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New technologies

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Editorial

The microchip, the microprocessor, communications technology and office automation, with their potential for rapid growth and for integration into complex systems, bear witness to the impact of new technology on our personal and working lives and must be taken into account at different levels of social and economic life. They have become a problem to be tackled by society. The alternatives must be made clear, so that we can take the decisions whereby we can map out our common future and take the direction we think best.

In the past, in other contexts, new technology has been a powerful factor in economic growth because it has released new potential for greater productivity, as in the case of labour-saving devices in the home, television and the car. Its effect has also been to concentrate production and enlarge production units to a mammoth scale.

Technological innovation is not a new issue, then, but the situation we now face is different compared with the past. With the interaction between the latest developments in microelectronics, information technology and telecommunications, the rate of technological change is accelerating and that change is spreading far more widely.

Some of the forms the changes will take are already becoming apparent, although it is impossible to comprehend all the ways in which we may be affected.

Many goods and service production sectors are being caught up in this process, or will be so in the near future. The most spectacular developments are to be seen in production processes rather than in mass consumer goods themselves. But the potential for innovation is bound to lead to the creation of new products. Our society already has to contend with the twofold problem of the disappearance of old jobs and the creation of new jobs, aggravated by the fact that the introduction of new technology is raising productivity at a time of crisis in which growth has virtually come to a halt.

The content of jobs is also about to change on an unprecedented scale. In the production sphere, there can be genuine choice as to the way in which work should be organized.

Our everyday lives will inevitably be influenced by the process of change, for example by the scope for individual access to data banks, teleworking, teleconferencing, the organization of health services and satellite broadcasting. All these innovations cannot fail to make their mark on the social system.

In the field of scientific research, new technology is being applied to genetics, biotechnology and alternative sources of energy and this in turn will lead to far-reaching changes in the long term.

The central issue at stake would appear to be whether we can be the masters rather than the servants of change. This is why the question should be treated as a problem facing society as a whole.

As is obvious, new technology affects and is affected by problems of employment, training, the organization of labour and other matters inherent in the social system.

One decisive factor within this complex and changing system is education and vocational training.

In our approach to the relationships between technology and education/training, all too often we try to observe and analyse the effects of technological innovation on vocational training and its content, our concepts of such training, its organization and its goals.

Is this the right way of stating the problem? Should it not be our primary concern to create conditions under which individuals and communities can master the tools that will become available to them? The task is to counteract the risk of a society divided into those who know and take the decisions and those who just have to live with those decisions. We must ward off the temptation of an updated version of Taylorism in the organization of labour. From now on, should we not view education and vocational training more as a vital social and economic investment, in which the individuals and communities affected have an equal stake? Should the priority not be to combat educational failure and technological illiteracy and to fight for the development of lifelong education and training?

R.F.

Now that we are confronted with a new way of life, we are called upon to devise new ways of learning and teaching.

The seminar arranged in Berlin by the European Commission and Cedefop in November 1982 tackled all these issues. The discussions themselves will be reported elsewhere, but its focal themes are taken up in this bulletin.

New technology is a problem for society. The problem must be approached in the right way, not emotionally or in a spirit of fear. It is a challenge, and we must accept the risks.

The challenge of technology: an approach to the problem

Paul-Pierre Valli

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Over the past few years, new technology has become a topic frequently covered by the mass media. Because of the way the media function, the issues are usually tackled in a sensational manner, the problems being exaggerated or presented in dramatic terms.

When discussing energy, the media proclaim the dangers of nuclear power stations or the almost unlimited possibilities which mastering nuclear fission would bring about. With biotechnology, they invoke the perils of genetic engineering or the prospects of reducing world hunger. With the new information technology, the stress is on robots, followed up promptly by the spectre of Frankenstein or reflections on artificial intelligence. In more concrete terms, this new technology has already entered everyday life, changing it radically, sometimes surreptitiously, at times more brusquely, in factories, offices, and even our own homes.

It follows that there is a need for a dispassionate analysis of the consequences of the introduction of new technology to skills, employment and training.

Technological change and job content

In actual fact, should we be looking at the issues in terms of their consequences? In so doing, we create the impression of something inexorable and intangible in the introduction of the new information technology. Some hidden profound reason, a combination of chance and necessity, a kind of new law of the evolution of species, a new and this time technological determinism, are said to govern the introduction of the new technology and all we can do is adjust to it.

This vision of things is upheld by the feeling that the gains in productivity claimed for new technology, especially in Japan and in the United States, are so great that it would be unrealistic or unreasonable to oppose its introduction or even to dream of slowing it down or putting it off. All we can do is try to limit the harmful consequences – de-skilling, perhaps, or a reduction in the number of jobs.

☐ *A few comments on method and procedure*

An examination of the reality reveals situations far more complex and subtle. New information technology is far from constituting a uniform whole, and the analysis which must be made of how it is to be introduced should single out carefully the sectors and activities concerned. To speak of technological change or the introduction of new technology in general makes little sense and there is a serious risk that hasty conclusions may be drawn from isolated situations. One way of defining the field of investigation is first to pick out what relates to planning, manufacture, maintenance, technical control and management control, and then to distinguish between the situations encountered according to whether services are provided or goods produced, whether production is continuous or intermittent and, in the latter case, whether it involves manufacture or assembly.

It then becomes possible to draw up a kind of double entry table, a feature of which is that it does not distinguish clearly between the manufacturing and service sectors. This is in fact the result of one observation: new information technology is generally introduced in a way that results in a blurring of the distinctions, in terms of job content, the skills required or the training needed, which we normally make between industrial jobs and training and service jobs and training.

However, the analysis of new technology calls for other precautions as well as defining the field of observation, to ensure that any comments that are made will be more generally applicable and representative.

☐ *Work systems and vocational advancement*

Another need is not to take too limited a view but to assess the change on the basis of a network of jobs rather than a single job.

In reality, this job network is twofold. On the one hand, an initial network is formed by all the jobs which are interconnected at a given moment. Various tasks are apportioned amongst several jobs. The introduction of new technology will lead to the concomitant modification of several jobs and a change in the apportionment of tasks. A simple example is the changes to manufacturing and industrial methods jobs brought about by the introduction of numerically controlled machines. Depending on the type of machines introduced, programming tasks will be carried out by production workers or by members of methods teams. This example also shows that developments often occur in waves, the results of one development sometimes conflicting with the results of its predecessor.

For instance, the introduction of numerically controlled (NC) machine tools leads to programming tasks being allocated to methods technicians, a development which is reversed when computerized NC machine tools are brought in and shop-floor workers are able, to perform certain programming operations. This development is in turn likely to be vigorously challenged on the introduction, for instance, of direct numerically controlled machines.

On the other hand, this evolution in job content, which can be assessed realistically only by observing a set of closely related jobs making up a sort of working system, will also have repercussions on jobs whose interconnections are more sequential than simultaneous.

From an analysis of the content of closely related jobs, it seems that certain jobs cannot be done unless the holder has previously worked in another. In France, for instance, few tool-makers have not done their stint on turning or milling machines, and in the same way designers' jobs generally go to ex-draughtsmen. This highlights the concept of occupational advancement and in correlation, the concept of the skill area or zone, in so far as it clearly shows that skills are not acquired during one specific period or even in one specific job but in a series of jobs. This also raises the issue of the company's role in the acquisition of a skill, not only as the place where the skill is acquired but also in terms of the policy on the acquisition of skills pursued by the company, which is determined by (or perhaps determines) its policy on labour management.

In these circumstances, the question raised by the introduction of new technology is not so much whether the skills for a given job or jobs are retained or reduced as how the job network to which we have referred evolves, i.e. how tasks are broken down and reconstituted within work systems or how vocational advancement and skill areas are disrupted.

☐ *Polarization or convergence?*

At the level of work systems, the real question is whether skills polarize or converge. By 'polarization' is meant an evolution whereby job structures are modified in such a way as to increase middle-level and higher-level jobs (technicians, senior technicians, executives) on the one hand and, on the other, jobs with a lower skill content (for semi-skilled workers, automatic machine minders). In a process of 'convergence', the number of skilled jobs is maintained and increased; new jobs may even be created demanding even higher skills of the people operating the machines which use the new technology.

It is at this point that the full significance of the warnings as to the diversity of situations examined becomes apparent: it is quite clear from observations that new technology is not in itself the determining factor in the changes noted, in that many other factors combine to produce those changes. Taking the example of the introduction of numerical control, we see that the size of the company, the size of a production series or the time taken to manufacture that series, the type of machining process and machine, a country's institutions and national labour, management and training practices are all factors that – by their interaction or even by their conflict – produce the situations that we then observe.

☐ *Technological determinism or margins of liberty*

Once we recognize the importance of factors of an institutional or political nature, we realize that there may be scope for manoeuvre and a margin of liberty on the

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introduction of new technology, and this considerably modifies – if not demolishes – the idea of technological determinism. We do not mean that there are no technical constraints, but that they should to an extent be viewed on a par with social or economic constraints. This being so, the important thing is to focus attention on the causes rather than the results, so that we can try to find the combination of factors through which we can achieve the objectives we have set ourselves. These may be economic objectives (since the reasons for introducing new technology undoubtedly include a desire for tighter management, greater flexibility in production and more adaptability to the market), but in its introduction account may be taken of such factors as social policy, labour management and the management of human resources and even the aspirations of the work-force.

To take an example, one way of manning a flexible workshop may well be to use composite teams, making skilled workers responsible for tool adjustment and supervision and semi-skilled workers responsible for palletizing and positioning components. As an alternative approach, however, the aim may be workforce versatility, with every member of a team, a skilled craftsman, working on each of the tasks in turn. This more flexible solution is not necessarily less economical.

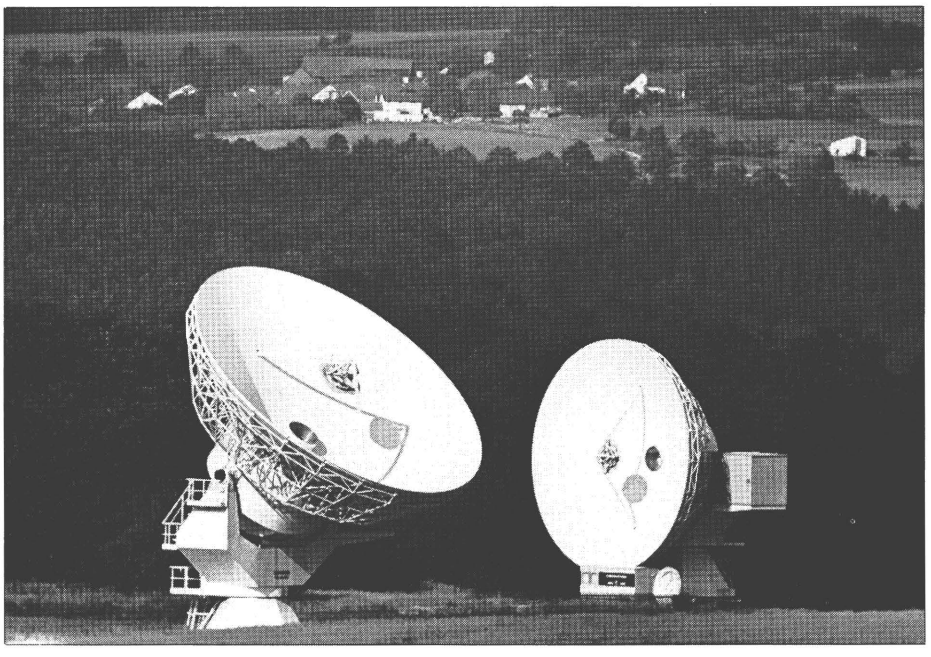
Conversely, the concept of the equipment and in particular the functioning of a flexible workshop may be governed by our attitude to night-work. In one case, night-shifts may be introduced, and volunteers sought who accept this constraint. In another, night-work may be eliminated and operation be virtually automatic if the production ranges are large or storage capacity extensive.

Technological change and training

On the basis of these remarks of the evolution of job content and more generally on the organization of work, it may be worth investigating the consequences to be expected or the conclusions to be drawn in the case of training.

Here again, it must first be pointed out that the notion of consequences is more a presentational device, a terminological aid, than the expression of a reality.

It will obviously be necessary to draw conclusions regarding training. Some will



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be elaborated on later. But the level of workers' qualifications, abilities or skills are elements which may equally be taken into account when choosing equipment and technologies. The choice of one technology rather than another at any given moment may not be so inexorable as is thought.

The technical choice is closely linked to what is seen as the ability of workers to operate the equipment. In some cases, the work-force is required to adapt to new plant, but in others the choice of the plant will be swayed by the consideration that the equipment installed must not leave the work-force too disoriented.

It is perhaps easier to discern certain fairly general trends in the consequences on training than to see the effects of new technology on job content.

☐ *Know-how and the control function*

Because of the increasing complexity of the new technologies, greater theoretical knowledge is frequently called for.

In concrete terms, automation involves the transition from machines operated by men to machines controlled by men. But control applied to a complex whole requires in the controller knowledge of the relationships between the different parts of the machine and the technical significance of any changes in the way they function. Before an operative can respond correctly to a signal he must know what this, of all the signals possible, means. Consequently, this new type of relationship with machines implies a different level of technical knowledge.

This higher standard of technical knowledge does not render all other skills obsolete, however, even though new technology may involve the transfer to machines of most of the work done on products.

In the textile industry, for example, a traditional skill – quickly piecing together a broken thread – disappears with automation, what is now necessary is the ability to manage a large installation and obtain the optimum output by coping with any problems as they arise.

In mechanical machining, purely manual skills (such as turning the cranks of a lathe in a careful, coordinated way) disappear but technical skills (such as choosing the ideal machining speed for the type of metal and equipment) are still needed. On the other hand, companies do not seem interested in acquiring skills specific to the new machines (partly because of their diversity). But new skills are making their appearance, such as the ability to 'play' with programming, perhaps for limited adaptations on an individual machine, or perhaps in a more personal, even creative, way with the programming system as a whole by, for instance, creating one's own data bank or subprograms.

In typing, knowing how to type is still necessary but speed is no longer a criterion. Mastering the programming system consti-

tutes a new skill (more or less as in the field of engineering).

The progression to a more complex automated office system implies the ability to understand, not only how it works technically, but also how it is organized and the overall functions of which it forms a part, the human relations it involves and so on.

☐ *Human qualities and collective qualifications*

As we have seen, it is important that not only job contents are modified but also organizations and the way they work are altered by growing complexity, the need for greater adaptability, the scope for greater diversity of tasks of a management as well as a production nature.

We come up against a change in the expectations of the production system with regard to human behaviour, together with a change in human relations within the organizations: greater value is placed on responsibility for quality and the ability to innovate and initiate.

Ultimately, what is needed is not so much the willingness to obey a rule to the letter but rather the ability to react to a difficulty. Social reliability, open-mindedness and tolerance, independence and cooperation, curiosity and imagination are the character traits likely to be regarded as the most desirable features for the efficient introduction of the new technology in relatively advanced forms of organization.

The importance thus conferred on aspects of human relations within groups of workers by new technology leads us to stress skill-acquisition methods linked with belonging to a group and the ability to integrate in that group, and also the social relationship developed within the group.

In this sense, we can speak of collective skills, despite being aware of all the contradictions between the two terms as of this time. Such skills are often implied, not recognized, because skills are assessed individually for the purpose of recognition. Nevertheless, experience has shown that the efficiency of a group of workers may fall on a sudden changeover in staff even though there has been no diminution in individual skills, clearly demonstrating the existence of informal skill-transmission networks. We must be careful not to disrupt them heedlessly – precisely what may happen when a new technology is introduced.

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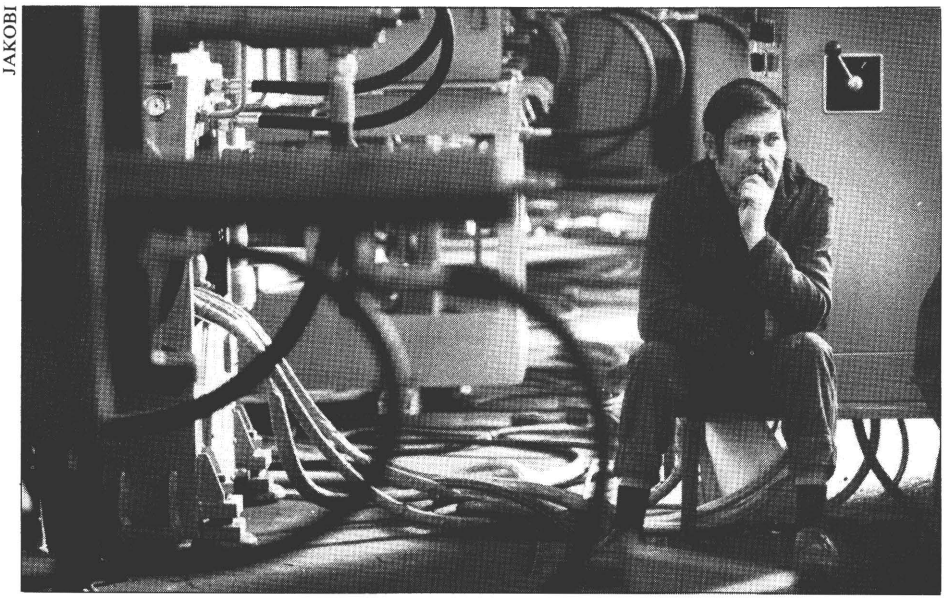


☐ *The value and limitations of alternance training*

An understanding of the workings of the system in which a person operates and the ability to identify which of the manual skills of all those who for various reasons work on a machine are lessened in importance often lead to the conclusion that technological change tips the balance – within vocational training – towards a general rather than technological training, placing the emphasis on a concept of 'technical culture'.

This is undoubtedly a field in which great uncertainty may exist. The need for broader-based training is nothing new, but the end objectives are now very different. The purpose of such training used to be to promote a measure of versatility, in practical terms compensating for mistakes made in quantitative predictions of training requirements at a time when the difficulties and limitations of the concept of training forecasts had not been fully realized.

Be that as it may, with the simultaneous development of a new type of basic training, one that leads to the concept of technical culture, and a need to master new skills in the interrelationships within a working group, the links between the various places in which skills are acquired are now called into question.

A rough-and-ready distinction may be made between theoretical knowledge, a need made all the more pressing by technological change, and certain forms of know-how which do not disappear but may sometimes be transferred to machines and the human qualities whose importance we have seen.

We must focus on the most significant places of training: the school or, in a wider sense, the training institute imparting theoretical knowledge, the company where social skills are learned and the workshop where practical skills are acquired. We use the rather ambiguous term 'workshop' advisably to show that these skills may be acquired just as easily at the place of work, on the job, as in the specialist classroom in a school, depending to a great extent on facilities for on-the-job training (which in turn depend on the social and historical evolution of an individual country).

