SOCIAL EUROPE

The software industry

SUPPLEMENT 6/86

COMMISSION OF THE EUROPEAN COMMUNITIES

DIRECTORATE GENERAL FOR EMPLOYMENT, SOCIAL AFFAIRS AND EDUCATION

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PREFACE

This Social Europe supplement on "New Technology and Social Change" was originally to be on the software industry and its employment and social implications.

While the text was being prepared, a report by Mr W. KOK to Mr J. DELORS, President of the European Commission, became available. The report "The Social Aspects of the Introduction of New Technology and Proposals for a More Fundamental Approach to the Social Dialogue" contains a reconsideration of Community policies on technological innovation and a number of suggested policy lines, particularly on how to improve the social dialogue on the introduction of new technology.

The report is published in full, except for an annex on a working visit to the United States, in Part II of this supplement. The first part deals, as planned, with the software industry, both at Community level and in the Member States.

Jean DEGIMBE

PART I

The Software Industry:

Employment Trends and Work Organization

EDITORIAL

New technology is not only a matter of new machines and production equipment; it is also to a large extent the development of new services. Indeed, advanced services are one of the sectors where technological development is expected to create a substantial number of jobs.

Software production and software services are of paramount importance in the development of information technology, due to their complementary role to the functioning of any computing equipment. Moreover, they have a rather peculiar status, insofar as they consist of the production of immaterial goods, variously considered part of industry or of services according to the main activity of the companies concerned. Even from a statistical point of view, software and computing services are not recorded as a separate branch, so that it becomes difficult even to know how many people are employed in the sector.

The publication of this supplement on software is aimed at gathering the existing information in the Member States in order to have a clearer picture of the size of the sector, its growth trends, the quantity and quality of employment it generates, and the problems it faces in terms of skill shortages and work organization. We have decided to focus on software production, whether carried out by equipment manufacturers or by software houses and consultancy firms.

The application software developed by data processing departments within user firms, which is even more difficult to grasp since it concerns all sectors of the economy, has thus been excluded from the analysis. Even so, it has often been difficult to single out the number of employees working on software in computer hardware manufacturing firms, and to identify which share of the activities of software houses and of their staff is devoted to software rather than to numerous other consultancy tasks.

We had in mind three sets of questions on which a comparison of the findings of national analyses would allow a better appreciation to be made of the employment potentials of the sector in Europe. The first issue concerns the contribution of software production to the growth of the information technology

sector, and the viability of the large number of software firms that are continuously created. Some national reports point out that the development of the software market is an opportunity not to be missed by countries which have been left behind in the production of hardware, since the market has relatively low barriers to entry, and the investment required to set up a software house is mostly investment in human capital. On the other hand, most national analyses report that birth and death rates of new firms are both very high, and that market conditions are rapidly changing with the increasing importance of standardized software packages. The ability of firms to adapt to changing market conditions and to anticipate market trends will eventually determine, among other things, the extent to which the sector will be able to create jobs.

The second set of questions concerns the quantity and quality of employment thus generated. Favourable expectations on employment trends are put forward in all countries, and software is widely mentioned as one of the most promising sources of jobs in the near future. However, it is worth remembering that the absolute number of software jobs is very limited and that, whatever growth may be forecast, the relative contribution to total employment will, in all countries, be small. What is more important is the quality of these jobs; in this respect, many countries report shortages of adequately skilled personnel or mis-matches between the level of qualifications supplied by the education system and the requirements of the sector. The situation and expected trends need to be closely monitored to avoid the job creation potential of the sector being hampered by the slowness of the educational system to adapt.

Finally, an issue of interest is the transformation of work organization. Software production, until now organized as an artisan production, where an individual employee entirely developed his/her own product, seems to be undergoing some changes, under the pressure of productivity requirements and in parallel with the ongoing process of standardization of software products. Studies on this issue were found only in few countries; the little available evidence nevertheless confirms that a change is occurring or is expected to occur with the beginning of a process of industrialization of software production. This is likely to bring about some changes in the terms of employment and working conditions in the sector, until now largely unregulated, due to the small size of firms and to the low degree of unionization of their employees.

The first part of this supplement provides some information about Commission activities in the field: first, the R & D programmes for software development which are being carried out in the framework of the ESPRIT programme. The second article, written by the Women's Bureau, reports on Commission programmes concerning new technologies and women: its scope is broader than software, since it concerns a number of initiatives to raise women's participation in high technology sectors and professions. Among these professions, a white-collar job like software is likely to be more open, and possibly more attractive to women, than conventional manufacturing jobs.

The second part, based on national reports from Member States (1), tries to provide some answers to the questions outlined above, together with some information on national government programmes in the field of software and on the positions of employers and trade unions. As we pointed out in previous supplements, these reports are meant to be only a first exchange of information and to stimulate the debate. The Commission hopes that they will also point out some of the gaps to be filled by further research on the sector.

Jean DEGIMBE

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1) The national reports were prepared in the summer/autumn of 1985, i.e. before the enlargement of the Community. This is why Spain and Portugal are not included.

THE ESPRIT SOFTWARE TECHNOLOGY PROGRAMME

1. Introduction

Software, and the development of software products, have become one of the most talked-about topics in government departments, industry and academia over the last decade, and there does not seem to be any sign of this emphasis decreasing in the foreseeable future. But what is software and why is it so important?

In essence software is the sequence of instructions applied to computers which direct the operation of the computer to enable it to perform the required task. The sequence of instructions can be very simple in nature to enable the computer to perform simple tasks (eg. addition) or the sequence of instructions can be extremely complex when the computer is required to perform very elaborate or complicated tasks (eg. power station control, aircraft navigation, etc.).

Software is now part of our everyday lives, albeit behind the scenes. As the number of domestic appliances, cars, etc. which include the small micro-processor increases then our dependence on high quality reliable software will increase significantly. From a more industrial point of view Information Technology is being described as an industrial revolution having greater impact than that experienced within Europe in the 1930s. The problem is that unless European industry is equipped to respond to this "revolution" then the opportunities which will open up for industry will be snatched eagerly by non-European companies. This situation would of course be quite unacceptable and the consequences would be very wide ranging and long-term. For this reason the Commission of the European Communities has embarked on a number of activities aimed at encouraging all sectors of the Community to face this challenge, and to take the appropriate actions which will ensure that the IT "revolution" is of major benefit to all of our citizens.

Part of the Community activity is aimed at the support of collaborative, pre-competitive research and development programmes, and at the present time the challenge in the software area is being taken up primarily in the ESPRIT programme which is managed by the Information Technologies and Telecommunications Task Force located in Brussels.

2. Requirements

With the high dependence on "off-the-shelf" hardware components the cost of the development of the software part of the new systems and products is becoming the dominant factor in development costs (70%-80%). The productivity of our software development teams is therefore of particular importance and it is imperative that the appropriate development methods and tools are available and widely used within industry.

The users of these systems are also becoming more demanding with respect to the quality of these products. In many instances, of course, quality is not just "nice to have", since the performance of the software could have a crucial impact on safety, the environment, etc. The quality factor has been important from a marketing point of view, but the high penetration of software controlled systems now makes the attainment of high quality systems an absolute necessity.

The need for major improvements in the quality of software systems and in the productivity of software development teams has provided the main motivation for the inclusion of software technology or software engineering as a key topic in R&D programmes in all of the developed countries. In the CEC funded programmes, and in ESPRIT in particular, software technology is seen as a key enabling technology and has been allocated more than 20% of the ESPRIT budget.

