6 Management of Technological Change

The PSI surveys on use of microelectronics in industry have shown that the introduction of new technology has met very little resistance from shopfloor workers, management or other groups within user factories. In order to find out more about the management of change involving microelectronics applications, we asked respondents about management policies on technology, the extent and form of consultations with the affected staff, and the degree of acceptance of new technology encountered over recent years.

6.1 Management policies

Planning

Few of the companies visited had a formal strategic plan for the application of new technology in products and/or processes. Those that did tended to be large groups with a long-term investment strategy which incorporated a plan for adoption and development of new technologies. Such strategies did not dictate the form of implementation of new technologies: there seemed to be in most cases considerable scope for management choice on how automation was introduced and used. The majority of respondents felt that there was a high level of senior management awareness of the importance of new technology applications to the business.

Most companies appeared to take a generally opportunistic approach to new technology. Potential applications were investigated more or less systematically and taken up when suitable openings occurred – for instance, when a new product was developed or when
a new factory was planned – but investment did not take place in the context of an overall strategy. Nonetheless, respondents stressed the importance of planning for particular purchases of equipment and subsequent implementation.

Most respondents said that new technology applications were carefully evaluated before investments were made, although this had not always been the case with microelectronics-based equipment, especially in the case of smaller firms. As one manager in a small company put it, "a lot of it’s a case of ‘suck it and see’" – his engineers had often been completely ignorant of the capabilities of a particular piece of equipment when it arrived. Although the company tried to find out as much as possible about new machines before making a final choice, they did not have the resources to carry out exhaustive evaluations of the available technology: "We’re a small independent – if you’re part of a large group there may be that facility, but I would doubt that in many cases”.

Few major mistakes were reported by respondents, but one case illustrated the importance of careful evaluation of potential applications and systematic planning of implementation of new equipment. One plant – part of a major multinational group – had attempted to automate several production lines at once using expensive and highly complex microelectronic control technology. Respondents acknowledged that the implementation had been inadequately planned, the new system inadequately developed and tested, and the period needed for commissioning and training of operators greatly underestimated. The result was that the equipment had to be withdrawn and the lines returned to manual operation, while a much more gradual and carefully planned re-implementation was worked out. In a few other cases certain forms of automation had been withdrawn and applications returned to wholly human operation: one plant had "de-robotised" a section because robots were proving less efficient than people had been – "a slight case of over-reacting to the new gadgetry", as an engineering manager put it.

Such problems clearly have their origins in a failure to plan effectively and in an over-enthusiastic and insufficiently critical approach to the potential of new hardware and software in manufacturing applications. In a number of cases respondents said that a degree of scepticism about the capabilities of new technology was healthy, and the generally incremental take-up of new applications
which was reported might reflect a widespread degree of caution towards the sometimes exaggerated claims made on behalf of new items of equipment and computerised systems.

Although there were few cases where a formal strategy for use of new technology had been developed, respondents often stressed the importance of planning for particular implementations when we asked about good practice in the management of technical change. The following points came up most frequently:

(i) Management should assess the current practices and specify exact requirements in a particular area of application before beginning to consider specific hardware and software products. It was easy to be ‘hardware driven’ or ‘software driven’ – to be carried away by the promise of particular technologies and purchase over-specified or inappropriate systems.

(ii) No matter how often new technologies were implemented, managers still tended to underestimate the overall budget and the time needed to get a system working to its full potential. It was essential to plan and manage projects carefully and to budget properly for software development and commissioning, which tended always to take longer than expected: in particular, "software can be a never-ending story", as one manager put it.

(iii) A gradual introduction of a new technology application was necessary to ensure an adequate period for installation, testing and training. A phased approach was also seen as important in gaining cooperation from affected staff and avoiding what was often referred to as ‘culture shock’ among staff unfamiliar with computerised systems: abrupt changes in working environment and methods caused lack of confidence, anxiety about the amount of training needed, and fear of complexity.