It is evident that the discernible changes in training requirements reinforce the role of both the school and the employer in the imparting of skills. This implies changes in the various training systems, apparently contradictory changes which in some cases strengthen the school's role and in others the company's. This is explained, however, by the conflicting nature of the different systems used at present, which range from the full-time school training system encountered principally in France to the alternance training schemes already highly developed in Germany.

The basic point at issue, however, it not the way in which each country's educational system is evolving with respect to one point or another, but the way the new relationship between the school and the employer is being defined, each one having to contribute, within its own sphere, to a sort of process of skill production.

☐ *The importance of labour management*

All this leads us to focus more specifically on two points.

With regard to training, the distinction between the goals and practices of initial training and continuous training is becoming more and more blurred. In both fields, the various components of a skill are acquired through the sequencing and interlinking of training activities and workplace activities.

The various skill-acquisition situations must continue to be combined in various ways depending on different regulations and responsibilities but, at least at the level at which policies are implemented, there is a need for close coordination, merely reflecting the focal role played by labour management policy in the acquisition of skills, just as it is in the movement and replacement of labour.

This is equally clear in respect of the training of young people: it is wishful thinking to imagine that employment problems can be solved by training unless at the same time continuous training policies allow for increased mobility, leaving more scope for young people in the process of labour turnover.

Another factor exerting a strong influence on the acquisition of skills is company policy.

The importance attached by companies to internal mobility or outside recruitment when filling vacancies calling for new skills, their choice between young people and adults with equal qualifications, their recourse to internal or external resources for continuous training and their policies regarding recognition of qualifications acquired during continuous training, all mean that employers play a key role in skill acquisition, transferability and dissemination.

Here we can see how important and also how difficult it is to perceive clearly the links between these policies and the size of companies. Small and medium-sized undertakings obviously merit special attention because of their social climate, their ability to cope with the problems of producing goods or providing services and their familiar difficulties with training (the lack of a structured training service, difficulties in replacing staff).

☐ *Training of the instigators of change*

As we have seen, because of all the factors intervening in the introduction of new technology and their relations with training problems, training objectives cannot be left to the discretion of those who will ultimately be implementing the new technology.

There is also a marked need for the training of those in charge, principally to make them aware of the margins of liberty in technical choices as well as the constraints linked to the characteristics of the work-force – existing skills, for instance, or the ability to acquire new skills.

The problem is more than a simple need to plan for the training of operatives on the one hand and decision-makers on the other.

Technological change has become such an important issue in social relations at work that it is often the focal point of the 'social dialogue' – a very broad term embracing all information, consultation and negotiation procedures. Some of these procedures are informal or at least variable in form, but others have now been introduced in many countries through legislation, regulations or agreements between management and labour. This situation is the obvious consequence of what has been said above, i.e. the fact no technical constraint is so inexorable that only one way of organizing work and working conditions is feasible. On the contrary, the same technology may be deployed in various forms of work organization, and there is freedom of choice rather than absolute contraints even in the solution of technical problems.

The aim is no longer to adapt men to a job or a system but to enable them to be the instigators of change – a challenge to the basic distinction between staff and line, planning and execution.

Here again training has a considerable role to play, but such ambitious aims obviously exceed the capabilities of traditional training methods and systems. This is why we now frequently encounter measures to make people aware of new technology, making intelligent use of the mass media we mentioned in our introduction, not so much to teach as to dispel people's ignorance, to acquaint them with the rudiments so that they are not out of their depth when new technology is introduced.

What about employment?

Meanwhile, we cannot ignore that new technology is being introduced during a period of grave economic crisis. Because new technology increases productivity, it is seen as potentially eliminating jobs at a time when the prospect is stagnant or even declining employment. Training people in new technology may be seen as hastening them on the path to their own destruction. A neo-Ludditism is coming into being, the same fear of mechanization that led to the smashing of looms in the early 19th century. To counteract this feeling, a more optimistic argument is often advanced: that new technology will bring about such changes in production and create so many new products and new markets that it will be an essential factor in, or even the driving force behind, strategies whereby the crisis can be overcome. The aim of training, then, should be to contribute to this most desirable of ends. In these fields, we must be on our guard against both lyrical optimism and the fear of sudden disaster.

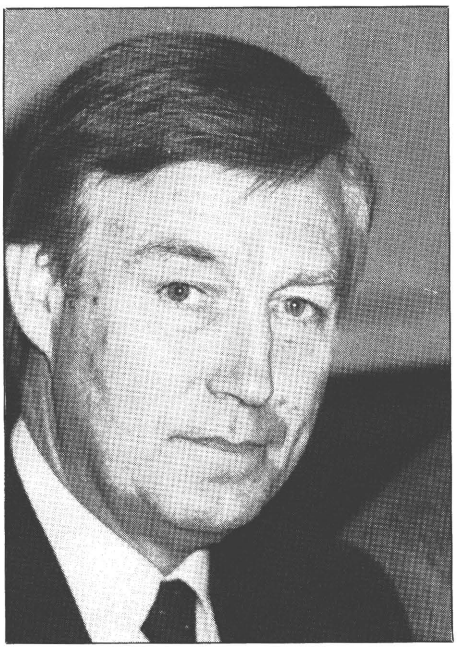
The relations between productivity, competitiveness, growth and employment are complex and are still a matter of unresolved debate amongst specialists. Since competitiveness cannot be confused with productivity and vice versa, there is no reason to think that higher productivity will enable us to conquer new markets, creating new outlets and more employment in the sector concerned.

Nevertheless, in considering the relationship between growth and employment we cannot ignore the effects of social policies, for example shorter working hours; there is no simple link between growth in the size of the work-force and growth in activity.

The attitude that should be adopted to training and employment on the introduction of new technology is one of modesty in its objectives.

Training on its own will not solve the problems of employment; the fact that the training is linked with the introduction of new technology changes nothing. Conversely, the lack of training, or badly planned training, may well have harmful effects on employment and these in turn may be even greater in the case of new technology.

This justifies all the efforts to increase knowledge in these spheres, paving the way for action.



Technological change, employment and occupational qualifications

Hermann Schmidt

Secretary-General of the Federal Institute for Vocational Training

Microprocessor technology – a new industrial revolution, a job-killer or a means of humanizing working conditions?

Many people are at present worried about a technology whose technical content is in essence relatively limited, but which is so versatile that its eventual effects on all aspects of life are as yet incalculable: microprocessor technology. At the heart of this technology lies a thin slice of silicon, the microchip, which, like the inhabitant of a technological ant hill, is tiny, precise and extremely industrious. It has a wide range of applications, from machines that can relieve man of heavy, dirty or soul-destroying work, to the 'intelligence amplifier', which would seem to indicate that it will not be long before machines are capable of thinking.

What makes this infant prodigy of technology attractive is its price. Never before has the essential item of a new technology been so cheap as the heart of the microcomputer. The economic factors which seriously obstruct the introduction of many technical innovations consequently have no significance here. New applications for microelectronics are therefore being developed at great speed and on an unprecedented scale, making capital- and wage-saving investments possible.

Microcomputer technology is so much more important than other innovations because of its simultaneous introduction into the work process, the home, leisure activities and entertainment, education and training. Unlike other technologies, such as nuclear power, the microcomputer represents a potential employment problem for everyone.

One of the most important questions arising in this context is this: 'Will the effect microcomputer technology has on our working lives, our homes and free time be gradual, or are we about to experience a sudden upheaval?' The experts disagree in their forecasts: either alternative seems possible.

Virtually every area of economic activity is affected. In manufacturing, production centres and fully automated transfer lines are emerging. The assembly line is being replaced by industrial robots. Computers are now used in design work (computer-aided design – CAD). And there are many other examples.

The industrial robot, a freely programmable manipulating device, is one of the most obvious examples of the application of microcomputer technology to the production process. A comparison of the state of industrial robot development in the Federal Republic of Germany and Japan shows that we can hardly be accused in this country of being overhasty in this field. Frenzied development is something we presumably still have to face.

In the commercial and administrative sectors microcomputer technology is largely determining developments in data and word processing. The Federal Institute for Vocational Training has examined 3 000 companies in industry, banking, trade and other service sectors to see how they have been affected by the 'office revolution'. At the time of the survey, almost half of these companies were using electronic data-processing equipment, foremost among them banks and insurance companies. While only 28 % of small firms with fewer than 20 employees had data-processing equipment, 92 % of companies with more than 200 employees were using equipment of this kind. Although centralized data acquisition still dominates (59 %), decentralization is on the increase (41 %).

Word processors are most frequently to be found in banks and insurance companies. The number of users in trade and the construction industry is below the average. But it is also worth noting that only 25 % of the larger firms, those with over 100 employees, use modern word-processing equipment.

The survey significantly revealed that half of all non-users of data and word processing do not intend to introduce this technology in the next five years. The survey indicated that in the same period the number of first-time users of data processing and word processing would grow by 10 % and 15 % respectively. Assuming these firms implement their plans, some 57 % of industrial and trading firms will be using data-processing equipment and 24 % word proces-

sors by 1986. This shows the moderate speed at which the new technologies are spreading in these sector.

Even the latest report to the Club of Rome, concerning the effects of microelectronics on the economy and society,[1] varies in its assessment of the trend.

In one respect, however, the experts agree: technological determinism can be ruled out provided the enormous technical and economic potential of the new technology is used in a conscious and responsible effort to shape working life with as much importance attached to employment and social aspects as to economic and technological factors.

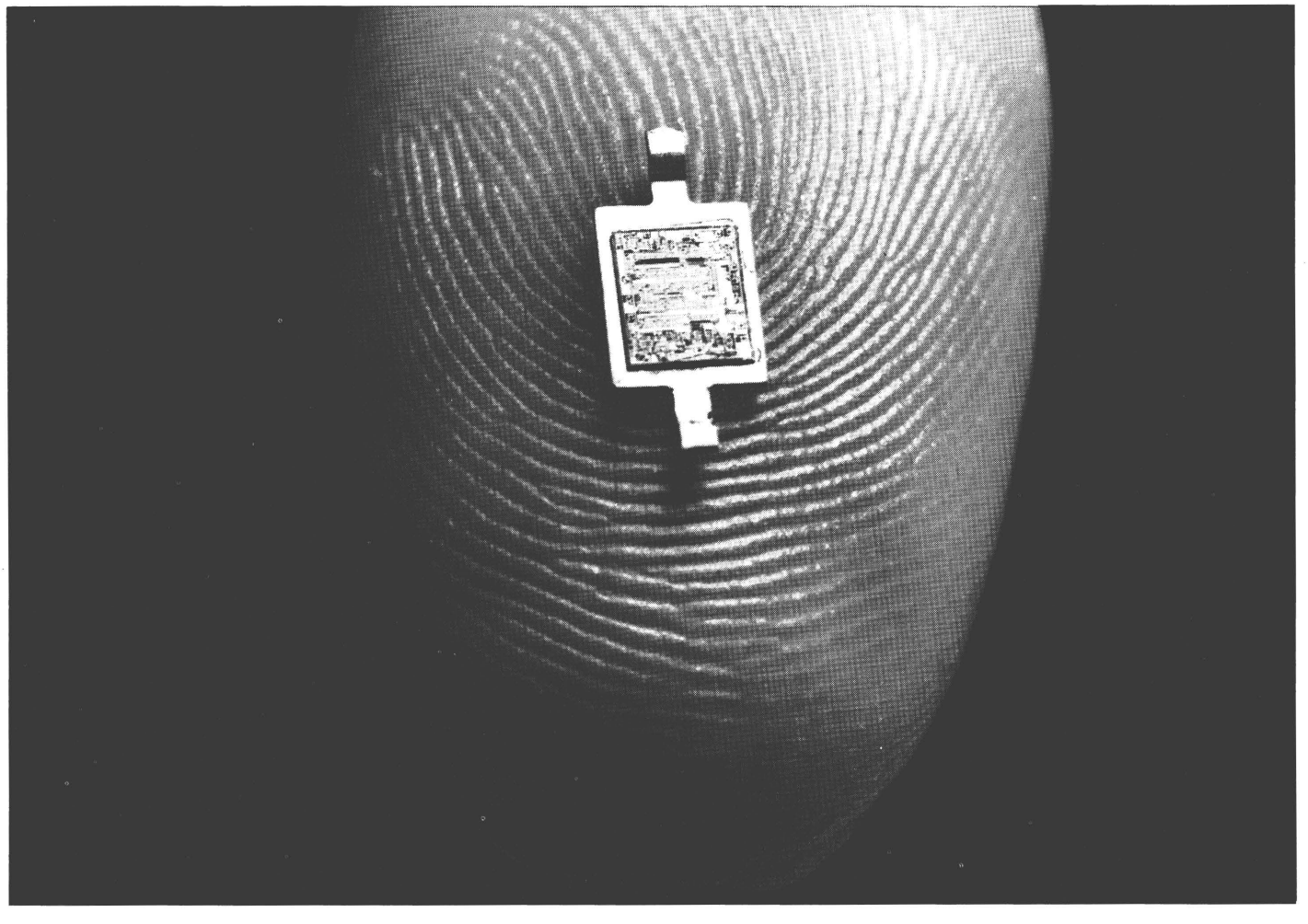
There is, of course, nothing new about the invention of technologies and their introduction into the work process and everyday life. The new technologies are a major issue because of the conditions under which they are being introduced, especially into the work process. Microcomputer technology has come at a time of global economic stagnation and unusually high levels of unemployment, the manifold causes of which are beyond most people. It was quickly made the scapegoat, even though it was not to blame for the crisis, being no more than a concomitant phenomenon.

The statements past studies make on the effects of microcomputer technology on employment are not consistent, however. The Swiss institute Prognos, for example, has predicted 4 % unemployment in 1990 without microelectronics and around 12 % if it is introduced on a large scale.[2]

At about the same time the German Institute for Systems Engineering and Innovation Research was claiming that microelectronics had had, and would continue to have, hardly any effect on the number of jobs.[3] Most of the studies that have been made reflect the findings of surveys of companies. What is striking here is that a marked reduction in the work-force is expected by firms which predict a general lowering of qualification requirements with the introduction of the new technology (the downgrading theory). The areas most frequently mentioned in this connection are production, administration, inspection and control, while maintenance, customer service and research are generally regarded as growth areas. Firms which forecast a general rise in qualification requirements (the upgrading theory), on the other hand, expect the adverse effect of the new technology on employment in production and administration to be less pronounced.[4]

The new technologies have acquired the reputation of being job-killers chiefly where they are used to develop new processing methods. Process innovations, such as production centres and fully automated transfer lines, replace human labour far more than they create new jobs.

In contrast, product innovations, of which Japanese electronic goods and photographic techniques are good examples, do more to create new jobs. The industrialized countries of Europe – and the USA – are clearly lagging behind their Far Eastern



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competitors in this respect. In the above-mentioned report to the Club of Rome Friedrichs says on this subject:[5]

> **'. . . a lengthy period will, however, elapse between the phase in which the use of microelectronics for process innovations dominates and the phase in which product innovations become dominant.'**

The question is whether and, if so, how our social systems can bridge the intervening period.

The policy-makers also face long-term problems. In a debate on microelectronics in the German Bundestag on 24 November 1982 one Member said:[6]

> **'. . . disputed though the forecasts of job losses in information-intensive activities may be, there is no disputing that rationalization will hit these sectors and occupations hardest and that in this area, which after all accounts for 10 million workers, about half of all jobs will be affected. It remains to be seen whether and to what extent they will be completely or partly eliminated.'**

Despite the dreadful visions conjured up by the new technologies, it should not be forgotten that they will also enable us to transfer to machines tasks which are unworthy of man or a danger to his health. In 1979 the Institute for Labour Market and Occupational Research pointed out[7] that 4.2 million employees in the Federal Republic of Germany still have to stoop all or most of the time to do their work, 3.8 million carry objects weighing more than 20 kilograms in the performance of their work and 4 million are still exposed to smoke, dust, gases or fumes all or most of the time.

The automotive industry, which is beginning to replace the ubiquitous assembly line with robots, now refers to the time b.J. (before Japan) and the time a.J. (after Japan). But the industrial robots that are taking over from the assembly line cannot be operated by unskilled workers. They even require a new type of skilled worker, who should ideally be skilled in both metal-working and informatics: he is already referred to as a hybrid skilled worker.

If the training system proves incapable of reacting in the foreseeable future to this demand for skills with appropriate courses and methods, we may miss a unique opportunity of replacing Taylorized work processes with varied skilled activities and of so achieving a form of production which is economically optimal and socially acceptable. Training can lay the foundations for job enrichment through a new method of organizing work and perform an important function in prompting desirable changes in the employment system.

The role of the man or woman working on a machine, in an office, in a hospital or wherever else must therefore be redefined. Plans must then be made to organize work in a way that is fit for human beings, and it must be decided what qualifications will be required, how they are to be obtained and where. The need to consider not only the technical possibilities but also their social implications for the work-force is now more widely accepted. There is a chance that attention will be focused more specifically on man in a holistic view of qualifications, the organization of work, productivity and the maintenance of jobs.

STERN

The effects of the new technologies on small and medium-sized firms

In the past new manufacturing methods primarily affected mass production. The manufacture of items singly or in small numbers, maintenance and the repair and service sectors were largely spared the job-destroying effects of such methods. The adaptability of microelectronics, however, is such that it can be used in many of the production processes and service activities that are typical of small and medium-sized firms.

Studies which have been made in recent years in the USA, the United Kingdom and the Federal Republic of Germany[8] clearly endorse the claim that small and medium-sized companies have done most to create jobs in the industrialized countries in the last few years and have thus prevented unemployment from rising even higher. Will the advent of the new technologies mean that small and medium-sized firms are no longer able to play this welcome role, of which we have only recently become aware?

Small and medium-sized companies in both the manufacturing and the service sector have shown in the past how much better they are than large firms at adapting to market trends. They have distinguished themselves particularly in the area of product innovation using new technologies and in the development of software for them. Having recognized the potential of these firms, the governments of the industrialized countries are trying to help them and ensure their continued development with aid programmes. The Commission of the European Communities has also expressed its confidence in their innovative strength by introducing a development programme financed from the Social Fund.

The greatest problem small and medium-sized firms in the production and

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service sectors encounter when introducing and using the new technologies is the initial and further training of employees. Craft firms installing, maintaining and repairing energy-consuming household equipment, for example, are at an enormous disadvantage if the only training they can obtain for their employees in new technologies is from the supplier.

This situation recently prompted the President of the Central Association of the German Craft Industry, Paul Schnitker, to appeal for craft firms to be helped to tap their innovative potential through an improvement in initial and further training with the assistance of research institutions and with financial support from the State.

How can we adjust occupational qualifications to this trend?

It must be said straight away that it does not seem possible to prepare for future technological developments, i.e. for the education system to anticipate future qualification requirements.