3. Software technology in CEC programmes

3.1. General

The development of software systems or components is occurring in almost all of the CEC research and development programmes. For most of these programmes software provides a convenient implementation technology, and therefore these programmes primarily provide application areas for software. This is not true for the ESPRIT programme. Of course, the ESPRIT programme does provide applications for software, but in this programme funds are allocated to the further development and maturing of software technology itself. In essence this covers the research and development required to develop a scientific basis for software production, and includes work on software development

methods (and the tools to support these methods), measures for assessing software product quality and development productivity, and project management.

Currently, there are about 40 projects underway in the ESPRIT software technology programme, which have an important role to play, not just from a research and development viewpoint, but also from the impact they have on the forging of industrial and industry/academia relationships which hopefully will extend beyond the lifetime of the ESPRIT projects. At this time there are 88 companies and 56 universities and research institutions participating in the software technology programme.

3.2. The ESPRIT software technology programme: Objectives and technical aspects

The objective of the ESPRIT software technology programme is to achieve the stage in which the development of complex information processing systems is treated as a fully industrial design process, supported by a highly integrated set of computer aided design tools. This objective requires concerted action on several fronts, and therefore sub-goals have been identified to provide the necessary focus within the programme.
These sub-goals are as follows:

(i) to make software engineering a formal engineering discipline supported by a sound scientific basis.

(ii) industrialization of the software engineering process to provide:

  (a) greater development productivity
  (b) higher reliability and higher quality software products.

For programme management purposes the workplan for software technology is broken down in the following way:

(i) theories, methods and tools
(ii) management and industrial aspects
(iii) common development environments
(iv) evaluation and demonstration projects.

3.3. The ESPRIT software technology programme: Current status

As a result of the pilot phase (in 1983) and the calls for proposals in 1984 and 1985 there are now 28 projects in progress and 13 further contracts currently under negotiation. During 1985 the opportunity was taken to conduct an in-depth review of the ESPRIT software technology programme. As a result of this review, and the actions subsequently taken, it is confidently expected that the projects supported within the programme will provide a sound basis for a fully integrated industrial development environment capable of supporting the complete software product lifecycle, i.e. from the capture of the user requirements through to, and including, product support and enhancement. Central to achieving this is the definition of a small number of key interfaces which will provide a level of standardization within industry, and also the vehicle for integration of the methods and tools emerging from the programme. These interfaces are particularly important and it is therefore very pleasing to note that the interfaces are beginning to be adopted by a number of programmes outside of ESPRIT, and that also the first industrial products supporting these interfaces are now coming onto the open market.

3.4. The ESPRIT software technology programme: Future directions

The ESPRIT programme was defined in 1984 as a 10 year programme. Therefore there is still plenty of scope within the programme to further support the advance of industrial competence in the development of software systems. In the short-term, i.e. within the next 12 months, there will be as in previous years, a public call for proposals which will help to consolidate work currently underway and also open-up new research directions. But the major emphasis in 1986 will be on the consolidation of the very promising work aimed at assisting industry to achieve the higher productivity and product quality levels required in the first half of the next decade.

In the longer-term, advantage will be taken of the close synergy between the software technology activities and those within the less mature (today) technologies associated with knowledge engineering, new computer architectures, etc.
Within the ESPRIT management team the responsibility for software technology and these other key technologies for the future lies within a single management unit within the Task Force, and therefore ESPRIT should be in an ideal position to take full advantage of the results of the research activities as they emerge.

J.A. ELMORE
(April 1986)

WOMEN AND NEW TECHNOLOGY

The introduction of new information technology may have an impact on skills by modifying jobs through the automation of certain tasks. When discussing the implications for women, it is important to recall the position currently held by them in the labour market and the characteristics of the work allocated to them.

Sexual segregation in employment exists, as has been demonstrated by numerous surveys and investigations. This segregation takes the form of an over-representation of women in the lower levels of the employment hierarchy on the one hand and a concentration in certain sectors on the other (tertiary - with a predominance in the social services, personal services, domestic servants, banks and commerce); but these are precisely the fields of employment where new technology is making the most headway, affecting the number of jobs and the quality of those that exist, working conditions and the health of the workers concerned.

Technological change is having a profound effect on qualifications. Women are at a disadvantage, the roots of which go back to their youth. First they lack sufficient education and training to enable them to adapt to the new requirements; furthermore, the vast majority of young women continue to choose traditional careers and "feminine" studies and training which makes them vulnerable on the labour market.

Secondly, their employment record is often lacking in continuity, since it is frequently interrupted by time spent in bringing up children or for other family reasons.

Thirdly, they often work part-time or at home, which handicaps them in choosing an interesting career.

The precarious position of women explains their relatively unfavourable attitude to new technology, which they share with better educated workers and socio-economically disadvantaged categories of workers who are of course the most vulnerable to technological rationalization.

(EEC) Community Policy

Community Policy towards meeting social challenges raised by technological change obviously concerns all those workers affected by it; but the Commission is aware that, in addition to an overall policy, a particular effort is needed on behalf of women workers.

In its first equal opportunities action programme, adopted in December 1981, the Commission paid particular interest to the effect of the introduction and extension of new technology on women's employment.

It continued and increased its efforts in the New Community Medium-Term Programme to Promote Equal Opportunities for Women (1986-1990), which was adopted by the Commission at the end of 1985 (1).

Meanwhile, a number of specific campaigns have been concentrating on the entry of women and young girls into working life and their initial and further training and employment, particularly in relation to new technology. The objective of these campaigns was to support and encourage a wider choice of jobs and mastering the new technology. The following is a brief summary of the methods used:

- Surveys and research: One survey was carried out on office automation and work for women, another on training in new information technology with the aim of anticipating the problems of certain groups of workers in finding work - among them, women workers -, and a third on training programmes in new information technology for women workers with a view to preparing them for work as laboratory technicians and industrial designers.

  A survey is in progress on remote working and women's employment, and another will soon be started on new-technology clauses in collective agreements and their effect on women's employment.

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1) Doc. COM(85) 801 final, of 19.12.1985.

- Seminars and colloquia: On the basis of the above-mentioned surveys and research the Commission is encouraging the organization of round tables in each Member State with the parties involved (governments, both sides of industry, training and employment organizations, journalists etc.) to examine how their conclusions and recommendations can be implemented. Such colloquia have already been held in Belgium and Denmark and others are planned for Greece and the Netherlands next May, and for France in September. After these meetings have been held, the Commission will carry out an evaluation of them and their results.

  The Commission will also subsidize conferences and seminars aimed at increasing awareness and preparing the ground at national level in directing young women towards new careers. Although such aid will be limited because of the Commission's restricted budget, it will help stimulate a dialogue between those concerned (training personnel, school leavers and potential employers). Similar assistance will be given to vocational training directed towards the new fields of employment.

- Community measures: The Council's resolutions on Measures of Vocational Training Relating to New Technologies (1), and Measures Relating to Introducing New Technologies in Education (2), together with working programmes adopted by the Commission in connection with the above pay particular attention to the subject of equal opportunities.

  At the same time, under the resolution on Equal Opportunities for Young Girls and Boys in Education (3), the Commission is supporting experiments and programmes aimed at increasing openings for young women in training programmes related to new technology, and is giving particular support to research programmes in this field. In its resolution on Action to Combat Unemployment amongst Women (4), the Council is involved in encouraging applications from and the acceptance of women for work using new technology.

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1) O.J. No. C 166/1 of 25.6.1983.

2) O.J. No. C 256/1 of 24.9.1983.

3) O.J. No. C 166/1 of 5.7.1985.

4) O.J. NO. C 161/4 of 21.6.1984.

The recommendation on the Promotion of Positive Action for Women (1) is also encouraging the recruitment and promotion of women in sectors and fields and at levels where they are under-represented, particularly in responsible positions. It is clear that new technology jobs are very important in this context.

