example of what can be done is the Lucas Aerospace Combine Shop Stewards Committee's alternative corporate plan for Lucas. From the knowledge of unionised workers within the company, they generated a host of ideas for socially useful products, which could be made using the existing equipment and the available skills within the workforce. Several of these – the 'Hobcart' for children suffering from spina bifida, the hybrid petrol-electric power pack for cars, the road-rail vehicle – have already been taken through to prototype stage or beyond, though not by the bosses of Lucas Aerospace.

The right to engage in such planning should become a trade-union negotiating demand. It has been called the demand for 'liberated time' – time at the workplace for office and production employees to work together collectively in support of their own interests.

