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EMPLOYMENT AND THE NEW MICRO-ELECTRONIC TECHNOLOGY

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## CONTENTS

INTRODUCTION	1
AREAS FOR ACTION	3
. Maintain and develop demand on a selective basis	3
. Productivity growth and the adaptation of working time	4
. Conditions of work	5
. The quality of life	6
. Orientation of training	6
. Orientation of labour market measures	7
. Social protection and support	8
. Monitoring changes in the employment structure	9
. Information and assistance	9
. The Social Partners	10
SUMMARY AND CONCLUSIONS	11

INTRODUCTION

In its Communication (1) to the European Council in Dublin on 29 November 1979, the Commission identified certain fundamental problems which will arise with the introduction of new technology, and showed how the Community could most usefully face the challenge.

The Commission emphasised the need to mobilise and co-ordinate the efforts of the Member States and the Community by creating a homogeneous European market, encouraging co-operation between the industry and users, promoting the European industry so as to ensure its competitiveness on world markets, and enabling the new information technology to be adopted in the most appropriate ways.

The Commission emphasised the need for a Community initiative, not only in order to maintain competitiveness or avoid the possibility of production over-capacity in the longer run, but also to ensure a coherent social progress across the Community, in view of the foreseeable employment consequences as well as the changes in working conditions and industrial relations which the new technology will bring.

In such circumstances, the social and industrial changes that are resulting from the new technology cannot be left to take place unaided, and need to be developed in the light of Society's overall political and social objectives. The new technology offers both risks and opportunities for Society with major sectors of production and use of goods and services undergoing changes affecting the skills and experience of many groups. At the same time, these technologies will create new activities and change many existing jobs.

In a period of rapid growth of the active population but weak economic growth, it is particularly important to foresee how the more or less rapid innovation of products and processes in the industrial sector, and the service sector, will affect the labour market. Whether the new technology will be a positive growth factor or a cause of crisis will depend on the Community, on the Member States, and on the two sides of industry.

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(1) European Society faced with the new information technology : a Community response  
[COM(79) 650 final].

Some Member States' governments are already evaluating the likely scale and areas of impact of the new technology, and considering their appropriate policy stances and actions (1). Trade Unions, conscious of the direct effects on their members, have been active in developing their own analyses and policy positions. (2) Employers have equally been conscious of the effects of the labour market on their competitiveness.

In order to develop an appropriate social policy to prepare the climate for innovation, the Commission proposed certain actions, in particular :

- a) the analysis of studies on employment and social consequences ;
- b) the examination, with the social partners, of measures such as technology agreements ;
- c) the establishment of a programme in the key areas of education, training and the dissemination of knowledge.

This present document to the Standing Committee on Employment is intended to assist the Member States' governments, the Social Partners and the Community to identify their appropriate roles and tasks. It presents various Fields of action which are summarised in the section Summary and Conclusions.

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- (1) National studies by both government and independent bodies are discussed in the Annex.
  - (2) Confederations such as the U.K.'s TUC, and the French CFDT have produced their own reports, as has the European Trade Unions Institute - see Annex.

## AREAS FOR ACTION

The Commission considers that early assessment and action is necessary on the social aspects to prevent regressive attitudes and to channel the change towards actual progress. In this context, the appropriate policy response must be based on certain principles, in particular :

- the re-inforcement of the dialogue between Social Partners at company level ;
- the improvement of the climate for innovation, with Government support in co-operation with the Social Partners ;
- the monitoring of developments and the adaptation of policy measures to meet emerging needs.

The following sections identify those areas where actions need to be taken in the light of these principles.

### Maintain and develop demand on a selective basis

The overall employment impact will to a large extent depend on general economic conditions, on the maintenance of Community competitiveness, and on the creation of new areas of employment. This implies :

- firstly, the need to bring about an increase in the rate of economic growth, and to tackle existing problems - inflation, energy constraints, and balance of payments - with renewed vigour ;
- secondly, the need to encourage active policies to aid in the re-development of regions and sectors affected since there will be a significant loss of employment opportunities in certain product areas. Such policies must be deployed before the situations develop into crises ;
- thirdly, to enable those sectors of activity to which new expenditure will be directed, and which provide the greatest potential for employment growth, to develop as rapidly as possible. These sectors include first of all those producing micro-processors and related activities - whose impact should not be overlooked. They also include services such as health, education and leisure, as well as other public and private services. The rapid increases in manufacturing productivity resulting from the new technology could provide the income to support this expansion by reducing the cost of existing consumption ;

- fourthly, that existing Community financial instruments can contribute to supporting and implementing the strategy developed above - within their own rules and respecting their own targets - notably through :
- . maintaining and developing demand for the new technology and assisting its introduction, particularly in small and medium-sized firms ;
- . contributing to the re-development of regions and sectors affected in their employment by the new technology ;
- . supporting the development of forms of training adapted to the new technology.

#### Productivity growth and the adaptation of working time

The large increases in productivity which may be associated with the new technology can fulfil one of the conditions necessary for the reduction of annual working time and overtime, whilst respecting concerns for competitiveness. Another aspect of the technology is the flexibility of operation that it makes possible, and the consequent scope it gives for the development of more flexible employment patterns, including additional part-time jobs.

At the same time, any measures to re-organize working time should bear in mind of the need for selectivity and flexibility, taking particular account of the competitive position of the sector concerned.

In situations where older workers lose their jobs as a result of technological change and alternative job prospects are limited, flexible retirement schemes may be appropriate.

The Council has already set out its first policy guidelines on the question of working time (1), and has requested a follow-up by the Commission. The Commission intends to take the possible employment effects of the new technology into account in developing its approach in this area.