Two statements by experts in American companies quoted in the above-mentioned study by the Battelle Institute[9] sum up this situation very accurately:

- **'At best the educational system lags behind the technology by five to ten years.'**
- **'Skills are still a free parameter.'**

Neither the fact that the education system lags behind by five to ten years nor the inability of the employment system to describe future qualification requirements is due to a fault in the system: it is a natural consequence of our inability to predict future technical, economic and social developments. It is therefore impossible to standardize and systematize the teaching of occupational skills in the training system until a technology is regarded as established.

The employment and education systems always react to technical changes or to changes in demand structures in essentially the same way. The question is simply how purposefully these reactions can be formed and what substance they can be given. There are four phases:

- comprehensive information on the new technologies and how those in charge intend to use them;
- in the short term, improvised adjustment of qualifications to meet the most pressing requirements;
- in the medium term, adjustment of initial vocational training to the new requirements with measures relating to content and organization (training plans, training centres);
- development of a further training concept to meet the new requirements and of appropriate courses.

Industrial unrest and disputes can be largely avoided if a policy of carefully informing the work-force about the new technologies

is adopted. An unemotional description of the changes in occupational requirements is a challenge to the employees to accept the further training that is needed. Exaggeration of the difficulty of such training often results in unjustified fear. It is essential at this stage to relate changes at the workplace directly to specific initial and further training measures.

The most pressing problem many firms and administrations at present face when introducing new technologies is in-service adaptive training, and it can be only partly solved with the help of the State education system. For the time being, the suppliers of the new systems train those who will be using, maintaining or repairing them by passing on their know-how. By selling the product and training as a package in this way, the supplier naturally increases the user's dependence on him. Further training designed specifically for small and medium-sized firms must therefore be made available at inter-plant vocational training centres in the near future so that they no longer need to rely on the suppliers. As the need to be innovative is common to most firms, they will be prepared to cooperate in setting up, financing and running initial and further training centres of their own. For the reasons explained in greater detail above, State support for such activities is both justified and necessary.

One of the most important tasks to be faced is the training of trainers. Close cooperation among company and inter-plant trainers and teachers at State schools is to be recommended in this respect. Through their professional activities vocational school teachers and teachers of technical subjects at colleges are the first to learn of theoretical innovations in their respective fields. Not even the practicians will deny that the new technologies have a higher theoretical content than the methods of the past. However, it is for the company or inter-plant trainer to translate theory into the practice of the office or shop-floor. Close and, of necessity, institutionalized cooperation between vocational school and college teachers on the one hand and trainers on the other is therefore essential.

Over the past 10 years, as occupational skills have steadily declined, restricted, specialized initial vocational training has given way to a more general form of basic vocational training. The qualifications required for the new technologies underline this trend in that they demonstrate the occupational significance of aspects of language and mathematics which hitherto have tended to be classified as general education. There is no doubt that familiarity with the information technologies must henceforth be considered part of the basic knowledge or basic vocational training required both for technical and for commercial and administrative occupations.

Special thought must be given to didactics, training methods and the organization of training. A good combination of theoretical training in school, systematic practical and theoretical training in the laboratory or workshop and dealing with specific problems at the workplace, each of these areas having its own didactics and methods, would seem to be one of the most effective ways of organizing learning, not only as a means of accomplishing short-term adjustments but also with a view to the implementation of medium- and long-term initial and further training concepts.

In the planning of further training measures in connection with the introduction of the new technologies, particular importance must be attached to vocational correspondence courses, since they enable the employee to study as he pleases in his spare time and at his own speed and to match the target qualification to the specific requirements of his firm and his job. As vocational correspondence courses are an extremely effective form of further training in terms of the costs involved, State assistance would be a very worthwhile investment in the future.

The need for employers, trade unions and the State to cooperate

If the problems we face in initial and further training as a result of the introduction of the new technologies are to be overcome, employers, trade unions and the State authorities must come to an agreement which defines the objectives to be pursued and the measures to be taken:

- First, the ways in which work will be organized in the production and service sectors must be described, with account taken of the technical possibilities and the social implications.
- On this basis, future qualification requirements can be described in greater detail. This description will indicate the required content of initial and further training measures.
- The places of learning must then be defined: depending on their didactic and methodological capacity, laboratories and workshops, workplaces and schools.
- Employers, trade unions and the State must also agree on the financing of the planned measures. To assist small and medium-sized firms, regional and sectoral inter-plant financing backed by State grants is needed.

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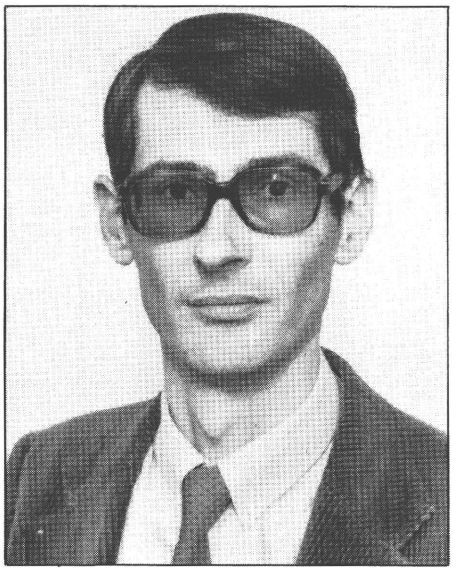

The need for vocational education

This article covers some of the points made in a paper read to the Cedefop conference on how society can cope with the new technologies. References are to the bibliography at the end of this article.

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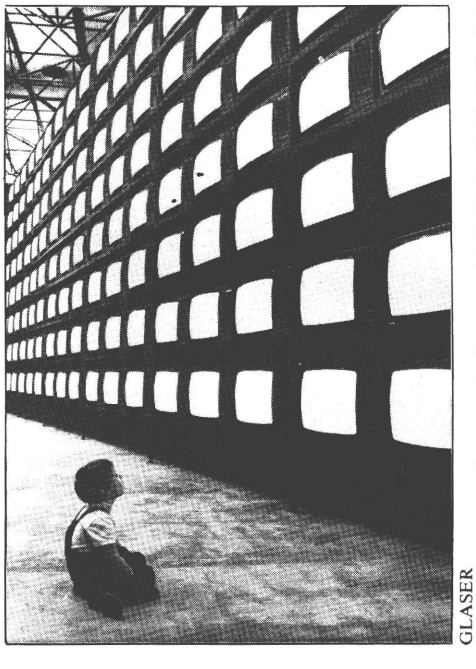
In speaking of vocational education', there is no desire to dabble in paradoxes. The term does not even have the merit of originality, since as far back as in 1967 it was used as the title of an OECD publication.[1] More basically, the intention is to reinforce the rejection of a contradiction which has probably been one of the gravest errors committed by industrial societies.

It is not surprising that it should have been in France, in a period of acute crisis and advances in the field of new technology, that this contradiction has once again been called into question. France, with its concept of culture and vocation and the stress it places on technological knowledge, is probably the country where the antinomy is most deeply rooted. With the crisis, the pendulum in the field of vocational training has started its – all too pernicious – swing back again. On the principle that the superfluous must give way to the useful, an old school of thought is re-emerging: that vocational training policy should be the handmaiden to employment policy in that its aim should be to reduce unemployment, harking back to the eternal myth that training should be attuned to the needs of the labour market. According to this concept, the counterpart to vocational training, education, is seen as an act that is free (but not without its price), something designed to help man to develop his talents to the full, something that is outdated now that affluence is a thing of the past. Because of the way that knowledge has apparently been revolutionized by new technology, the skills the trainers claim to impart are called into question and they are forced to think about what they are really doing and teaching. It should be borne in mind that these comments apply not only to training and trainers but are at least as relevant to companies and the way they choose to organize themselves, their method of allocating power in the decision-making process and their choice of men.

The intention in suggesting the concept of vocational education is to draw attention once again to the grave risks inherent in tackling the problems of vocational training and the development of new technology from a standpoint that is not sufficiently objective or wide-ranging. The risk is that by plunging headlong into a study of the changes to socially recognized skills we might overlook the essence of the problem, the fact that most of the difficulties that arise in the spread of these new technologies and their introduction, acceptance and acquisition are due to the demonstrable inability of modern industrial society to plan and create a popular technological culture that is in line with the development of the community. Again, the concept of technological culture, laying the foundations for vocational education, is not new but was being mooted as far back as 1850 – 80.[2]



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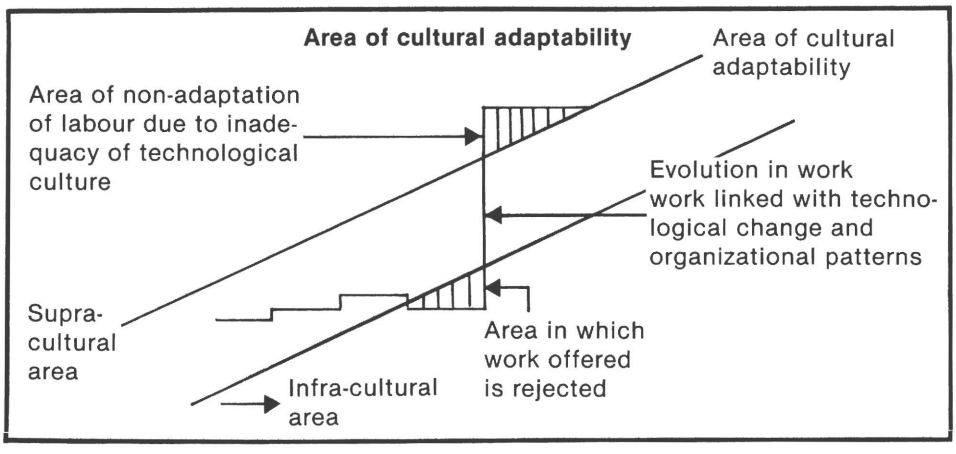
A partial explanation for the short-sighted view taken by many, if not most of us, may be the unprecedented growth of the post-war years, which camouflaged the phenomenon now exposed by the crisis. That growth was merely sustained by drawing upon skills deeply rooted in the community, the product of an intimate and informal mixture of working and social life, without thought for its replenishment. Where Taylorism has been taken as the dominant model for industrialization, those skills have been consumed and depleted and are nearing exhaustion. It has not been replenished by the educational, production and social structures, which have developed along lines that have proved inadequate for the purpose. Despite an almost universal raising of the school-leaving age and an expansion of technical and vocational instruction in various forms, this seems to have been a period of declining production potential for the population of many countries, not of widespread growth. France has probably been one of the countries most affected.



Qualifications and social norms: work and culture

As already pointed out in a publication on qualifications,[3] 'the relationships between work and training and the strength of those relationships cannot be fully understood without considering the broader context of social activity and education'. The authors go on to say that 'there is a cultural definition of qualifications which serves as a set of basic norms . . . In the light of these norms, certain types of work could by their nature be defined as infra-cultural, others as supra-cultural . . . Infra-cultural work is work calling for individual qualities that no longer form part of the cultural heritage of the society in question'.[3]

Today one might say that supra-cultural work is work that calls for skills still in the process of gestation, skills not yet generated on a wide scale and that have not yet permeated society.

Between these two extremes – these two inflexible areas – lies an area of adaptability in which there is a measure of congruence between systems of work and existing cultures.

It is, we feel significant that the idea is gaining acceptance by company management, which is beginning to use these terms to interpret inconsistencies in labour shortages and adopt this approach to the dynamic relationships between training and the organization of work within the company.[4]

The need for vocational education as the core of a training system

With the advent of new technology and the need, in the present climate of competition, to put it to optimum use, there must be clear-cut guidance on know-how and attitudes. The demand for individual potential through the types of skill mentioned cannot be viewed in isolation from education and culture. The distinction so often made between vocational training requirements, which it is said relate to the sphere of production, and the cultural needs linked with other places and times in which human activities take place, is highly artificial. The immediate problem in the training and education of young people is whether society can produce men and women capable of coping with work and the changing nature of that work as the general situation changes, in other words people with the ability to acquire qualifications. This applies to all members of a society, blue- or white-collar alike, since they are interdependent when faced with the task of production. In other words, the training and education of one group cannot be dissociated from the training and education of others.

As always, when considering the relationship between training and employment we come back to the question of an individual's qualifications. These are more than the ability to achieve a pre-set output within a pre-set time: they are his ability to see himself in relation to his work, think about his job, look beyond the immediate and suggest improvement, face up to change – in short, his possession of sufficient intellectual resources to master his work.

There is too little theoretical groundwork to back up the practical training given to subordinate workers, and the training itself takes far longer than necessary because of its pedagogical shortcomings. The situation is doubly harmful. First, apprenticeship diseducates rather than educates unless it is well planned. 'The worker inevitably bears the imprint of a poor vocational education. With no love for his trade, no urge to find out a better way of doing things, he sees his work as no more than drudgery.'[5] Second, inadequate theoretical and intellectual training generates a negative attitude to technological development, usually giving rise to deliberate hostility, since the worker sees only the negative side of technical progress, above all the risk of losing his job and having to earn his living in another trade. The fear is all the greater if a poor apprenticeship has protracted his training and perhaps has made him feel that advancement in his job would be too great a challenge for his intellectual resources. Inadequate training also causes him to adopt a negative attitude to technical improvement in his own job. His intellectual faculties are blunted because they are seldom put to use or because he uses them to throw spanners in the works. In such cases improvements are imposed upon him from above and his only response is to apply the brakes; a cycle of conflict is thus created between those who think and those who do.

What the work-force needs, then, is vocational education. Nevertheless, this will be truly effective only if there is a change in the status of theoretical and intellectual training designed to create an élite – or, on a more mundane level, executives and management.

The first step must be to do away with the model that prevails in general education. That model has been criticized by H. Abel, who feels that education is confined to 'the dogmatic teaching of objective logic, benefiting only the pupil whose contemplative nature brings him closer to his teacher. Until now education has offered little scope for development to the child who is more drawn to an active life, who is able to perform practical tasks and who longs to learn and assert himself in an active field (the pupil endowed with common sense). This is a situation commonly observed with "ingenious" pupils. They are often classified as having "practical", in contrast to "conceptual", talents'.[6] Such education crushes what is in fact a vital type of knowledge. The people who come out on top are those whose intelligence is theoretical and whose practical knowledge is altogether illusory. In working life, the social and intellectual gap between the people who give the orders and those who carry them out will be unbridgeable.

Back in 1858, A. Corbon wrote that 'the study of drawing is included in most curricula. Would it be so absurd to go a step further and require pupils to handle the blacksmith's tools, or the stone-cutter's, the

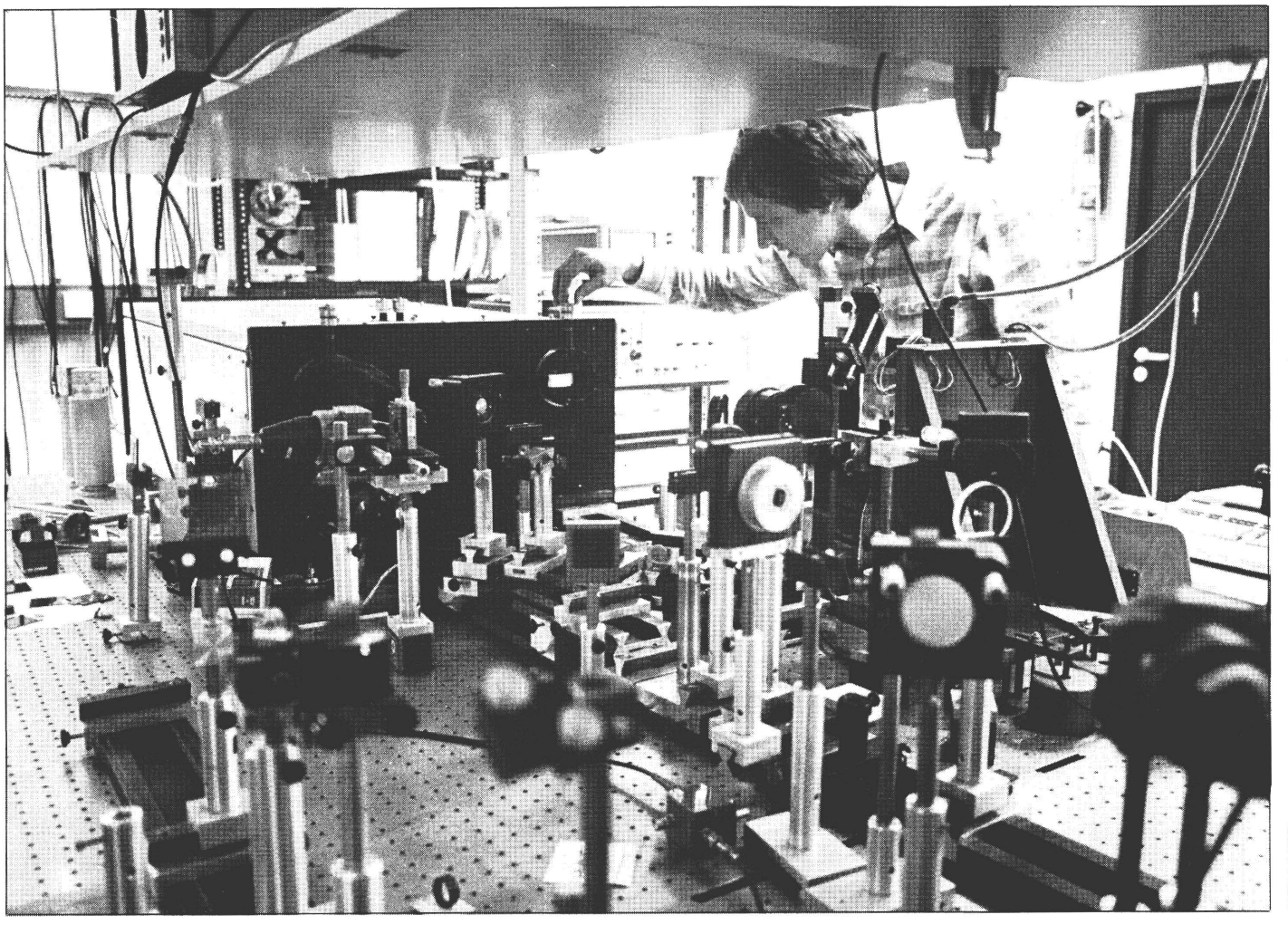
carpenter's, the lathe operator's or the pattern-maker's? . . . If by remote chance . . . a candidate for the Polytechnic were asked to give evidence of his ability to work with his hands, it would naturally be a desirable development in the education system'.[7]

His sentiments were echoed by J. Ferry in comments on the 1882 Law on compulsory primary education, 'Once the plane and the file take the same pride of place, the place of honour, as the compasses, the map and the history book, once they are the subject of reasoned, systematic teaching, many prejudices will disappear and a good deal of the conflict between castes will vanish.'[8] In other words, the quest for vocational education is nothing new.