(iv) Training was emphasised as part of good practice in managing technical change by only six respondents, but those who did mention it saw it as a crucial factor in successful implementation of new technology, and one that was often neglected. "Your training is not half an hour: it’s long, on-going", as one respondent said, emphasising that training and technical support were essential elements in the overall investment in automation.
Reasons for new technology investment

What was the underlying rationale for introducing automation? Respondents identified successful application of microelectronic technology as an important element in staying competitive and increasing efficiency (but by no means as the only or necessarily most important element). It was widely seen as a means of increasing capacity; achieving greater consistency of output; cutting material costs; and increasing productivity.

Respondents tended not to see new technology investment simply in terms of a direct substitution of capital for labour in order to cut labour costs. Some middle managers criticised senior management for taking such a view and seeing new technology’s role in production "purely from a financial aspect", as one technical manager put it; overall, however, few regarded new technology principally as a means of cutting out people wherever possible. Although, as we have seen in the previous section, jobs were lost in several plants as a direct result of automation, the changes tended to be piecemeal, phased over many months or years, and were often small by comparison with losses caused by plant closures or other organisational changes. Moreover, even where management had a goal of minimising headcount wherever possible, this did not necessarily involve reducing numbers by using new technology: rather, it frequently meant using technology to boost productivity while keeping headcount static, recruiting only when essential.

In a number of cases managers said that the scope for introduction of new technology into production processes was clearly limited by the age and layout of the plant, and/or by the skill composition of the workforce and local labour market. For some the difficulty and expense of adapting existing factory layouts would not be justifiable; in a few cases managers felt that their workforce was ‘too set in its ways’ to respond effectively to substantial technological change and lacked enough young adaptable staff. One manager in a relatively remote rural location said that investment in new technology was constrained by the considerable difficulty of finding enough skilled recruits in the local labour market and attracting suitable staff from other parts of the country; one respondent, running a small firm in South London, was unable to compete on pay in the labour market and inability to attract skilled staff obviously restricted the scope for any new technology investments. Several respondents said that they would
prefer to put large-scale automation into brand new plants, accompanied by new working practices and a smaller, more highly skilled workforce, than into factories which needed costly physical reorganisation and which had built up more or less rigid organisational structures and cultures over the years.

Several of the firms in the sample – mainly the larger companies – were concentrating new technology investment in green field sites, where flexible working practices could be agreed at the outset and where plant layout could be optimised for automation and efficient production flows. New factories with a high level of automation employed significantly fewer staff than older plants, and the workforce had a higher proportion of skilled workers.

Consultation with the workforce
We asked respondents about the degree to which the workforce was consulted and informed about the introduction of new technology and the effects it was likely to have on job numbers and job content. In their comments on good practice in managing technical change, many respondents emphasised the need to keep affected staff well-informed, to be "upfront" about any job losses which might be caused, and to involve staff in the planning of the introduction of new equipment. It was widely felt that it was essential, as one manager put it, "to carry as many people as possible along with you" from the moment of decision on an investment in new technology. Giving information to all levels of staff with any involvement in the change was the key to dispelling anxieties, avoiding rumours and building up confidence: "It takes away the mystery... they’ll generally come along with you". Another respondent emphasised the need to explain why changes were being planned and what benefits they would bring, and to allow affected staff to put their point of view: "We ask their opinion - as a manager you’re crazy if you don’t do this... If you tell them what you’re doing, allow them to voice their opinions and get rid of their suspicions... I think you’ll find the thing works very smoothly".

In no case did ‘consultation’ involve discussion with the affected staff about the principle of investment in new technology. However, all respondents said that management informed staff well in advance of the introduction of any new equipment – usually several months ahead of installation, sometimes longer.
A few firms with no trade union presence used informal briefings to communicate investment decisions and discuss the details of introduction of new technology. In most cases, however, information was provided through formal channels such as works committees as well as via briefings and presentations. Several respondents said that the employees concerned were taken to see the new technology at work at the supplier’s plant or in another factory, or that they set up special demonstration areas with models of the new equipment.