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(1) Council Resolution on the Adaptation of Working Time of 18 December 1979.

### Conditions of work

Whatever the ultimate effects on the overall level of employment, the new technology will profoundly affect working conditions. On the most readily identifiable level, namely safety and health, there are both gains and potential losses. Healthier working environments, with less extreme temperatures, less physical exertion are beneficial but off-set in part by possible stress in the use of visual display units and related equipment.

At a broader level, the new organization of work which is resulting from the increased use of information analysis and transmission devices in the production process offers the possibility for more flexible working methods. This may ultimately both transform the pattern of responsibility and man-to-man relationships in the work-shop and replace the traditional tendency to concentrate work places in centralised locations by more decentralised working methods. A more decentralised, data-linked, organization system could play its part in correcting present regional and urban imbalances.

Prior to arriving at this new distribution of work, however, many problems of adjustment will need to be faced, covering questions such as the downgrading of skills, the need to develop job enlargement and enrichment, job rotation and personal development, job status and hierarchy, and the need to avoid the sort of job alienation that an increasingly impersonal process of product tends to bring. Particular attention should be given to the risks that more decentralised methods might re-inforce discriminations or segmentations on the labour market. In addition, the development of home based productive work will no doubt have substantial implications in such areas as the sharing of responsibilities at home between men and women.

In all these areas, the Social Partners have no doubt a major responsibility here, but so do Governments who must develop policies which transcend the narrow limits of traditional concerns for physical well-being and safety at the work-place.



### The quality of life

If the new technology succeeds in raising the productivity of labour and capital, and in reducing energy consumption, the quality of life can be improved. The benefits of this process should be seen in terms of the possibilities it gives Society to better fulfil its responsibilities to the less fortunate as well as in terms of goods, services and increased leisure.

This can in part be achieved by releasing consumption expenditure and manpower for highly labour-intensive activities related to help for the sick and aged (the latter forming an expanding section of the Community population), but it also implies the specific application of the new technology to social needs such as the relief from the tedious parts of housework or the equipment of old people's homes.

There is also a need for a careful examination of the question of the confidentiality and security of information. This issue needs to be carefully monitored, perhaps by independent, Government appointed agencies, and safeguards and regulations developed so as to ensure that the rights of the individual are respected. The Commission will consider the most appropriate forms of Community action in this area.

### Orientation of training

The impact of the new technology on training goes well beyond the traditional concept of marginal re-adjustment and re-training of workers affected. It raises a set of questions to the existing training and education systems as to their ability to equip workers - and consumers - with the skills required to cope with change.

Processes of production will become less concrete and tangible and hence less easy to grasp, and will require different types of man-machine relationships. The development of skills and abilities appropriate to the new technology thus implies the development of a flexible approach which permeates through the training process, and not just the provision of explicit training and re-training in skills in demand.

Many existing skills - including some currently in short supply - will, however, become progressively obsolete, with a likely disproportionate effect on women. At the same time, many of the skills required for the implementation of the new technology continue to be scarce. Hence a series of training, guidance and placement problems present themselves, of which the following seem the most urgent :

- a) provide better links between education and training, as set out in the Council's Resolution on Alternance Training (1), and improve the content of basic education in order to prepare for the use of the new technology at all stages of life ;
- b) ensure the development of a new combination of process rather than product oriented systems of vocational guidance, basic training and training in specific skills ;
- c) provide re-training for scientists, engineers and technicians ;
- d) provide for the re-training needs of persons affected by job losses in order to preserve their access to the labour market - noting in particular that women may be affected in significant numbers in the tertiary sector.

At Community level, the Commission will prepare a summary of the training requirements of the new technology based on an opinion of the Consultative Committee on Vocational Training. The European Social Fund provides opportunities for assisting the re-training and re-adaptation of workers whose skills are no longer required towards the techniques required in the microelectronic and computer oriented industries.

#### Orientation of labour market measures

A major re-appraisal and re-invigoration of labour market support measures is needed if existing job mismatch unemployment is not to be seriously worsened. This re-appraisal should aim to achieve two major objectives :

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- (1) Council Resolution on linked work and training for young persons, of 18.12.1979.

- a greater flexibility and readiness on the part of placement and guidance services to cope with short-term needs, both of the economy in general and of the workers affected ;
- a medium-term approach which enables them to both anticipate critical situations through adequate monitoring, and to improve links with firms, training facilities and the school system.

The Standing Employment Committee has already discussed a paper on the reduction of the qualitative mismatch between the supply and demand for labour (1), and the Commission is developing its own suggestions in a paper on the Orientation of Labour Market policies for discussion at the Council later this year.

#### Social protection and support

Existing systems of job and income protection and of redundancy policies may not be fully adequate and appropriate for the problems that will develop in the new circumstances.

Among the most immediate issues, two deserve particular attention :

- the systems of job protection or income guarantee. These should be considered as one of the major safeguards for those workers threatened with dismissal, and to prevent widespread resistance to industrial innovation. Legislation or agreements on dismissals should be approached with the prevailing concern to facilitate access to alternative jobs ;
- the problems of workers, particularly older workers, who find above average difficulty adapting to new working patterns or in obtaining new employment. Loss of jobs for such people can be a traumatic experience, calling for a composite of social, employment, training and leisure support which is as yet under-developed in the Community.

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(1) Commission Paper on Reduction of the qualitative mismatch between the supply of and demand for labour : guidelines for labour market policy and working conditions policy, of 11.4.1979.