Technological culture as the basis of vocational education

In the introduction to his work on the 'mode of existence of technical objects', Gilbert Simondon wrote that 'the greatest cause of alienation in the world today is this lack of understanding of the machine, an alienation caused not by the machine but by ignorance of its nature and essence, the absence of the machine from the world of meanings and its omission from the table of those values and concepts that make up our culture'. He had preceded this by declaring that 'the attitude of the educated towards technical objects is like the attitude of a man who allows himself to be carried away by a primitive xenophobia when confronted with a stranger . . . If general education is to play its full role, it must assimilate technical objects in the form of technical skills and a sense of values'.[9] In the absence of an education of this kind, the object is put on a pedestal. It is regarded as a black box, and man feels himself incapable of identifying its technical components or their respective roles or of comprehending the links and interaction between these components or developments in their operation.

Nor is man able to grasp to the full its value as an object which, depending on its origins in the manufacturing process, can be used or traded. In other words, he does not understand the socio-economic relationships between technical objects and the different strata of society.[10] Until fairly recent times, manufactured objects and the tools needed for their manufacture were relatively simple and were to be found in social environments familiar with them from direct experience. The technical products of industrial societies first placed man at a remove from objects. That gap has gradually broadened to a gulf, across which man regards the technology needed to create the objects with growing bafflement. The principle of the steam engine and the way its components worked, for example, could easily be grasped by a wide public; the village craftsman could carry out repairs and maintenance on such machines. The transition to electricity gave rise to more abstractions, incorporating 'intellectual models of flux, fields of intensity and



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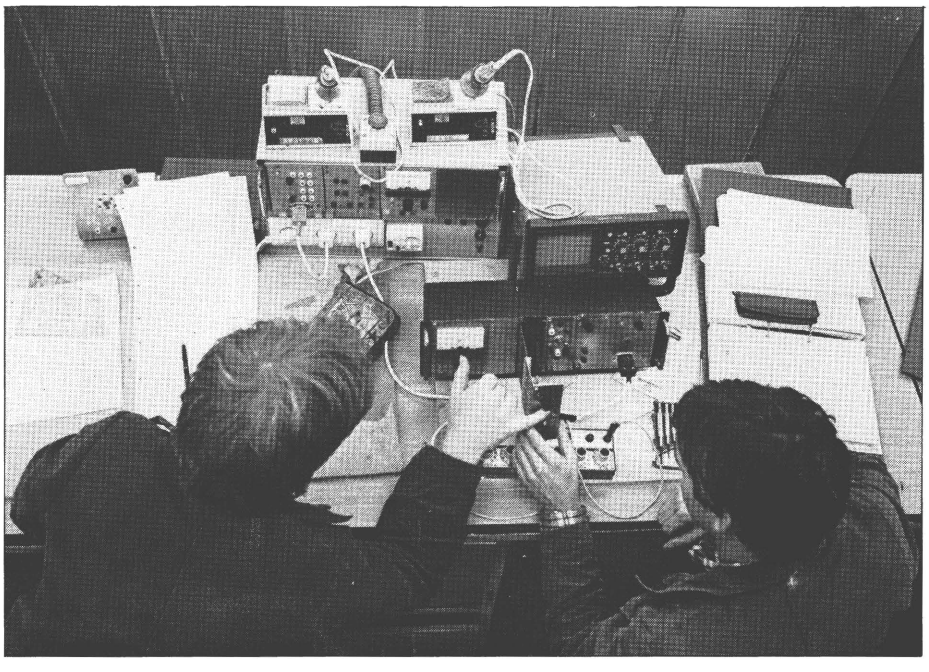
differences of potential' whereas 'mechanical coordination was superseded by the sequential logic needed to create and explain the chain of actions and reactions'.[11] The computer has introduced a system-based logic which makes it even harder to interpret what is happening and how things work.

The arrival of the microchip has led to a new 'phenomenon: the elimination of tangible technological media (mechanical or electro-mechanical), implicitly seen as outmoded'.[12]

Such thinking is misguided, as this operational component is still essential. There is, then, an even greater need to create a technological culture, which must incorporate knowledge of both the nature and essence of technical objects and the operating components of those objects. Acquiring that culture 'would imply the acquisition of knowledge, referents, models, conceptual analytical tools and a method of communication suited to the level of the technical message being conveyed'.[13] It should be backed by a coherent body of written material; the educational approach should be systematic, starting with the simple (objects or elementary components) and following through right up to the most complex (net works). A standardized approach along these lines could be adopted throughout training, at every level, thus leading to 'profound coherence in the discipline of step-by-step familiarization with technology'.



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General rules governing the creation of technical education

The school and the employer both have their own separate part to play in imparting technical education, but the process may be structured in different ways depending on the specific situation in individual countries. What may be a good solution in one country is unlikely to be a panacea in all the others. The comment made by R. Gregoire on this point is still valid: 'It is intriguing that innovators almost everywhere advocate the solutions applied elsewhere, even though they are criticized by their counterparts in the countries in question in the light of their own experience.'[14] Quite simply, it should be borne in mind that every piece in the puzzle interlocks with others and must be fitted together with a minimum of coherence, and that the completed puzzle must also fit into an economy that must have at least a minimal ability to create jobs.

In our opinion, the company is no substitute for the school, which has a vital part to play in the accumulation of knowledge, a role that is bound to be extended. We feel, for instance, that the pre-apprenticeship basic education given in Germany is not enough. This school should not be just any school. Some abstract and theoretic knowledge takes a long time to acquire, and is taking even longer as time goes by. That introductory knowledge can only be acquired in the school. As a corollary, practical and manual skills must be integrated into the process right from the start and continue without a break, being acquired gradually in parallel with the learning of theory. One of the ways they should be acquired is by didactical use of technical instruments. Finally, apprenticeship must be genuine; in other words, every effort should be made not to waste the trainee's time.

Three major factors are essential: in terms of teaching methods, subjects should be related to each other, however difficult this may be; in terms of attitudes, the school (teachers and pupils) must open out to the working world so that it can start to acclimatize to working life; and, in institutional terms, a school of this type must not be a dumping ground for the second-rate but must be a central structure, making its own contribution to the formation of an élite. If it is not in the mainstream in providing basic education it will never be socially credible.

Conclusion

We have endeavoured to draw attention to what we believe is – in conjunction with the depletion of natural resources – one of the major problems facing industrial societies now that the 21st century is about to dawn: their limited capacity to mass-produce the rudiments of skill needed to control the production and consumption of technical objects, despite the fact that these objects are a predominating feature of the societies in question. We have tried to show that the generation of such knowledge affects all of a society's structures – educational, productive and social – as a whole, whatever the specific approach that determines the way they are organized, and that the policies of authorities should be viewed from this overall standpoint.

Not every country is affected by the situation in the same measure. It could be argued that France has been unable to produce true worker qualifications. Despite its efforts to establish links between the school and industry, its failure is reflected in the high level of its youth unemployment. This unemployment is in fact no more than an outward sign of a more deep-seated sickness. To simplify, this sickness can be

described by three of its symptoms: schools are still cut off from the world of work and, because the young people sent to them for vocational training are those who have dropped out of the mainstream of education, they cannot fulfil their role as educators; companies are still cut off from schools and from young people emerging from the schools, who have no faith in the value of the training they are offered; and there is a general failure to see skills as an investment, as manifested by the temporary work and dead-end jobs on offer and on-the-job training courses that are no more than stage dressing. In contrast, Japan could be said to have gone even further than Germany, where the stress has been on vocational skills, since it has opted for the development of a vocational education based on technological culture, the training being imparted and prolonged by companies, as well as being based on personnel management methods.[15]

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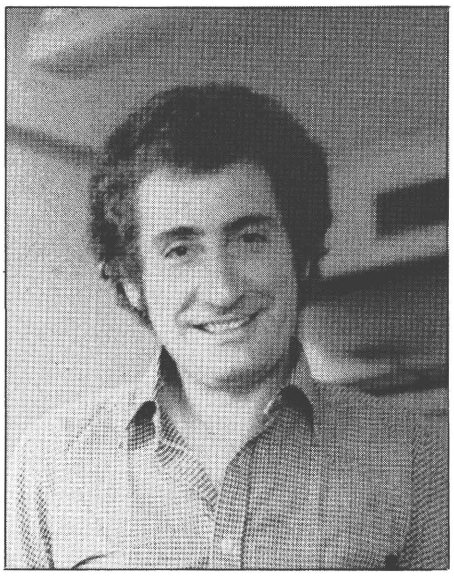


New technology and public awareness

The experience of the BBC in Britain

David Allen

Senior Producer and Editor,
BBC Computer Literacy Project

Last year the BBC launched the first part of its Computer Literacy Project, which is probably the largest and most ambitious project in the history of educational broadcasting. It consists of a number of television series (the first of which was watched in whole or in part by 7 million viewers), a book, which turned out to be a number one best-seller during the early part of 1982, a number of courses – including another best-seller – '30 hour Basic' (programming for beginners), the BBC's own, versatile Microcomputer system (about 100 000 of which have now been sold), associated published software (computer programs), a broadcast telesoftware service – the first in the world – and a postal referral service (which has so far answered 120 000 queries). The project has been and is being backed up by research, some of which is already published.

Why the Computer Literacy Project?

For a number of years it has been clear that microelectronics is likely to be an important technology, affecting many people in their working lives as well as offering them new recreational and educational areas of interest. In 1980, considerable formative research by the BBC's audience research department suggested that most people recognized the importance of computers, were simultaneously fascinated by and felt threatened by them – or the idea of them – and that they would be interested in a series which explained what they were all about. A surprisingly large number (about 20 %) said they would be interested in owning a personal microcomputer themselves. Perhaps the most surprising fact was that although most interest was shown by young middle-class men, the differences between the sexes and between classes was not all that great – and in the event, about as many women watched the series as men, with a slight bias towards people aged 25-54 and those in skilled working class groups. Confirming the early research, it is estimated that, in the last year and a half, between 700 000 and a million people in Britain have bought a personal microcomputer.

The philosophy behind the project

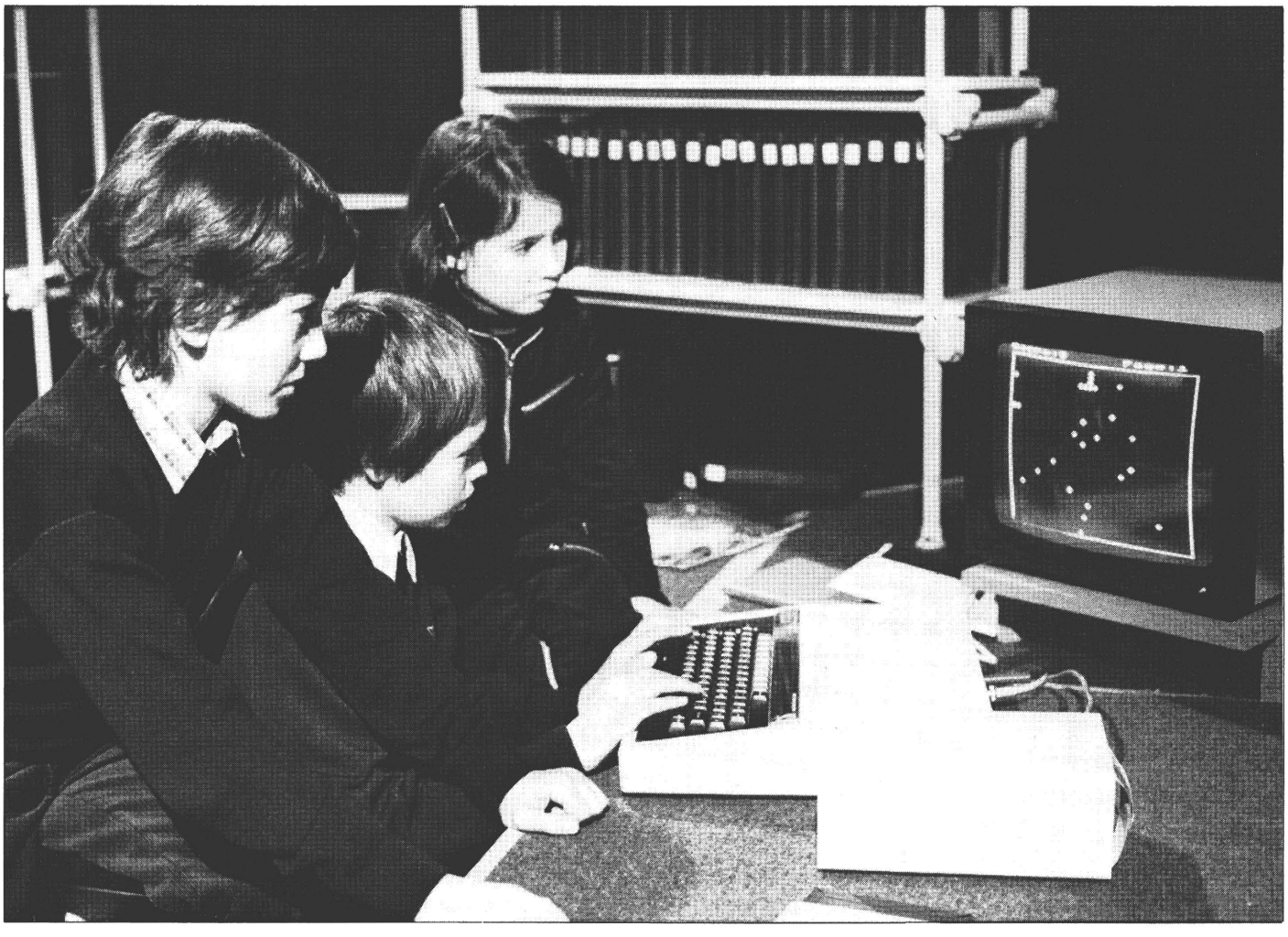
The original idea came in 1979 from work done for 'The Silicon Factor', the first television series on the subject to come out of BBC Education Department. A grant from the Manpower Services Commission enabled the author and a colleague to travel to a number of countries, including Japan, to discover what was going on in the world of microelectronics and information technology – and especially to look at the economic and social effects. This involved discussion with industrialists, union leaders and academics.

Few people now doubt that the so-called 'microelectronics revolution' will have, and is having, a profound structural effect on the quality of work. The effect on the total amount of work is the subject of heated disagreement. Optimists look forward to the appearance of a plethora of new jobs as yet unthought of (and point to the United States where 80 % of job descriptions did not exist ten years ago). Pessimists talk of the collapse of work and the end of the Protestant work ethic, of the need for society to rethink its attitudes to work as fewer and fewer are employed in an increasingly automated world. The Germans, for instance, have called the chip 'The Job Killer'.

Frankly, though, no-one knows how the human profit and loss account will work out. At present, in the name of 'rationalization', both the service sector and manufacturing industry are shedding jobs in an attempt to survive. The resulting streamlining, which occurs when computer-based machines take over the clerical and other highly defined jobs which have for so long been the respectable haunts of the semi-skilled, is a considerable cause for concern. Especially in the absence, as yet, of much sign of the creation of new areas of employment. (There are notable exceptions, of course – microcomputer manufacturers are doing well, and so are the retail outlets for video cassette recorders. Britain, it seems, not only makes more microcomputers than any other country, it is also the centre for video piracy!)

In the long run, the areas where we can expect net numbers of new jobs to be created will be in the 'people to people' industries – those creating new kinds of personal services – in health, education, welfare, in crafts, the environment, the arts, and, of course, the 'software' – the information – industries.

Meanwhile, in both manufacturing industry and in the service sector existing jobs are



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changing in nature with some indication of 'polarization' – that is the disappearance of semi-skilled tasks and a greater emphasis on more highly skilled as well as relatively unskilled activities. 'Software' skills are already at a premium and we are entering an age when Britain is likely to be earning its way in the world more by the development of high-level technology and a concentration on 'information'-related industries than by traditional manufacturing.

Certainly, existing industries will require a workforce more able to cope with change, and since the changes are occurring rapidly and are unpredictable, the skills required will need to be 'transferable' skills, and simply vocational in a narrow sense. They will need to be 'transferable' skilly, and many of them will have to do with coping with information and the ability to use computer-based equipment for, for example, data retrieval. They will, in short involve – amongst other things – a kind of 'computer literacy'.

What is computer literacy?

This ugly term is easy to use but more difficult to define. It implies an understanding of the range of things that computers can do and some understanding of how they do them, the understanding preferably coming from practical exposure to the computer itself in a variety of ways, with experience of the use of 'applications' programs and the use of high level languages, but certainly including some simple programming. It also involves understanding the effects of the use of the technology and the way information can be handled by it.

Considerations such as these created in our minds a need for a project to develop public awareness as well as to provide material which might be useful in a whole range of vocational settings. Vocational training needs will change quite considerably and the changes are more likely to be facilitated if there is a broad public understanding of the new technologies. The provision of multi-media materials which develop an understanding of computers and computing on a broad front are themselves useful in training the trainers. This is particularly important in Britain where there is no central control of the educational curriculum and teachers are free to be eclectic in their use of material. It is also true to say that there is very little good, systematic material available which is accessible to those who are unfamiliar with computers. Most technical computer manuals and courses are notorious for their technically impenetrable language.

The cornerstone of the project is a belief that it is only by gaining personal experience ('hands-on' experience) in an unthreatening situation – preferably at home – that a genuine understanding of the technology can be achieved and that this understanding-through-experience is essential if people are to lose their fear of computers and begin to see them for what they are – useful tools

which can and should be at the service of man, understood by many, able to be harnessed by many and certainly not to be controlled by an exclusive elite, as in the past.

A major part of the project is concerned with making a whole range of learning materials available for those who want to develop a particular interest – whether this is in using the computer to control things or using it as a data retrieval system or as a word-processor or a music synthesizer or an educational device for reinforcing basic skills in primary school mathematics, or whatever . . .

Another justification for the project – which has become clearer as the whole thing has progressed – is that it helps to satisfy the sheer epidemic of popular recreational interest in personal computers which has manifested itself for one reason or another over the last year or so. It is a phenomenon more noticeable in Britain than in the rest of Europe as yet – possibly because of national character, but also because the language of the personal computer is largely English-based (the language, of course, is Basic, which was created in the USA).

Whereas, when we first thought of the project, personal microcomputers were largely in the hands of the technical enthusiasts or the professionals, now it almost seems as though there is not a single middle-class family or unmarried engineer, scientist or technician who does not boast a micro or claim an interest in buying one soon. Fashion is obviously a factor, and so is a desire to play (most machines come with games), but a genuine (if over-simple) feeling that 'the future lies with computers' is undoubtedly at the back of the minds of many parents as they buy machines.

The fact that so many people in the professional managerial and upper working classes in society are buying and using machines does have an important corollary – they are the people most likely to be affected by or responsible for the installation of computer-based machines in industry and commerce, and the fact that they are moving along the 'learning curve' by gaining experience of the computer in the unthreatening situation of their own homes does mean that many ingenious uses for micros are being thought up but also that many of the transitional problems which occur – usually through misunderstanding or ignorance – when new systems are installed at the workplace are perhaps mitigated. Brutal exploitation by management or mindless Luddism by the workforce are less likely if people are informed.

