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Vocational training

Technological development and vocational training

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Vocational training

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Editorial

'Technological development and vocational training.' We hesitated to select this title for this issue of the Bulletin. New technology seen as an element of a development process and hence as a phase of an *evolution,* or seen as a break in continuity and hence as a *revolution?* We do not have the answer. Perhaps no *single* answer even exists.

In all probability the answer is dependent on the level of approach from which this phenomenon is observed: at the level of macroanalysis it is to a large extent characterized by a change in the means of production, in relations within the firm, and in demand and supply of vocational training; at the in-firm level of microanalysis it is characterized largely by the introduction of new technology, coupled with the gradual adaption of work organization and of training measures facilitating the changeover, thus bearing the earmarks of continuity which typify a process.

The discussion on this question is in any event an old one and need not be added to here: it is being amplified and further deepened nearly every day in political, economic and social circles.

The consequence of the impact of technological development on the labour market is the elimination as well as the creation of jobs: most probably, at least in the early stage, the number of jobs eliminated exceeds the number of jobs created. The phenomenon of technological development is furthermore directly related to the elimination, modification, and creation of qualifications; changes in work organization; relations within the firm; and, finally, vocational training.

Vocational training is frequently recommended as an effective cure for the pathological situation which exists, that of a system thrown off kilter by the introduction of new technology. However, there is good reason to doubt that vocational training can provide effective solutions if conceived as an *isolated* response rather than as a response combined with all measures aimed at exerting influence on work organization and production and at sensitizing designers and users of new technology.

Development can be held back, endured, or mastered: the urgent need to master this development means that mastery is the only road open. The problem then is to assign vocational training its proper role within the effort to meet the challenge raised by changes brought about by new technology.

We must ask ourselves whether, in the wake of the rapidly accelerating dissemination of new technology, we are not perhaps witnessing a shift in the objectives of vocational training, whether the traditional objective of linking vocational training to employment is not perhaps being re-oriented towards a qualitative need to better equip young people educationally so that they can actively participate in the technological changeover rather than just enduring it as something predetermined and inevitable.

This implies that particular attention must be paid to employed workers: it is they who are expected to have the ability to adapt. This ability to adapt presupposes that they have acquired both sound job experience and relevant knowledge and can also draw on a basic educational background and qualified occupational skills.

It is furthermore not possible to ignore the problem of young people entering the labour market who have had very little vocational training, if any at all. Technological development certainly does not hold out much hope for this group of young people unless steps are taken to improve their training.

Vocational training is therefore a prerequisite to technological development if this development is likewise to constitute progress. Implied, however, is a type of vocational training which is conceived as a response integrated into the *ensemble* of measures aimed at mastering the technological phenomenon, as a preventive long-term response, capable of producing real professionalism while remaining open to educational enrichment and thus capable of breaking down the traditional dividing line separating vocational training and education.

Hopefully it is reflection in these directions which will be stimulated by this issue of the Bulletin, to which a number of authors involved in Community-level actions or in research or study work have been asked to contribute their opinions.

The second part of this Bulletin contains articles submitted by selected authors who are being confronted with this problem on a day-to-day basis: the cases in Italy, France, the United Kingdom, and the Federal Republic of Germany are clearly neither comprehensive nor representative and are presented solely in order to provide the Bulletin readership with a few concrete examples.

Telematics in Europe: a strategy of challenge

An interview with Étienne Davignon

This interview with Commissioner Étienne Davignon took place in December 1980. He was at that time the Member of the Commission of the European Communities responsible for industrial affairs.
Since 1 January 1981 Etienne Davignon is also responsible for energy and research.

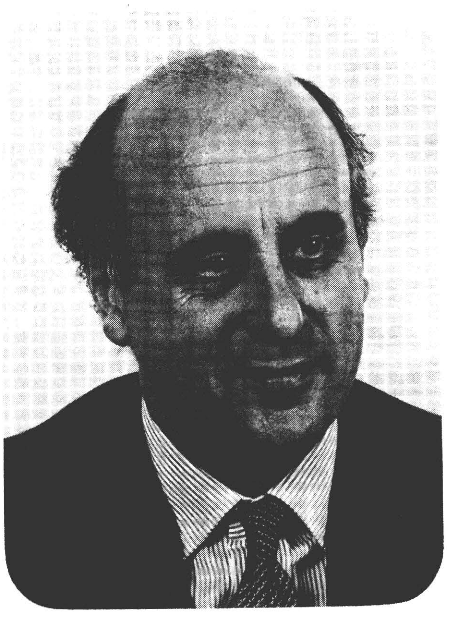
CEDEFOP: The discussion on new technologies appears to be taking on a new dimension at political level in the European Community. Engaging in this discussion are economists, sociologists, psychologists, and, finally, the man in the street: in what way does this old discussion represent a new approach and in what terms does this constitute a problem for the Community?

E. DAVIGNON: It took us considerable time in Europe to become aware of the fact that a new technological revolution was already at our door. There is no doubt, given the rapidity with which things are progressing, that this new revolution has now practically run its course and that its focal point lies in the sectors of informatics and telecommunications. As you know, a new term has been created for this subject field: telematics.

What must therefore be determined is whether the Europeans – for what is involved is a challenge at the level of a continent and not of one or more countries in isolation – intend to play an active role in this race or, with arms crossed, be content to impassively witness the strategies being pursued by their competitors, the Americans and the Japanese.

CEDEFOP: What is the European Commission's response to this question?

E. DAVIGNON: For the European Commission the answer is simple: Europe cannot afford to absent itself from the *rendez-vous* of modern technology; otherwise it must resign itself here and now to the fate of playing second fiddle. The Commission has already been widely criticized, to my way of thinking unjustly so; we have received unfriendly comments to the effect that we of the European Commission are the gravediggers of industry, that we want to see the iron and steel industry, the shipbuilding industry, and the textile industry in Europe disappear (the term generally used is dismantled). In the face of the hard realities of a world in a state of constant evolution, the European Commission can do no less than fulfil its mission, which is to work for the common weal of an entire continent, at least almost an entire one. We have tried to close the gap caused by inaction at national level, where the main concern is that the necessary adaptation takes place without completely disrupting European society. Confronted with this strategy of withdrawal, the Commission has directed its efforts towards a strategy of challenge. Telematics constitutes a part of this strategy of challenge, just as do aeronautics, the automobile sector, and other economic sectors which can be characterized as growth sectors. In the field of telematics, action at European level is all the more indispensable in that the fate of the citizens of the Community in the last two decades of this century is at stake: employment, type of society, protection of the individual against the abuses of information technology, etc.



'... set in motion a real European market ...'

CEDEFOP: How do you envisage this strategy of challenge? What means do you intend to employ?

E. DAVIGNON: In our opinion action at European level does not imply that interesting projects must first be endorsed by nine or ten governments or that they must result from the concerted action of *all* the industries involved: no.
We do not intend to put a tight corset on industry. We are no longer unrealistic to the point of wanting to have a special

budget established before moving into action. No: what we must do is to effectively set into motion a real European market, a common market which will enable manufacturers to above all benefit from conditions comparable with those which their arch competitors, the Americans and the Japanese, enjoy. As a matter of fact, that which we are proposing is neither a European solution, cost it what it may, nor a national solution at any price. Plagued for nearly seven years now by an economic crisis, the general public would certainly not allow Europe and its member countries to waste public funds in new technological sectors. Having said this, it is important, if the operation is to be successful, to surmount certain obstacles which hinder this common market from becoming a reality: national monopolies, public procurement contracts which are strictly national in nature, and divergent technical standards are among the obstacles which hinder the European machines from communicating easily among themselves.
The sociological obstacles are likewise hard to overcome: they tend to curb innovation, which is still viewed unilaterally as a menace.
The telematics market is a bearer of hope in that it is expected to expand rapidly (on average 15 % a year). This market would provide an indispensable basis for a spectacular effort in the field of training and in the creation of numerous new services and equipment of all sorts.

CEDEFOP: You have advised the industrialists not to lose themselves in excessive optimism. Why?

E. DAVIGNON: Certainly the question is raised now and then as to why the European Commission is getting involved in telematics. We are told that everything appears to be moving along well in the telematics market and that the industrialists can fend very well for themselves without any help from the technocrats in Brussels.
This is exactly my reply: in Europe everyone is fending for themselves. And this shifting for themselves is illustrated by the following example: the European advanced components industry constitutes only 10 % of the worldwide advanced components industry whereas the EEC represents 25 % of the world market in this sector. This illustrates in very clear terms the fact that even if the European market were to expand considerably each year, the gap between it and its competitors would continue to widen.
With regard to the peri-informatics sector it must be realized that even though Europe is in an enviable position, its share of the world market dropped from 33 % in 1973 to 25 % in 1978. It would be dangerous for Europe to fail to analyze these data and instead to carelessly indulge in euphoria. The truth of the matter is that even an expanding European industry supplies only a fraction of the European market.

CEDEFOP: What objective do you feel would be within the realm of possibility for European telematics?

E. DAVIGNON: In the opinion of all those concerned, that is to say, of the governments, the industrialists, and the European Commission, European industry should aim at supplying one-third of the world market in telematics by the end of the 1980s: this is an ambitious objective but it is within reach.

CEDEFOP: And American and Japanese competition?

E. DAVIGNON: I realize that there are those who are still sceptical. They ask themselves: how is it possible to compete with firms in America, where the policy of public procurements in favour of the sector is much more ambitious than that of the governments in Europe? We need not have any complexes in this regard: we are not doing any worse than they are, if I might express it in this way.
As a matter of fact I requested my services to undertake a comparison between Europe and the United States with regard to public contracts in the field of informatics. European public contracts account for 35 % of worldwide public markets in informatics. This firstly.
With regard to the markets in informatics hardware, public contracts in Europe in 1978 just about equalled American public contracts: 790 million European Units of Account for Europe as against 880 million for the United States. This secondly!
That which weakens us competitively is not the volume of public procurements but rather the manner in which these procurements are distrubuted: rather than constituting the focal point of a concerted action, an overall strategy, these procurements are divided up in Europe between nine national markets.

CEDEFOP: In concrete terms, what do you propose to do?

E. DAVIGNON: The European strategy proposed by the European Commission involves a sequence of priorities which we formulated last July. I will recall them here briefly. What we have, in fact, is a strategy of catching up. The first task is to increase Europe's share in the world production of integrated circuits from 6 % at present to 12 % by 1984-85. This first piecemeal operation is all the more important in that Europe's share in the world consumption of integrated circuits is much greater, namely, 25 %.
If we do not achieve this we risk becoming even more dependent on non-European

sources for the provision of this 'primary product', which one might call the chip. By way of comparision we should note that even with public expenditure at a lower level than that in Europe (a little less than BF 8 000 million as against BF 14 500 million in Europe), the Japanese have captured about 40 % of the world market in integrated circuits and have overtaken their American competitors.

The action proposed by the European Commission involves three steps:

□ coordination of national programmes;

□ investigation into new possibilities in the field of design and computer-aided tests;

□ promotion of a European equipment industry.

This last step is without doubt the most urgent, in our opinion. At the present time the major part of this key industry is located in the United States.

The fragmentation of the European market is disadvantageous to the development of specialized companies manufacturing new equipment and hardware.

The danger of such a situation is quite evident: the technology of production is generally acquired under licence or purchased in the United States several years after American companies have made their purchases. Thus a new generation of equipment arrives on the American market by the time the European purchasers have acquired equipment of the preceding generation.

It is as if the European mechanical industry could not count on the support of the machine tools industry.

In the telecommunications sector, finally, the task is to establish a European market of new generations of equipment step by step. Electronic mail, video texts, data transmission: the entire gamut of new services is based and will remain based on an effective and economical communications systems. If Europe were to continue to maintain its practice of national identity as regards telecommunication techniques and networks, the setting up of most of the new services would be practically impossible.