### Monitoring changes in the employment structure

Precise forecasts of future employment trends and structures are not possible, and monitoring methods must be developed at national level so as to permit the early identification of problem areas. In this context, a greater transparency regarding investment intentions of Employers is needed in order to assist in identifying areas of employment to be affected.

Monitoring should look to the longer term development of the structure of employment as well as specific aspects such as :

- a) product areas, branches, sectors, regions
- b) specific groups, notably young, women, older workers
- c) training and vocational guidance needs
- d) effects on working conditions
- e) use of existing labour market and social support structures
- f) effects on productivity, investment, real income growth.

Monitoring should take place in a concerted manner at appropriate levels within the Member States, but in a manner which also permits an exploitation at Community level where the results can be related to other forecasting activities, including the Community's FAST (Forecasting of Science and Technology) programmes and the 1990 projections. The Commission is currently setting up a European pool of studies and analysis for the use of all interested parties, and seeks the cooperation of all concerned, in particular the Standing Employment Committee.

### Information and assistance

Information campaigns directed to the general public and specific interest group, including the Social Partners, can do much to develop a climate favourable to socially-desired innovation, and several Member States have already begun.

The public, especially the young, need to be aware of the opportunities created by the new technology and the scope for its use, while being familiarised at an everyday level in handling and using it. Those directly affected by the new technology have the right to be informed.

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Particular efforts should be made by the Social Partners, with Government support, to increase awareness of the new technology and to develop existing educational and training programmes so as to encompass the effects of the changes on employment, working conditions, training needs and management structures. National, regional and local tripartite discussions have proved particularly successful in those Member States which have tried them. The Commission intends to play its part with Information campaigns on the new technology as part of its own Information policy.

The scientific community also has its part to play at national and Community level in the development of appropriate policies, and should be closely involved in the discussions.

### The Social Partners

The new technology brings changes in the distribution and scale of industrial and social power, as well as substantial upheavals in the lives of many workers. The consequences of such changes should be recognised in the Trade Unions having full access to all necessary information, and the right of consultation in proposals for the implementation of the new technology, whether or not there are job losses.

Job losses cannot always be absorbed by companies. Hence there is a crucial role for the Public Authorities in ensuring an adequate compensation of such losses by new growth within the regional or local labour market, with appropriate support from placement services. Companies should assist the Authorities in such functions by the speedy provision of information about immediate employment effects, and by developing company manpower planning over the medium-term.

In cases where the impact on the work-force is widespread, bringing changes in working methods, job grading and so on, a system of technology agreements would be appropriate whereby the employment changes involved would be discussed and agreed between joint trade union/management teams. This form of agreement has been adopted in certain cases in the Federal Republic, Italy, the Netherlands and the United Kingdom. The issues covered vary widely between agreements, but cover such issues as target employment levels, rights to training, regrading, security of employment, working hours and redundancy provisions.

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A much quoted agreement is that between the Norwegian social partners concerning computer-based systems which pays particular attention to the trade union right to information. (1) Care should be taken to ensure that in protecting incomes and job grades, these technology agreements do not degenerate into anti-technology agreements, especially in industries open to international competition.

The implications of the new technology are such as to throw into question many existing practices and structures. This poses a challenge for both Social Partners who must develop and modify their policies, structures and capacities so as to meet the new circumstances. Levels of discussion and negotiation may need to change, and every effort must be made to adopt institutional arrangements to meet the new challenges.

#### SUMMARY AND CONCLUSIONS

The suggestions contained in this document, and which are submitted to the Standing Employment Committee, represent a first step in the development of appropriate employment policy reflections and responses to the new micro-electronic technology.

As the Commission has pointed out in the document, it is for the Public Authorities and often for the Social Partners themselves - in liaison and in concertation with the Public Authorities and with their support - to indicate the ways in which they propose to tackle the social and employment problems, and to define appropriate procedures for discussion and negotiation, whether at company level or at the appropriate levels of the respective organizations.

In this light, as has been discussed in detail in the text, it will be necessary to :

- a) stimulate and orientate economic policy in order to maintain demand, support structural change, encourage the development of new demands, particularly in the service sector ;

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(1) See Annex, point 8

- b) in following up the Council Resolution of 18 December 1979 concerning the adaptation of working time, to take into account the possible employment effects of the new technology ;
- c) increase awareness of the problems raised by the new technology in terms of conditions of work, in order to promote specific actions to improve the situations, in terms of job enrichment, prevention and protection against new risks ;
- d) ensure that the quality of life of all members of Society can be improved through the application of the new technology to the problem of less privileged groups ;
- e) develop new orientations for vocational training, including the use of alternance training, in order to increase the adaptive capacity of all workers, as well as providing appropriate training of specialists able to exploit the new technology ;
- f) adapt and develop other supporting labour market measures (guidance, placement, mobility) in order to reduce existing job mismatches and avoid their development in the future ;
- g) adapt and re-inforce social protection arrangements in order to avoid that the new technology adversely affects the standard of living of workers, particularly those who have difficulty in obtaining alternative employment ;
- h) create monitoring systems, associating the Public Authorities and the Social Partners, in order to identify the evolution of needs and changes in the structure of employment ;
- i) direct information campaigns to the general public and specific interest groups, including the Social Partners, and aid the development of national, regional and local tripartite discussions ;
- j) ensure the active participation of the Social Partners in the process of adjustment, not only at company level - where technology agreements may be appropriate - but also in the regional or local labour markets where the Public Authorities should seek to develop new employment possibilities.