Not that people are just 'more aware'. As we have discovered in our feed-back from the project, many of them are already installing microcomputers in their own small businesses to do simple book-keeping or data retrieval tasks, some of them inspired by what they have seen on television.

And, for example, a fish farmer is using a computer to monitor the environment in which his fish breed and to control equipment; a journalist is using one as a word-processor; a small shop uses one to advertise special offers in the shop window; two deaf people communicate with each other using computers connected to the telephone line, and so on.

The elements of the project

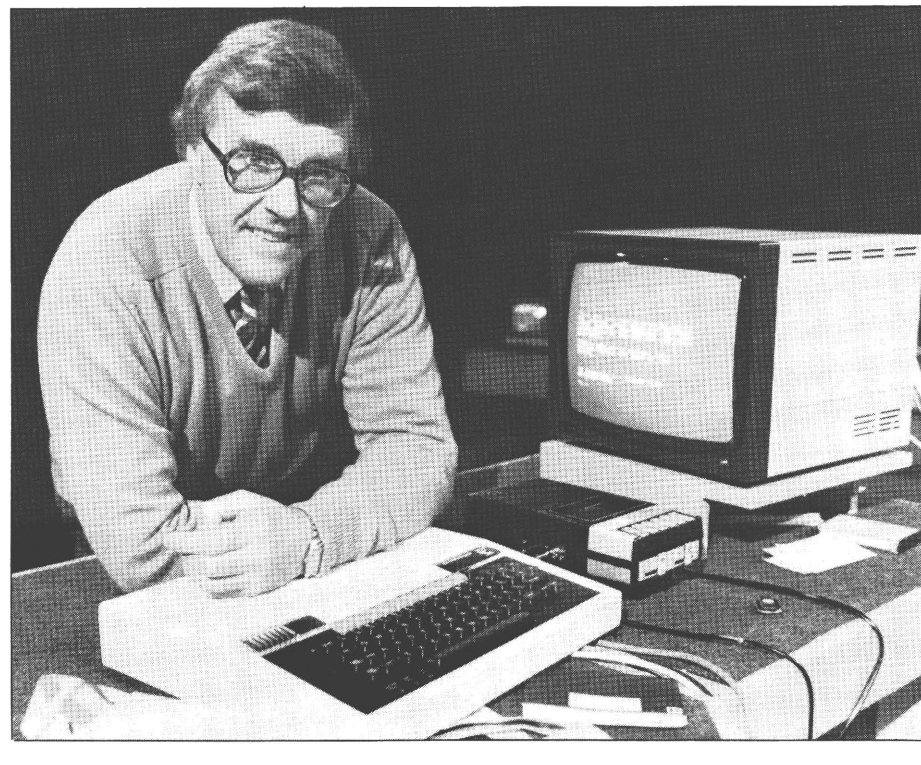
Seen from the point of view of the customer – the viewer – what does the BBC project offer?

The television series

An important philosophy behind the project is that the various elements, while reinforcing each other, stand on their own, and enable individuals to pursue interests in a wide range of directions. The television series can stimulate and encourage and give an illusion of understanding. However, the real learning comes through the other parts of the project.

There are two series. The first, 'The computer program', aims at the complete layman. It introduces many of the basic principles of computer science in friendly and accessible terms. The presenter, a seeker after information, is himself a layman, guided through the subject by a computer expert – Ian McNaught Davis. Considerable use is made of analogy, and there is a mixture of applications from the very large to the very small computer. Audience research shows that for those who were indeed complete laymen, the series succeeded in its aims. Those with some technical knowledge, or those with machines already, found it too slow and too simple.

The second series – 'Making the most of the micro' – caters for those who have just bought or are just buying a microcomputer, or are just plain technically curious. The presenter is Ian McNaught Davis, himself the managing director of a large computer bureau service. In each programme he is involved in a a substantial amount of 'hands-on' demonstration, showing the audience how they could themselves do



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various things on the computer. These things range from writing programs to working a word-processor to configuring and using a data base and interfacing a temperature-sensing device with the machine. There are filmed case studies of people using microcomputers in the real world, but each story is carefully chosen to illustrate some principle which has relevance to the more modest machines that the audience might themselves own.

The BBC microcomputer system is used consistently through these demonstrations. However, there is an ever-increasing range of machines in the market, all of which differ in detail and in the language that they respond to. One challenge in making the series has been to draw out the fundamental principles of an area of interest – like graphics, for instance – so that owners of machines other than the BBC microcomputer feel they are learning something which they can apply on their own machines.

The BBC microcomputer system

The main reason for having a computer as part of the project was that it enabled us to generate an internally-consistent learning package round a machine whose design we could influence. The idea was for a machine with as much flexibility and capacity for expansion as possible. The machine is made by a Cambridge company – Acorn Computers, who sell it under licence from the BBC. It incorporates eight different screen 'modes' (including teletext), can support high resolution colour graphics, four simultaneous sound channels and a host of peripherals. It has, for example, its own built-in analogue to digital converters. We were anxious that, having bought it, people should not easily exhaust its capabilities. It comes with its own user-guide and a tape containing 16 programs, themselves designed to illustrate the range of things a computer can do.

Print back-up

The BBC education departments are used to producing series of programmes which are backed up by printed material, and BBC Publications is a major publishing house. To reinforce both series there is *The computer book* – an introduction to the world of computers and computing. It stands on its own but covers in more detail much of the ground covered in the television series. The idea is that one need not have seen the series to find the book useful, neither need one have the book to benefit from watching the programmes: the one reinforces the other.

Some of the audience, we felt, would want to learn to program the computer themselves. For them, as part of the project, the National Extension College in Cambridge has produced '30-hour Basic' – a 30 hour self-tuition course for beginners, and will in the next few months produce a sequel – 'Structured programming on the BBC microcomputer'. Other courses will include a course on 'Assembly Language' programming and a course on monitoring and control applications.

Software

A wide range of software is now available for the machine – these include games, of course, but also a word-processor, a data base, financial modelling (spread-sheet) programs for the small businessman, illustrative programs from both television series and programs involving the use of music and graphics. These latter will include a music editor. They are being published by the BBC and other sources.

One important liaison has been with the Microelectronics in Education Programme (MEP) – the organization funded with UKL/10 million by the Department of Education and Science to produce programs and teacher-training materials for schools. The Department of Industry has sponsored the buying of microcomputers by schools by 50% funding for certain approved machines – of which the BBC machine is one (and, it seems, by far the most popular). Virtually all secondary and many primary schools in Britain now have computers as a result of the scheme, which obliges a school to train staff in their use before the grant is forthcoming.

Working semi-autonomously, the MEP has begun producing some impressive material for use on the BBC machine at all levels in the classroom (but also in the home). Some of this material is being published by the BBC and more will be available through the new telesoftware service (see later) and therefore accessible through the whole country free of charge to those with the appropriate receivers, whether they are in the formal education sector or not.

The referral service

Individual viewers who want information can write in to a central referral service, funded as a charity but situated within BBC premises. This uses a computer data base to enable enquiries to be handled a quickly as possible. It is able to provide information about local courses, and sources of advice about hardware of software, for example business software. As well as acting as a referral service, the centre acts as a central information point for the BBC project as a whole.

A number of standard information leaflets have been prepared on the subjects of microprocessors and business use, national and regional clubs and other user-group contacts, jobs in computing, a publications digest, microprocessors within the education system and advice on setting up a club.

To give some indication of the success of the service, 120 000 enquiries were answered up to November 1982.

Telesoftware

A completely new broadcast service is currently being set up as an extension of the existing teletext service: telesoftware. Computer programs are transmitted as pages of the existing teletext magazine (which already 'rides' on top of the broadcast picture as four lines of digital information). An appropriate decoder connected to the BBC microcomputer will enable these programs to be loaded directly into the memory of the computer and then 'RUN' like any computer program loaded from disc or tape.

Programs have been promised from the MEP and other educational sources and it seems likely that there will be a 'club' page of software received from viewers as well as programs commissioned to support broadcast series.

The importance of telesoftware is that it provides an 'interactive' element to the broadcast signal as well as a source of readily available educational material which can be used by anyone with the appropriate hardware.

There is clear evidence that in the short term this project has been a success in terms of the interest shown in its various parts. Whether or not it has a long-term influence on education or training for the future remains to be seen, but there is no doubt that the challenge of new technology will more likely be met through broadly based understanding than without it.

Polarization of skills in the future?

Arndt Sorge
Gert Hartmann
Malcolm Warner
Ian Nicholas

The evolution of work processes and of the distribution of skills has been a central focus of research on technical change, organization and training. It has mainly been argued that in the course of technical change, the distribution of skills becomes polarized so that more skilled work is concentrated on a growing proportion of managers, engineers, work and production planners, foremen and commercial employees, whereas most production jobs are becoming de-skilled.[1] We have shown that it would be futile to explore the effects of technical change as such. It is only sensible to study effects of technical change when influences from the socio-economic context which impinge on technical change are made explicit.[2]

In the meantime, the field of applications of information technology and microelectronics has become so large and diversified that statements about their effects on a general level have to be regarded with suspicion. It is necessary to differentiate carefully between different branches of the economy and areas of application. On the other hand, one may also conjecture that there is a **logic of application** of microelectronics which is not confined to particular sectors or branches of the economy. It is not the only logic of application where work **processes** are concerned. The logic may be different when microelectronics form part of products.

Applications in work processes are mainly:

— computer numerically controlled machine-tools (CNC machines) as the prevalent and most important application in production;

— shop-floor data collection and production control systems;

— word processing and man-machine dialogue on computer terminals, in shared logic or distributed intelligence networks, notably in banks and insurance companies;

— small or medium-sized computers in service in a wide range of uses (sales departments of smaller companies or other, primarily office-bound functions).

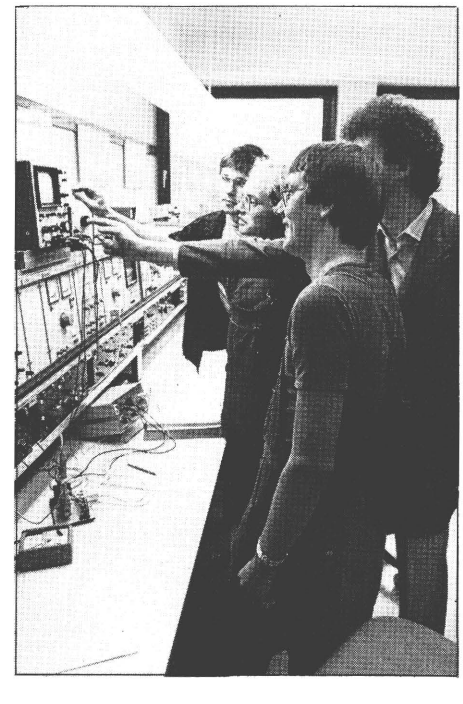
The argument here is developed from a study which we had done at the International Institute of Management, Labour Market Policy Unit, and at the Henley Management College, to explore organization and qualifications under CNC machine-tools in Britain and the Federal Republic of Germany.[3]

The discussion of work and employment under new technology has suffered from a speculation where truisms, truths, half-truths and errors are strangely mixed. We suggest that the analysis of CNC application is of importance beyond the area of metal-working; it demonstrates effects of technology under prevailing socio-economic conditions which are more general, and thus not limited to CNC. Therefore, we offer some tentative generalization of findings.

Development in phases

We propose to distinguish between different phases of microelectronics applications and development. The first one, which corresponds to the phase of polarization of qualifications and skills, is that of organizational centralization of data-processing within particular departments and separate, expressly informatic functions. In this phase, information technology is primarily polarizing skills, centralizing decisions and data-processing departments and functions, including programming and system analysis. Manpower requirements from this phase still find expression in figures for most of the years of the last decade. But this phase is marked by the impact of 'conventional' electronics and NC. To merely extrapolate this trend for microelectronics is quite inappropriate.

In the second phase, the picture changes somewhat. Microelectronic applications are less distinctive for intellectually demanding data-processing, but for being tools which are increasingly more simple to handle and less in need of specialized informatic expertise. Whilst it is true that software engineers are still very much sought after, it has to be recognized that their design effort contributes to making electronic data-processing increasingly easy for the non-edp specialist. Thus, as information technology becomes ever more widely diffused, this is increasingly so without raising requirements for separate 'information workers'. On the contrary, it is the more demanding aspects of other specialties which are emphasized by microelectronic applications.



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We have shown how CNC is linked with increased emphasis on tools, fixtures, and cutting expertise, instead of on the informatic aspects of programming. Just as CNC focuses attention on evolving machining skills, so would, following our proposed generalization, other microelectronic applications be distinctive for raising the occupational expertise of different vocational specialisms. As information-processing is diffused to a great number of occupations, it becomes less demanding on its own. But through expanded capacities of action, it helps to carry forward the evolution of existing trades and professions.

In a thorough analysis of employment in data-processing occupations in Germany, Dostal has shown that although employment of programmers and other informatics specialists was still increasing, 'rates of growth are not as high as often said'. There were larger increases in trades where some informatic expertise is added to a different vocational expertise.[4] This analysis, which is about data-processing in general and situated at the level of the working population, thus corroborates our own, more company-centred analysis of a specific case of application of microelectronics. Research on the use of microelectronics in administration also confirms this pattern; Dirrheimer has shown that computer dialogue with visual display terminals broadens the vocational expertise which is used by commercial staff and administrators.[5]

From an analysis of responses of vocational training experts from member countries of the European Community, it emerged that new information technology raised the question of basic skills in very different vocational specialties, and that adaptation of training happens by very trade-specific introductions of information-technical and microelectronics contents into existing training courses.[6]

Thus, we would characterize the future of work under the prevailing socio-economic context of technical change by a **paradox of data-processing**. The more micro-electronic information technology is diffused, the more technical information-processing enters into a greater number of occupations. Its role is, however, not to focus attention on information-processing tasks as part of a whole set of tasks proper to an occupation. Rather, it is distinctive for making the evolution of 'traditional' skills towards new levels of expertise and contents of work possible.

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Future traits of machining work

In addition to such general considerations, some specific conclusions can also be drawn with regard to the foreseeable future of machining work. Here, the discussion is again fixated by some ideas which are increasingly to be viewed as obsessed with an extrapolation of trends that have been reversed. There is widespread fascination with the automated factory as the culmination of technical ingenuity. We think that this view is seriously wrong.

The further development of CNC which can be observed at the present time, points in the following direction:

- CNS machines are further mechanized by the automation of work-piece handling. This will allow work-pieces to be fed into the machine, re-set, extracted, and provisionally stored automatically. Different **flexible manufacturing cells** of this kind have been exhibited at the 1981 European Machine-Tools Fair, and they are likely to be the next stage of wider application. A flexible manufacturing cell thus consists of one CNC machine, plus automated handling equipment attached to the machine.
- Further steps of automation which also contribute to relieving the operator of some tasks, are automatic work-piece measurement and adaptive control of the cutting process. These are expected to leave the experimental stage and be incorporated into CNC machines on a larger scale, in the future.
- Machines are linked, by automatic transport and feeding mechanisms, to form a successive chain of machining operations through which work-pieces progress without having to be handled by operators. Such **flexible manufacturing systems** have been experimented with in different countries, by some companies and development institutes. Their development was often backed up financially by governments. Logically, a flexible manufacturing system is one step of automation further than the flexible manufacturing cell since it does not contain one CNC machine only, but links up two or more machines, usually of different types or having different tasks.

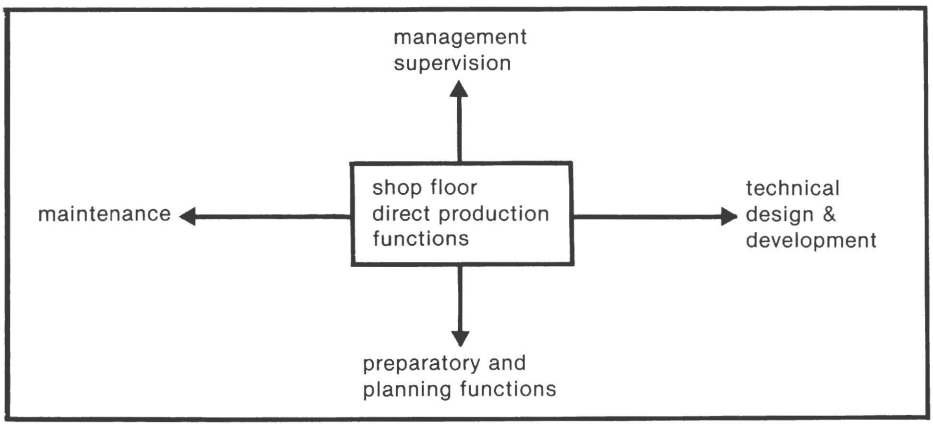
Automation, polarization and de-polarization

It is not difficult to construe a logic of development which emphasizes the evolution towards roduction processes which become more and more automatic, and culminate in the 'automatic factory'. This is often presented as the most advanced achievement of Japanese industrial efficiency. But by and large, Japanese factories are not necessarily more automatic than European ones. Takamiya has found that British plants may be more automated than the Japanese, and that the efficiency of Japanese plants rests more on the meticulousness and dedication to detail of various employees, particularly operators who are more charged with responsibility for quality of work.[7]

The usefulness of highly automated flexible manufacturing systems has also been questioned. Blumberg and Gerwin show that they may turn out to be too complex to operate effectively and continuously; it may

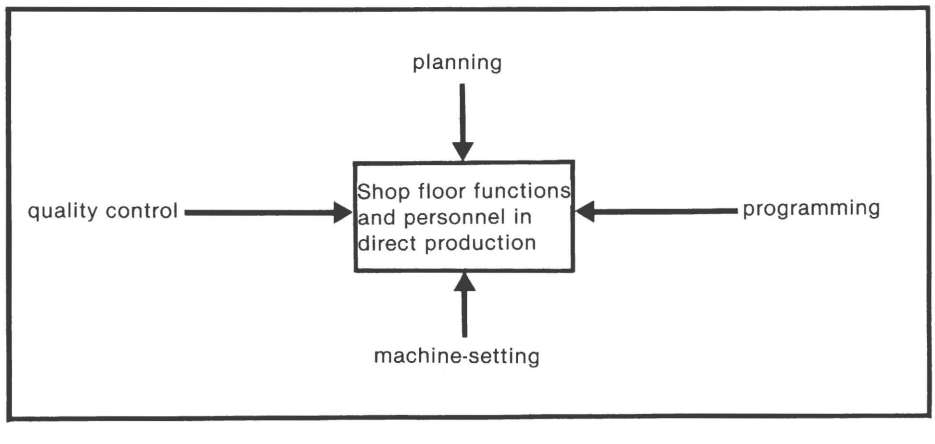
be difficult to make them work economically.[8] They do not recommend themselves for more widespread application. The authors then question whether it is sensible to think of technical advance in manufacturing as going in the direction of large, automatic factories, after the experience with flexible manufacturing systems.