CEDEFOP: The introduction of new technologies is accompanied by a certain fear of the unknown: fear not only of risks involved in the field of employment but also of anticipated upheavals in our social and economic structures: how can we prepare our societies for these changes?

E. DAVIGNON: It is evident that a technological revolution such as that of telematics will involve upheavals in the field of employment, in work conditions, and in professional relations.

We have often been asked to draw up a balance sheet of expected job losses and job gains resulting from the introduction of new technologies.

Numerous studies and forecasts have been published on this subject, but it is evident that nobody can make a definitive statement in this regard.

I think that it is by all means legitimate for the trade unions to raise these questions regarding future developments; furthermore, we are including persons carrying responsibility in the working world in our effort to elaborate an effective strategy. Particularly in Europe innovation is frequently looked upon as a menace, above all as regards employment. Having said this, I would add that I consider it somewhat hazardous to approach the problem solely from the standpoint of the equilibrium of employment.

But the lessons of history should not be ignored: in every epoch industry has had to adapt itself to new circumstances, always bearing social repercussions in mind. If, therefore, because of a fear of risks and of the unknown no effort is made at European level to participate in the technological revolution during the 1980s one thing is certain: there is no doubt that major problems will arise in the field of employment in Europe.

If, to put it another way, were to let our competitors share in the growing European telematics market, it could be comfortably wagered that they would be content to simply flood the market with new machines without creating any new jobs here in Europe.

CEDEFOP: And what about vocational trainig in this context?

E. DAVIGNON: This is a central problem. As my colleague Mr Vredeling has announced, the Commission will prepare at Community level a survey of needs in the field of vocational training arising from the introduction of new technologies. We have furthermore requested that at national level decisions be taken to carry out on a continuous basis an analysis of changes in the structure of employment. The proper response to the technological challenge does not consist in rejecting the machine but rather in making every effort to tame it. It is high time that a simple message be addressed to young people preparing for a career: it is now necessary to become accustomed to no longer thinking of a career as a specific occupation which will continue to be exercised without change right up to the age of retirement. The rapidity of changes linked with the introduction of new technologies implies the need for occupational adaptation on an almost permanent basis.

To make possible this adaptation, this flexible vocational training, this is the challenge which telematics poses to all those carrying responsibility in economic, political, and social life within the European Community.

'New technology': what direction is vocational training taking?

Arndt Sorge

Discussions on the relationship between technical development and vocational training are in general quite unsatisfactory not only from the standpoint of the researcher but also from that of the practitioner in vocational training and in industry. On the one hand thought is being given in some quarters to the question as to what demands *new technology* is placing on the educational system, in which connection the inevitableness of *technology* seen as a revolutionary factor of general import is taken for granted. Arguments of this nature pleading for qualification upgrading, qualification polarization, and the like are usually somewhat vague and much too generalized. All too frequently enthusiasm for broad trends obscures the demands of special pressure groups working quietly in the background. On the other hand resentment against technical innovations is gaining ground; experience gained with environmental pollution and the negative impact of large-scale industrial production are far too generalized, and every effort to adapt the educational system to the imperfect working world is stymied. It is felt that the main characteristic of current technical development is that it further intensifies the disadvantageous effects of past technical development.

Both approaches are too undifferentiated and too cumbersome for persons who are thinking seriously about the further development of vocational training. A more useful approach is to concentrate on inter-relationships instead of inevitabilities and to identify potential actions instead of deterministically hemming in creative thought. In order to avoid ending up in a fruitless effort to achieve technocratic harmonization, this approach must be taken precisely when a comparison is undertaken at European level. It would then be appropriate to consider the following questions:

☐ How is technical development to be viewed, particularly current technical development?

☐ What has brought about this development, what special motivating forces are currently at work?

☐ How can vocational training come to grips with current technical development?

These questions will be dealt with in sequence. Serving as basic documents are selected papers presented at a seminar on technical development and vocational training, held by CEDEFOP in Berlin on 18–21 November 1980. *

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Technical development

Discussions on technical development are frequently coloured by the great fascination exercised by *revolutions* or breakthroughs in development. Repeated usage of terms such as *technology innovation* and *basic innovation* create the impression that current technical development is above all the result of changes of a revolutionary nature stemming from scientific findings.

All too often the realization is emotionally repressed that these findings are of relatively little importance to technical development. Quite erroneously and all too frequently technical development is conceived as being tantamount to the application of scientific theories and findings. Of course this is true to a certain extent; but the art and the problem complex of technical development resides not in science-related specificities but rather in the imaginative creation and production of something which has hitherto not existed and which therefore cannot be observed, analysed, and with the help of experience-related knowledge described.

For microelectronics and its development, semi-conductors are now an old story. New scientific findings in the field of solid-state physics, which have made possible a steady increase in the integration density of switching circuits, are only peripheral to the problem of rendering the mass of electronic transistor functions contained in a component useful at practical level via the development of suitable software. The problem and task of the engineer is to find a solution which is completely undeterminable from the scientific standpoint. Furthermore, scientific findings frequently set in only after a technical development has occurred and the gaining of experience with this development has taken place.

It is admittedly often maintained that something in historical development has undergone a fundamental change, that the importance of the scientific basis has increased. This is certainly true insofar as more and more technical developments are based on scientific findings. Yet this by no means implies that the importance of pragmatic, imaginative experimentation and gadgetry has in turn decreased. In this sense the term *technology* is as misleading with respect to microelectronics as it is with respect to an axe in that it deceptively implies that the most important aspect of a technical development is the principle of *logic*.

Also misleading is the practice of speaking of technical revolutions. Certainly breakthroughs do occur now and then, without which further developments would be practically inconceivable. But the breakthrough itself, for example the construction of the first transistor, gains significance only by virtue of the subsequent development. Here again the importance of experimentation and gadgetry becomes evident. The uniqueness of technical

* Participating institutions:
Deutsches Institut für Wirtschaftsforschung (DIW), Berlin;
Wissenschaftszentrum Berlin (WZB), Berlin;
Laboratoire d'Economie et de Sociologie du Travail (LEST), Aix-en-Provence;
Analisi ricerche piani economici e sociali (ARPES), Rome;
Instituut voor Toegepaste Sociologie (ITS), Nijmegen;
Istituto per lo sviluppo della formazione professionale dei lavoratori (ISFOL), Rome;
Ministerie van Onderwijs en Wetenschappen, The Hague;
Ministerie van Sociale Zaken, The Hague;
Stichting interuniversitair instituut vor sociaalwetenschappelijk onderwijs (SISWO), Amsterdam;
Administrative Staff College, Henley-on-Thames.

development rests in the sequence of many small changes which in themselves differ one from the other only very insignificantly. The engineer thus tends to find the term *microelectronics* curious in that it somewhat arbitrarily emphasizes the importance of single technical developments.

Having characterized technical development as the continuous sequence of an endless number of equally important changes in detail and having stressed the impossibility of determining technical development via scientific logic, a further step is implied. Technical development then does not seem to lie in the nature of things or to be predetermined within itself, and the question arises as to where technical developments come from, if not from nature, from science, or from 'just happening', so to speak. Out of constant experimentation in an endless number of tiny steps two apparently contradictory characteristics emerge:

☐ on the one hand there are obviously manifold choice possibilities in a development sequence;

☐ on the other hand the selection of choices is oriented in specific directions, since otherwise there would be no harmonious development but rather a jumble of random changes.

It is clear that technical development is pushed forward by virtue of a process of give-and-take with social and economic conditions. Gadgetry and experimentation take place in the hope that the result will be of economic and social use. This implication is somewhat trivial, but it is often overlooked in assuming that a certain *technology* is automatically headed for a brilliant future. The problem is to identify those socio-economic conditions which motor technical development. Only when this has been accomplished fairly precisely can one speak of technical innovations. In the last analysis newness was always characteristic of technical developments. What do CNC machines, dialogue data processing, opto-electronics, biotechnologies, and similar developments have in common? There is no purely scientific or technical answer to this question, since these technical innovations are in fact not innovative but rather constitute consequent, step by step developments, and even microelectronics is common only to specific technical developments and delimitive only in an artificial way.

A machine tool linked to a computer (CNC = computer numerical control) is a further development of a traditional NC machine tool (NC = numerical control). The ever-tighter integration of electronic switching circuits and the rapidly sinking prices of each transistor function have made this development possible. The transition from the NC to the CNC machine is, however, an extremely smooth one. Similarly, it is not possible, on the basis of technical criteria, to divorce microelectronics, claimed to be *revolutionary,* from traditional electronics. Technically speaking, the above innovations are therefore in no way revolutionary.

In other terms, it is only against the socio-economic backdrop that that which is *new* in technical developments taking place in front of this backdrop can be determined.

Socio-economic challenges to current technical development

In the course of the last decade the logic governing the development of the national economies became bent. Up to the end of the 1960s post-war development leaned strongly on the increasing exploitation of ever-cheaper natural resources. This process was paralleled by expanding markets, specialization of production coupled with increasing mass production and consequent utilization of cost degression advantages, a trend towards ever-larger enterprise sizes, and the rapid spread of the practice of an international division of labour. Involved was a type of economy which drew its motivative power from *extensiveness.* This development was matched by a vertical differentiation and polarization of occupational qualifications. This logic has now been definitively bent by both natural and planned shortages of known, utilizable resources.

Now in process is a changeover to a more *intensive* type of national economy, from huge wheat farms to a much greater number of small farms, each growing a great variety of products. Industrial enterprises are diversifying their output and paying greater attention to the wishes of their customers; selective reductions in mass production and greater variety in component design are leading to a greater flexibility of production; craftsmanship is again coming to the fore. Rather than being expanded quantitatively, markets for specific products are now being differentiated qualitatively, even though no absolutely clear distinction can be drawn between these two phenomena. This applies to the baker and the mechanical engineering firm as well as to the bank and the manufacturer of electronic entertainment equipment.

This, then, is the backdrop in front of which technical innovations take root. As compared with the NC machine, the CNC machine is much better suited when greater component variety and more flexibility in mass production are aimed at. The wide-band cable enormously increases the flexibility of communication. Prefabricated parts mean less rigidity in standardized products. Bakers with a large assortment of bread do much better business than bakers with only a few varieties do. The same applies to farmers who bring high-quality products of many kinds onto the market. It is evident everywhere that market participation can be maintained and increased when products are further diversified and greater flexibility of production is achieved, and technical development is becoming more and more closely oriented towards such diversification and flexibility. A visit to any technical trade fair and a glimpse at the products being offered and the advertisements used makes this abundantly clear.

The corresponding trend in political, social, and economic organizational structure takes the form of a rising demand of smaller units for full autonomy. On the other hand, the growing negative tendency of national economies to wall themselves in and consequently the standstill in which European integration finds itself also stems from this phenomenon.

Technical development is thus inevitably linked to economic and social development, as is likewise vocational training. The main thing is to avoid viewing these trends as narrow constraints which vocational training must bow to. On the contrary, herein lies an opportunity to energetically push forward effort to achieve carefully planned vocational training for all who seek it. The inter-relationship is quite uncomplicated: when decentralization, diversification, flexibility, and intensive-oriented rather than extensive-oriented economies come into their own, the job-oriented practical skills of all workers come into demand. A firm is only as flexible and diversified as are the skills of its workers. The diversified practical skills of the workers stem, in turn from qualified vocational training which, rather than being just an appendage to formal education, is carefully tailored in each case to the manifold job tasks of a specific occupational group.

Orientation guides for vocational training

The vocational training systems in the EC Member States differ widely, and there would be little point in striving for standardization in view of the fact that the national situations are so diverse; social systems rightfully have too much weight of their own and too great a sense of continuity to expect any change. On the other hand certain parallel trends are discernible in all the Member States quite in spite of this diversity. Emphasis was formerly placed on formal school and university education, and this trend is now in too many cases still continuing. There is the conviction that new technical developments are stressing informatics and knowledge work and that the resultant qualification upgrading of future workers must therefore take place within the framework of formal school education. This argumentation is all too easily blinded by dichotomies which stem from a former phase of technical development: vocational training geared to *new technologies* is associated with

☐ information-processing activities,
☐ knowledge work instead of manual work,
☐ salaried-employee occupations instead of wage-earner occupations,
☐ tertiary-sector occupations instead of secondary-sector occupations.