The various actions to be taken fall within the responsibility of both Public Authorities - at national and local level - and the Social Partners. The Commission will equally bring its contribution, as has been indicated in the document. This will include the examination of the appropriate use of the Community financial instruments in their own areas, and of how to achieve a greater transparency for investments.

The Commission would like the Standing Employment Committee to give its opinion on the various suggestions which have been made and, in particular, to indicate priority areas for the follow-up.

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Encl. : 1



COMMISSION  
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ANNEX

EMPLOYMENT AND  
THE NEW MICROELECTRONIC TECHNOLOGY

EVALUATING THE  
EMPLOYMENT EFFECTS

## CONTENTS

	Page
ANALYSIS OF EMPLOYMENT EFFECTS	1
1. Overall employment levels	1
2. Changes in the structure of employment	1
Effects of new products	2
• substitute products	
• complementary products	
• new products and radically transformed products	
Effects of new production processes	2
• cost reduction	
• optimum use of limited resources	
• price elasticity of demand	
3. Time scale of change	3
QUANTITATIVE ESTIMATES OF THE EMPLOYMENT EFFECTS	4
1. Indicative estimates	4
2. Aggregate estimate	4
3. Sectoral estimates	5
• Industry	5
- electronic watches	
- calculators	
- telecommunications and home consoles	
- cash registers	
• Services	8
- office organisation and administration	
- banking, financial services and insurance	
• Process control	9
- computer numerically controlled (CNC) machine tools	
- printing and publishing	
- cars	
STUDIES, PAPERS AND ANALYSES CONSULTED	11
A. ECONOMIC ANALYSES, GENERAL SURVEYS, BACKGROUND AND POLICY DOCUMENTS	11
B. SECTORAL IMPACT - TRADE UNION AND OTHER ANALYSES	13
C. CONFERENCE PAPERS	14

## ANALYSIS OF THE EMPLOYMENT EFFECTS

The employment consequences of the new technology are clearly widespread, resulting in job losses and job gains in different branches and sectors, changes in the demand for different occupational skills, and changes in job content within different occupations.

Analysis of the employment effects needs to take into account three aspects :

- first, the overall level of employment,
- second, the change in the structure of employment,
- third, the time scale of the change.

### 1. The employment level

The net effect on the overall level of employment will be primarily determined by the relative speed of the Community in innovating the appropriate products and processes compared with our world competitors. If the Community innovates in line with its competitors it will, like its competitors, lose some jobs in areas where the new technology, by its greater efficiency, reduces the demand for labour. This process, however, releases additional demand because less expenditure is needed to maintain current production - with this saving going on increased consumption of existing goods and services, whether or not these have been made cheaper by the new technology.

The risk for the Community is that, if we do not innovate as quickly as our industrial competitors, we will lose jobs more rapidly than them, be forced to increase our purchases from them and, by so doing, increase their employment and income at the expense of our own.

This maintenance of employment is conditional also on both the achievement of a growth - oriented economic policy in the Community and the world at large, and on the implementation of appropriate adjustment policies to facilitate the job changes which will be occurring.

### 2. Changes in the structure of employment

Changes in the structure of employment will be complex. They will not be limited to the direct effects of the creation of new products and processes, and the elimination of obsolescent ones, but will depend also on secondary and tertiary developments resulting from these. Such effects are difficult to evaluate, but can be described analytically.

#### Effects of new products

The new micro-electronic technology, like all previous technological advances, creates new products whose consequences extend far beyond their direct uses and lead to secondary products not even conceivable when the new technologies were first developed. The effect of such development on the structure of employment is clearer when we consider the cases of substitute and complementary products as well as new or radically transformed ones.

- substitute products

The new technology is producing some products which perform similar functions to existing products, but more efficiently. The reasons for such substitution are clear enough : better performance of the main function; increased reliability and lifespan; reduced cost.

This has three main consequences for jobs : the firms making the substitute products are frequently not the same as those who made the earlier product; the skills involved are quite different; there is generally a considerable reduction in employment both at production and maintenance level.

Whether overall employment prospects will be reduced by product substitution depends on how far cost reduction and increased efficiency could result in an increased market for the product.

- complementary products

Few products are demanded in their own right; the majority are used in conjunction with others. The improved performance, price and availability of one product has a direct bearing on the demand for its complements. As a result, it is not always easy to identify the ultimate job-creating effects of a new product and there is a tendency to overlook or underestimate them. In any case they are likely to extend beyond those sectors, skills and firms directly producing the new products.

- new products and radically transformed products

Employment consequences are potentially greatest when wholly new products are introduced. The net employment effects are less clear when existing products have been radically transformed. Where there is little complementarity and little increase in overall demand, the employment effects are likely to be negative. When there are many complementary products, and where the potential for increased demand is high, it is most difficult to evaluate final employment because the increased employment resulting from the increased production of complements must be set against the job losses associated with the production of the new product.

Effects of new production processes

The new technology is affecting both the control and operation of many industrial processes. Changes in processes may imply reductions in employment opportunities but, as with new products, the net employment effect will depend on a variety of factors, in particular the effects on costs, on the use of resources and on demand.

- cost reduction

The use of micro-electronics should enable reduction in requirements of capital and labour by the more efficient use of available resources, by prolonging life and reducing wear and tear and maintenance, and by the elimination of unnecessary steps in processes.

Such reductions in cost are among the major motivations for changes in productive processes, and imply elimination of some traditional skills and reduction in total employment. At the same time it is not inconsistent with additional posts in some skill areas.

- optimum use of limited resources

Optimal use of scarce input resources - both labour and material - could eliminate bottlenecks enabling substantial increases in supply, mitigating and even reversing the reductions in employment due to increased productivity in some areas.