Where consultation and negotiation took place it concerned the details of introduction of technology: changes in job numbers and job content, implementation of new systems, possible changes in pay and grades, and training for users of the new equipment. In a few cases the shopfloor staff who would be working with new technology were involved in selection of the equipment, an arrangement regarded as sensible and valuable by the respondents concerned, and in several plants we were told that the relevant shopfloor workers were involved in advising on the details of installation plans. In such cases respondents stressed the amount of expertise in effective use of equipment to be tapped on the shopfloor. Some of the larger companies had negotiated formal new technology agreements with the unions which specified procedures for consultation: elsewhere consultation practices concerning new technology had simply developed in a piecemeal fashion over the years, and much depended on the attitudes of particular managers.

Interviews for this study were confined to respondents in management positions, and clearly the views expressed cannot give the whole story. A smaller study by PSI on new technology and jobs in six plants in the food and drink industry was carried out for NEDO at the same time as the project described in this report: the NEDO study involved discussions with skilled and semi-skilled workers as well as with managers. (It must be emphasised that the very small sample size in this study means that findings need to be treated with caution and cannot be claimed to be representative.) Shopfloor interviewees tended to distinguish carefully between ‘consultation’ and provision of information in advance of introduction of equipment: some felt that managers believed they were consulting when they were simply giving information about forthcoming changes. It was generally not expected that management would consult in advance of investment decisions, but staff did expect that management would provide detailed
information on the implications of any new technology well in advance of its introduction. Most respondents were satisfied with the amount of information made available and with the notice given of changes; some said that insufficient use was made of shopfloor expertise in considering implementation of new technology.

6.2 Acceptance of new technology

The great majority of respondents in the case studies, as in the PSI surveys on microelectronics, reported little or no resistance from any groups within their companies to the introduction of new technology. The level of enthusiasm they described varied from plant to plant and also tended, unsurprisingly, to be higher among skilled staff than among unskilled/semi-skilled operators, who were the most vulnerable section of the workforce if jobs were to be shed. Why had there been such a high degree of acceptance of new technology in the workplace, contrary to many forecasts in the early years of microelectronics and to the perceptions of much of the public?

The fact that new technology was in many cases not associated with major job loss was seen by respondents as very important in securing the high degree of cooperation they had typically experienced; however, even those plants where there had been sizeable losses had not experienced any major disputes about new technology. Several plants had a formal policy of no compulsory redundancies due to automation, and this was evidently a major factor in removing fears about the advent of new technology.

The recession of the early 1980s clearly had a major effect on the subsequent acceptance of change in the workplace, and several managers commented on the relative ease of securing agreements and implementing changes in the industrial relations climate of recent years. The job losses directly related to the arrival of new technology have been smaller and less traumatic than those caused by plant closures and the failure of businesses in the early 1980s; moreover, the experience of recession and mass unemployment had, it was felt, sharpened employees’ awareness of the need for their firms to increase their competitiveness, and new technology was seen as essential to this effort.

The message has therefore been absorbed at all levels that new technology is vital to continuing competitiveness and long term survival and that its adoption is inescapable. One manager observed
that there were always some staff at all levels who were resistant to
derchange, but that new technology was recognised as inevitable: "Most of them know that it is job security in the end anyway, that we’ve got to keep up with our competitors". A few respondents felt that there would be disquiet among the younger generation of skilled production staff and engineers if the firm was seen not to be modernising its equipment and manufacturing methods.

A further important factor is that microelectronic technology is widely seen as a sign of ‘progress’, and it has an aura of glamour – certainly for many skilled shopfloor staff and engineers – which promotes its acceptance, especially when its introduction is not accompanied by job losses. Automation, said one manager, was seen by most employees as an indication of progress within the plant, even if it was a form of progress "which they can’t do anything about". Others noted a high level of enthusiasm among staff, and several managers said that new technology was a source of general ‘excitement’ in the factory, particularly among the craftsmen and engineers concerned with developing and maintaining systems. In general it was felt that skilled workers saw new technology as a positive force which tended to enhance their position.

The progressive aspect of some new technology applications was a factor in securing acceptance in a number of plants even where jobs were eliminated: automation often displaced jobs which were regarded as tedious, dirty and hazardous, and was felt to contribute to a better working environment for staff.