Such associations are, certainly from the standpoint of their generality, misleading and indeed often erroneous. Of course diverse, completely justified national accents can be discerned at Member-State level. If, however, the premise that the socio-economic backdrop is the determinant of technical development is accepted, then this fact should not be ignored, certainly not in the case of technical innovations, since these latter lead nowhere if they are not imbedded in the respective socio-economic framework.

On the other hand there are parallel trends in the development of socio-economic conditions which in turn influence supranational trends in vocational training. These latter trends differ markedly from the associations listed above. The development of occupations in the field of information-processing belongs rather to the past than to the future. Instead we are now witnessing the integration of computer-aided information-processing into a great variety of occupations without these occupations in any way turning into information-processing occupations. The fact that information-processing has been mechanized implies merely that work has thereby become simpler and easier. Just as persons knowing very little about the construction mechanics involved can drive automobiles, so workers making use of computer-aided information-processing need only a basic knowledge of the construction techniques involved. The most striking example in this connection is the CNC lathe operator, who can now easily set up a computer-aided programme for his lathe. In other words, it is the ability of a technical innovation to become increasingly flexible, defect-proof and simple to use that ensures its widespread adoption. Likewise, the more computer-aided information-processing takes root and the simpler it becomes, the more decentralized it becomes. In the face of these trends the idea of a growing *information sector* is as ridiculous as is the idea that in the wake of motorization all the citizens of our countries must become automobile mechanics.

It is also important to warn against hastily placing emphasis on knowledge work. Certainly heavy manual work is now less common, but wherever tools are used, manual work is still necessary. It is precisely a national economy of the intensive type – examples being the renovation of old buildings, work in biologically sophisticated agriculture, and the handling of special customer wishes in industrial production – which places increasing value on manual work, now closely linked with knowledge work. More and more young people undergoing vocational training are shying away from one-sided knowledge work and are looking instead for a perfect synthesis of manual and knowledge work.

The line of distinction drawn between wage earners and salaried employees is obviously becoming increasingly artificial. How this situation can be changed and whether or not an institutional solution can be found depends less on technical development than on the sociocultural structure of the country involved. It is possible that wage-earner occupations will be transformed into salaried-employee occupations more rapidly in France and Italy than in the Federal Republic of Germany, where the class-distinction element of the social structure tends rather to underpin the parallel existence of workers and employees in the working world.

A characteristic of each viable technical innovation is the changing or elimination of both existing occupations and vocational training at the basis of these occupations. This has often been used as an argument to emphasize that the loss of jobs is a concomitant phenomenon of increasingly rapid technical change and thus to give formal education preference over vocational training on the assumption that young people who have the broadest theoretical knowledge will be the most successful as workers in meeting the challenge of technical change. The falseness of this argument is becoming increasingly clearer. Ability to adapt, opportunity to work independently, and continuing education possibilities in working life depend not so much on general theoretical knowledge as on a broad spectrum of practical skills acquired at the beginning of working life. In this sense occupational specialization is a precondition of occupational mobility. Persons who have in actual practice familiarized themselves with all the skills of a particular occupation will find it much easier to learn more later in order to move up the career ladder. Solid, practice-related, basic vocational training is a prerequisite to any adequate adjustment to the demands of the working world. Only when we have learned to learn can we learn more; this conclusion is pretty well generally accepted. However, coupled with this must be the realization that only that which we actually do is what we have really learned. Consequenly, vocational training must aim at the transmission of practical skills rather than general theoretical knowledge. As soon as this lesson is learned, vocational training can so move forward rather than fearing that we are being threatened or hemmed in by technical development, we can look with confidence and hope to the future.

Break the vicious circle!

An interview with Burkart Lutz

Director, Institute for Social Science Research, Munich. The Institute, founded in 1965, is concerned with problems and aspects of labour market structure, qualification development, and vocational training. Financed exclusively by research projects, the Institute now has roughly 20 scientists on its permanent staff.

CEDEFOP: Professor Lutz, we are hearing a great deal these days about technical progress and new technologies. How do you judge the way in which this discussion is being conducted, particularly with regard to questions concerning qualifications development and vocational training?

Burkart Lutz: This discussion is being dominated by simplifications and mystical colourings which are very dangerous. Particularly in connection with microprocessors the very complicated inter-relationships between the development of a new technological principle, its penetration into various fields of application, the resultant changes in the respective technical processes relating to products and production, and the quantitative and qualitative development of human labour are for the most part seldom taken into account. It is assumed that the development sparked off by microelectronics is an homogenous, coherent process whose problems could be solved by a homogenous, coherent policy at European level, although the changes in qualification structure and qualification requirements which can be observed in the wake of the inroads being made by microelectronics differ from country to country not only according to branch but also according to industrial tradition, labour market structure, prevailing types of company organization, and, last but not least, national educational systems.

CEDEFOP: If the application of new technologies has led to such varying consequences and problems, do you feel that it is at all possible to arrive at a common policy of vocational training?

Burkart Lutz: It is my conviction that in the light of current problems and those that can be expected to arise in the future it is very possible that common principles and guidelines of vocational training policy can be established. However, in view of the challenge raised by new technologies the opportunity and indeed the need to find a European answer cannot be assumed to stem from the technical characteristics of these new technologies; the commonalities of the problematic situation must be sought elsewhere. I find three characteristics common to all the Member States to be of particular importance.
Firstly, nearly all the economic sectors in all the Member States are being increasingly constrained to step up productivity. The tempo of technical-organizational changes in firms and workplaces has obviously increased. Entire economic sectors and in-firm functions which can be termed 'tertiary' by way of simplification and which in the past have provided a great many additional and generally very attractive jobs are being increasingly affected by rationalization and mechanization measures.
These technical-organizational changes are extremely varied as to detail; common to them all is the accelerated tempo and the practically open-ended process of dissemination.
The second common characteristic of the present situation is the likewise rapid and fundamental change taking place in the educational and vocational training system, which in turn leads to changes in the flow of young people coming onto the labour market and in the qualification structure of this group. In order to stress how important the role of this trend is *vis-à-vis* the challenge of new technologies and common European vocational training policy, a third aspect must be gone into.
The third common characteristic of the present situation stems from the fact that in the wake of the many techno-scientific innovations of the past decade – among which microelectronics, although very important, is nevertheless one among many – the relationship between human labour and technical processes has become more amenable to adaptation and more flexible than ever before: as a result of the increasing mechanization and automation of production processes, human labour is no longer viewed as, if you will, a factor of production; no longer closely woven into the technical process, work is now distanced from it. Decisive now is the design and development of 'interfaces', to use a term taken from informatics, between the worker and the technical process. Even where the same technical processes are involved, these interfaces can be very diverse, and often very small technical changes which at first glance do not seem important at all can have far-reaching implications for human labour and qualification requirements.

CEDEFOP: Can you give us an example of this?

Burkart Lutz: A good example is the computerized numerical control of machines. This technology (CNC) has spread rapidly in recent years, thanks to the fact that it permits much more flexible utilization of the machines than was the case with traditional numerical control (NC). CNC machines are now being used in many different ways and run by workers having extremely different qualifications; above all when they are linked via direct numerical control to a central computer, CNC machines lead, even in small- and medium-scale mass production, to the complete deskilling of the machine workers. When, on the other hand, use is made of the possibility of setting up programmes in direct dialogue with CNC machines, qualified tasks can be taken away from the technical bureau and transferred back to the workshop. The skilled worker is the ideal partner for a CNC machine programmed in the workshop; there is conviction in the workshop that only a highly-qualified technician can handle this task. In some countries the use of CNC machines is typical for large firms; in Italy there are apparently a growing number of very small firms which place great value on this type of machine in view of its great flexibility and higher output capacity. But to return to the example. Behind all these considerations there is a common, uniform basis upon which also vocational training policy can react: the extremely divergent working situations and types of work organization which characterize technologically-identical machines in turn reflect the varying qualification structure of available manpower.

CEDEFOP: Are you saying that occupational qualification and vocational training are not dependent variables of technical development?

Burkart Lutz: That I am. According to a widely held, but certainly no longer scientifically tenable, opinion, technical development can be compared to a majestic river which seeks its own course and cuts its own bed; the main task of vocational training is then to make certain that the qualifications of the workers are adapted to this development in good time. I am convinced that this comparison is completely without foundation. On the contrary, the qualifications of employed manpower definitely influence the way in which the man-machine relationship develops and consequently also influence to varying degrees the technological development process itself. This has been the case ever since man began to work with machines, but it is even truer today, now that advancing mechanization and automation have made possible such a flexible combination of technical processes and human labour.

CEDEFOP: What role do microprocessors play in this connection?

Burkart Lutz: As I have already said, microprocessors acquire an aura of mystification when it is implied that direct consequences for vocational training can be deduced from technological principles governing the production and application of microelectronics. This assumption is just as erroneous as would be the case, were we to assume that the expected favourable development of the price-output ratio for microprocessors or the gradual reduction in their size would automatically lead to the discharge of workers. Of course the very much smaller microelectronic components of much higher output which are now available at much less cost have made the man-machine relationship considerably more flexible. We can easily imagine two comparable production plants or two administrations with the same tasks but with many different types of work organization which combine workers with totally different education and training backgrounds and varying qualifications without there being any great difference in the profitability of these plants or the effectiveness of these administrations. Of course we must have no illusions. What is both conceivable and possible need to necessarily become a reality. Firms nearly always prefer conservative, time-proven structures and solutions. And engineers frequently tend to neglect what they feel to be secondary problems, even though it is the solutions themselves which decide whether a certain job is interesting or monotonous and promising or not of responsibility and initiative and qualification upgrading.

CEDEFOP: How, then, can vocational training orient itself, if the future development is so open?

Burkart Lutz: What we need is a vocational training which has the courage to join in the task of designing the future. This is exactly the opposite from that which is often being called for today, namely, timely preparation on the part of education and vocational training for a technical development in which they have no say whatsoever. This of course makes it very easy for the decision-maker in the field of education or vocational training. His sole responsibility is then to make certain that the manpower demand forecast which he either undertakes himself or commissions is correctly calculated. If, however, policy accepts the premise that the structure of the educational and training system influences the future development of work, production, and technology, then it finds itself caught in a vicious circle which it has possibly helped set in motion.

CEDEFOP: What vicious circle are you referring to?

Burkart Lutz: This vicious circle stems from two development processes which began in our countries about two decades ago and have had an intensifying effect on each other. This has led to a steadily growing contradiction between the expectations with which most young people enter the labour market and actual working conditions.

As a reaction to the labour market conditions which prevailed in the 1960s and the early 1970s, conditions in many respects similar to those which gave rise to Taylorism in the United States at the turn of the century, the firms have used the margin of play open to them in work organization and in the man-machine relationship to create, via a more rigid horizontal and vertical division of labour, many jobs calling for very low qualifications only. These jobs, which were first filled by migrant workers and low-skill workers leaving agriculture for the cities, naturally became in the course of time unacceptable to young people to the degree that their qualifications improved. This in turn, and

this is the second mechanism at work, has fed the tendency of young people, supported by their parents, to work hard at school in order to earn a certificate which will open up the way to a good job. Consequently, fewer and fewer young people, particularly those with at least average ability, are willing to prepare themselves for just a low-skill job in the factory or the office.
A growing number of young people are therefore finding themselves squeezed in between development in the educational system and development in employment structures, developments which are moving in different directions and influencing each other.

CEDEFOP: What lesson has vocational training to learn from this? Is it not thereby becoming increasingly discredited?