- price elasticity of demand

The employment prospects will be particularly dependent on whether cost reductions brought about by the new technology lead to large enough increases in demand to offset the loss in jobs caused by the change in technology.

This is a common concern, but it may be asked why manufacturers should choose to concentrate investment in areas where there are limited opportunities to increase sales or capture markets from competitors rather than move into areas of high price elasticity so as to capture competitors' markets, increasing penetration and enlarging the total market.

3. Time scale of change

The time scale of the implementation of the new technology is crucial in determining the extent of the employment problem. In the Community's history there have been, and continue to be, major job losses in particular areas. In the period 1960 to 1980 agricultural employment fell by over 50 %, a net loss of 9 million jobs. Reduction also occurred in mining and in many other areas - steel, textiles, railways, heavy engineering, shipbuilding.

Such job losses have brought heavy social costs and have not always been treated with adequate social concern. Nevertheless such losses have been absorbed into the economic system, albeit in more prosperous times. In very large part, they have been compensated for by job gains in services and newer industrial areas of employment.

Time therefore, permits the process of change to occur. The crucial question is, how much time is there before the application of the new technology begins to have its most widespread effects ?

Speed of introduction depends crucially on :

- 1) the scope for specific applications of the new technology;
- 2) the organizational capacity of companies to accept changes;
- 3) the financial capacity of companies to invest in products embodying the new technology;
- 4) the capacity of investment good and technology hardware industries;
- 5) the availability of suitably skilled labour.

It is difficult to judge the realistically obtainable rate of innovation, and this is one of the points on which existing studies tend to be weakest. Recent experience of the introduction of computers, for example, does suggest, an initial tendency to over-estimate the speed with which change takes place. Certain applications - in particular, the substitution of new products for old - can achieve their full effect very quickly, bringing sudden job losses. The effects of the more fundamental, and pervasive, changes in the handling of information within production processes are likely to be much more drawn out, since they imply changes in complex organization structures - changes which it will not be easy to make quickly.

#### QUANTITATIVE ESTIMATES OF THE EMPLOYMENT EFFECTS

Much research has already been carried out in the Member States into the scale and incidence of likely job changes arising from the new technology and further studies are due to be published this year. Published estimates fall into three broad groups :

- indicative estimates
- aggregate estimates
- sectoral estimates

##### 1. Indicative estimates

These seem largely designed to emphasise the importance of the subject matter, and their accuracy should not be overestimated. Thus one estimate [2] of the use of the new technology in offices in France, suggests that it could lead to an increase of 6 m in unemployment, but this is derived mechanically by assuming a productivity increase of 100 % among 12 m employees which increases unemployment by 6 m. Another estimate [20] which received wide publicity in the United Kingdom forecast 15 % unemployment by 1985 and 20 % by 1990. This was based on rough and mechanical estimates (whose limitations were freely acknowledged by their authors). The much publicised figure produced by the Rand Corporation in the USA, that by the year 2000 only 2 % of the labour force will be engaged in manufacturing is based on projection of present trends, and in itself implies nothing as to either the likelihood of this figure being achieved or as to what the other 98 % would be doing at the time. There are many such estimates, which tend to show the same weaknesses.

2. Aggregate estimates can best be obtained from detailed reviews of likely effects across a wide range of industry. A number of such studies already exist and further detailed analyses are in progress in a number of Member States. There is widespread agreement on the importance of information related activities and the consequent proportion of the workforce who will be directly affected by the micro-electronic technology.

The highest estimate appears to be that of ASTMS [27] which regards 62 % of all occupational groupings as at risk, while believing that displacement will be in the range 10 - 30 %.

On the basis of its studies, [10] the German government expects that up to 50 % of jobs could be affected in the long term, a figure with which the CPRS [14], the DGB and others [29] agree. The OECD takes a lower figure [32] suggesting 35 %. There is a reluctance among the major studies to produce estimates for the overall consequences of the new technology.

The British Central Policy Review Staff [15] rejected as too pessimistic forecasts of 3 1/2 m unemployed in the United Kingdom, while not making a forecast of its own. This position has much in common with that of the French Nora report [9], which agreed that large numbers of posts would be affected, while pointing to the difficulties of a general estimation. The Rathenau report for the Dutch government (1) likewise takes a cautious view. While recognizing the widespread and unavoidable effects of the new technology, it even suggests that total employment might increase under certain conditions.

The IRIS report [1] foresees the suppression of some 200,000 jobs in France, with the creation of tens of thousands of new service posts, in the period to 1985. FIET [24] notes that uncontrolled use of the new technology could result in large scale job losses amounting to "many millions of jobs". A report for the Dutch Government [7] argues that it is not possible to arrive at any conclusions as regards the overall consequences of micro-electronics on employment.

3. Sectoral estimates have been produced for governments and by the various groups involved - trades unions, employers and producers of the new technology. These analyses, which often incorporate internal information, need to be studied with care, for they are apt to concentrate on small sub-groups within sectors, usually those most affected. To the unwary reader this may lead to false general conclusions.

Many of the figures have their origin in manufacturers studies. Such studies have a clear publicity value for the manufacturer. These figures also often form part of the case presented on the union side for controlling the introduction of the new technology. Thus the sources of such figures are not neutral : both manufacturers and unions have an interest in emphasizing the potential technical efficiency of the new equipment. A number of branches of industry and services have featured prominently in research reports as those sectors and occupations in which the employment effects are most likely to be significant and these are briefly reviewed here.