- Contact and exchange networks: A network of information resources in the field of equality, set up to promote a wider range of employment choice, is primarily concerned with those fields affected by new technology. The network consists of one expert per Member State specializing either in school education matters or employment and training issues. Excellent work has been produced and the network is becoming increasingly successful.

- European Social Fund: One of the Fund's priorities is the training of women for non-traditional jobs, particularly in new technology where they are under-represented. The possibilities presented by the Fund in this field should be better used.

- Research programmes in certain sectors: With the aid of experts, the Commission is proceeding with the implementation of research programmes (positive action programmes) in the banking sector, where new technology is playing a major role.

The aim of these programmes is to promote equality of employment opportunities in all sectors, in all occupations and at all levels of the employment hierarchy. They are currently being extended to the industrial sector, and will later embrace the public and social economy (non-profit).

Conclusion and Action to be Taken at National Level

The New Community Medium-Term Programme to Promote Equal Opportunities for Wom (1986-1990) reflects the assessment of the previous programme underlining the need to continue and intensify the programme, particularly in terms of adapting it to economic, social and technological developments.

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1) O.J. No. L 331/34 of 19.12.1984.

This second programme envisages a number of important campaigns relating to women's employment, particularly in supporting equal employment in jobs involving new technology. With this in mind, the Commission is preparing a series of initiatives aimed at continuing current programmes and meeting new economic and social challenges in the field of equality.

This article has given a brief summary of the programmes being undertaken by the Commission in this field; but governments, employers and workers have an equally important role to play at national level. Here are some proposals for action:

- Clearer identification of employment statistics relating to the new technology, the number of women workers and the levels they have reached in relation to male workers, and the development of the qualitative analysis of this problem;

- Promoting and drawing up guides containing equal opportunity recommendations for establishing new technology introduction programmes, in terms of education and training as well as employment;

- Encouraging application from and the acceptance of women for posts using the new technology;

- Developing pilot training programmes for women in the new technology together with better use of the possibilities offered by the European Social Fund;

- Supporting bodies responsible for disseminating and exchanging experience and knowledge relating to the impact of new technology on the training and employment of women and promoting greater awareness amongst the groups concerned;

- Developing programmes aimed at increasing awareness of the situation (prizes, brochures, information campaigns etc.);

- Encouraging and developing networks of concerned people and organizing research programmes in schools - introducing girls and boys to the new technology at the end of primary school and in all secondary schools.

The new technology may reinforce segregation in employment and have a detrimental effect on working conditions. It may also de-skill employment, and represent a new way of putting women back in the home. On the other hand, it can also help them break through into new fields of employment, organize their time and work better and acquire new skills. Which happens, depends on the policies pursued. For its part, the Community will continue to support the development of what might be called "the European technological woman".

Marie-Josée RAETSEN

SOCIAL CHANGE IN THE SOFTWARE AND COMPUTER SERVICE INDUSTRY

OVERVIEW AND INTRODUCTION

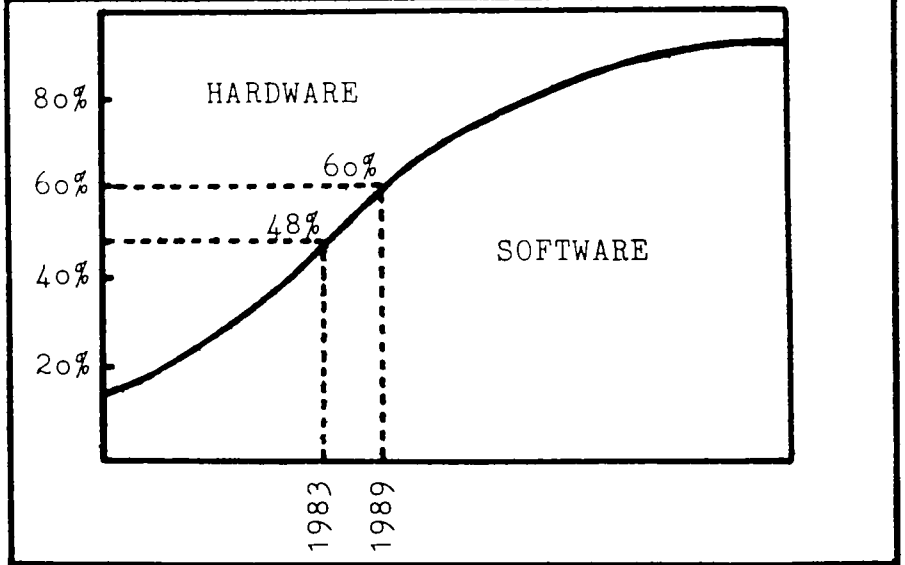
Dr. A.J. HINGEL

April 1986

"The decade of software" - this is the designation which has been given to the 1980's. In fact, computer technology has until recently been identified with computers, printers, external memory units, visual display screens, numerically controlled machine tools, robots, electronic telephone sets, point-of-sale-terminals etc. - in short, with the hardware aspect of technology. The software side has been given relatively little attention, although it is software that controls the running of the computer systems and it is software that determines to which end the hardware should be applied.

Economically one can justify this one-sided view of computer technology: hardware has represented the major part of computer costs. But the situation is swiftly changing. As one can read from the table below, 48% of computer costs was related to software in 1983 in Germany; it will be 60% in 1989. A British survey points at the year 1986 as the 50%-turning-point and by 1987, 75% of the total computer system value will be software (1).

Table 1 HARDWARE / SOFTWARE COST RATIO CURVE



Source: Computerwoche 5 April, 1985

1) Financial Times, 4 October 1985.

There are several reasons for such a change, but one of the main reasons is the sharply falling prices of hardware products. One can illustrate this development by referring to the price of logic chips. One chip cost in the mid-1960s US$ 15, in the early 1980s it cost 2 cents. Since the beginning of 1984 the prices have literally collapsed: a 256,000 bit integrated circuit which by the beginning of 1984 cost US$ 84, could be bought for US$ 3 by January, 1985.

Let us briefly look at what hides behind the concept of "software". The field is divided into two major subgroups: system software and application software.

System software is mainly the operating programs that are delivered together with the hardware - the computer - and which tell the computer how to carry out various standard tasks. The system software controls and runs the connection between the central processor (the central operating unit of a computer system), the printer(s), peripheral memories, display screens, etc. There are about 240 different operating systems on the market of which the most used are the MS DOS (used by IBM) and the CP/M. It is the choice of system software that defines to which degree two different computers are compatible, i.e. able to work together and communicate.

System software is, however, not only operating programs, but also "compilers" and "interpretors" that translate programs written in different programming languages into operational computer instructions. Other types of system software include "data-base management systems" which give the computer instructions on how to organize data files and how to store data; and "programming aid systems" which significantly increase programming productivity.

Application software, the other major field of software, is the designation of all other programmes that serve the purpose defined by computer users. There are two types of application software: "standard software", which is also termed "packaged software", that is software products developed for sale on the general market of software in order to give standard programme solutions to standard computer applications; and "custom software" - also named "bespoke software", which is software developed in response to specific computer user demands.

The Software and Computer Service Market

The software and computer service market of the European Community amounts to 16-18 thousand million ECU, 1984/1985. The market is growing by some 20% per year. As one can see from the table below, the average yearly growth rates vary between countries, but it is noticeable that the bigger countries (Germany, France, Italy and the United Kingdom) seem to have the highest yearly market increase (see Table 2).

It should be stressed here that the software and computer services "market" does not coincide with the total production in a country. In fact, in almost all countries, a large amount of software is produced by the user companies (1). However, the ratio varies strongly between countries. In the Netherlands, 74% of software is produced in the user companies; in France the ratio is 27%; in Ireland 9% and in Greece almost no production of software takes place in the user companies.