We interpret the fascination with the automated factory as a misguided trend extrapolation. It rests on past experience with the expansion of homogeneous mass markets, and stable demand for specialized products over time. Particularly, in continuous flow production, where transport and feeding of throughput is less problematical, this has led to highly automatic factories, such as refineries or ethylene plants. It is right that in this type of context, technical advance has meant automation in the sense of production operatives becoming rarer and less involved in the process. The picture is one of 'flight' away from the shop floor and operative functions, in such a manner:



In this phase of technical advance, increased productivity and capital intensity signify a 'crowding-up' of direct labour, and of labour generally. This view of automation is, however, increasingly misleading. The present phase of technical advance is less characterized by stable, specialized mass markets, but by more differentiated and shifting market patterns which always bring about the need for human direct intervention because standard solutions are too costly, complex, and liable to fail in view of unanticipated variety.

The present current of technical advance appears to combine productivity increases, and greater mechanization and 'electronization', with the continued presence of directly intervening production operators on the shop floor; labour is not necessarily 'crowded out' of the shop floor, and the drift into planning activities is checked. It may therefore be inappropriate to call this 'automation', which raises connotations of empty factories, remaining operatives being bored in a remote control room, and planners with white collars and ties designing processes which can be left to themselves. Instead, the present phase of CNC application is more marked by greater interchange of personnel between production and planning departments, and by a drift of planning and programming functions into the shop floor, in this manner:



This evolution depends, however, on a mentioned socio-economic context, rather than on properties of technology which are assumed as given. A change of context will also entail a change of technical development and modes of use. There will also always be a range of social-technical options which can be taken up. This can be exemplified by the flexible manufacturing cell, which appears to be the next more widely applied system after CNC.

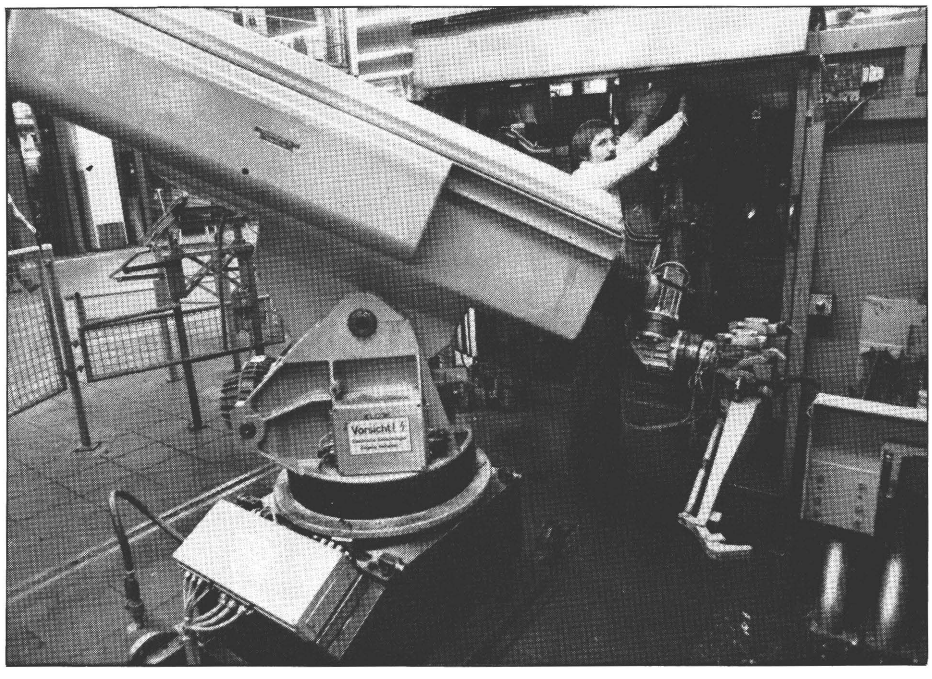
Such a cell, from its technical properties, does not prejudge the attribution of qualifications, production organization, and manning policy. It allows very different solutions, just like CNC. The common factor is that operators are relieved of work-piece handling. The question then is, how this saving of work is made use of.

Alternative forms of automation

Different directions of socio-technical development can already be discerned. On the one hand, the reasoning of a user may be as follows:

- We already have machines which can be programmed whilst the previous batch is being processed. Up to now, it was difficult to make use of this facility because the operator had to concentrate too much on handling pieces. Thus, he could not programme as much as desirable. But now that he is relieved of the handling, there is the possibility of letting him take over planning and programming completely. This logic of development combines the attachment of a very skilled operator to one or two machines with a high degree of mechanization.
- Another user might conceive of a different solution. He would think that operators are now only needed for residual functions, and he would increase more strikingly the number of machines to which an operator or a group is attached. Programming and machine-setting before the start of processing a batch would be taken over by setters-programmers who arrive at a machine when it has to be prepared for the next batch.

Both of these strategies are conceivable, and we have seen both of them considered by engineers of different machine-tool manufacturers. Intermediate solutions can also be imagined. We predict that different solutions will again be developed; these will



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depend, just as much as under CNC machines, on prevailing national or company-specific organization and manpower patterns, and they will be strongly interdependent with the batch size and production flexibility strategy. The more advanced stage of mechanization does not necessarily imply automation in the conventional sense. In a context where increased flexibility and shorter batches are aimed at, the opposite will be true.

It will also be increasingly necessary to distinguish between shiftwork of personnel, and of machines. The link between higher capital intensity, and shiftwork on the part of personnel, thus becomes less evident. Automation of handling makes it possible for a batch to go on being processed after working hours, if measurement and fault-finding are also automated and it is possible that a machine is switched off automatically.[9] Thus, longer working hours for machinery can be combined with normal daywork or two shifts for employees in production.

A more mechanized factory may therefore be more capital intensive without 'crowding out' direct labour. The work content of operators can evolve further towards planning, programming, and setting functions. Looked at from this angle, the future factory for small batch processing is not 'automatic' in the received sense because it is not emptied of workers. After working hours of employees, it may however very well be 'automatic' in that sense. This shows the necessity to arrive at new concepts of automation which allow a combination of craft-style worker involvement on 'his' machine or machines and little polarized skills and qualification pattern, with more self-contained, automatic operation during the normal run of some batches, after employees' working hours. This ought to make it possible to attract suitably skilled personnel for a type of work which is not made unpopular by involving strenuous shifts, and where the competitive advantages of more extensive utilization of machinery are still not lost.

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Dossier

Vocational training and new technologies:

new Community initiatives

Last June the Commission of the European Communities presented a communication to the Council of Ministers on Community initiatives in the field of vocational training in view of the processes of change being brought about by the introduction of new technologies.

The communication starts with a review of the situation created by new technology in Member States and states the political and institutional reasons for the communication.

We are reprinting the third section here, although readers are referred to the full text of the document (Com(82) 2196 of 3 June 1982, H. Schmidt, Secretary General, Bundesinstitut für Berufsbildung (Berlin)).

III. New Community initiatives

In formulating the proposals for action set out in this Communication, the Commission has taken into account the opinions expressed both by the Standing Committee on Employment and the Advisory Committee for Vocational Training. Moreover, account has been taken, where appropriate, of the results of completed studies and publications available from the European Centre for the Development of Vocational Training (CEDEFOP), the European Foundation for Living and Working Conditions, and from the Commission's FAST project and European Pool of Studies and Analysis.

The Commission has selected a limited number of specific initiatives considered to be priority concern and common interest, where cooperative effort at Community level would appear to be most fruitful and which could help identify new lines of policy development in the Member States as well as for concerted action in the longer term. The proposals herein also complement the wider range of proposals regarding vocational training policies for the 1980s which the Commission intends to transmit to the Council later this year (Parallel work by the Commission in the area of employment policy and working conditions will also be developed in the light of the conclusions summarized by the President at the meeting of the Standing Committee on Employment in November 1981). The Commission envisages that the various initiatives to be undertaken with regard to training should by based on a number of general guidelines, for adoption by the Council including the following:

i. the need to ensure a broadly-based approach to training which provides for both the acquisition by the individual of a wide range of specific skills so as to realise his or her full potential and also to facilitate greater vocational and professional mobility and contribute towards enabling workers to play a more active role in their work;

ii. the development of provisions for training in this field to be directed at the working population as a whole, regardless of previous levels of education, sex or age, so as to avoid polarisation of attitudes between specialists and other workers and the adult population generally;

iii. the need to develop balanced systems of social and vocational preparation and training designed to familiarise young people and adults both with applications of the new technologies and with their social consequences;

iv. the need to take account of the specific training needs of staff in managerial positions in the context of the training programmes to be made more generally available;

v. the need to encourage intensified collaboration between public authorities and the social partners in designing training programmes in this field and in drawing upon all available resources to this end;

vi. the need to link measures in this field with the provisions for the release of workers for their further education and training;

vii. the introduction of special efforts to improve the employment prospects of those who are unemployed especially young people, by incorporating appropriate units of study regarding new technology in their training programmes;

viii. the pursuit of special efforts to improve the quality and quantity of the training of personnel responsible for setting up programmes for the social and vocational preparation of adults in this field.

Within this framework of general guidelines, the Commission proposes that the new initiatives to be carried out in the period 1983 – 1987, should focus on the following priority issues;

i. small and medium-sized enterprises which seek to modernize their production processes by the application of new information technology: their training needs and the implications for the planning of training provisions on the basis of consensus with all employees.

ii. large scale enterprise in the services sector which are committed to the progressive introduction of automated techniques of administration and management (for instance in banking, and retailing sectors): the implications for enterprise-based training personnel policies and the scope for positive action towards employees whose skills become redundant.

iii. unqualified unemployed young people who have little aptitude for more traditional forms of vocational training: the scope for using new information technologies as a learning tool to facilitate the acquisition of technological and other vocational skills.

iv. older skilled workers made redundant as a result of the restructuring of traditional manufacturing industry: the scope for the adaptation and updating of existing skills to improve the employment prospects of those in areas of industrial decline especially those dominated by the steel industry;

v. the evolution and comparability of vocational qualifications throughout the Community: the implications for the mutual recognition of diplomas.

vi. public awareness and understanding about the applications of new technology: the implications for non-vocational training

and information activity, especially by broadcasting authorities.

With regard to the first four priority issues, it is appreciated that Member States have made different degrees of investment and have a richly varied experience given their different social structures and training systems. The Commission therefore proposes the setting-up of a coordinated process for exchanging ideas and experience between Member States over the next few years to assist in the continuing evaluation and development of national policies. In this way, it will be possible to develop and try out new approaches, to explore common problems in greater depth, to encourage the transfer of experience and promising innovations and to build up a platform for a more concerted effort in the medium term to achieve a breakthrough in this field.

To this end, the Commission proposes that a network of 4 groups of pilot/demonstration projects be set up, according to each of the four priority issues, to run for a period of 3 operational years, allowing a 4th year to complete the dissemination and reporting of the experience gained. This network of 4 groups of projects should be designed to strengthen the capacity of Member States to draw practical insights from the collective experience acquired. A bank of documentation should be set up by the Commission, consisting of material culled from the 4 groups of projects, which could be drawn upon by policymakers in the areas concerned and made more widely available, in cooperation with CEDEFOP, to trainers and other multipliers in this field.

So as to exploit the specific insights for training policy of these 4 groups of projects, the Commission proposes that a general liaison group be set up, to be designated as appropriate by each Member State, consisting of those with responsibility for the coordination and monitoring of national policies and initiatives in this field.

Within each group of projects, certain specific exchanges and studies would be provided for to enable teams of observers, delegated by the relevant representative organisations, to report on the projects to the principal interested parties, such as trade unions, employers organisations, women's associations, personnel officers, and training instructors.

As regards the mutual recognition and comparability of diplomas, the Commission intends to present proposals in the near future regarding an overall framework agreement, in the light of a number of preparatory activities undertaken in co-operation with the framework of the Advisory Committee for Vocational Training. Without prejudice to these proposals, the Commission intends to give priority to detailed examination, drawing on the expertise of CEDEFOP, of the evolution of qualifications in the following specific sectors: data processing, electronics and information technology. This examination is intended to lead *inter alia* to greater comparability in the qualifications on offer, to identify developing standards and content in these new fields, and to provide the bases for the free movement of workers in these fields.

As regards general public awareness about new information technology it is important that the population at large should understand the social and economic options available. This cannot be achieved simply by a public relations operation. An educative effort is all the more necessary, for without it, misconceptions and defensive attitudes may develop while, simultaneously, new and more sophisticated devices are penetrating the family home and the local community (microcomputers, videotext, etc.). Such an effort would both increase the awareness of the public, and develop an active participatory attitude in mastering the implications of the new information technologies for both the family and the local community. A wide ranging activity is thus needed in order to reach the greater part of the population and involve it in a process of exploration and mutual education. Little, however, has so far been done to promote understanding and informed discussion through adult and continuing education of a non-vocational kind. National broadcasting organisations have contributed, in some cases very effectively, to public information through programmes which explore the possible effects of informatics, but broadcasting alone is limited in what it can achieve.

The Commission therefore proposes to encourage, in collaboration with the broadcasting organizations, the development of such programmes for adults, in connection with the mass-media at national and local level so as to familiarize the public with the potential of the new information technologies and so to guarantee wider understanding of their importance.

Dossier

Comparing ideas

DG – Cedefop

Impressions of the European seminar on 'technological changes, employment, qualifications and training'

The Commission of the European Communities, with the support of Cedefop, arranged a meeting in Berlin on 24, 25 and 26 November 1982. This was done in furtherance of the broad-ranging strategy for new Community initiatives upon which the Commission is embarking, in view of the changes being brought about by new technology.

The issue is highly complex and it was difficult to establish a common language among people who had come to the event from the 10 Community countries, each with his or her own individual background and attitudes, experience and interests: representatives from various authorities, unions and employers' associations, research workers and those responsible for training ventures.

The diversity of mentality, interests and language may have made it harder to summarize the discussions but it had the merit of enriching the debate by a wealth of thoughts and ideas.

The proceedings and conclusions of the seminar are now being prepared for publication, but a few jottings from the reports given at the end of the seminar may be of interest. Such 'fragments' do not, of course, give a full picture of the seminar and all its logical flow, but they give some idea of the points and topics seen as most relevant in this Community forum.

Jottings from reports by the work groups

Each Member State has its own perception and experience of new technology, whose repercussions have differed in each one. Its introduction may be regarded as a challenge to the educational and training system in countries like France and the United Kingdom, while in others (the Federal Republic of Germany, for example) the school-based training system has been able to tackle the problem of the relationship between new technology and skills.

It is not enough to set up one-off training measures in an attempt to cope with change; there is a need for broad-based vocational training with a good deal of stress on theory, one that will create a 'technological culture'.

Two general concepts of the goals of basic education and training became apparent:

- that basic vocational training should be an integral part of general education (as in the case of Italy);
- that basic vocational training should be clearly job-related and a practical application of potential acquired in the course of initial education and training.

The feeling was that it would be pointless to try to impose a uniform pattern of basic training in Europe, where the nature of training systems is so diverse and so dependent on economic and social structures within each Member State.

The generation of job skills, micro- and macro-economic employment structures and the dynamics of change brought about by new technology are linked in complex ways. Only an outline picture can be drawn of the relationships and it is still impossible to define the interlinks between some factors and others, for example the connections between vocational training and the organization of labour. This points to a need for more intensive efforts in the fields of basic and applied research.

Europe's strength lies in the multiplicity of its national structures, its thinking and the solutions at which it arrives. This could be used to create a sort of 'genetic pool'. An invaluable working instrument is the knowledge of what is happening on the other side of national frontiers.

New technology is as an evolution, not a revolution.

The work-force needs some knowledge of microelectronics. Through training and information, workers should acquire as broad an understanding as possible of the system in which they work so that they can participate in negotiations on changes to their working conditions.

Technological change, employment, qualifications and training

Conference organized by the Commission of the European Communities – Directorate-General 'Employment, Social Affairs and Education' – and the European Centre for the Development of Vocational Training

Reichstag, Berlin, 24 – 26 November 1982

The seminar was chaired by Roger Faist, Director of Cedefop, and Hywel Jones (Directorate-General V, EC Commission). The person responsible for the technical arrangements was Georges Dupont (Cedefop).

Introductory papers were given by:

P.-P. Valli, Director, Centre d'Études et de Recherches sur les Qualifications (France);

H. Schmidt, Secretary-General, Bundesinstitut für Berufsbildung (Berlin);

A. Sorge, researcher at the Wissenschaftszentrum (Berlin);

D. Allen BBC editor;

A. W. C. van Kemenade, Analysis, Planning and Management Consultants (Vessem);

A. d'Iribarne, Director, Laboratoire d'Économie et de Sociologie du Travail (Aix-en-Provence).

The four work group reports were given by Burkard Lutz (Group I), Lotte Valbjørn (Group II), Sergio Bruno (Group III) and Paul Debaty (Group IV).

The general rapporteur was Paul-Pierre Valli.

We are moving towards an 'information society' which will probably change our lives in radical ways, not just our jobs. The effects will be felt in the whole social context by all members of society, not just by those in employment. The media should make a determined effort to foster understanding,

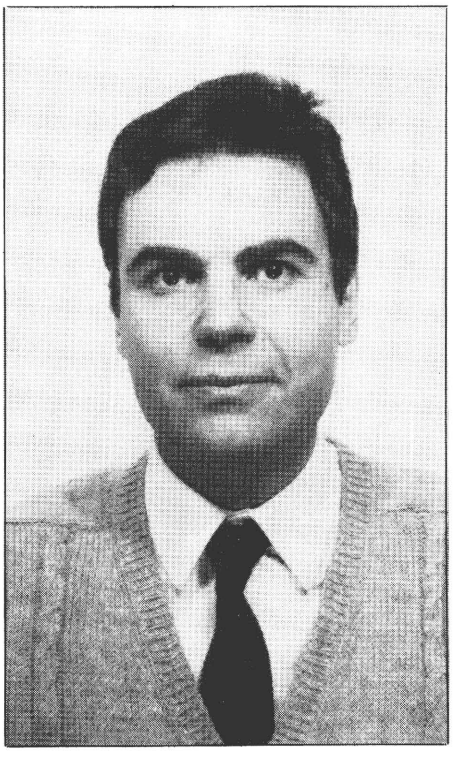
acceptance and use of information technology.

Television and the media can do more than arouse awareness and gain acceptance for innovation. They can promote qualifications by giving individuals the skills they need to perform certain tasks and, at the same time, encourage 'social consciousness-raising' and the ability to define one's own role in the working world, in other words to devise a new style of employment and new roles.

Technological innovation is neither the cause of the current crisis nor its panacea. The world has gone through other crises in the 20th century and has pulled through. In periods of grave crisis, new products have made their appearance, have paved the way for an upturn; today, it seems that we cannot count on new products resuscitating demand. The management of demand has been restrictive, the aim being to combat inflation; governments seem incapable of controlling the crisis. There is a tendency to fall back on a defensive form of competition, a factor by which technical innovations are being increasingly influenced. There is also a tendency to defend one's own interests at the expense of others, and our reaction should be to appeal for a more rational spirit, a greater effort of the imagination and greater political commitment.