Burkart Lutz: Yes. The perversity and the drama of this situation is that in their own interest young people are finding themselves compelled before entry into working life to learn a great many things which are of little use to the national economy and to strive for a high level of education; they thus neglect to acquire directly applicable occupational skills which the national economy is in dire need of.

CEDEFOP: How can this development be stopped?

Burkart Lutz: The aim must be to make work so attractive again that more and more young people will opt for qualified vocational training. This is, however, only possible to the degree that in their decisions on the introduction of new technologies, the firms and indeed the engineers in the firm engineering departments count on the availability of qualified skilled workers in sufficient volume. This probably means that for a certain period of time training must run ahead of the actual development of working conditions. This is very difficult to achieve, because it implies that young people must be persuaded not to work for higher school certificates even though, at least for the time being, the jobs that would correspond with their training level are not attractive enough. But if we do not succeed in this effort, we in Europe will find ourselves in the same state in which the United States now finds itself, one in which willingness to do low-skill jobs can be expected only from the weakest social groups, particularly the various minority groups.

CEDEFOP: Whate role can vocational training play in this connection? To what extent can it influence the development of the relationship between technology and human labour?

Burkart Lutz: First of all we must openly admit that we have no knowledgeable answer to this question. The only thing we can do in attempting to describe what a future-oriented vocational training should look like, which does not just adapt itself to assumed technological developments but rather consciously influences the application of new technologies, is to formulate a number of general principles and more or less well-founded assumptions.

CEDEFOP: For example?

Burkart Lutz: It is very important, in my opinion, that basic vocational training achieves a balance between two prerequisites. It must transmit those general concepts, insights, and skills to the learners which will enable them to continue learning throughout their working life; on the other hand this training must be so practice-related that the learners can do productive work without instruction from others soon after they have completed their training. In the discussion on education and vocational training this second prerequisite has been systematically neglected for two decades now. The conviction has prevailed that the training spectrum for a specific occupation can be broadened by rendering the training curriculum increasing abstract and general. This, I feel, is a very basic error. Com-

The aim must be to make work again so attractive that more and more young people will opt for qualified vocational training.

pletely forgotten has been the fact that productive work is always something practical and concrete. Only those persons who in the course of their vocational training have gained concrete experience and have been prepared for working life at practical level can expect to find employment where they can further qualify themselves. A young worker who knows only the theory of his occupation is of little actual use to his firm. If he is lucky, his firm lets him undergo a period of practical training which, however, will, in all probability, not cover the entire spectrum of his occupation but only that very small part in which the firm is interested; his qualification is then primarily firm-specific and thus restricts his career opportunity to a single firm. Or the firm is not interested in or has no possibility of letting the young worker who has only a general knowledge of his occupation undergo practical training; the best it can offer is to let him do simple tasks which teach him nothing.

CEDEFOP: What message would this have for the relationship between vocational training and formal education?

Burkart Lutz: Without doubt the formal school system as it has developed in all European countries serves to ensure its graduates privileged jobs within a tight structure of social injustice and to justify this situation. Certainly to the extent that even today remains of this powerful social function are still around, we must expect not only rivalry but also open conflicts between the formal educational system and a vocational training system which is attempting to strike a balance, as I remarked earlier. I hope very much that we shall one day succeed in harmonizing formal schooling with vocational training. In the present circumstances I tend very strongly towards the conviction that it is above all necessary to first establish a very viable vocational training system before any effort is undertaken to integrate vocational training and formal education, vocational training institutions and educational institutions.

We must not assume that this vicious circle can be broken by simply attacking it at the level of basic vocational training and young people. It is my conviction that adult training should likewise be assigned a strategic role in this endeavour. In contrast to the generally prevelant practice, of course, all efforts must be directed towards the very large body of wage earners and salaried employees holding simple jobs and for the most part having no systematically acquired qualification who cannot by themselves overcome their strong aversion to learning. In most of the economic sectors these workers constitute the large majority of the labour force. Precisely because they are present in such large numbers, they are pushing the development of job structures in the direction of deskilling, and this trend will continue unless we succeed in enabling them to undergo training aimed at transmitting general, theoretical, job-related knowledge which will effectively supplement their job experience and job routine.

CEDEFOP: You stated that pre-occupational vocational training should be sufficiently general and at the same time sufficiently concrete. Are you thinking in this connection of the so-called *alternating training strategy*?

Burkart Lutz: I do not think that we can call alternating training a strategy. What we have here at most is an instrument making use of a strategy. We must first define a strategy before we can discuss what function alternating training can discharge within this strategy; I feel that the term 'alternating training' can logically only imply more or less long periods of practical work experience integrated into a full-length course of vocational training. There are certainly a great many alternating training measures which in no way correspond with this definition; such measures are in all probability not only completely useless but indeed highly counterproductive in that by showing young people what working conditions actually prevail in the firm and at the workplace they motivate young people even further to complete their formal schooling so as to earn a certificate which will enable them to start on the good side of working life. Alternating training is a difficult and even dangerous instrument to use precisely because within the framework of a comprehensive qualification strategy it could have such an important function to discharge. I really do believe that actual practice and observation, which must be part of every genuine vocational training, must take place at alternating learning sites and involve varying subject-matter and learning methods, but this by no means implies that spending whatever period of time in whatever workshop has any qualification value whatsoever.

CEDEFOP: Finally, what role could the European Community play in this connection in spite of the extremely diverse situations which characterize the individual Member States and the economic sectors?

Burkart Lutz: I believe that the European Community could play an extremely important role, not, however, in spite of but precisely because of the great diversity of the national situations. Political decision-makers look far too seldom across the borders of their own countries and generally tend to consider national development and the structures which then ensue as something dictated by nature and therefore quite inevitable. It is precisely this great diversity of national situations characterizing the European Community which sharply underlines the opportunity and indeed the need to implement an active vocational training policy at national level.

From the single-skill worker to the multi-skill worker

Alessandro Fantoli

Automation, qualification, and training

In connection with the subject-matter of this article, namely, automation, qualification, and training, there now exists a large body of both general and specialized literature, and I therefore do not feel that within the space allotted to me I should review or draw on this material. Although my approach must perforce be schematic in nature, I would rather address myself to the development of a number of areas of consideration in order to encourage further thought and help launch a more profound discussion.

Hidden behind the apparent abstractness characterizing these areas of consideration are concrete realities encountered in the course of many years of experience in company management and applied research work.

Technology and work organization

The identification of qualifications required in a production system is one of the functions of work organization, which latter determines and designs the individual workplaces.

In turn, work organization is itself a function of the characteristics of technology, the (objective and subjective) characteristics of the labour force, and the play of forces among the social groups.

There is thus no deterministic relationship between technology and work organization in the sense that specific technological solutions correspond necessarily to specific models of work organization; in other words, the ratio between technology and work organization is not that of 1 : 1 but rather that of 1 : n in that even though a certain type of technology may exclude the possibility of adopting certain work organization models, all types of technologies permit the adoption, to a greater or lesser degree, of organization models of one type or another.

Thus in no event does technology automatically dictate selection; rather, technology and appropriate work organization are functions of general strategies at economic and social level.

Human labour as an appendage of single-skill machines

The widespread process of industrialization which has taken place in the course of this century is characterized by the use of a specific work organization model (we will call it Taylorism for the sake of simplicity). The characteristics of Taylorism can be summarized as follows:

○ radical separation between the conception and the execution of work: this is reflected in an organizational structure which distinguishes sharply between those responsible for conceiving, planning, and programming of production and those who execute the actual work operations required in a production process;

○ fragmentation of work into small, repetitive, low-skill jobs which can be quickly done. Each job and hence each work assignment consists of a very small, isolated work segment of a sequence of operations which in most cases are complete within themselves, leading to a production result which can be identified only at department or indeed at factory level;

○ separation of the tasks of scheduling production, providing equipment, and feeding machines as well as those of actual production, quality control, and maintenance one from the other and their assignment to workers among whom there is in general no relationship of direct interaction;

○ analytical planning of all operations by special services; such planning serves not only as a technical instrument of organization but also as a means of controlling the profitability of the operations

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Human labour is changing in quality: no longer simply an appendage of single-skill machines, it is rapidly becoming an integral part of the complex process of production.

* ARPES: Analyses, research, economic and social plans, Rome.

and the level of productivity of the workers.

By virtue of the division and fragmentation of work the production system tends to create (design) jobs of high 'fungibility' which can be filled by a growing supply of manpower (farm labour, women, illiterates); the possibility of drawing on continually new sources of manpower (either indigenous workers or migrant workers) has in turn led to marked increases in productivity achieved by coupling advanced technology with the utilization of workers whose qualifications correspond with the low level of manpower productivity required.

Highly compatible with this organizational system from the standpoint of effectiveness is the technological system characterized by mechanization.
A mechanized process can be described as a process involving a set of simple, specialized machines operated by low-skill workers and incorporating, via applied science, operations previously executed by highly- skilled workers; control of the process of manufacture and elimination of problems which may arise is placed in the hands of a limited number of supervisors; the tasks of planning, programming, and coordinating the set of machines and the installations do not constitute part of the production process but are instead assigned to a team of specialists and technologists. Every operation and every modality of intervention, be it in connection with the product or the machines, is envisaged and predetermined in detail; single-skill machines, single-skill workers appendaged to single-skill machines; a limited number of individuals conceive, design, coordinate, control, and regulate the entire production process.
Applied science has incorporated the worker (his experience) into the machine.

Human labour as an element of the complex process of production

The situation described above is now in the process of innovative change. I believe that we can speak of a major innovation, even though the modality of the innovation and the graduality of its introduction lead us to believe that we have to do with the acceleration of a 'continuum' rather than with a genuine, profound modification of the chracteristics of the production process.
Indeed, the process of automated manufacture is characterized mainly by integrated pieces of equipment which operate independently of human labour, proceeding directly to control product-processing operations and to intervene whenever necessary for the purpose of regulation or correction; involved is a complex, interdependent, self-regulatory process: applied science has been incorporated not only in the individual single-skill machines but also in the complex process of production. Gone are the manual production tasks and much of the work of control and regulation, gone are the single-skill workers and most of the supervisors; on the other hand the tasks of conception, planning,and coordination are gaining in importance.

Human labour is changing in quality: no longer simply an appendage of single-skill machines, it is rapidly becoming an integral part of the complex process of production.
Under these conditions it can be assumed that automation is in fact capable of eliminating the highly negative aspects of the dequalification of manpower (single-skill jobs, dichotomy between knowledge work and manual work) which typify a mechanized process, one within which, given the fact that from 60 to 70 % of the operations required in a production process are repetitive single-skill operations, it is very difficult to design new models of work organization aimed at ensuring a considerable rise in qualification level: even if supervision is effectively reduced and if part of the creative work is redistributed so as to decentralize decision-making, a good percentage of manual labour operations will necessarily still be required in the production process.
When a production process is to a considerable extent already automated, this percentage is considerably reduced, leaving a larger margin of freedom for the introduction of new organizational models which call for a change in manpower qualification: from the single-skill worker to the multi-skill worker.
If this hypothetical model is correct, its impact on the work force, on employment levels, and on qualifications and relevant training required would be of great significance.
Employment levels in the production sectors would automatically drop not only because of the disappearance of the majority of manual jobs but also because of the elimination of a good number of tertiary occupations (programming, process and product quality control, supervision, line management control), an increase in which characterized the final period of the application of the Taylor model: * many of these teritary occupations would in fact become incorporated in the direct process of production via either microprocessors or the capillary diffusion of information systems.