It is also important to bear in mind that for most plants the type of microelectronic applications in question no longer represented especially ‘new’ technology. In some cases several generations of microelectronic equipment had come and gone. The fact that workforces had often experienced a number of phases of advanced technical change, usually without major job loss, meant that early apprehensions had vanished or were fading, and that new forms of technology were seen as less of a potential threat than they would have been a few years before. Moreover, the gradual and piecemeal fashion in which companies had introduced many microelectronic applications also played a part in the low level of opposition to change. As one manager put it, the introduction of automation "has been so gradually done it creeps in without your realising it... It hasn’t taken away at a stroke great quantities of jobs"; there had not been any
massive organisational changes or culture shocks for the workforce to cope with, unlike in the much publicised case of the newspaper industry, where the scale and speed of developments in recent years "would wind anybody up".

Respondents in companies which had concentrated new technology developments in green field sites reported no problems over acceptance, since by definition no jobs were in jeopardy and no existing structures or methods were being affected by automation. One respondent felt that bringing in a high level of automation at one of his firm's old sites with an ageing and "very staid" workforce would have aroused resistance; in a brand new factory with many automated processes there had been no difficulties with the (much smaller) new workforce, "because they had nothing to compare themselves with".

Where did problems arise over acceptance of new technology? A few respondents reported persistent anxieties among semi-skilled staff, who were by far the most vulnerable group when jobs were shed. Some said that there were occasional individual cases of resentment over new working conditions – for instance, among operators whose jobs had become 'machine-paced' – or over redeployment in new production areas. In a few cases there had been arguments over management’s refusal to link pay increases to introduction of new technology. There were, however, more reports of difficulties in negotiating the introduction of organisational changes – such as flexible working practices or extra shifts – than that of any new technology application.

A few respondents said that neglect of training for new technology could cause friction, and this view was echoed by some of the shopfloor interviewees in the NEDO case studies. One manager remarked that the workforce at his plant was generally "receptive" to technical change "as long as they’re given the right instruction": difficulties only arose when the unions felt that training was not being given a high enough priority – "that’s when you get reaction".

In some cases there were anxieties over the potential loss of skills as well as of jobs (see section 7 for details of the effect of new technology on skills and job content), and these tended to be centred on the introduction of CNC machines and CAD systems. Where there was resistance or resentment, it tended to come from older staff with a ‘traditional’ training who felt that new technology eroded skills and who had difficulty in adjusting to using the new equipment. In some
cases there was a clear ‘generation gap’ in use of new technology: older staff were more likely to develop what one respondent called "keyboard phobia", while it was widely remarked that younger staff took to using computerised equipment with far more ease and confidence. In one company the introduction of CAD had been a difficult process, since the head of the drawing office and other older draughtsmen disliked the slow, complex and unreliable first CAD system installed, whereas trainees "couldn’t wait to get their hands on it". The new technology gradually won acceptance as the system’s performance was improved and after it was decided that new staff would not be allowed to use CAD until they had completed basic training. This solution led to increased acceptance of CAD by the ‘traditionalists’.

In a few plants our respondents reported unease or resistance from sections of management. These cases tended to involve older engineering managers who felt out of touch with new technology. In one company the general manager was felt to be against the introduction of information technology because he saw it as a distinct "source of power" which he did not understand: he objected to seeing engineering managers sitting in front of keyboards "like a secretary". In a few other plants some older ‘traditionalist’ managers (including one senior electronics engineer!) had moved on or taken early retirement because of dislike of using new technology, but overall, resistance from management to technical change was very rare. Rather more commonly reported was a degree of unease among engineering managers over the complexity of the latest microelectronically controlled equipment: as one respondent put it, they tended to feel insecure if they were not as familiar with new hardware as the skilled workers and technical specialists – which nowadays, given the sophistication and specialisation of the equipment, would be impossible as well as unnecessary.

In general then, the introduction of new technology in the plants visited had not aroused significant opposition from shopfloor workers, management or any other groups. In the few cases where problems arose, they tended to centre on pay or training rather than on the principle of bringing in new technology. Any opposition to the technology per se tended to come from the older generation of affected staff.