### Industry

The production of electronic equipment and components is the industrial sector most directly affected. Large numbers of individual components have been replaced by integrated circuits, which require less labour in their production and which can often be inserted into equipment in

(1) Volkskrant 4 December 1979.

automatic production processes. Not only has the production and use of components been affected, but the market for products itself is changing.

Electronic equipment was a source of employment growth over the last decade, employing 2,85 m workers in 1978, of whom nearly 40 % were women. This represents some 7,5 % of industrial employment. As a result of the developments foreseen, a change in employment patterns is inevitable, and whether there is net growth or decline depends to a large extent on how successful the industry is in adapting itself to the new situation with its new requirements. Thus in France the industry is seen as having the capacity for net job creation for the period 1977-85 ranging from a gain of 17.000 posts (6%) to a loss of 12.500 posts (4 1/2 %) [1]. In the United Kingdom on the other hand the electronic industry has suffered loss of employment. This is to a considerable extent due to import penetration, and contrasts with the American and Japanese industries which are expected to show substantial growth in employment over the next decade [12].

New products are the most promising source of additional employment but risk losses in other products for which they are substitutes. Thus a series of new or radically improved products are appearing on the market :

- electronic watches : the market for watches has already been revolutionised, and it is presented here chiefly as an example of the extreme consequences of failing to face up to the new technology in time. The nature of the product has been changed so radically as to justify the term "new product". Employment of the old skills has fallen sharply, and where old firms have managed to retain their names, it is often by bulk purchase of movements to be inserted into their own cases. Thus employment in the German watch industry fell by 40 % during the mid-1970s. [8]
- calculators : this market has been revolutionised in the 1970s. The development of cheap portable electronic calculators has made generally accessible a product which was formerly confined to limited office use. The development has been characterised by a change in the dominant firms, many of those formerly prominent having failed to maintain a position in the new market, while new firms have been dependant on rapid innovation to maintain and increase their market share. The innovating firms chiefly based in Japan and the United States, achieved a large and rapid penetration, with consequent benefits to their employment and that of their countries. There has been a loss of employment in the older firms, offset by employment in the enormously expanded new market. [8]

The two examples just cited are principally of interest because they have already happened, and their consequences are clear. Other developments will take place in the near future, and are therefore to some degree speculative.



- telecommunications and home consols : The telecommunications system is in process of major changes, affecting the type of transmission and reception equipment used, and the services offered. At the first stage there is a major change in switching equipment from electromechanical to electronic. This has resulted in major reductions in assembly work. American Telephone and Telgraph is quoted [25] as having reduced its employment by over 50 % in the period 1970-76 as a result of the introduction of electronic switching. Ericsson cut its production workforce by 33 % in less than four years for the same reason, although its white-collar labour force was unaffected. (+). Siemens has recorded a reduction of 20 % over two years in its employment on production of electronic telex machines, despite trebling output, and the International Federation of Metalworkers believes that 60-80 % of jobs could be suppressed in the production of telexwriters [19]. Similar experiences are quoted in the French and British telecommunications industries. Olivetti has pointed to the reduced proportion of remaining employment which is to be found in production, while for many of those who remain, there is a risk of deskilling.

Home consols, giving individual subscribers access to data banks, information networks, banks and other services will have a rapidly expanding market in the 1980s. The market for this product will be international, and the countries and firms which establish a lead will benefit most from the consequent new employment in a market estimated at \$ 12 bn by 1987 in France, the Federal Republic, the U.K and USA [16].

Despite the great increase in telecommunications services there is likely to be substantial reduction of staffing in some areas (e.g. through the increase of electronic mailing). However, other analysts [7] point out that with the rapid development in demand foreseen for the next ten years the employment prospects are satisfactory. Thus the British Post Office [2] hopes to maintain constant levels of employment over the decade, and recent experience in France where large increases in output have compensated for substantial productivity gains indicates the possibility of continued stability in the 80s. In general, although there is likely to be a substantial improvement in the reliability of equipment, it is expected that there will be an increased demand for maintenance workers on account of the large increase in equipment in use [7].

- cash registers : the production of cash registers has been substantially affected. NCR estimate the labour content of electronic cash registers as only 25 % of that of earlier electro-mechanical products. This has lead them to reduce their employment in this sector in the Federal Republic by 90 % and in the U.K by 65 % . Electronic cash registers and stock control have already led to some reductions of retailing personnel.

(+) Financial Times, September 25, 1979

Services

The services have traditionally been a low productivity, high employment growth area, with low capital per head in some areas compared with manufacturing. Introduction of the new technology provides the opportunity for substantial productivity increases especially since information handling and organisation constitutes a large part of a number of services.

Two examples are :

- office organisation and administration : the likely changes involve reorganisation and rationalisation of office procedures, and replacement of personnel by micro-electronic handling of information flows. The unpublished Siemens report "Office 1990" [ 8 ] is quoted as considering just under half the clerical type posts in the Federal Republic, of which it estimated over 40 % could be standardised and 25-30 % automated. In the public sector it estimated that 75% of jobs could be standardised and 38% automated over the next ten years. This is held to imply an average productivity gain in offices of 2,2 - 3,5 % per year to 1990. It would result in a fall in employment among the unskilled, while bringing increased employment to the semiskilled and highly skilled. Similar argument leads FIET [26] to forecast displacement of 20-25 % of the current 15 m clerical staff working in the Community.

The increased productivity of secretaries made possible by the use of word processors rather than traditional typewriters has been widely publicised. The potential productivity gains are great, especially where texts undergo frequent amendment : retyping is unnecessary and correction or amendment can be done by authors. IBM estimates [6] that the use of word-processors could increase typists productivity by almost 150 %, while others estimate the increased productivity of a copy-typist at 100 % [25]. The IRIS study [ 1 ] points to possible reductions of 20-25 % in the employment of secretaries in France.