Table 2
The National Software and Computer Service Industries.

Country	Annual Sales (estimates) (1985) bnECU	Average Annual Growth-Rate	Period	Total Employment (estimates) (1985)	Productivity* (ECU)
(D)	5.36	2o% - 25%	-		
(F)	2.33	24%	'83/'84	47,ooo	5o,ooo
(I)	1.6-1.9('84)	31%	'84/'86	34,ooo	47,ooo
(UK)	3.14 ('84)	-	-	7o,ooo	45,ooo
(Nl)	2.18 ('83)	1o% - 2o%	'82/'84		
(B)	o.56	16,8%-19%	'73/'83	6,725	83,ooo
(DK)	o.44	16%	'79/'84	8,6oo	51,ooo
(Irl)	o.12	-	-	1,3oo	92,ooo
(Gr)	o.oo2** ('84)	-	-		

*annual turn-over per employee (rounded figures) **only software
SOURCE: National Correspondent Reports

1) OECD, Software: An Emerging Industry, ICCP publ. No. 9, Paris, 1985.

Computer users are nevertheless becoming still more dependent on software development external to the company. The relative importance of "in-house production" of software is diminishing rapidly: in Germany, in bigger companies, 74% of software was produced in the user company in 1978 - the ratio was 58% in 1985.

Let us below, in more detail, describe the software and service market. The traditional product of the industry is "processing services", but its relative importance has constantly been falling. The market for processing services will stagnate, or even fall, during the coming years, according to professional estimates. Local batch processing services will fall by about 1% p.a. in the bigger EEC Member States. However, other computer services are expected to perform better: e.g. "remote autotransactions" is expected to increase by about 16% p.a. (1).

The size of the processing services market varies from country to country. Denmark has the highest service expenditure as a percentage of GNP, 0.56%, whilst 60% of the market is processing services. In other countries, like Germany, Italy and the U.K., 32-39% of the market is covered by these services.

The market is, however, not only characterized by the diminishing relative importance of processing services, but also by a significant change in the software market. As can be seen in the table (Table 3), packaged software is increasing its share of the market, whereas that of custom software is shrinking. Only Italy seems to be an exception to the rule. In percentage growth one expects custom software in real terms to increase sales by 17-24% and packaged software by 29-35% p.a. (2). According to these forecasts, packaged software will account for about half of the total software and service market by the end of the 1980s. One of the reasons for such a change towards packaged software and away from custom software is the fact that packaged software to a still higher degree is flexible enough to satisfy individual users' specific demands.

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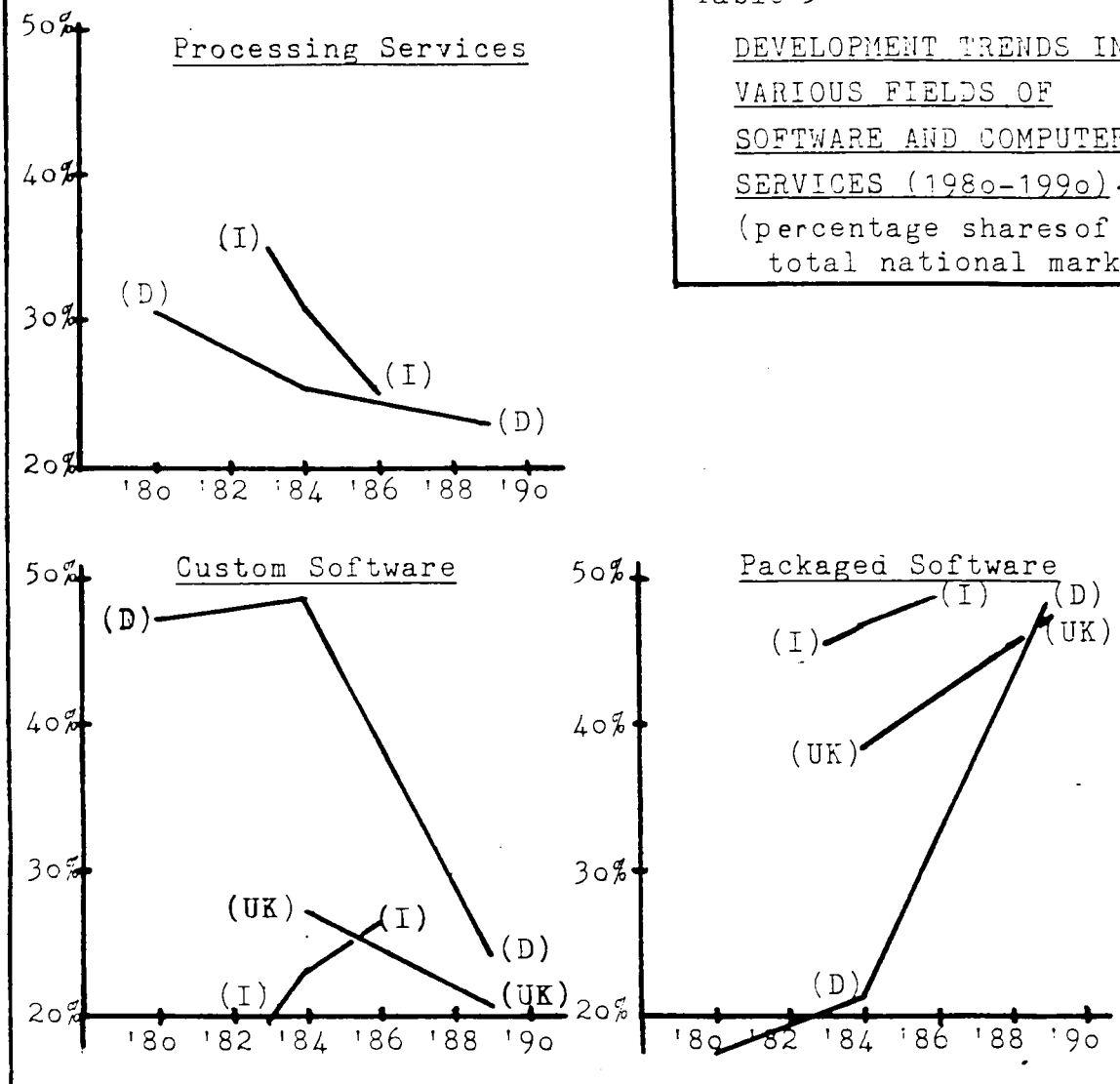
1) International Data Corporation, in Financial Times, 4 October 1985.

2) Financial Times, 4 October 1985.

Table 3

DEVELOPMENT TRENDS IN VARIOUS FIELDS OF SOFTWARE AND COMPUTER SERVICES (1980-1990).
(percentage shares of total national market)



SOURCE: National correspondent reports.

Together with the massive spreading of personal computers, it could be expected that software for these computers would dominate the market now or in the near future. This is not the case. The major part of the software market is, and will for several years, stay related to the market of mainframe or mini-computers. In 1985, only one sixth of the software market was dominated by software for personal computers - it is expected to be one fifth by 1989. Nevertheless, the personal computer software market is the fastest growing segment of the market.

Within smaller parts of the software and service market one finds elements of a significant future growth. This concerns for example the market of on-line services and register consultation, and also such fields as independent computer maintenance. Maintenance of computers has until now mainly been carried out by the computer manufacturing companies. Independent maintenance companies have conquered 12% of the market in the U.S. In the EEC only 2% of the maintenance market is to date controlled by independent companies. The maintenance market is growing by 3 % p.a. (1).