Quite naturally parallelling these reductions would be the development of activities of a creative nature such as the conception, planning, design, and implementation of new integrated processes, new information systems, microprocessors, etc.; nevertheless it appears to me to be sufficiently evident, obviously at a parity of goods produced and annual duration of work, that from a purely numerical standpoint the algebraic sum would be a minus one.
It therefore does not seem realistic to expect that the modifications hypothesized above could be implemented within relatively short periods of time: there is considerable viscosity within the production apparatus and this tends to slow down the process of innovation diffusion. Firstly, there is the tremendous patrimony of installations still to be amortized; secondly, there is the cautious, indeed anxious attitude of management personnel who have a very scant knowledge of advanced technology and whose training, although of a high level, differs from that required to give assurance of being 'in control' of a new situation, of 'keeping under control' the innovative process; thirdly, there is the great distrust on the part of both wage earners and salaried employees, who feel themselves threatened both individually and as actors in an historical process by a profound transformation of job content.

Qualification, training

With regard to occupational qualification and the relevant training involved, there is no doubt that a multi-skill worker will be required to have on average a level of

* With the passage of time the disadvantages of the Taylor model have become increasingly troublesome: rigidity, bureaucratic sluggishness of the control system, and proliferation of the teritary sector (planning, programming, maintenance, quailty, information system, etc.) within the production process.

qualification which is considerably higher than that now prevailing, however different it may be.

The complexity of work increases to the same extent that the work of each operator is geared no longer to single-skill machines but rather to a *system* which is complex, interdependent, and self-regulatory.

Likewise expanded are the tasks of conception and of the creation of processes, characterized by a much greater degree of flexibility: the degree of autonomy of work increases as the number of alternatives open for selection increases.

More autonomy and greater complexity implies a different quality of work, a higher occupational qualification, and a homogenization of learning processes which are typical for the various levels of operation. In the mechanized process the production worker experiences a sort of spontaneous learning which starts with the perception of signals emitted directly from the product and the machine. Via trial and error and the passage of experienced-filled time, these signals gradually become interpreted on the basis of production processes. The engineer, on the other hand, proceeds from an abstract concept of the production process in terms of physico-mathematical variables learned in school, a concept which is later verified on the basis of observation.

The dichotomy between learning processes is tending to disappear inasmuch as the body of workers must intervene, even though at different levels, in a complex system of production and act and dialogue with physico-mathematical variables which are identical even though applied to diverse segments of the process.

The multi-skill worker should by no means be envisaged as a systems technician, even when highly systemized knowledge at diversified levels of in-depth treatment (mathematics, physics, cybernetics, etc.) is involved.

We are concerned, in essence, with a homogeneity of functional language: if the most significant aspect of relationships within the material process itself and between this process and the workers is communication, then comprehension of one and the same functional language is the key factor and hence indispensable to the smooth functioning of the entire process. The dichotomy of the learning processes which by virtue of its tendency to encourage a positive dialectical synthesis could in a mechanized process serve as a means of developing the production system would have, by contrast, a paralysing effect in an automated process.

The teaching of functional language thus becomes the focal point of training, the indispensable *toile de fond* of innovation, of the technological leap with which we are now confronted.

The focusing of training on functional language is, necessarily, a prerequisite to the conception and creation of advanced technology whereas training in specific technical languages is required for the implementation of individual, technologically-advanced production processes.

Precisely with regard to training policies and their implementation I do not believe that it is possible to speak of an *exclusive influence* being exterted by information technologies. Such policies are in fact already strongly conditioned by a series of variables functioning both within and outside the firms (internal variables are organizational and contractual in nature, external variables are mainly inherent in the consolidated structure of the educational system and in local and supra-local labour markets), and it can be hypothesized that particularly with regard to this assumption a discrepancy exists between current training strategies and practices and emerging training needs. This conflict can in some cases negatively influence and indeed retard the development and consistent utilization of relevant information.
In other words, given the traditional approaches and attitudes as regards vocational training (gap between school education and work experience, failure to coordinate technological changes with pedagogical programmes and methods, among others) it is sufficiently realistic to assume that in the field of training the conflict with information-related innovation will be resolved, at least in the early stages, to the disadvantage of the latter. At this point two partly converging possibilities would open up: a postponement of the utilization of new technologies in certain disadvantaged production situations and/or the introduction of these technologies at random (this is the most likely approach) with the effect of provoking a flare up in conflicts already raging in the field of training.
In a situation of this nature the interests of the strongest (or protected) sectors of the labour force would prevail to the detriment of the marginal groups excluded from the consolidated circuits of the labour market and training.

Conclusion

As with every organized community, a production system is not the result solely of a logical-mathematical rationale; the factors of production, namely, technology and manpower, do not combine on the basis of abstract, absolute rules, they combine in order to enable a specific society to achieve established economic and social objectives.
In other words, its objectives stress not only maximum efficiency but also, and indeed primarily, maximum efficacy in that they correspond not with the simple logic of mathematical rationality but with the logical tenets of political science. They place considerable importance on technology and its development but nevertheless adhere to the principle that evolution in the field of production is essentially a function of political and economic objectives which a society sets itself within a specific historical context.

The above reflections and affirmations in connection with the areas of consideration dealt with can therefore acquire varying historical connotations according to the play of forces prevailing within each nation and between nations (or groups of nations).

Peter Senker

Impacts of technological change on skills in the engineering industry

This industry is important, both as a large employer (see Table 1) and because engineering skills are also needed in other industries. Equipment produced by the engineering industry is used throughout the economy. Examples are computers, mechanical handling equipment, motor-cars and television sets, all of which require maintenance by people with engineering skills. The widespread use of engineering products implies that changes in skills needed are likely also to be widespread if engineering products change significantly.

Table 1

Wage earners and salaried employees in manufacturing and engineering (selected countries) 1977

	Total manufacturing ('000)	*Manufacture of fabricated metal products, machinery and equipment ('000)*	*%*
United States	19 647	8 257	42.0
Japan	7 195	3 207	44.6
France	5 419	2 297	42.4
FR of Germany	8 268	3 899	47.2
United Kingdom	7 352	3 300	44.9

Source: OECD, Labour Force Statistics, 1966–1977, Paris, 1979.

The present gloomy economic climate, with high or rising levels of unemployment in Italy, the United Kingdom, France, the Netherlands, Belgium and the Federal Republic of Germany, may affect the rate of technological change, especially as there is evidence that manufacturing employment may be experiencing long-term structural decline. * The engineering industry is very diverse. The central manufacturing function performed by engineering firms is the transformation of metal into finished products. Materials other than metal are also used – for example, glass, rubber and increasingly plastics.

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* See R. Rothwell and W. Zegveld, *Technical Change and Employment,* Frances Pinter (Publishers) Ltd, London, 1979.

The main types of products manufactured can be broadly classified into:

MECHANICAL ENGINEERING. A large proportion of the products of this sector are production machinery, for example, agricultural machinery, machine-tools, textile machinery, construction machines, mechanical-handling equipment.

VEHICLES. This category includes motor-cars, commercial vehicles and aircraft.

INSTRUMENT AND ELECTRICAL ENGINEERING. Office and data-processing machinery include growing areas where the use of electronics is becoming increasingly dominant. Capital equipment such as telephone exchanges and broadcast transmitters and domestic equipment, such as radios and television sets, are all very dependent on electronics.

In addition, a vast range of miscellaneous metal goods are manufactured.

Skill implications of technological change

PRODUCT CHANGE. Table 2 classifies the impact of micro-electronics on products and systems in various sectors of the engineering industry in the United Kingdom.

The principal impacts of new product technology on manual skill requirements are likely to be felt in those areas where electronic products are already established, or where they are taking over from products based on older technologies. The following examples of implications for skill requirements are taken from a recent study. **

THE ELECTRONICS INDUSTRY. The development of increasingly sophisticated test equipment and changes in product design have deskilled much testing work, but some remains very highly skilled. Because of increased component integration, new products have less circuits to test, and plug-in modules are used more widely. More of the testing is 'go/no-go' and instruments display information which is easy to interpret. This testing is less skilled than before and is performed by semi-skilled female operators. However, the requirements for highly skilled testers, for example, for large or complex installations, is as great as before. Previously, less skilled testers could move easily to more highly skilled work. Now, formal training is necessary.

SUBSTITUTION OF MICROELECTRONIC PRODUCTS FOR PRODUCTS BASED ON OLDER TECHNOLOGIES. A firm introducing microprocessor-based telephone equipment to replace electromechanical equipment anticipated that their installation and commissioning staff would be halved within two years. In a further year and a half, when teething problems will have been dealt with, this number will be halved again.

But electronic equipment based on microprocessors requires some new, higher level skills within the installing and commissioning workforce. The firm devised a

** N. Swords-Isherwood and P. Senker, *Microelectronics and the Engineering Industry: The Need for Skills,* Frances Pinter (Publishers) Ltd, London, 1980.

procedure to select employees with the necessary aptitudes. All employees, including some who had been performing semi-skilled work, were invited to apply. Those passing the selection test, including some semi-skilled workers, were sent on training courses. The company trained a small corps of installers capable of dealing with most of the problems of the new electronic equipment.

Table 2

Impact of microelectronics on engineering products and systems

Most significant product/system impact	Principal sectors affected	Sector employment '000s Feb. 1980	Total	% of industry employment
New and improved electronic products	☐ Electronics industry	316	316	10.6
Products based on micro-electronics substituting for products based on older technologies	☐ Instrument engineering	144		
	☐ Office machinery	22		
	☐ Telegraph and telephone apparatus and equipment	64	230	7.7
Enhanced performance from products and systems based on microelectronics	☐ Mechanical engineering	842		
	☐ Electrical engineering except electronics	351		
	☐ Tractors, cars and cycles	487		
	☐ Aerospace equipment	200		
	☐ Railway equipment	44	1 924	64.6
Miscellaneous	☐ Metal goods not elsewhere specified	511	511	17.1
Total UK engineering industry		2 981		100.0

Source: Department of Employment, London, 1979

IMPACTS OF MANUFACTURING PROCESS CHANGE. Manufacturing process changes embodying microelectronic components are occurring throughout manufacturing industry. Most such changes can be classified broadly as automation. Numerically controlled machining of batches of components (NC) has probably been the most important form of automation in the engineering industry for many years and NC has become particularly important in electrical, instrument and mechanical-engineering sectors. NC machines first became available in the early 1950s. By 1970, numerical control systems could provide all the basic control systems for both traditional machine-tools and for more complex machining centres which had been developed specially to allow the maximum number of different machining operations on a component at a single setting. At this time, systems were all hard-wired and special purpose. Separate controllers had to be designed for each type of machine. The need for large computers for computer-aided part programming tended to concentrate the use of NC in the larger, more sophisticated firms. But by then, minicomputer prices had fallen to the point where it was economic to build an NC system around a standard minicomputer. The main feature of such computer numerical control (CNC) systems is their flexibility. The features provided can be changed by altering the control programme. More extensive diagnostics can be provided by CNC systems. All new systems now incorporate microprocessors and this has made possible cheaper and more reliable systems, which usually offer more features at the same price as the equivalent hard-wired systems.

We carried out a study* based on a series of detailed interviews in a sample of six machine-shops in the UK matched as closely as possible by size and industry with six in the Federal Republic of Germany. Two German companies were experiencing skill shortages. Both were in the most heavily industrialized area in the Federal Republic of Germany. One was overcoming this by training migrant workers. Training these men who came from rural areas was a difficult task for production engineers and supervisors. Skill shortage problems were somewhat more widespread in the UK. Four of the firms interviewed had problems in obtaining sufficient craftsmen. This could be partly because the demarcation between craftsmen and semi-skilled workers is not so closely defined in the Federal Republic of Germany as in Britain. For example, one of the German firms which suffered craftsmen shortages was able to solve the problem by upgrading semi-skilled workers relatively quickly. The use of numerically controlled machine-tools; and of other advanced machinery, such as robotic welding equipment, places increased demands on maintenance functions. Preliminary results from a survey undertaken in 1980 in the UK indicate that the use of more automated equipment is likely to increase demands for new electronics maintenance skills. Although some manufacturers of advanced production machinery have suggested that maintenance skill needs will be reduced by the use of automatic diagnostic equipment, present equipment is only capable of diagnosing some electrical faults. It is likely to be many years before such equipment is sufficiently sophisticated and comprehensive to deskill maintenance tasks.