There is a marked difference between jobs that call for ever-more sophisticated skills and familiarity with new technology and jobs where the worker's abilities are less important than the machine's. In the former case, new technology raises the level of skill; in the latter it de-skills. In both cases, however, the introduction of new technology creates a need for training, retraining and more advanced training in job skills.

- No serious problems seem to arise with in-company training; when training is conducted elsewhere, even in the school, the tendency is to involve employers more and more. The goal of training – in company or not – is still employment: to help people find their first job, a new job, a better job.
- Vocational training does not in itself create or eliminate jobs, even though the people hardest hit by unemployment are the least qualified.
- Does technological change polarize or depolarize the structure of job skills? It is still a controversial question and there seems to be no one answer as things now stand.



Four brief interviews conducted with some of the participants at the seminar on 'Technological changes, employment, qualifications and training'.

The opinion of . . .

Saul Meghnagi

Istituto ricerche economiche e sociali (IRES) – Sindacato OGIL – Corso d'Italia 25, Rome.

Q. On the subject of the changes brought about by new technology, there has been a good deal of discussion as to the scope for negotiation and consultation between the two sides of industry. Is this a significant aspect of the problem?

A. It is undoubtedly one of the problems, one of the most important problems, in that the situation has altered over the past few years. Technological changes and above all the economic crisis have altered the places at which consultation and negotiation on economic issues take place. They now occur at a far higher level, leading to greater centralization of negotiations and making it harder to manage all the processes of consultation from grass-roots level.

Q. Yes, but what path should we take to ensure that we do more than negotiate, that we look for real and practical solutions to the problems?

A. I believe we should be moving along two lines: consultation and the formulation of policies. Outline guidance should be formulated at national and central level, especially on investment, economic matters and the ways in which technological innovation may affect major national decisions, but there must also be room for a second path: discussion, analysis and dissemination of information on intervention in specific situations when changes are occurring at regional or local level or even within individual firms.

Decisions of national importance have to be centralized, but we should try to ensure that there is consultation on those decisions at other levels as well. Other more peripheral channels of consultation that have been more widely used in the past must not be allowed to become rusty.

Q. What do you see as the role of vocational training in this context? What type of training?

A. Vocational training undoubtedly calls for greater flexibility today than in the past. The term may be a little vague. What I mean is that training can no longer be regarded as a pre-packaged activity. In essence what is needed is to define training profiles and curricula appropriate to the innovations that are being introduced in each individual situation. If this is not done, there is a risk of accentuating the dichotomy that exists between occupational qualifications at a general level and the skills and experience needed on the shop floor or within a particular company.

G. Satta

Head of the vocational training unit of Confindustria, Viale dell'Astronomia, Rome.

Q. There has been discussion of the urgency of finding ways and means of consultation between the two sides of industry on the subject of new technology. Do you feel that this is in fact a priority for intervention?

A. I believe that intervention should occur upstream, to adopt the current jargon. I mean that new technology is so wide in its dissemination and has such radical cultural implications that it will have a marked impact on the basic issues of concern to the social partners. This being so, consensus reached merely by negotiation at the summit, between the representatives of management, the unions and the authorities, may not lead to adequate solutions or adequate guarantees. The guarantees may not be adequate in that the negotiated agreement does not reflect the real issues at stake, and the solutions may be inadequate in that they are not the best ways of dealing with the issues or achieving the cooperation needed to make them work. The real problem is how to use the new technology as an instrument to change our attitudes and mentality in the broadest sense rather than merely our attitudes and mentality at work. Taking this as our viewpoint, the problems that emerge are:

(i) the conveyance of information through the mass media;

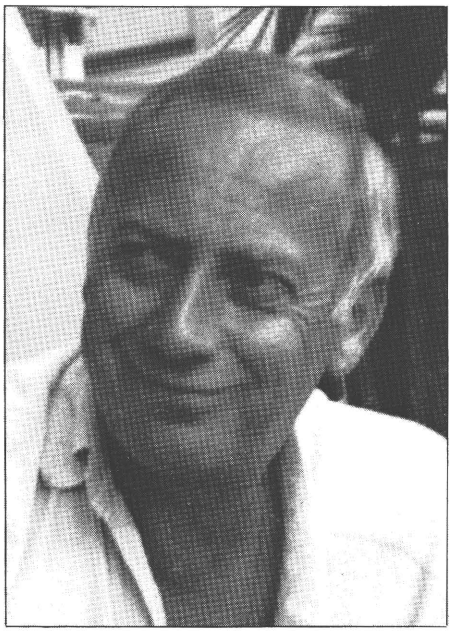
(ii) guiding school education towards objectives that are compatible with new technology;

(iii) short-term action in the training field in favour of those whose jobs are threatened by the introduction of new technology.

Q. What type of training? What type of intervention? Short-term or one-off measures or a global rethinking of training policies and strategies?

A. One feature of new technology (and I am talking mainly about the electronics/information/communications group) is that communication between different types of knowledge and skill becomes feasible and different types of knowledge can be put to use and made operative. In all probability this will lead to a gradual – but in some cases a radical – change in the mix of knowledge and skills applied, and this in turn will call for different job skills. When this occurs – and it will not occur in every instance – the real need will be to effect just as radical a change in training. This brings us back to basic education, where the goal must be far higher standards than at present. The focus should be logic and language skills. Young people should be taught not only the Galileo or Newton type of experimental science, for example, but should learn about the language aspects of science, making the acquaintance of such thinkers as Bertrand Russell. Vocational training, on the other hand, must be more closely related to work in a practical sense. A bridge should be built between the abstractions taught in the school and the more specific needs that arise at work. The only change in strategy I see, then, is even greater flexibility of vocational training on the one hand and, on the other, a more substantial investment in basic education.

Dossier



Dr Pol Debaty

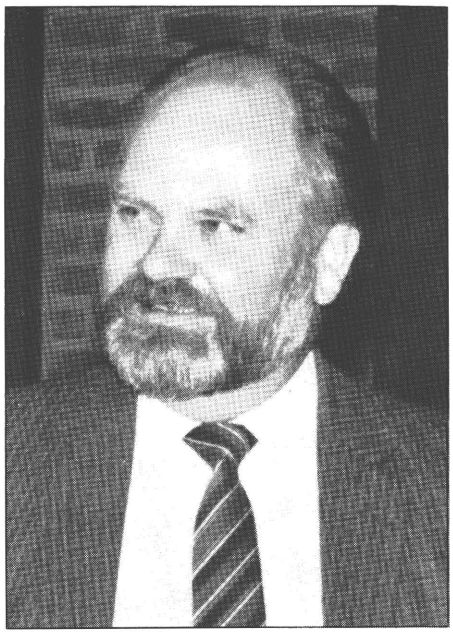
Technical Adviser to ONEM (Office national de l'emploi)

Q. Mr Debaty, in your opinion, with the arrival of technological change should we be thinking about revising the content of vocational training, particularly basic education?

A. There must be a response to the vocational training needs that are coming into being in business and industry following the introduction of all forms of new technology. This is obvious, because a number of new skills and forms of expertise are emerging and, as a corollary, new patterns of social behaviour and must be taken into account, leading to new training programmes with short-term objectives.

The need is less obvious at the educational level. It should be pointed out, however, that the names of most courses inspired by new technology make reference to areas of knowledge and skill that at first sight seem to have no direct connection with new technology but to relate to far broader objectives. When such knowledge and skills are taught in the schools, they are regarded as part of what we call 'general education'. The examples I have in mind include what is called a logical mind, an ability to distinguish between the essential and the incidental or to classify problem-solving data in an appropriate order. All these forms of knowledge and expertise should be integrated into the curricula of secondary schools, since most of the work-force will have attained that level of education in the years to come.

Within organizations, this will make it easier to arrange more directly relevant in-company training; the time saved will save money, which can then be allocated to the realization of other goals. The kind of thing I have in mind is an introductory course on information technology like the course now given by our vocational training agency, which could be cut by half if exercises in 'logic' had been done in the secondary school as part of a broader-based curriculum.



Antoine Hardt

Secretary, Cepfar
(European Training and Promotion Centre for Farming and Rural Life)

Q. We hear a good deal of talk about new technology, usually with reference to industry, but what effect is this technology having on farming and rural life?

A. First of all, I would say that there has been a technological revolution over the past 30 years unprecedented in world history. In this general context, farmers have demonstrated a very great measure of adaptability, not without a good deal of sacrifice for which they have not always been compensated.

Secondly, new technology has sometimes been introduced despite agriculture rather than with its support, in the sense that technological changes have been imposed on agricultrue that have not been attuned to its vocation, and famers have been unable to withstand outside pressure.

Lastly, in spite of everything, farmers have managed to fulfil their basic role – giving Europeans their daily bread – by means of this technological progress.

Q. What about the future?

A. Agriculture faces a great challenge in the future, and the problems will arise at different levels.

First of all, at the level of rural life in general, the technological revolution will generate substantial changes and we have no guarantee that the help and services needed for the maintenance of this sophisticated equipment will be available to agriculture or the rual environment.

The enlargement of the European Community will generate further problems by increasing the size of the agricultural population of the community as a whole, with all its organizational inequalities between north and south.

New technology may have very serious consequences by causing an exodus from the land, especially in the southern areas of the Community. This would make it impossible for the peo-

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ple living in those regions to control their own future development.

If those regions are to be revitalized, it is essential that their economic, social and cultural heritage should be protected.

Q. Are there any changes at the level of agricultural training?

A. There have been great changes in several countries within the Community. In the confrontation between agricultural training and new technology, the former has undoubtedly become more flexible than in the past. In the course of this seminar, we were very much aware of the technological challenge and the need it creates for some sort of preparation for the future of agriculture, or at least an awareness of that challenge. Above all, agricultural training should not become isolated or be bogged down by traditional methods but should face the future in an open-minded spirit. One essential way of achieving this is to delegate responsibility for training to the farmers themselves, at the same time providing them with the practical resources so that they can regulate training in the light of their own requirements.

Q. What do you mean by 'delegating responsibility for training to the farmers themselves'?

A. The person most familiar with the needs is always the practitioner – whether he works on the shop-floor or is the managing director – because he has to cope with the practical situation day by day, both personal and at work and is better placed than anyone else to see what is required. The farmer and his representatives must be given the responsibility and the resources to train in the light of his own needs. At present, the authorities tend to assign the responsibility to others and to organize training and the dissemination of knowledge in the light of criteria other than than those relevant to the agricultural calling.

There is one last question: Will new technology help to narrow the gaps between agricultural and rural regions in the Community, opening them out to a wider world and improving the means of conveying information and training in what is still the far too isolated world of agriculture and rural life?

The challenge of technological development to vocational training

Horst Lemke

Head of Section in the Federal Ministry of Education and Science (January 1983)

The new technologies – pivoting on microelectronics and its applications – are making great demands on every country's education and vocational training system. Experience and studies show, however, that the organization of work and the structure of jobs are determined less by the new technologies than by the occupational qualifications of the employees concerned and their ability to put the new technologies to appropriate use.

Education and vocational training can help to ensure that the new technologies are used sensibly in the shaping of work and leisure activities. It is to be hoped that they achieve this in two ways:

- quite generally, by increasing 'acceptance' of these new technologies, i.e. by getting people used to them and allaying their fears. This is a task for all sections of the education system and also for the media;
- very specifically, by teaching occupational skills, a task for vocational training. Whether every country's vocational training system is equal to this task of teaching the skills required for the various occupations, sectors of the economy and sizes of firm concerned is a question to which there is no simple, straightforward answer. But four general criteria can be used as a yardstick. When compared with these criteria, the dual system of vocational training which dominates in the Federal Republic of Germany inspires considerable confidence:

Contrary to many earlier assumptions, the skills needed in the use of the new technologies are essentially occupational, professional in nature. In other words, we shall continue to need not 'microprocessor experts' who also know something about an occupation, but specialists in their own particular fields – mechanics, fitters, bank clerks and laboratory technicians – able to use the new technologies. The emphasis in training will also continue to be on the teaching of advanced know-how, skills and abilities in occupations which have existed for some considerable time. The dual system of vocational training meets these requirements. It produces not 'jacks-of-all-trades' but reliable specialists who know their jobs. Confining training to a single occupation does not, however, signify one-sidedness and inflexibility: the basis of specialized skills it provides enables the employee to cope with change because he has an extensive knowledge of a few areas rather than a superficial knowledge of many.

Most of the skills required in connection with the new technologies develop on the job, as these technologies are introduced and used in production, administration and organization. And it is here that they are best learnt and put to use. The dual system again meets this criterion, since it focuses on training in firms.

The amount of essential basic knowledge that can be learnt on the job is, however, very limited. For this systematic learning in courses and something like school education are needed. As the dual system includes vocational training in school – and also interplant training to help small and medium-sized firms – it gives everyone taking a course of vocational training an opportunity to acquire this 'basic knowledge'.

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The new technologies will be important not only for a limited number of experts but for almost all employees. Again, the dual system forms a good basis for meeting these requirements. It is essentially designed to permit all young people to obtain a sound training. And so the circle is complete: since so many young people have been trained in the past – over 60 % in any age group by the dual system – every sector of the economy has a large number of qualified specialists, and with so many specialists, firms are able to train large numbers of young people.

This is also an important factor in efforts to resist downgrading tendencies: the well-trained specialist can assume more responsibility, take more decisions and arrange his work better than someone who has had a limited amount of training and whose activities are always dictated by the instructions and plans he receives from others.

To summarize

The constituent features of the dual system of vocational training are such that it provides a sound basis for meeting the challenges posed by the new technologies, which does not mean, however, that this goal will be achieved automatically. What it does mean is that, provided employees and the trade unions are prepared to join with the State and its education policy in accepting responsibility in a system of this kind, the requirements of the future can be met.

Dossier

Bibliography

Professioni e mestieri del 2000. Rapporto sui cambiamenti, occupazione e formazione in Europa

Nicola Cacace

pub. Angeli, Milan 1982.

The author, President of Istituto di studi delle relazioni industriali (ISRI) in Rome, is an expert in the problems of technological development in industry. Looking ahead to occupations and trades in the year 2000, he reviews the situation in Europe and makes useful comparisons between national economic systems. These are particularly enlightening in the case of countries like Italy which have few natural resources of their own and have to make intelligent use of new technology to compensate at least in part for this handicap, in so doing 're-inventing' production cycles and working methods. The message of the book on this point is explicit: only by the rapid introduction and rapid improvement of innovatory technology for specific needs and by its widespread use can countries lacking raw materials hold their own.

Discussing the current educational system in Italy, the author calls for improvements in basic education and general training in the schools, universities and institutions of vocational training. The alternance method of training, both multi-purpose and specialized, is the ideal way of preparing young people, those who have a job and those still in search of employment, for the not-so-distant future.

In our opinion, Cacace's analysis is impeccable both technically and in terms of documentation. Sociologically it goes into great depth: as is obvious from his subtitle – 'a report on changes, employment and training in Europe' – the focus is the jobs and trades that will make use of the potential offered by new technology rather than new technology itself. Most of today's working methods will have to be rationalized, but it should not be forgotten that it is the individual engaged on the job who is most directly affected by these far-ranging changes, whether in Italy or elsewhere. The publication deserves to be consulted for its thorough investigation of the economic, technical and social issues raised.

L'évolution des systèmes de travail dans l'économie moderne: conséquences sur l'emploi et la formation

Actes des journées nationales d'études (Délégation générale à la recherche scientifique et technique – DGRST, Centre d'études et de recherche sur les qualifications – CEREQ, Centre national de la recherche scientifique – CNRS), 1, 2 and 3 December 1980

CNRS, Paris, 1981, 287 pp.

These proceedings of the national seminar on the evolution of working systems in the modern economy and its effects on employment and training include the reports and papers of more than 40 authors delivered during a conference held in Paris in December 1980 to celebrate the 10th anniversary of the foundation of the Centre d'études et de recherche sur les qualifications (CEREQ). As pointed out in the foreword by Gabriel Ducray, the Director of the Centre from 1970 to 1981, to an increasing extent CEREQ is being regarded as the inter-ministerial institutional body for analysis and preventive action on skills and qualifications, helping with the formulation of training policy.

The 'national research days', one of whose organizers was the École nationale d'administration (ENA), helped to clarify the impact of changes in working methods on the economy and employment in France. In the broad context of the papers given by experts and specialists, of special interest in our view are the review by Paul-Pierre Valli (who succeeded Mr Ducray as Director of CEREQ in 1981) and Alain d'Iribarne (Deputy Director). As the reader will have noted from their articles in this issue of **Vocational training**, the points strongly brought out in their research are the need for change in vocational training, the need to formulate strategies that will promote effective improvements in the position of the individual at his place of work and the proper response to the challenge of technology. Their ideas were contained in embryonic form in the papers they gave to the Paris conference.

It would be foolhardy to attempt to summarize their proposals in a few words: they are so apt, so precise, so well developed and supported by an unerring familiarity with the problems discussed and by lengthy experience. Conferences of this kind, attended by politicians, experts, academics, unionists, field workers and the decision-makers, bring about an understanding that the time is more than ripe for effective change in the working systems of today's economy.

Mikroprozessoren und Bildungswesen

Untersuchung im Auftrage des Bundesministers für Bildung und Wissenschaft

Rainald von Gizycki and Uwe Weiler

pub. Oldenbourg, Munich and Vienna, 1980, 315 pp. (in German).

The authors' names are already familiar to those concerned with the problems of introducing new information technology, particularly microprocessors. In 1979 they carried out research on behalf of the German Federal Ministry of Education and Science, the results of which have now been embodied in this new publication in the Frankfurt Battelle-Institut's 'Social Science Collection'.

Central to their theme are the changes that microprocessors are making to traditional working methods in many fields of employment, perhaps in every field, and in many other areas of our everyday lives today. They examine closely the impact on current educational methods, especially in the Federal Republic of Germany, looking to the model of technologically more advanced countries, Japan and the United States. The role and function of microprocessors are examined in detail (are they job-killers or job-enhancers?), above all their applications in the service sector. A wide range of facts and figures is given, incorporating the findings of surveys conducted in more than 300 firms and numerous interviews with experts, as well as opinions expressed by those directly affected by the 'revolution' (people in employment and people involved in continuous education courses).

Because of the scientific stature of the research (to which the bibliography of German and American publications bears witness), we feel that this book will provide ample food for thought for readers whose appetites are not altogether jaded from over-indulgence in the issues it discusses.

Pour

Bimonthly journal of the Groupe de recherches pour l'éducation permanente (GREP), Paris, directed by Paul Harvois, printed and distributed by Privat, 14 Rue des Arts, 31000 Toulouse (in French).

The issue reviewed – No 85, September 1982 – takes as its theme future changes in continuous training, its title *La formation continue: vers quels changements?* Launched in 1968, GREP's journal keeps a watching brief on developments in permanent education and in society as a whole, technological innovation and government action, especially in rural areas in France.