The Industry and Its Major Companies

The processing service sector was born together with the spreading application of computers during the fifties and sixties. The independent software market emerged in 1969 when the world's most important computer manufacturer, IBM, was asked by the U.S. Department of Justice to "unbundle" sales of hardware and software. Previously software had been sold "bundled" together with the hardware. The first independent companies to take up the software market were naturally the computer service companies. With the emergence of mini-computers in the mid-Seventies, a new kind of company, the so-called software houses, were set up in order to satisfy the growing demand for appropriate software, and during the latter years an increasing number of independent vendors, computer consultancies and general consultancy companies have entered the software market.

Since the unbundling of the software market, hardware manufacturers' share of the market has been in constant decline. The present situation is shown in the table below (Table 4). The outstanding features here are the relative big presence of hardware producers on the German software market (29.5%) and the significant low levels in France (17%) and Denmark (14.6%).

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1) Financial Times, 4 October 1985.

Table 4 The Hardware Manufacturers' Share of the Total Software and Service Market (1983)

Spain	33.5 %
Germany	29.5 %
Portugal	27.3 %
United Kingdom	26.3 %
Italy	25.4 %
Belgium	22.7 %
France	17.o %
Denmark	14.6 %

Source: International Data Corporation, IDC.

It has proven to be extremely difficult to present a clear picture of the national software and service industries. Only very few statistical data are available. Mostly one has to rely on information from the relevant professional associations.

A good illustration of the state of confusion can be found in the case of Italy. Estimates of the number of companies in the software and service industry vary between 5,400 and 1,000 - the latter figure being stable companies "constantly on the market". The basic reason for this unclear picture of the industry is the very high number of small companies. In Italy, 25% of the employment in the sector is to be found in companies with less than 5 employees. In Belgium, for example, 86% of the companies employ less than 9 employees. The average size of company has been constantly falling in Belgium: in 1974 there were an average 34 employees per company; in 1980, 19.5 employees; and in 1985, 9 employees.

Due to the relatively high number of small companies, the industrial concentration in the industry is low. However, in most countries one finds a few very big software and service companies which in some cases hold a significant market share (Table 5). In the case of Denmark, the two biggest computer service companies account for one third of the total market. In other European countries the presence of the biggest companies is relatively smaller. In the U.K., Germany and Italy, the ten biggest companies account together for 20-22% of the market, whereas in France they control about 33%.

Table 5 The Major National EEC Computer Service Companies within the European Top 3o Companies (1983) *

Company	Country of origin	Revenue $ million	Number of employees
SG2	France	144.7	4,2oo
CAP Gemini Sogeti	France	139.1	4,ooo
GSi	France	128.8	2,4oo
Scicon Int.(1)	U.K.	11o.4	2,65o
Thorn EMI	U.K.	62.4	1,69o
LOGICA	U.K.	38.5	1,428
DATEV	Germany	1o8.9	1,788
Kommunedata	Denmark	66.8	1,447
Datacentralen	Denmark	59.4	1,281
CIG (2)	Belgium	42.8	1,o52
VOLMAC	Netherlands	42.3	68o

Source: ECSA/IDC, 1984 (OECD Software: An Emerging Industry Paris, 1985)
(1) Composed of GFI(France, Scicon(U.K.) and SCS(Germany)
(2) Includes LA Computer Services(U.K.) and Rhein Main(Germany)
*Includes all third party vendors' software activities.

The software and service industry is an extremely mobile industry: new companies are constantly being created and old companies close down. A British study calculated 158 creations of new companies during the first five months of 1985 in the U.K., but in the same period, 67 companies stopped activities (1). It is also, as mentioned above, a fairly new industry. An Italian survey of the Lombardy region showed that 66% of software and service companies were less than seven years old (2). It should nevertheless not be forgotten that the biggest and internationally most important companies are not of recent date. The average age of the top ten American software and service companies is almost 28 years. IBM has been active in the computer field for 34 years.

Trade and Commercial Balance

The market for software and service products is just as turbulent as the industrial structure which was described above. A British survey estimated that 27.5% of the 10,000 or so products on the market had been changed within

1) The National Computing Centre, 1985.

2) RESEAU, La produzione di servizi di informatica in Lombardia, Milan, 1984 (mimeo).

the "previous three months". Taking into account the products which had been withdrawn from the market, the survey estimated the number of monthly product-changes was about 1,000 (1).

The software and services market is to a relatively high degree a national market. Most companies are based only on domestic revenues.

If one takes the U.S. as reference one finds that 12% of revenues are realized abroad. In Europe, it is first of all in France that one finds companies achieving high levels of sales outside national borders. Companies like SEMA and CAP Gemini Sogeti find 50% and 40% respectively of their revenues abroad, and almost 27% of the revenues are obtained outside Europe. The often high export performances of French companies clearly contradicts the general viewpoint that "language differences" is the chief obstacle to software and computer service exports. The French companies are especially well introduced on the German market.

In the United Kingdom, the export trend has been strongly upwards. Companies like THORN EMI, SCICON Int. and LOGICA are all well introduced abroad, but in total figures only 7% of revenues in 1981 were found outside the U.K. - in 1984 the level had doubled, reaching 14%.

SOCIAL ASPECTS OF THE SOFTWARE AND SERVICES INDUSTRY

The software and services industry in the EEC Member States (exl. Spain and Portugal) employs about 200,000 persons (see Table 2). National figures on employment levels are, however, all estimates which have been presented by professional organizations related to the sector. No official statistics are available.

Thus, where direct employment is concerned, the software and services industry is not one of the important industrial sectors. However, it is an employment creating sector of high growth: employment levels are increasing by 5-10% per year which means 10,000 to 20,000 new jobs per year. In the case of France the software and services sector has created 30,000 new jobs since 1975.

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1) The National Computing Centre, 1984.

Will the job-creation in the software and services industry continue in the future? There are certain elements that seem to indicate significantly lower levels of employment growth in the industry in the coming years. The productivity level (turn-over per employee) has constantly increased in all countries: in France by an average of 14.2% per year (1978-1983). New programming tools - "programming environments" - which have already been developed and are now available on the market could markedly increase productivity levels. A German expert estimates that these tools could increase programming productivity by 350% (1), and according to British estimates, 24,000 software engineers could be "freed" in the U.K. (2).

The levels of overall productivity vary strongly between the Member States (see Table 2). In one group, consisting of the bigger countries - England, France and Italy - plus Denmark,the productivity level lies between 45-51 thousand ECU, whereas in Belgium and Ireland productivity is twice as high. These differences are difficult to explain. Two factors have, however, been discussed in order to explain the productivity in the software and services industry of the U.S. and Japan: the product-mix and the quality of software products. A statistic from Japan tells us that in software houses in that country each employee on average produces 1.7 software packages per year - whereas the corresponding figure in the U.S. is 0.12. In software production productivity is thus 14 times higher in Japan than in the U.S. A quality gap in software between the two countries has been mentioned as the most important explanation (3). As to the importance of the product-mix, a U.S. experience tells us that productivity is 38% higher in software production than in processing services (4).

As to the composition of the workforce in the software and services industry one finds - perhaps not surprisingly - that a large majority has got "computer skills": 70% of employees in the U.K. and 75% in France. Most of these have university level education: 55% of employees in Belgium and 50-70% in Italy.

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1) Neugebauer, U. et al., Der Markt für Software, Systeme und DV-bezogene Dienstleistungen in der Bundesrepublik Deutschland, GMD-Studien No. 74, Sankt Augustin, 1983.

2) DTI, The Benefits of Software Engineering Methods and Tools, PACTEL, 1984.