The author is grateful to the United Kingdom Engineering Industry Training Board for sponsoring most of the research on which this paper is based. The opinions expressed are the author's alone.

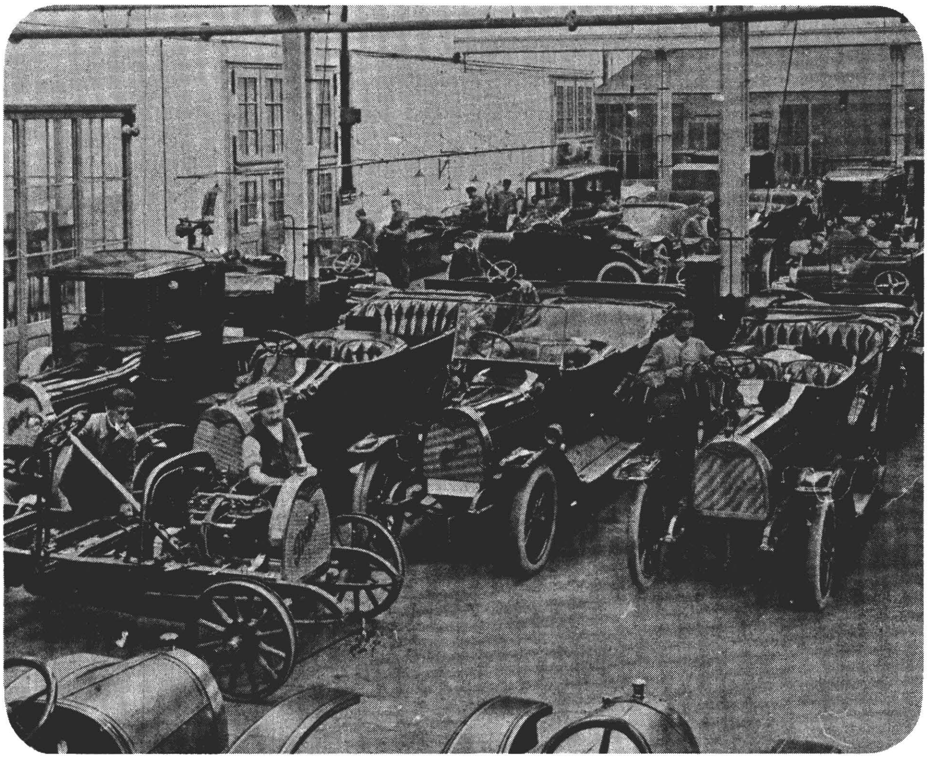
* N. Swords-Isherwood and P. Senker, 'Social Implications of ASP', Chapter 2 in *Automated Small-batch Production,* National Engineering Laboratory, Department of Industry, London, 1978.

Daniela Pescarollo

The automobile sector: technological development and vocational training

'Mechanization is increasingly reducing the quantity and intensity of physical energy expended in labor ... Now automation seems to alter qualitatively the relation between dead and living labor; it tends toward the point where productivity is determined by the machines and not by the individual output.'

H. Marcuse,
One-Dimensional Man, 1964



In Italy the automobile sector is making extensive use of the mass media in order to provide the general public almost daily with relevant information.

The Alfa-Nissan agreement and the case of the 24 000 workers at Fiat who were receiving unemployment benefits dominated the front pages of the daily newspapers for months; not only relevant news items on which the newspaper information was based but also some of the more serious aspects of industrial policy involved were dealt with.

Public interest in this sector stems from a number of characteristic factors which are of both national and international significance:

- with 300 000 workers and with roughly 1 000 000 other workers in the upstream companies and the services network, the automobile sector accounts for a high percentage of industrial employment in Italy;
- being so greatly dependent on phenomena linked with the energy problem and confronted in growing measure with competition on the world market, the sector is definitively drawn in as an actor in connection with economic policy at international level;
- the processes of organizational and technological reorganization ongoing within the sector and determined by factors mentioned above have led to the sector automatically becoming a key point of reference within the new organization of industrial production;
- finally, the signs of dissatisfaction and uneasiness being manifested at various social levels and the resultant call for an improvement in the quality of working life have had a new type of impact on the management of industrial relations in that the demand for improved social status has taken precedence over the demand for improved economic status.

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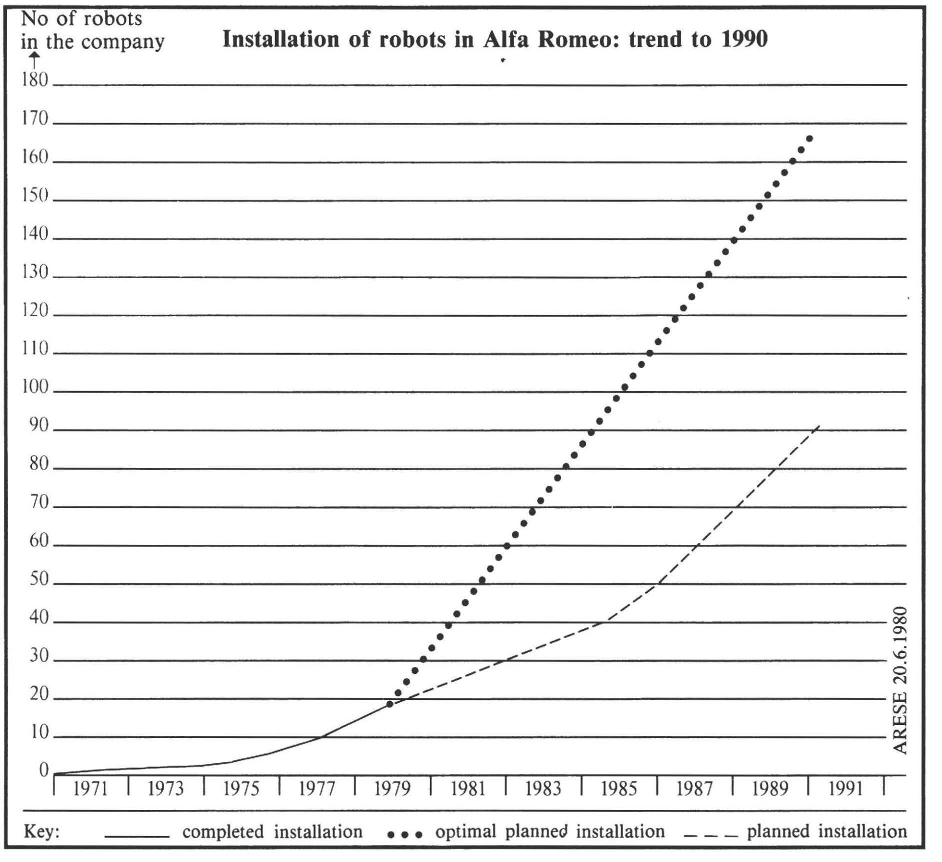


It is against this background that the events, dynamics, and changes typical of the individual automobile companies must be interpreted.

One aspect of the ongoing change is of particular interest here, namely, the problem of new occupations and corresponding training, both of which are correlated with a new technological and organizational system now being introduced in certain areas of the production process and in the services of the automobile companies.

Without becoming involved in considerations of a larger scope and given the intrinsic limits of industrial production in general and automobile manufacture in particular, this latter still bound by systems and circumstances stemming from and remaining unchanged since its earliest days (prior to the great economic crisis), it can be said that the technological and organizational change-occupations-training circuit is contingent on at least two exigencies of varying nature:

- the first is that the companies must ensure higher productivity at less cost of labour per product unit;
- the second is that the workers are acquiring even greater socio-cultural awareness which is leading them to reject the old rhythms and the old logics of industrial capitalism.

All this is reflected in strategic and economic choices made by companies manufacturing automobiles, choices which determine the future qualification profiles of the workers.

In order to study these lines of approach at practical level, we decided to examine a concrete case at first hand and undertook to reconstruct, in collaboration with company staff, the framework within which the problem complex of the introduction of new technologies in production processes and in the services, the impact which these technologies exert on the company's system of occupational qualifications, and the training needs which derive from this changed system falls. The company we selected for our case study is Alfa Romeo di Arese.

Case study of Alfa Romeo

Alfa Romeo di Arese, Milan, has a labour force of roughly 23 000.

The company management has had a great deal of work to do, in particular recently, in connection with the task of implementing in its manufacturing plant a large-scale changeover in production and services on the basis of very detailed organizational changes plans.

Above all at strategic level the automation of certain production processes via the introduction of advanced technologies assumes a very important role.

'We began to use robots in production about ten years ago but we have only now arrived at a clear strategy in connection with this problem and are anticipating considerable development in the near future,' we were told by Giuseppe Scardigno, who is in charge of the work organization sector. He showed us the graph reproduced above.

Robots were initially used to replace manual labour required for heavy and disagreeable jobs (forge, foundry); steps are now being taken to automate to some extent all simple, repetitive work processes, especially compression moulding and the assembly of body parts, tasks which involve very little skilled labour. The company is becoming increasingly cognizant of the fact that even though a completely new method of producing automobiles has not yet been found, some corrective measures must now be taken in the face of a changed attitude on the part of workers on some jobs (they are no longer willing to raise and lower steel plates for the rest of their lives nor are they any longer willing to breathe in cancer-causing PVC contained in the varnish). The number of robots used by Alfa Romeo increased from five in 1978 to 20 in 1980. They have revolutionized all the work organization in the departments in which they have been installed.

'The automation of production processes should not be viewed myopically simply as an industrial strategy aimed at minimizing costs and easing conflict situations. Such motives do exist and are linked to the economic policy of the company, but automation also brings advantages to the workers in terms of an improved quality of working life. For this reason,' Giuseppe Scardigno said, 'the company and the trade union have joined forces for the purpose of implementing the organizational changes plan.'

Faced with the alternative of either simply replacing human beings by robots while retaining the traditional pattern of work organization or completely transforming the production and qualification systems, Alfa Romeo decided in favour of the latter. According to a company statement, in fact, new occupations have now been introduced: thermal processing specialist, automated varnishing specialist, etc. Such occupations are indicative of a gradual vertical integration of work and a shift towards occupations geared to processes rather than to specific skills: regulation of parameters, quality control, minor maintenance, financial management, etc.

The introduction of robots by Alfa Romeo also serves as a significant example of how technological and organizational change can contribute towards achieving the objectives of a strategic plan aimed at enabling the company to acquire a new image in terms of qualification profiles and job structure, as summarized in the table below.

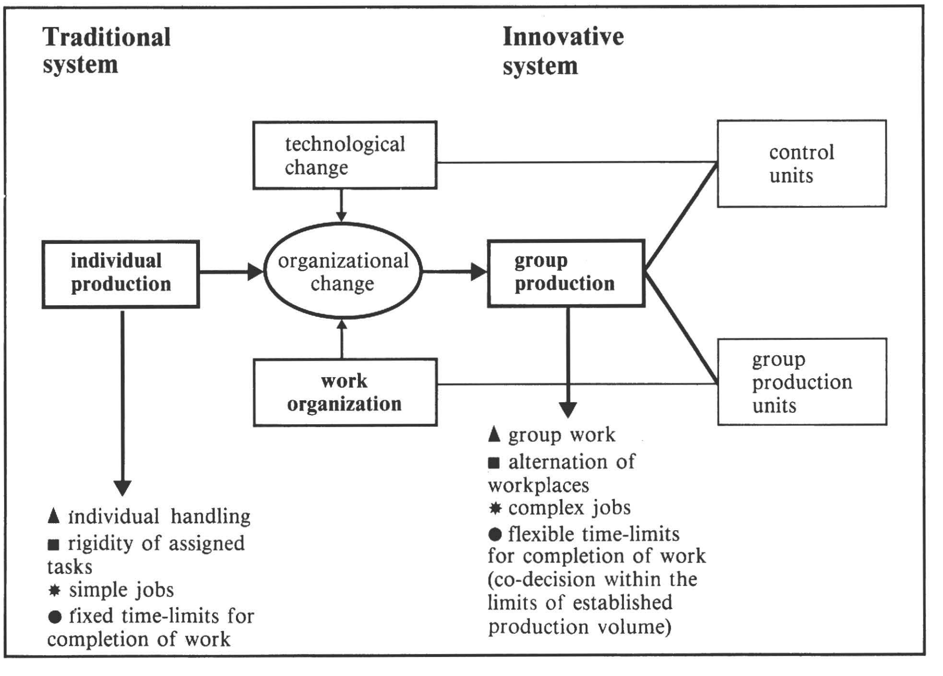
For good reasons structural changes, which involve not only production workers but also workers in the tertiary sector (via information dissemination, office automation, interactive graphic systems, automated planning, planning by means of experimentation via word processing, etc.), are always accompanied by training and occupational requalification measures.