Every year the journal brings out special supplements on specific topics. Many specialists in vocational training are members of the group's 'Guidance Council' and standing committees responsible for the research sectors mentioned. The journal does not merely deal with technical or specialist subjects but makes major contributions in the sociological field.

What attracted our attention in this issue was an article by P. Harvois (on the application and consequences of laws on vocational training in France between 1971 and 1982) and an interview by the editor, Rolande Dupont, with Bertrand Schwartz (on the findings of his report on the occupational and social integration of young people). We also found the article by Claude Lubar of Lille University of great interest: looking at new technology and training needs, he laments the inadequacy of the existing certificate of vocational ability – the *certificat d'aptitude professionnelle* (CAP) – faced by the challenge of technological progress today. He recommends an increase in grass-roots contact between the social groups concerned with the solution of the problem.

A useful source of information and practical suggestions, we see this journal as essential reading for experts, field-workers and those responsible for training in the European Community.

L'insertion professionnelle et sociale des jeunes – Rapport au Premier Ministre (Pierre Mauroy)

Bertrand Schwartz

pub. by La Documentation Française, Paris, 1981, 146 pp. (in French).

In June 1981, the French Prime Minister, Pierre Mauroy, gave Bertrand Schwartz the task of conducting a survey of the chief victims of the economic crisis (then, as now): young people in search of their first jobs. The unemployment rate in this group is far higher than among adults and it is a matter of concern that many such young people remain outcasts on the fringes of society.

In drawing up a working proposal as to how the problem can be solved, Professor Schwartz drew on research work done by an extensive team (their names are listed in the foreword) and specialists from the Agence nationale pour le développement de l'éducation permanente (ADEP). More than 400 experts, field workers and specialist institutions in the public and private sectors were consulted. The findings form the fascinating material of this report on the vocational and social integration of young people.

In the introduction, the author clearly outlines the content and aims of the project, stating the limitations and scope of his research. He gives a lucid picture of the integration of young people (with a breakdown by age group) at work and in society, advancing proposals as a long-term action and as to more immediate and urgent measures.

In addition to the sections designed to stimulate thought and action by the French Government, we were particularly interested in the proposals set out in Chapter V on an 'international solidarity programme', placing the problem in the broader European and international context and appealing to the social forces of individual countries which are concerned with finding a solution to this serious problem.

New technologies: their impact on employment and the working environment

International Labour Office, Geneva, 1982, 174 pp. (English and French).

This is an anthology of articles on the repercussions of new technology on employment and jobs that have appeared in ILO's quarterly *Social and Labour Bulletin* since 1979, based on newspapers and magazines, official publications by governments, unions and public- and private-sector institutions and significant extracts from books on the theme. The reprints (more than 150) are grouped according to their country of origin, under six main headings: general policy issues; privacy protection; labour relations and collective agreements; union views; the work environment; and employment, training and qualifications. Most of the pieces originated in the European Community (the lion's share from Germany and the United Kingdom) and the US, although there are articles from countries that have only recently concerned themselves with new technology.

To judge by its general layout and the carefully planned grouping of articles, we feel that the publication achieves its purpose. Attentive reading of individual sections will spark off ideas and provide food for thought on problems of concern to every highly industrialized country in which technology has reached an advanced stage.

This publication comes under the overall programme of research on new technology on which ILO has been working for some years. Its bimonthly journal *International Labour Review* has also devoted a good deal of space and attention to the topic.

Frauenemanzipation und berufliche Bildung (Programme, Bildungskonzepte, Erfahrungsberichte)

Marianne Weg and Angela Jurinek-Stinner

pub. Hueber, Munich, 1982, 187 pp. (in German).

This miscellany is in two parts. The first consists of four contributions depicting the position of German women in the existing vocational training system and society in general. The second tackles head-on the issue of genuine emancipation for women and the difficulties they face because of their dual role, at work and coping with domestic tasks in the family.

Of particular interest to the European reader is the article describing the jobs that have traditionally been male preserves, on which women in the Federal Republic of Germany are increasingly encroaching.

Dossier

Politique d'éducation et organisation industrielle en France et en Allemagne (Essai d'analyse sociétale)

M. Maurice, F. Sellier, J.-J. Silvestre,

Presses Universitaires de France (PUF), Paris, 1982, 382 pp. (in French)

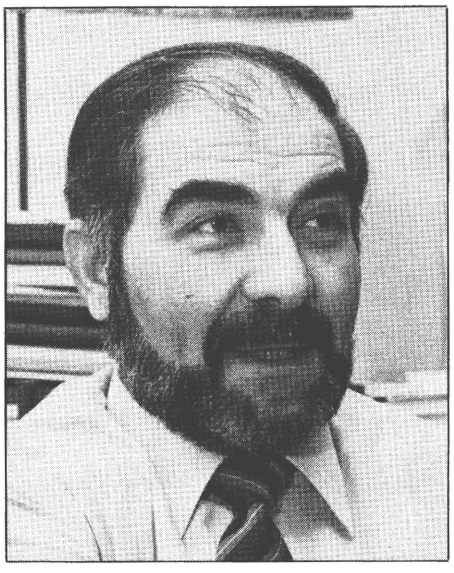
The authors have undoubtedly put a good deal of spadework and patience into this book on educational policy and the organization of industry in France and Germany, and the goals they have set themselves in their 'attempt at societal analysis' have, we feel, been achieved in full measure.

Their methodological and scientific approach to the work is flawless. They devote the first three chapters to a comparative review of educational structures, company organization and industrial policy in France and the Federal Republic of Germany. Chapter IV is a bold discussion of the social problems arising in the broad spectrum investigated in the course of their research. They consider the mobility of labour, the versatility and flexibility now demanded of skilled workers, the impact of new technology on employment, the need for new job descriptions and, finally, the processes of socialization and the organization of labour (together with possible forms of control) designed to promote more active participation in the company's affairs.

It is rare, we feel, in comparative research of this kind for such a painstaking look to be taken at social phenomena and the organization of labour in two EEC countries – countries whose socio-economic and organizational systems differ so greatly.

The description of research and publications, both theoretical and practical, in Chapter V is, we believe, particularly useful.

We see the book as intended not just for specialists (as the authors point out in their introduction), but also as an excellent introduction to current and past scientific theory for the interested layman, making it far easier for him to understand the application of social science to industrial policy and training. Such comprehensive and carefully structured scientific publications are rare. It is to be hoped that others (especially in other areas of the European Community) will follow in the footsteps of Maurice, Sellier and Silvestre, deriving encouragement and useful pointers from their fine book.



Europe in transition

an interview with Riccardo Petrella*
by Duccio Guerra

Question: Europe is changing. Our society has become a complex system of interactive complexities. Which are the areas most affected by this process?

Answer: Many of the changes so widely discussed are in fact 'turbulences' (Ed. note – see Table A). The change is superficial. It is no easy matter to identify the structural changes in an industrial society (Ed. note – some of these are listed in Table B for guidance), especially when trying to select the most important with a view to mapping out strategic guidelines for short- and medium-term action.

A distinction I feel to be significant and useful is between changes in *things* and the way they are managed and changes in *people* and their relationships.

Changes in things (energy from agricultural waste, heat pumps, the microchip in the dishwasher, satellites and so on) come within the domain of instruments, the means to an end.

Changes in people and their patterns of behaviour (shorter working hours, the computerization of a town, drug abuse among the very young, etc.) come under the heading of the end. Changes in things are of value if they extend the range of options available to meet individual or community needs; changes in people are of value if they raise the level and quality of the goals for which society strives.

Taking this distinction as our starting point, the field in which the changes have been most momentous is probably that of human work. The 'metamorphosis of labour' is evident in two respects:

- in the nature of work (for instance, the introduction and spread of new technology in most areas of human activity: automation, information and communication);
- in the place and role of work in society, both as an activity and as a value (the 'centrality' of work has not been challenged but is being expressed in new ways, through mechanisms of a new type with different contents).

The alarming problem of rising unemployment (2 million jobless in the Community of Ten in 1970, 6 million in 1978, over 12 million early this year and, in all probability, over 15 million by 1985) is certainly a factor (both cause and consequence) in the current and future 'metamorphosis' of work.

In practical terms, the striking feature of the 1980s will be the radical reordering of the rules and mechanisms which determine the place and role of work in the office or factory, individual or family life and the economy as whole. The core of that reorganization will be a revolution in hours of work (shorter working hours and part-time, temporary and shift work, flexible working hours, etc.), in the relationship between work and wage-earning ('black' or 'submerged' economies) and in the places where work is done (teleworking, etc.).

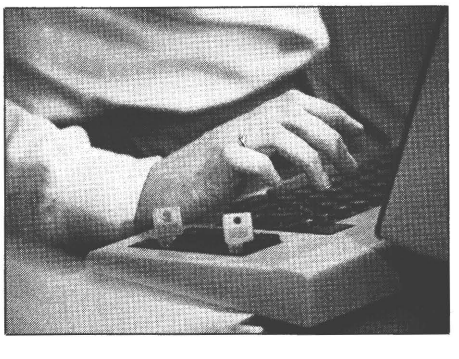
* Dr. Riccardo Petrella graduated in social and political science and has an honorary degree from the University of Umeå (Sweden). The former director of the European Coordination Centre for Research and Documentation in Social Sciences heads the EEC FAST programme (science, research and development).

This reorganization will not be to everyone's advantage but may well run counter to the interests of certain social groups, just as it may well provide an opportunity for remodelling the Tayloristic organization of labour.

Q. – Human labour is undoubtedly going through a process of radical change. Do you not think that information is another significant area of change?

A. – Certainly. The second field, closely related to the first, in which major changes are taking place is the field of information and communication.

Information has always been the foundation of all human activity, both individual and collective. New technology is not altering the nature of information but is transforming, and will transform, the 'nervous system' of industrial society, affecting all the quantitative aspects of information. In addition, a 'new world order of information' is about to appear and develop: information serving banks, companies, radio and television, science, culture, tourism, etc. Under this new order, satellites, optical



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fibre, decisions reached by the authorities and consumer behaviour will play a decisive role in this information. For Europeans, it is a change of overwhelming importance, especially because the birth of this 'new order' is – at least at the moment – being controlled by non-European countries.

Q. – Technological problems are essentially the problems of society, and innovation is attended by uncertainty and fear of the future. How can change be controlled?

A. – It is because the role of science and technology is to extend the range of complementary and alternative solutions to individual and collective problems that technological decisions are basically social decisions. Technology both influences and is influenced and organized by society. Technological change is the result of an intentional social process. The more we set up technical and production systems that are standardized and uniform on a world scale, the less we deploy tangible and intangible local resources, the less we promote the special features of a region or country, the greater the loss of identity and independence for small-scale and local systems and, as a result, the greater the sense of uncertainty as to the present and future. Such uncertainty is not caused by the speed and multiplicity of changes but by the sweeping nature of those changes and the tendency towards standardization and monolithism. It is when we lose our own sense of identity that the future seems uncertain, in combination with the feeling that we have no say in the decisions that shape our present and future. These 'fears' and this feeling are the reasons why some of us refuse to accept technology blindly and lethargically. We realize that the development of certain technologies entails a measure of risk of major disaster, placing human life at peril either insidiously (through pollution, the extinction of animal and vegetable species, sickness, etc.), directly (thalidomide, mercury poisoning in Japan, dioxin at Seveso, distilbene, etc.) or potentially (radioactivity, genetic engineering, epidemics), not to mention the risk associated with the threat of nuclear warfare.

Technological change cannot be planned (nobody innovates by law), but it can be encouraged and channelled and its goals can be stated. The difference between the concepts of 'technical progress' and 'innovation' is that the former is seen as inevitable and automatic whereas the latter is intentional and purposeful and can be organized.

Q. – In saying that innovation can be organized, do you mean that it can be managed by means of a policy on technological change?

A. – Yes. In my opinion, there are four guiding principles for an active policy on technological change:

- **The approach should be overall and integrated.** It would be a delusion to believe that a company, region or country could overcome a crisis solely by regulating industrial factors. One of the paths to success is the integrated management of industrial *and* social change. Experience has shown that to dissociate technological from social innovation is the sure recipe for failure.
- **The priority should be functions and systems.** The new technologies differ from their predecessors in that they are fundamentally combinative and contagious. They are 'combinative' because they cannot be used in isolation but must be combined with other forms of technology. They are 'contagious' because they multiply the potential of the technologies with which they are combined (genetic engineering, for instance, has recently made enormous strides because of its use of new technology in the fields of automation and information), which they revitalize (information technology in the textile industry, for instance, or telematics in the audiovisual field) or which they 'irrigate' (biotechnology in the agri-food sector is one example).

The development and dissemination of new technology, therefore,

- break down the barriers between disciplines, areas of competence and economic sectors;
- challenge production and management structures at the level of the individual company or branch of industry or region;
- pave the way for better integrated management of natural resources (the way in which land is used, for instance);
- alter the circumstances and content of vocational training;
- transform areas of specialization, promoting cross- or multiple-specialization;
- necessitate a major overhaul of institutions and administrative rules and regulations.

Commission of the European Communities DG XII The FAST programme

In response to proposals put forward by the 'Europe plus 30' study group, in 1978 the Council of Ministers of the European Communities decided to initiate a five-year experimental programme entitled 'Forecasting and assessment in the field of science and technology'. This programme, known by the acronym FAST, was launched in 1979.

The main aim of the research programme is to help to define long-term Community research and development priorities and objectives, with a view to the formulation of a coherent science and technology policy over the long term.

The Council of Ministers laid down three priorities for the programme:

- to analyse existing forecasting and assessment research activities associated with science and technology policies within the Community;
- to highlight prospects, problems and potential conflict likely to affect the long-term development of the Community, identifying alternative courses of Community research and development;
- to promote the development of information networks of exchange and cooperation between research centres specializing in forecasting and assessment in every Member State.

The Council mandate also specified that the Commission of the European Communities would be responsible for implementing the programme, and that it would be assisted in its task by an Advisory Committee on Programme Management (ACPM), consisting of nationally appointed experts. The Committee has been involved in all the major decisions in the FAST programme and has met 11 times between 1979 and 1982.

The FAST programme has a total budget of 4.4 million European units of account, to include the cost of a staff of 10 (six researchers and four research assistants).

The second phase of the programme will start in the course of the current year.

■ **There should be many instigators of change and they should be autonomous.** A system whose members have no powers of initiative is a system incapable of innovation. Autonomy must be widespread among both the producers and the consumers of the new products, goods and services. For example, the introduction of information technology into schools as a teaching medium will spark off less conflict and help to solve more problems if the groups directly affected by the change (teachers, the producers of the 'machines', parents' associations, pupils, the authorities, etc.) are independently and actively involved in the planning and decision-making process. Innovation cannot be spontaneous unless those concerned with its development are given free rein. It is hard to work for development if other people administer the resources and lay down the priorities.

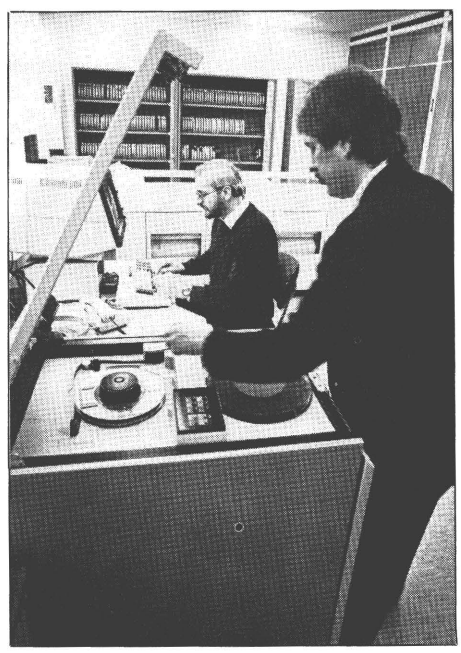
The specific reason why many underdeveloped regions, or regions which were industrialized a long time ago, find it so hard to be, or go back to being, the source or place of innovation is that they have lost their autonomy and, paradoxically, are dependent on outside assistance to regain it.

■ **There should be solidarity within Europe and between Europe and the Third World.** We should bear in mind that the economies of European Community countries are closely interdependent. This means that higher productivity in one nation may lead to a loss of jobs in another; an innovation policy whose sole aim is to make a country more competitive in fact intensifies competition, especially between economies within the Community, widening the structural gap between our countries. It is vital, and it is also feasible, jointly to optimize the use of European science and technology inspired by shared socio-economic objectives, particularly in the fields of health, communications, transport, the environment and energy.

The same is true of the role of European science and technology in tackling the problems and needs of developing nations. As argued by European Commissioner Mr E. Pisani we must help the Third World nations to develop for their own sake, not just to create markets for our own products and services.

Q. – Under the FAST programme, what are the main guidelines for technological development in the Community?

A. – In the light of the 36 research projects carried out under the FAST programme, five major guidelines have been formulated which should help to broaden and enrich the work of the Community in the field of science and technology over the next few years. Put very succintly, these five guidelines are:



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- the consolidation and modernization of the European industrial base should be stimulated along two axes: agriculture/chemicals/energy and space/electronics;
- the Community should help to design and develop the infrastructure of the next 30 years for new services;
- the metamorphosis of work and employment should be supported and the emergence of new **relationships between man and machine** facilitated;
- encouragement should be given for the use of science and technology to help solve the most pressing problems of Third World countries and develop their 'local' scientific and technical potential;
- Community institutions should be given the vital knowledge they need for the **common 'control' of technological change.**

'Turbulences' of the present time

- the oil crises,
- slackening of growth rates,
- 25 million jobless (in 1982) in OECD countries,
- persistent inflation,
- the 'black economy' – unofficial employment,
- the emergence of a 'submerged economy',
- enormous indebtedness among developing nations,
- robots in the factory, information technology in the office, etc.

Certain radical changes in industrial society

- reorganization of the energy base,
- science is becoming more industrial, industry more scientific,
- metamorphosis in the nature of work,
- a shift towards the redistribution of living time,
- the internationalization of national economies,
- the nation State is both too small and too large,
- reshaping of the family.

Q. – What do you see as the role of vocational training in **the support of** change?

A. – The Commission of the European Communities has already formulated a set of clear-cut, pertinent proposals, partly in the light of the work done by Cedefop. If I may speak as someone not directly engaged on the work, I feel that two of the functions of vocational training in the 1980s are:

- **to act as an instrument of individual and collective flexibility** so that each one of us can actively participate in defining and administering our own 'working system', whatever our field of activity, type of job, sex, age, region and country of origin;
- **to act as an instrument for the lessening of inequality** in access to the labour market, an inequality that typically affects some of the most vulnerable sectors of society. Women are a signifi-

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cant example: the inequality by which they are penalized is to a great extent due to and perpetuated by vocational training. Unless coherent and energetic measures are taken at the proper levels it is very likely that the introduction and use of new technology will only aggravate the position of women and create new forms of inequality.

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