3) Koichi Iio, The Personal Computer Software Market in Japan, EPOS, DG V/A/2, Commission of the European Communities, Brussels 1985 (mimeo)

4) Read from graphic presentation. Data from 1982. OECD (1985) op. cit.

The demand for highly qualified computer specialists is still high and in most countries largely unsatisfied (only Ireland is a well-known exception to the rule). According to a French statistic, the yearly number of graduates with higher level university education (A-level plus 4-5 years) is 20% below satisfying the need of the software and services industry - and the software and services companies are clearly not the only companies to demand these qualifications. On the other hand, the demand for lower levels of computer qualifications (less than two years of studies after A-level) of the software and services industry annually covers "only" 50% of the number of students finishing their studies.

The labour market in the software and services industry is very mobile. The computer specialist changes job frequently. A large proportion of company employees has only two to three years length of service. As a result of this turbulent labour market situation - and often a direct and primary individual reason for changing jobs - salary levels have until now been relatively high for most employee categories. Recent data from several countries, however, point to a salary "squeeze" which has hit all levels of computer specialists except the most senior jobs (1).

The need for up-to-date competence and skills in the software and services industry cannot be satisfied exclusively by a laborious recruitment procedure. Training of employees is considered by most employers to be of crucial importance. Nevertheless, only very few, and mostly bigger, companies have set up training programmes for their employees. Considering the extremely fast technological change in the field of software and services and the general lack of training, the competence and skills of individuals tend to become obsolete within only few years. "Old" computer specialists - i.e. employees at the age of 35-40 years - find themselves less qualified than young graduates. Many software and service companies experience these social problems, which up till now have been solved by transferring older software engineers, analyst programmers, etc. to general management tasks or marketing activities.

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1) See f.ex. Le Nouvel Observateur, No. 1118, 11-17 April 1986.

THE FUTURE DEVELOPMENT OF THE SOFTWARE AND SERVICES INDUSTRY

Most governments have during recent years not only supported the software and services industry by means of public procurement programmes, but also explicitly by promotional development schemes. Financial support of software development has for several years in most countries been an inherent part of general technological development programmes like the Alvey programme in the U.K., the French Plan Action Filière Electronique or the Danish Technological Development Programme. However, promotional schemes directly focusing on software development and products are becoming more frequent - e.g. in the U.K. the so-called Software Product Scheme, which is a part of the general Support of Innovation scheme, launched back in 1973, but the funds allocated were relatively limited until 1983.

Besides direct public financial support to the software and service industry in order to promote the development of software products, there are also schemes to boost, for example, exports, as is the case in the Netherlands, or the quality of software products, as is the case in Ireland where a National Software Centre was set up in 1984.

The major general threat to the future development of the national software and services industries is not only development costs or foreign competition, but also the widespread piracy of software. According to British data, half of all software packages in use are pirated copies. In Denmark it is estimated that 80% of packages are fraudulent and according to a Japanese survey of computer users, 44% of the software programmes in use come from "other sources" than computer and software shops or "self-programmed": that is piracy copying (1). Piracy copying of software packages entails major losses to the software and services industry, although software producers to a certain degree take piracy into account when pricing their products.

Stronger legal protection of software has been demanded in most countries although a caselaw was developing in the field: this was the case in countries like Germany, France and the Netherlands. Hence, the United Kingdom, Germany and France passed laws on computer software copyright in 1985. In other countries - Italy, Denmark and the Netherlands - similar laws are expected to be passed in the near future.

1) Iio (1985) op. cit.; Dagbladet Information, 12 September 1985; Financial Times, 4 October 1985.

BELGIUM *)

I. TECHNICAL AND ECONOMIC ASPECTS OF SOFTWARE

1. Diffusion of Software

There is obviously a close connection between the distribution of software, hardware and the type of application for which they are acquired. A recent survey by ASAP-VEBI/EURODATUM (1) has provided some precise data on the nature of these applications. It emerges that, up until now, it has been the commercial, accounting and order processing functions which have benefited from the software on offer; this type of application probably corresponds to a first "wave" of computerization which is largely complete among large companies. The results of the survey have been confirmed by a study carried out by A.L. Pete on the software industry (2), which showed that the demand for software is greatest in the following fields and sectors (in order of decreasing importance):

- management and financial accounting
- production management
- power (distribution and safety)
- personnel management
- insurance
- banking management
- property management.

The growth rate in the "IT services" (IT = Information Technology) sector emerged as around 16.8% per annum on average between 1973 and 1983, with peaks of 26.6% in 1978 and 43.8% in 1979.

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*) Summary of a report by P.M. BOULANGER, Adrass, Ottignies.

1) ASAP-VEBI/EURODATUM: L'informatique en Belgique. Les chiffres-clés, (Information Technology in Belgium. Key Figures) in Computer Organ Inform, No. 62, October 1984.

2) André L. Pete: L'industrie du logiciel (The Software Industry), Université Libre de Bruxelles, Walloon Regional Centre, Nivelles 1985.

It is currently estimated at 19% per annum, below the European (20%) and American (24%) averages. The growth in demand will be sustained by the entry of small and medium-sized companies into the market, given that most of them still have to meet their first wave of computerization, and that this is now more within their reach because of the fall in hardware prices and the extension of the range and power of "micros" on offer.

Demand from large companies may also be sustained for three reasons given by R. Crott and J. Houard at the FAST European network Belgian study day on services (7.2.1985):

- the renewal of old hardware and software as they are made obsolescent and down-rated by technological progress. The average working life of software is estimated at between 8 and 15 years, which would mean a 15% demand per year simply in terms of replacement.

- extension: even where IT is relatively well established, new functions are constantly being computerized, and new departments are buying equipment. This inevitably involves:
  - adapting existing configurations to new systems, calling for connections and communications between systems. The development of distributed systems leads to increased demand for communications software, both internal (local networks) and external (telecommunications).

There are three niches which appear particularly important for the future as far as software is concerned: distributed systems, office automation and automated production (robotics). It is no coincidence that the major software houses have declared a particular interest in these fields. Demand is currently greatest in the field of office automation, growing at 65% per year. As far as automated production is concerned, there is a distinct gap in the software on offer, and we expect that there will be a major increase in investment in this field.

2. Industry and Domestic Production

Is it possible to assess the economic significance of software production in Belgium? Although official statistics are sorely lacking, because of the failure to recognize software production officially as an industrial sector (no N.A.C.E. code), it is possible - for want of anything better - to extrapolate from data supplied by the members of ECSA (European Computer Services Association) (in Belgium, INSEA (Information Technology Services Association)).

Total output in this field is estimated at 25 thousand million BFR in 1985 (ECSA/IDC survey, July 1985), 5.3 thousand million of which went to hardware manufacturers, and nearly 20 thousand million to software houses. In spite of this, software production properly speaking accounts for only a part of the activities of software houses, alongside data processing services in general and consultancy work.

"A part of software production (30%) is internal to IT user companies, the remainder (70%) being on the open market, hardware manufacturers accounting for 54%, software houses 44%, and the public sector 2%" (1).

If one assumes that IT services account for 10% of total software production, the Belgian market in this field would be in the region of 2.5 thousand million BFR in 1985.

The ASAB-VEBI/EURODATUM survey (2) identifies the main participants in software activities, and their current relative importance:

- manufacturers were quoted in 13% of cases. It appears that their role in the production and marketing of applications software has been diminishing since the seventies in favour of special companies with more knowledge of user requirements.

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1) A.L. Pete (1985), op. cit.

2) ASAB-VEBI/EURODATUM (1984), op. cit.

- software houses came next, with nearly 27% of replies. We will see below how this sector appears in Belgium.

- users remain by far the major producers of the software which they put into operation themselves. In the same study, we learn that, even in word processing, 45% of them have developed their own applications software with the aid of a manufacturer.