'We are now in the process,' Carlo Agazzi, officer-in-charge of personnel recruitment and training, told us, 'of launching training programmes called for in the Technical Progress Project which was submitted to the European Social Fund by Alfa Romeo and approved last September by the Committee. These training programmes will serve to inform management personnel, technicians, and operators on the development of automation via the usage of robots and to further train technical staff involved in automatic planning operations, including training in the use of plotters in technical design.'

This is a very ambitious project, planned on the basis of modular criteria and the principle of alternation between theory and actual practice. At Ancifap, a training centre which also works with Alfa Romeo, a very advanced experiment to be undertaken at national level is now in preparation. 'The training courses in robotization are designed for three levels: for outside personnel (persons in charge of robotization who manage the process), for company personnel at low level, and for company personnel who are highly specialized in industrial automation and job robotization.' Not without a sense of pride a member of the Centre's staff who is involved in planning and training told us that the Centre hoped to bring together the best people in this sector so that highly advanced training could be provided.

The Lombardy region, which is sponsoring this pilot project, is extremely anxious to take advantage of this opportunity to accelerate the process of further training and requalification in its own training centres. On the basis of alternation schemes arranged with firms, these centres will play an active role in the management of innovative measures introduced under national skeleton legislation on vocational training *(leggo quadro)* and under regional legislation which regulates the specificities of application of this national legislation.

According to Franco Sala of the Assessorato alla Formazione (Regional Administration Committee on Training) the Lombardy region intends to concretize the nexus between technological evolution and the requalification of training processes, making use of all the technical and financial instruments in its possession relating to economic planning and to the orientation and regulation of the labour market in the direction of integration and coordination. Concrete steps of this strategy are, on the one hand, the implementation of training measures planned for in projects of the European Social Fund and intended for individuals and for regional training centres and, on the other hand, the establishment of study groups and research teams for the purpose of examining the quality of ongoing processes. One of these groups is now directing its attention specifically to the problems in the automobile sector.



Norbert Wollschläger

It almost went unnoticed

Influence of technological development on vocational training in the printing industry

In the course of the expansive economic development which took place from the early post-war years up to the recent present the printing industry in the Federal Republic of Germany went through a number of rationalization processes which were practically overlooked by the public at large. There was a general tendency to regard the printing industry as an economic branch barely touched by technical progress. Jochen Lippold, vocational training expert of the federal German printing industry, is of the opinion that 'if we had not had the collective bargaining controversy, this situation would also have gone unnoticed.' In fact it was the bitter labour disputes in the spring of 1976 which for the first time brought to the attention of the general public the problems of technical development plaguing the printing industry. This occurred at a time when the new technology had long since begun to make inroads into the branch and when the actual and potential rationalization effects of this technology had begun to create insecurity within the entire profession.

This process began very quietly. Just as was the case in other industrial branches, there was no sudden 'leap' in development; the beginnings of technicalization and automation in typesetting operations can in fact be traced back to the end of the past century. Nor were the efforts of the printing industry to reduce production costs and increase production output in any way different from those undertaken in other areas of German industry. The first clear signals that a recession in the printing industry was on its way came before the economic recession of 1975, indeed even before the oil crisis of 1973. Beginning with 1968 the growth rate of the branch gradually declined. True, the branch had expanded rapidly from 1950 to 1970, with the number of workers employed increasing by 100 %, but from 1971 on the work force decreased in size quite rapidly. The skilled worker-intensive (labour-intensive) method of production characterizing the printing industry automatically led to a more intensive search for technological answers which could help lower the share of wage costs in the overall production costs.

At first it was only in the twelve largest firms of the German printing industry that use was made of electronics to control and supervise the printing processes and that opto-electronic procedures were adopted, resulting in an increase in typesetting output which had hitherto been considered impossible. The large-scale investment and rationalization measures intended to offset rising typesetting and printing costs were undertaken above all by the newspaper and magazine publishing firms. In view of the large volume of capital involved, however, it could not be expected that this new technology would rapidly be introduced elsewhere in the branch. Of all the occupations involved, this technology was destined to have the gravest negative impact on that of typesetter.

In October of 1971 the Federal Ministry of Economics issued new vocational training regulations governing the occupation of typesetter in which the knowledge and skills required were newly defined. These new vocational training regulations replaced old regulations that had been established some 10 years earlier and of course did not take into account the change that since then had taken place in the economic and social environment within which the occupation of compositor was anchored. The new training regulations for the occupation of compositor came into force at a time when that phase of technological development was ongoing during which photocomposition was just beginning to permeate the printing industry. The reason that the significance of this new technology for the vocational training of compositors was not properly grasped at that time was 'that nobody had any clear idea of what photocomposition was all about' (Lippold). Although a smattering of knowledge concerning photocomposition (not skills!) was transmitted during training, the main emphasis remained fixed on type-metal skills, and a statement issued by the Ministry of Economics confirming that in accordance with these new regulations training in photocomposition could also be provided was subsequently rescinded.

NORBERT WOLLSCHLÄGER
Staff member of CEDEFOP.

Furthermore, nobody could really foresee how rapidly and steadily the profitability threshold for new technologies in the printing and duplication industry would drop. As an immediate result of the production of ever cheaper electronic components, coverage of the required investment costs became feasible even for smaller enterprises, a trend which, by the way, is still continuing. New technology equipment which, when it first came onto the market, required investments running into six figures is now available at one-tenth of the original cost. Ten-year amortization periods which were formerly common have long since become a thing of the past. H. Berthold, Inc., the leading firm in the branch in Europe, with the largest production turnover in photocompositors, fixed the service life of a machine generation at from three to five years.

Likewise inconceivable was the output capacity of the new technology in the field of typesetting. This Bulletin contains roughly 120 000 characters; the average output of an experienced manual typesetter using a composing stick and a lettercase is 1 200 characters an hour. Photocompositors are already on the market which can reproduce 28 million characters in one hour. Today a photocompositor costing DM 50 000 can accomplish what formerly could be accomplished only by moving 30 000 tons of lead.

Paralleling the encroachment of electronics and electronic data processing on typesetting operations was a very sharp drop in the number of apprenticeships preparing for the occupation of compositor. This drastic drop was in all probability due to a considerably reduced demand on the part of the printing industry for skilled workers. Whereas formerly the industry had to recruit its workers from persons trained within the branch, the new technology soon enabled it to recruit persons from outside the branch who had simply undergone from two to three weeks of rapid training. 'More and more part-time workers are earning their pay checks' (Lippold) by typing up texts for photocomposition, thus taking over the typesetting domain which once belonged to highly-skilled workers. Helmut Christ, officer-in-charge of vocational training matters in the Federal Executive Board of the relevant trade union, is likewise thoroughly convinced that in this branch typists and housewives will soon predominate over skilled workers.

The steadily accelerating speed with which the new typesetting technology found application in the printing firms placed decision-makers responsible for vocational training in an increasingly difficult position. The vocational training regulations governing the occupation of compositor neglected to a large extent to take technological development into account. The knowledge and skills being transmitted to the apprentices on the basis of the training regulations had already become outdated in the wake of the innovations, the consequence being that in-firm training no longer tallied with actual on-the-job requirements. For various reasons the social partners could not agree on a joint action aimed at re-designing training. Just about this time the supplier industry made it known that because of the new typesetting technology no more manual typesetters would be needed in the future. It was not until January 1978 that the Federal Ministry of Economics issued an amendment to the training regulations to the effect that an apprentice preparing for the occupation of typesetter had a right to receive training not only in type-metal skills but also in photocomposition skills. Even at this time there were in all probability many firms in which the traditional type-metal procedure found application only in the apprentice workshop.

Although when they first launched their products on the market the manufacturers of the new technology did have some trouble in making certain that the purchasing firms had sufficient knowledge of how to operate and service the equipment, the situation has long since changed. In rapid courses lasting from one to three weeks, depending on the type of machine involved, whole generations of typesetters have been trained in the new technology, their training being publicly financed, primarily out of unemployment insurance funds. On the other hand, an undesirable result of this system of product-specific qualification in the new technology has been that even up to this day no suitable basis exists for an up-to-date course of training in photocomposition which is not linked to a specific product. The various machine systems now on the market differ so much as to design (lack of compatibility, dissimilar keyboards, varying symbols, etc.), operation, and application that problems even arise in connection with the establishment of standard examination regulations governing training in photocomposition. However, as Heinrich Metz, Chairman of the Board of H. Berthold, Inc., has stated: 'Nobody wants compatibility as regards machine structure, certainly we don't.'
The part-time vocational school, characterized in most instances by institutional cumbersomeness, lack of flexibility, and financial rigidness, was certainly unable to react properly to the challenge of technological development. 'Conditions were really terrible,' Helmut Christ of the relevant trade union recalls, adding that of course these schools now have much better technical equipment. The manufacturers also help in providing these schools with modern technology, having realized that in the last analysis it pays them to have future skilled workers use their products while training. The part-time vocational schools negotiate with the manufacturers with regard not only to the provision of machines but also to the supply of materials free of charge, since the school budgets cannot cover the costs which continue to pile up. 'Sometimes the teachers must really bargain with the manufacturers', trade union representative Lippold says, adding, somewhat with resignation, that it is not possible to persuade the social partners and the school administrators to sit down together and attempt to visualize what shape vocational training should take in the 1980s and 1990s.
The course of technological development as sketched above and its impact on occupational qualification leave room for quite justified doubts that even the German dual training system, which has a reputation everywhere of being particularly close to actual practice and extremely flexible as to structure, is in itself sufficient guarantee that the challenge of technological change can be properly met and mastered.

Dominique Vignaud

Security of information systems

The increasingly important role being played by informatics in industrial production and the tertiary sector raises the question as to the reliability of information systems and the protection of stored data: what would happen if the system of electronic reservations used by an airline company were to be disrupted or if the address directory of a mail-order house were to fall in the hands of the company's competitors? It is probable that both companies would suffer heavy financial losses which could eventually put them out of business.

In the interest of effectively guiding the development of informatics and minimizing the risks of error or theft which are inherent in this sector, the largest users of information in France joined together in 1978 to form an association: a research committee on the security of automated information systems (CORSIA – Comité de recherche pour la sécurité des systèmes d'information automatisés).
Unique in Europe and closely followed in the United States, the activities of CORSIA have produced progress in the analysis of information risks and in the elaboration of security plans comparable with those established in other high-risk areas: aeronautics industry, space industry, nuclear industry.

By virtue of the broad experience of its members – all of whom have joined the association voluntarily and are either pub-

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Project coordinator, Centre INFFO, Paris. Information obtained from CORSIA and the Secretariat-General of Vocational Training.

lic or private users of large or medium information systems – CORSIA is able to keep very much in touch with human problems posed by the introduction of information systems in companies and by the authorities. It undertakes to call attention to the *entire gamut of risks* which, if overlooked now, will develop just as rapidly as the computer is developing, finally becoming uncontrollable at exceedingly high technical, economic, and social cost.