- banking, financial services and insurance : the new technology will affect the services provided in this sector, and give rise to new services.

A significant proportion of banking jobs can potentially be rendered automatic. Such development includes the computerisation of records, a process rapidly advanced in the 70s; the introduction of cash dispensers and electronic inter-bank transfers, which has been spreading rapidly in the late 70s [ 24 ]. and the introduction of cashless transactions - electronic funds transfer - by linking sales points directly to the banking system, a process which is feasible but still experimental.

The banking sector experienced rapid growth in employment through the 60s and 70s, increasing by some 70 % over the years to 1978. At that time it employed some 4,8m people in the Community, of whom 54 % were men. Thus the period of computerisation of records coincided with a considerable increase in staff levels. Accounting firms have also found that greatly increased demand for their services has more than compensated for the increased productivity of their workforce, leading to a net increase in employment.

A survey of bank attitudes in the United Kingdom [7] has shown that there are substantial obstacles in the way of very rapid introduction of new technology, and employment growth is consequently expected to continue. This view is in agreement with both US [18] and Canadian [19] sources, which argue that the coming period is likely to see a reduction in the rate of increase of banking sector employment, but that increasing demand is still likely to outrun increasing productivity. Even the seemingly pessimistic Nora report [9] which estimates that the new technology could permit staff savings of 30 % at present levels of service, believes that the expansion of demand in France will be such as to imply stability of employment rather than redundancies.

#### Process control

The robot controlled factory, in which intelligent machines control the process, input the new materials and test and package the final product has long been a manufacturers' dream. In a number of cases it is now feasible to automate significant parts of production. The potentially greater speed of reaction and more delicate control of the process made possible in such circumstances threatens to displace skilled workers from the production process.

Continuous production processes are not new. The production of plastics and petroleum derivatives has always been a highly capitalised, continuous process, with relatively little opportunity for manual intervention. What has been unusual until now is the spread of such continuous processes to assembly and execution of manual activities. Three examples illustrate the developments which are taking place :

- computer numerically controlled (CNC) machine tools carry out machining and preparation of high quality parts to standards of accuracy and speed which exceed these of existing manually controlled tools. This constitutes a development in cost-effectiveness beyond the numerically-controlled (NC) technology which has been available for some time and has brought significant changes in itself.

The NC technology has not so far been rapidly adopted. Nowhere does it exceed 5 % of the total stock of machine tools [12]. The speed of introduction of CNC technology will depend on the improved cost-effectiveness of the new equipment. How rapidly it will replace existing equipment will only become clear over time. Some authorities [13] believe that rapid replacement is now likely; this would certainly imply elimination of jobs, and a change in the character of the work to the supervision of machines. It would also tend to replace traditional skills with computer-oriented skills. However other studies [12] argue that there are other motives for introducing CNC tools. These include shortage of traditional skills and increased flexibility of operation. In such cases, although labour productivity would be increased, the displacement of labour might not be significant. Similar doubts were expressed about skill requirements.

- printing and publishing : the development of more efficient printing systems and the decline in demand for traditional skills has hit this sector during the 70s. Composition direct from the keyboard is now possible and block production is becoming increasingly automatic. This is believed to put at risk some 60-75 % of jobs in composition [7] in the United Kingdom (composition amounts to some 15 % of employment in the sector). The CFDT has forecast [24] heavy redundancies in graphic work in France, while in Germany the development of printing technology led to a series of strikes in the late 70s, culminating in an agreement between the social partners regarding the implementation of the new technology. The implementation of the new technology and its manning implications have also been the subject of disputes in the United Kingdom. In the less immediate future, the industry is likely to face developments such as automatic text scanning, translation and even composition on the basis of verbal input.

- cars : there are two main areas of application. First the introduction of robot-controlled processes such as welding and die-casting on assembly line production of vehicles has already shown productivity increases (on individual stages) ranging from 30-80% [8]. Such technology has already been introduced by some manufacturers, eg Volkswagen, Saab and Volvo and its generalisation cannot be far off. Second, there is likely to be a substantial new market for electronic ignition and control systems. The market for this in France, the Federal Republic, the United Kingdom and the USA has been estimated at \$ 7 bn by 1980 [16]. Innovation is imminent in the USA, but seems less so in Europe. This risks reproducing some of the employment consequences of the introduction of electronic watches, if the manufacturers of existing mechanical equipment do not themselves innovate the new equipment.

STUDIES, PAPERS AND ANALYSES CONSULTEDA. ECONOMIC ANALYSES, GENERAL SURVEYS, BACKGROUND AND POLICY DOCUMENTS

1. Automation, travail et emploi : IRIS - Université de Paris Dauphine 1979.

An empirical study of the main developments in automation, with macro-economic approach.

2. "Bientôt 7 millions de chômeurs" : P. Berger in "Informatique et gestion" June 1977.

3. Der Einfluss neuer Techniken auf die Arbeitsplätze  
Institut für Systemtechnik und Innovationsforschung (ISI),  
Institut für angewandte Systemanalyse (IAS), Karlsruhe 1977.  
This is a broad survey of the methodological approaches used in existing studies of links between new technology and labour market development.

4. Employment and Technology - a TUC report : Trade Unions Congress, London 1979  
A general survey from the point of view of the British trade union movement

5. European Society faced with the challenge of new information technologies : a community response : [ COM(79) 650 final ]

This is a policy document presented by the Commission to the European Council of November 1979, outlining the challenge of the new technology for the Community and describing a possible policy response.