The appearance and growth of software houses on the software production market is due to the strategy used by manufacturers and - increasingly - users of externalizing the costs and risks of software development.

According to INSEA, there are nearly 750 software houses in Belgium (1985), of which the 40 largest account for 60% of the software on offer and 45% of the personnel employed.

The 10 largest software houses in Belgium alone account for 35% of all analyst programmers and 40% of turnover. These are:

Table 1: Leading software houses in Belgium

Name	Origin	Shareholders	Personnel	Turnover (1982) mio BFR
C I G (group)	B	Société Générale de Banque Belgo-nucléaire FN, A.G. group	550	3.573
IBM-INS	USA	Public Co	-	-
INTERSYS (comprising SLIGOS, SMCS, UNIVERSAL SYSTEMS, TELEMEDIA, SPECI, etc.)	B	Belgian Paper Co	302	630
SOBEMAP (group)	B/F	SEMA METRA/ ELECTROBEL	218	869
ORDA-B (group)	B	Boerenbond/ KUL/KB/BELL	261	501
TRASYS	B	TEACTIONEL	140	491
STERIABEL	F	Steria/BBL/SODERI	190	306
CULLINAME	USA	Culliname	53	195

Table 1 (continued)

Name	Origin	Shareholders	Personnel	Turnover (1982) mio BFR
CAP GEMINI	F	Cap Gemini/ SOGETI	100	147
SG2 Belgium	F	SG2	75	135

Source: Quantum Science, INSEA, ESCA-IDC in Pete, op. cit.

As well as these "large" companies, there are a number of small enterprises whose number appears to be growing from one year to the next, so that the average size of a software house has been falling accordingly, from 14.5 employees in 1980 to 9 in 1985, while the average number of employees in 1974 was around 34.

3. Trade and Commercial Balance

For those software houses which replied to Pete's survey, exports accounted for 3% of turnover. Also, software production is by no means the main activity of companies in this sector, including so-called "software companies". In fact, the main activity of software houses consists of marketing software produced elsewhere and adapting it as necessary to Belgian conditions (translation into Flemish, for example). In most cases, production strictly speaking accounts for 30% of turnover at best.

II. SOCIAL IMPACTS

1. Employment

As far as employment is concerned, the major effects of software production are felt amongst users. If we are to believe the ASAB-VEBI survey, it would seem that there were nearly 150,000 people employed in company IT services in 1984. Since 52.6% developed their own applications, one might therefore assume that software production accounted for half of these jobs, or around 75,000 people.

As far as manufacturers are concerned, the Department of Social Security counted 1467 employees in some 20 establishments in 1983. There is no way of knowing how many of these were involved in software production.

Finally, there are the employees of software houses, whose numbers are estimated at 6725 and are growing at around 10% per year. On the basis of this information, this would give a maximum of 10,000 people employed in the software production and distribution sectors, not counting of course those employed by users (1).

The overall impact on employment is therefore low, barely 3% of the tertiary sector as a whole.

2. Qualifications and Working Conditions

According to the Pete study, 16% of the information technologists in the software industry are project leaders, 28% are analysts and 56% programmers. The average gross salary of an analyst/programmer in a software house is some 70,000 BFR/month.

Of these, graduates account for some 55%. Average working hours do not seem any longer than elsewhere in industry: between 36 and 40 hours per week. The figure is probably much higher for small producers, who work in a more artisanal fashion.

Personnel turnover is fairly high, at 20%; the average length of service is no more than 2 or 3 years.

Employees place great importance on working conditions, and on intrinsic job satisfaction related to independence at work. It is not uncommon for employees to have shares in the software houses where they work.

One might wonder how much longer employment in "software factories" will continue offering the independence and creativity which make it attractive to information technologists. Most observers and professionals agree that software production itself is becoming more and more automated (2).

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1) R. Crott and J. Houard (Oral communication).

2) B. Tinant: Les usines de software (Software factories), in Computer Organ Inform No. 59, April 1984, pp. 8-12.

The use of automated production techniques is aimed mainly at reducing development and production costs; this explains the R & D investment in the field of automating "software engineering". The ultimate objective is described by B. Tinant as setting up a real "software factory", where information processing ceases to be an art and an empirical field and becomes a science, an engineering technology like all the rest (1).

There is already a definite increase in production amongst programmers as the result of the development of more powerful programming tools (structured programming, code generation, etc.), estimated at 8% in the USA (1981-82) and 5% in Belgium (increase in turnover per employee).

3. Training

Belgium seems to have a shortage of good programmers and high-level analysts: this shortage explains the relatively high turnover in specialized personnel.

The rarest and most sought-after specializations are in the fields of distributed systems and automated production. It seems that there are also difficulties in finding DP experts in PASCAL, or even FORTRAN or PL/I.

Even applications systems specialists seem few and far between. It is as if the majority of analysts had been trained with a bias towards information management, where COBOL and BASIC are the main languages in use.

III. GOVERNMENT POLICY IN THE FIELD OF SOFTWARE

1. Research and Development

In the "Action programme for microelectronics-based technology", which is the basic yardstick for national government support for R&D, software technology is not dealt with separately.

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1) B. Tinant (1984), op. cit.

In a brochure recently published by the Scientific Policy Programming Services (SPPS) (1), three disciplines are identified within information technology: microelectronics, software technology and advanced information processing.

This document states: "Software development and production is still based on primitive, fragmented tools, which is having a braking effect on information development, both in terms of the number of applications and in the complexity and viability of those applications. There is a shortage of suitable qualified personnel in this field".

Since the universities are some way ahead of industry in this field, specific programmes supported by the SPPS consist of transfers of technology from the former to the latter.

2. Software Legislation

As far as the prevention and suppression of computer crime is concerned, attention to date has focused on respect for privacy and database control, but has not yet produced any results in terms of legislation.

IV. SOCIAL GROUPS

There is no specific trade-union position on software production. The Christian Trade Unions see an opportunity to be grasped:
"Software production is also of interest, since this is a market which is rapidly expanding, and where we have the requisite skills. It also represents a means of liberating ourselves from external dependence, when one takes into account that in the next few years 80 to 90 per cent of investment in information technology processes will be tied up here. Companies involved in designing adequate data processing systems for industry, installing them and ordering equipment is one example of the possibilities for us to exploit." (2).

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1) Scientific Policy Programming Services: La Politique Scientifique. Ses objectifs et ses instruments (Scientific Policy. Its Objectives and Instruments), (undated), 59 p.

2) Nouvelles Technologies , Syndicaliste CSC, No. 191, December 1982, p. 58.

On the other hand, the main software houses (40 in all at present) in Belgium, which account for 60% of total turnover in the sector and half its personnel, are members of INSEA, which in turn is a member of FABRIMETAL, the metal industry federation.

INSEA's statutes prevent it from recruiting hardware manufacturers' software divisions or independent companies. In 1982, INSEA published a "White Book" giving details of the Belgian software industry, which made a number of appeals, in particular for greater involvement by its members in the public sector.

INSEA emphasizes the potential role of the state in developing the Belgian software industry, quoting countries where public-sector orders account for 80% of software house turnover. The advantage of building relationships between the software houses and the public sector is that it encourages the marketing of spin-offs of public-sector software development.

INSEA underlines the potential for high-grade employment associated with the increase in activity of its members. It also proposes that the state should in one form or another subsidize private companies, enabling software houses to put their own computerization into effect, and claims that this would provide proof of the success of computerization and optimum use of human and equipment resources.