The importance of effort in the social sphere has by no means been overlooked in the work programme of CORSIA. With the support of the Secrétariat général de la formation professionnelle (Secretariat-General of Vocational Training),* CORSIA is endeavouring, in line with progress achieved in its technical work (analysis of risks; elaboration of objectives, plans, and techniques of security), to identify responsibilities and training measures which will ensure the security of information systems.**

Methodological approach of a new field of information

The methodological approach of CORSIA is based on a detailed study of information risks and information security and the repercussions of all kinds which they have from the point of view of application to jobs and work organization in particular. The analysis of information risks reveals that the smooth functioning of information systems is dependent on the application of security plans and techniques not only at the juncture of actual data processing but also upstream and downstream from this process. Occupations and activities of a most diverse nature in production and in the services in both the public and the private sectors must be supported by personnel training in the application of information security techniques: short-term training for users and long-term training for information security specialists (informatics personnel, control personnel).

This training in information security will be targeted on the one hand to personnel already employed and on the other hand to personnel being recruited from the pool *of new jobs* created by the implementation of security plans – informatics and control personnel.

The attitude of users exposed to information risk was investigated in an enquiry conducted with selected interviews: decision-makers, informatics personnel, users, control personnel. The enquiry clearly brought to light the fact that the users were quite undecided as to what training should be provided. There was furthermore great diversity with regard to an understanding of the risks involved as well as uncertainty as to what measures should be launched and a vague feeling of guilt in the face of errors which might creep in.

Gearing the training machinery to three tasks

On the basis of its analysis firstly of the changes taking place in jobs and responsibilities and secondly of the attitude and motivation of information users, CORSIA set up three information security training tasks:

briefing of decision-makers: only if decision-makers are thoroughly sensitized can users be motivated to recognize and avoid information risks;

training of users in information security techniques: all persons involved with automation processes must be familiar with the basic principles of informatics, telematics, and system security. They can then comprehend and properly deal with changes in work organization and working conditions which will result from the integration of security into their work;

advanced training of specialists in information security: highly qualified and experienced informatics personnel and control personnel will have to be schooled in the art of conducting studies on the security of automated information systems. This long-term training at high technical level will be provided at the publically run university institutes of technology (IUT – Instituts universitaires de technologie). *** Here the specialists will acquire the basic theoretical, methodological, and technical knowledge and skills they need in order to do their job properly.

The above courses of training will be started in 1981, not by CORSIA, which remains a research committee, but by public and private training institutions. The trainers will have at their disposal:

☐ the body of reference material which CORSIA has compiled in the course of its activities: estimate of open job figures, changes in responsibilities, training projects, and pedagogical methods;

☐ computer-aided training programmes.

Conclusion

In a sector at the spearhead of technological progress, provision of training has been one of the responses which has been given priority in view of the pressing need of information users for information security. Training has been understood as one of the priority actions serving to awaken a reflective attitude and lead to a mastery of automated information systems.

All the more interesting, therefore, is the voluntary joining together of information security specialists and information users in an association and also the fact that this association was established at the joint initiative of the public sector – the Secrétariat général de la formation professionnelle – and the private sector.

The training effort to be launched in 1981 will have specific economic impact: it will make it possible to generalize the security of information systems in all their industrial, commercial, financial, and household applications.

It will furthermore help support progress being made in the sector of peri-informatics and thus contribute to creating new jobs.

* Public authority at national level charged with implementation of the French policy of vocational training.

** A study was completed by the Secrétariat général de la formation professionnelle in October 1980.

*** The university institutes of technology offer, within the framework of the respective university short two-year courses of vocational training leading to qualification as 'technicien supérieur'.

Information and the creation of jobs

Pol Debaty

On 20 November 1980 the Office National de l'Emploi (ONEM – National Employment Office) brought together, at the initiative of CEDEFOP, representatives of five companies specializing in informatics which are providing company training within a training project for chiefs of information services. This round-table discussion, in which Messrs Debaty, Flamand, and Vanhove (ONEM); Messrs Vandersande and De Roy (IBM); Mr De Schepper (Siemens Data); Mr Taulet (Phillips Data Systems); Mr Van Der Flier (Correlative Systems); and Mr Frooninckx (Honeywell Bull) participated, was devoted to a progress review of the objectives and implementations of this training project which since 1978 has accommodated 317 trainees.
For publication-related technical reasons this article covers only the main problems dealt with in the discussion. Other problems dealt with were the motivation of trainees *vis-à-vis* training and work, and the role of communication capacity in the processes of training and placement.

ONEM: At the beginning of 1978 the Secretary-General of IBM informed the Administrator-General of ONEM of the company's need to train as, in his words, 'chiefs of information services' qualified personnel scheduled to work primarily in small and medium enterprises which were installing computers. Other companies confronted with similar problems also expressed interest in providing company training in collaboration with ONEM. In the course of time Philips, Siemens, Correlative Systems, Steriabel, and Honeywell Bull all became associated with this training project, and by the end of 1980 three years of experience had already been gained.

From 1978 to 1980:
Dutch-speaking region:
331 candidates,
164 trainees,
rate of placement upon completion of training: 90%.
French-speaking region:
791 candidates,
153 trainees, of whom 10% were women in 1978 and 50% were women in 1980.

ONEM has nearly always been successful in its efforts to recruit and preselect the trainees, and the companies have likewise nearly always been successful in their efforts to train and place their trainees. Since there is now a great deal of talk about eliminating jobs, it is a propitious time to take stock of this action, which on the contrary promises to bring about an increase in employment by virtue of the creation of new jobs in this sector.
It is interesting to determine, first of all, whether the initial job description is always applicable. Are we really training chiefs of information services?

HONEYWELL BULL: On the basis of a period of training lasting only nine months it would be more correct to speak of training for chiefs of small information centres.

CORRELATIVE SYSTEMS: I believe myself that most of the trainees do not wish to assume complete responsibility of an information division. They are technicians rather than managers.

IBM: A small change should be made in the terminology. The persons whom we place with our clients are responsible for an information service at the level of a small or medium enterprise (SME). Of the 120 to 130 persons whom we have placed since the project began, 80 % are in charge of an information service and 20 % are capable of taking over the service but are at present only second in command. Carrying of responsibility is an important motivating factor.

POL DEBATY
National Employment Office, Brussels.

PHILIPS: The trainees are to become information service chiefs in SME: starting off in SME with informatics enables them to gain experience with relatively simple applications and to evaluate the results of their nine months of training.

SIEMENS: It is also essentially a question of orienting training according to whether a small or a large system will be involved. It is easier to become the chief of an information service in a 34 system. Actually, we do not have any illusions; there are not even 1 000 enterprises who are waiting for an information service chief.

ONEM: Let us now see how your training is organized. It consists of a technical stage – lasting a few months only, thanks to the qualification level of the trainees – followed by a practical stage which you arrange for either at the user's place of business, in your own service, or in a specific project.
We have observed that after six months of training some of the trainees had already accepted employment whereas others wished to undergo a longer period of training.

SIEMENS: Theoretical technical training lasts three months. A number of our trainees were able to do the technical work at the place of business of users or clients of ours who had heard about this training. In other words, their stage of practical training was undergone at the place of business of their future employer. Recently we have had our trainees undergo a stage of practical training at a training centre or at the place of business of certain of our users where they had an opportunity to conduct interviews, this being perhaps the only efficient form of communication training. During this period the trainees enquire here and there as to employment opportunities and easily find a job later.

CORRELATIVE SYSTEMS: We do just about the same thing; we have two and a half months of theoretical training, after which we divide the trainee group in two. The first group of trainees concern themselves primarily with applications. Subsequently both groups receive advanced training in the field of microsystems. The difference between us and the other companies is that all our trainees remain with us after training and are integrated into our company systems.

PHILIPS: In connection with the new product which we are marketing we provide nearly three months of theoretical training. For the practical stage we used to assign the trainees to our own product development services, since they then had a real opportunity to work at this level. Gradually, however, we shifted practical training to the firms of our clients. Everything is arranged in advance and when the time for the practical training stage arrives, we assign the trainees to the branches which meet their needs and, indirectly, the needs of each client involved in training.

IBM: Our technical training, lasting two and a half months, is mainly oriented towards low-level hardware with RPG 2, above all traditional applications at the level of SME such as invoicing, compatability, and management of salaries, these constituting the daily problems of a firm. We have added a second programme language, namely, BASIC. In other words, we have oriented ourselves towards the sector where demand is greatest. At regional level the situation is the same; we have adapted our training to demand.

HONEYWELL BULL: Our training lasts four months and begins with COBOL. Each time we make a selection we undergo a rather large risk. Nevertheless we feel that we can help people to find employment. With regard to training, we see to it that each trainee is equipped to work with either a small or large system, according to what type of job opens up. We add supplementary courses on compatibility, etc., as required. Results obtained at the level of placement are, moreover, very convincing.

ONEM: This scheme of theoretical training combined with a practical training stage and matched with supplementary training oriented towards the management of a firm has borne fruit; that is to say, it has made possible the placement of most of the trainees. And now: what are your plans for the future regarding this training project? Are you still as enthusiastic as when you began collaborating with ONEM to put this project into implementation?

HONEYWELL BULL: We are in favour of continuing this project with ONEM, hoping that the candidates will be better informed on what we expect of them and what we would like to achieve together.

IBM: We shall continue in 1981 in the same way as before except that we will diversify our approach to cover environments of various types. The duration will be the same but the subject content will be different.

PHILIPS: We are going to continue in the same manner. Since we have launched a new product on the market which is compatible with the other product, we shall, beginning with the next group of trainees, provide training in both products. We hope to enjoy very close collaboration with ONEM with regard to the pre-selection of candidates coming from specific regions. We also hope that it will be possible to complete beforehand the training of the candidates in communication and compatibility.

CORRELATIVE SYSTEMS: I would again insist on the importance of pre-selection and on the difficulty of reinserting a former job-holder with high qualifications and high salary expectations into a new occupational field. Perhaps ONEM should initiate some sort of action before training starts.

SIEMENS: The practice of selection in the regional offices should be reviewed, and perhaps more thought should be given to the suitability of the title 'information service chief'.

IBM: Personally I favour this term in environment marketing. We have the same problem, there would then be two terms.

ONEM: It would be the task of the central administration of ONEM to distinguish between candidates for the post of informatics specialist and the post of information service chief and to help the candidates to make their choice.

What do you think about the teaching of informatics in school? Is this a solution for the future?

IBM: There is general consensus that it is better to sensitize young people to informatics at secondary school, level rather than to restrict such instruction to university level, since every worker will be confronted with a computer sooner or later. We have launched a project at secondary school level which is very simple: the firms purchase a minicomputer for a school. This will make it possible to lay the groundwork for the learning of a programme language.

ONEM: In other words, the job-seekers of tomorrow will be different from those of today in that they will have already had some training in informatics.

SIEMENS: Informatics does not exist as an end in itself but rather as a means to an end. For trainees at university level it is a means of solving most of the problems of company management in a different and more effective way. To the degree that instruction in informatics is introduced in secondary education and completed at technical college or at university level, thus providing a very good basic training in informatics, our collaboration with ONEM in the field of training of this type could be oriented towards more specialized informatics training.

ONEM: We have covered many problems and I note with great pleasure that in view of the good results obtained to date you intend to continue on with this project. We have arrived at certain conclusions. Since these conclusions take the form of recommendations regarding instruction, we are admittedly exceeding our competency in this respect. I trust, however, that we will again be initiators in the field of advanced training, and that education, which carries more responsibilities than we do in this field, will do what is necessary in the years to come. It remains for me to thank you very much for having participated in this round-table discussion. I also thank you on behalf of CEDEFOP for your contribution to these reflections on the role which training can play in the creation of jobs linked to developments in the field of informatics.

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