6. Growth, structural change and labour market policy : the challenge of the 80s : Report of the Director General, International Labour Office, Geneva 1979.

This contains a useful brief survey of the employment effects of the new technology.

7. "The impact of chip technology on employment and the labour market".  
Metra Consulting for the Ministerie van Sociale Zaken, Netherlands 1979.

8. The impact of Microelectronics on employment in Western Europe in the 80s.  
European Trade Union Institute, Brussels 1979.

This is a comprehensive survey of the field, bringing together studies from many European countries and providing a useful synthesis of empirical work.

9. L'informatisation de la Société : D. Nora and A. Mino : Paris, La Documentation française, 1978.  
This surveys the likely applications and impact of micro-electronic technology across French industry and services, giving qualitative assessments of the likely employment consequences in each sector.
10. Langfristige Wirtschafts- und Arbeitsmarktentwicklung in der BRD und Baden-Württemberg sowie Vollbeschäftigung und des Wirtschaftswachstums : PROCNOS AG, Basel 1978  
This study contains a detailed forecast of jobs affected by technological change in the short and medium term.
11. Innovatie : Preadviezen van de Vereniging voor de Staathuishoudkunde : S. Kroese, Leiden/Antwerpen, 1979.  
This is a collection of papers on innovation. One in particular by F. Prakke gives a valuable analysis of the likely effects of micro-electronics, and reflects on why the forecasts of the effects of computers were too pessimistic.
12. The Manpower Implications of Micro-electronic Technology: J. Sleigh, B. Boatwright, P. Irwin, R. Stanyon, Dept of Employment, London 1979  
A survey of the scope and likely consequences of the use of micro-electronic technology in the U.K, this represents a broad survey of all industrial and service applications and their consequences.
13. Micro-electronics - a new dimension of technological change and automation: G. Friedrichs, 1979 - a paper submitted to a FAST seminar at the Commission of the European Communities.  
A review of the industrial and employment consequences of micro-electronics, mainly concerned with the Federal Republic but also with examples from elsewhere.
14. Mikro-processoren - Auswirkungen auf Arbeitskräfte - Werner Dostal, Klaus Köstner, Mitt AB 2/77, Nürnberg.  
This study is part of a research programme into key technologies. It warns against the isolated evaluation of micro-processors effects, which should only be treated within comprehensive forecasts.
15. Social implications of microelectronics : Central Policy Review Staff London 1978.  
A general review of the implications of the new technology for British industry and employment.
16. Strategic impact of intelligent electronics in U.S. and Western Europe, 1977-8 Report by Arthur D. Little Inc. for the Commission of the European Communities 1979.  
This reviews the applications and equipment business opportunities arising from micro-electronics in four areas : industrial, automotive, business communications and consumer.

17. Technical change and employment : R. Rothwell and W. Zegveld:  
Frances Pinter, London 1979.

This book, which developed out of the Six countries Programme on Aspects of Government Policies towards Technological Innovation in Industry, analyses the effects of technical change on employment, including the effects of microelectronics.

SECTORAL IMPACT - TRADE UNION AND OTHER ANALYSES

18. Technological change and manpower trends in six industries: US Bureau of Labour Statistics Bulletin 1974.

This is an early study of the effects of changes including computerisation and microelectronics.

19. The effect of technological changes on educational and skill requirements : S. Peitchinis, Calgary 1978.

This report for the Canadian government covers a wide range of industry.

20. Aspekte der gesellschaftspolitischen Problematik der Informationstechnologien : Ulrich Briefs, in WSI - Mitteilungen 8/1979

This article sets out the social implications and possible trade union response to new information technology.

21. La micro-électronique menace-t-elle l'emploi ? : Problèmes Economiques, Paris n° 1618, 1979.

This reviews papers presented to the conference of the International Federation of Metal Workers, Geneva 1978.

22. Computers and work : FIET action programme : FIET Geneva 1979

23. "Effets de la rationalisation sur la situation de l'emploi dans le secteur européen du commerce" : FIET 1979.

This reviews the forms and consequences of rationalisation in the commerce sector, and proposes union policies for the defence of the labour interest.

24. L'information du secteur tertiaire : Paper by H. Blassel and M. Le Trou CFTD 1978, Paris.

25. Office technology : the trade union response : Association of Professional, Executive, Clerical and Computer Staff, London 1979.

A trade union review of the special problems of the new technology in its area, with a suggested response.

26. Report on the Trade Section Conference of salaried employees in industry : Euro FIET 1979

This contains a number of interesting documents relating to technology and employment in the area of the European section of the International Fédération of Commercial, Clerical and Technical Employees.

**C. CONFERENCE PAPERS**

27. Technological change and collective bargaining : Association of Scientific, Technical and Managerial Staffs. A discussion document, London 1979.
28. Papers submitted to the conference of the Deutsche Postgewerkschaft, 1979.
29. Informatique et Société : colloque international : papers from a colloquium organised by the French government in 1979.
30. Papers submitted to the Conference Europe in transition : the challenge of the future, Arc - et - Senans, France 1979
31. Micro-electronics : secondary and tertiary changes in technology and society : E. Braun, K. Brunstein, L. Emmerij, G. Friedrichs, A. King, 1979.  
Draft papers for the Commission of the European Communities
32. Science and technology in the new socio-economic context  
Papers of the O.E.C.D. Committee on Science and Technology.
33. Papers submitted to the Special session on the impact of micro-electronics on productivity and employment, Working Party on Information, Computer and Communications Policy, OECD 1979.