(September 1985)

DENMARK *)

I. TECHNICAL AND ECONOMIC ASPECTS OF SOFTWARE

1. Diffusion of Software

The computer services market in Denmark amounted in 1984 to DKR 3.6 thousand million (estimate) and has increased by an average of 16% per year since the beginning of the eighties (see Table 1).

Table 1: Computer Services Market in Denmark 1979-1984 (1)

1979	DKR 1.7 thousand million
1980	DKR 1.9 thousand million
1981	DKR 2.3 thousand million
1982	DKR 2.8 thousand million
1983	DKR 3.1 thousand million
1984	DKR 3.6 thousand million (2)

Source: EDB Systemleverandørernes Forening, 1985

1) Includes all services from "software houses" etc. plus software purchased from hardware manufacturers. The figures are estimates on the basis of information from member companies

2) Future estimate.

If one subdivides the computer services market into its above-mentioned components and further adds the market of software delivered by hardware producers one sees clearly that the market of "processing services" by far is the most important computer service market in Denmark. The market of processing services covers 60% of the total software and software services market in the country. "System houses" and "independent vendors" cover 23% of the market and "hardware manufacturers" 13%.

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*) Summary of a report prepared by Dr. A.J. HINGEL, Institute of Organization and Industrial Sociology, Copenhagen School of Economics, Copenhagen.

Table 2: The Software and Services Market in Denmark 1983

	Million US$	%
Hardware Manufacturers	53	13%
Packaged software	38	9%
Custom software/consultancy	15	4%
System Houses	27	7%
Packaged software/consultancy	12	3%
Custom software/consultancy	15	4%
Independent Vendors	67	16%
Packaged software/consultancy	20	5%
Custom software/consultancy	47	11%
Training	15	4%
Facilities Management	3	1%
Processing Services	247	60%
Local batch	77	19%
Remote problem solving	89	22%
Remote autotransactions	81	20%
Total	412	100%

Source: IDE/ECSA, 1984 (OECD "Software: An Emerging Industry", Paris, 1985)

The relative importance of the "processing service" market in Denmark is remarkable also in an international comparison. In fact, Denmark is the country in the EEC where the processing services sector plays the most important relative role. It is clearly the importance of this specific sector that makes the country number one in the world in "computer expenditures" as a percentage of GNP: 0.56% of GNP against 0.28% as an average for the West European countries (1).

1) Quantum Science Corporation, 1983.

2. Industry and Domestic Production

In order fully to understand the relatively high level of processing service turn-over in Denmark one has to remark the importance of the public sector. In fact the two biggest computer service companies in Denmark are: "Kommune-data", which is owned by the municipalities and "Datacentralen" which is owned by the State. Both companies provide processing services, custom software and consultancy to the public sector institutions. Their sales together account for about 30% of the national market of software and computer service. Among the world's biggest computer service companies, "Kommunedata" is number 13 (revenues of US$ 66.8 million) and "Datacentralen" is number 17 (US$ 59.4 million) (1).

At present, the most important developments are taking place in the design of sector-adapted application software systems. Such systems which satisfy the specific needs of specific industrial sectors have been developed and are about to be introduced for example in the textile industry, the furniture manufacturing industry, slaughter houses and other industries. The systems are developed by the relevant professional organization in the industrial sector in co-operation with software service companies and technological service institutions (e.g. the two "technological institutes" and the Council of Technology under the Danish Agency of Technology) (2).

During the coming years there is likely to be a major trend towards the concentration of the market for software packages. Two to three wholesale software companies could share the market in the future, according to the predictions of experts (3). The most important companies on the wholesale software market in Denmark are: Datateam, PolyData and Berendsen Computer Products.

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1) OECD, Software: An Emerging Industry , Paris, 1985, p. 195.

2) Arbejdsgiveren, 5 June 1985; PS Produktivitet, No. 2, 2 April 1984.

3) Computerworld, No. 11, 21 May 1985.

3. Trade and Commercial Balance

As to the commercial balance in the field of software and computer services, a negative balance of trade is evident. A few examples of exports do, however, exist: e.g. the purchase of automatic telephone enquiry systems by Norway and a number of large US cities, Arabia, etc. - a system developed by the company RC Computer (owned by ITT); a rail security system purchased by Bulgaria and developed by Dansk Signal Industry (owned by L.M. Ericson). "System-exports" are indeed regarded as an important future product of export.

II. SOCIAL IMPACTS

1. Employment

There are no official statistics available on employment levels in the software and computer services sector. According to estimates presented by the professional organization of computer system contractors, the software and service sector has a total of some 8,600 employees (1984). These employment levels represent a slight increase compared to the previous year (1).

A report carried out at the request of IBM/Denmark in 1983 predicted that the employment level of computer personnel would peak in 1986 and thereafter fall (2). However, the relative share of application programmers and system developers would increase. The number of computer operators will fall, relatively and in real numbers.

The computer services industry will be influenced by the increasing application of "fourth generation" programming and system development languages. The application of CAD/CAM in programming and system development will make it possible for the end-users of computers to carry out most of the application programming themselves - the total system development will, however, still need specialist skills. The development of the so-called "firmware" (the software is recorded once and for all in the hardware by the hardware contractor) will accentuate a development where one can expect the need for application programmers - in companies as well as in the services sector - to decrease during the coming years, other things being equal.

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1) Information communicated by M.F.M. Jensen (EDB Systemleverandørforeningen).

2) Elmark & Christensen Marketing Aps., EDB-udviklingen. En undersøgelse af anvendelsen af EDB , 1983.

2. Skills and Qualifications

In the field of software development there is a large and unsatisfied need for computer specialists. This fact has been expounded by numerous social actors. As mentioned briefly above, certain developments within the field of system software - fourth generation languages etc. - could indicate an easing-up of the demand for specialists although the setting-up of total computer systems and the choice of system architecture still needs computer specialist intervention.

The situation is not, however, as clear-cut as this. Experience has shown that the skills required for the development of programmes and systems have to a great extent been non-formal computer skills acquired through the participation in training courses, which have generally been offered by the hardware suppliers. Almost 65% of programmers and system developers have had no formal computer training according to a 1981 survey. Only about 4% of these personnel categories had a higher level of education in computer science, and 32% had a background of three years of "computer assistant" training (1).

The growing need to develop programmes and systems and the demand for qualified programmers and systems developers can under no conditions be satisfied by computer specialists in the near future - the number of graduates is and will stay too low. For that reason alone, the need for computer related qualifications will have to be reorganized during the years to come. To illustrate this development one can refer to the fact that, while in 1965 there were three programmers for each computer, by 1985 the ratio was expected to have declined to one programmer for every 5 computers (not taking into account the large number of personal computers) (2).

3. Work Organization

The major problem in the field of work organization - stressing that the subject of the report is software production in the software and service industry - is the choice of individual companies to set up computer departments or to purchase service software and computer power outside the company.

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1) Dansk Databehandlingsforening, EDB-branchens hovedproblemer, Copenhagen, 1983, p. 18.

2) Dansk Databehandlingsforening (1983), op. cit. p. 8.

The economic calculations clearly show the relative fall in hardware prices and the increase in software and service costs. Together with the widespread demand for distributed computer power in companies, computer equipment is bound to be introduced in an increasing number of companies and departments. However, the processing service companies are not expected to disappear: hardware price developments, fourth generation programming tools and especially the development in the field of telecommunications provide excellent grounds for rationalization and product development in the sector.

Furthermore, as mentioned above, many companies are aware of the social problems related to the setting-up of computer departments. These problems are of an organizational order - reorganization of authority and power relationships - but also relate to the specific characteristics (young people with higher education coming directly from outside the company) and especially to the relatively high salaries of computer personnel.

4. Education and Vocational Training

The need for computer specialists and computer skills in a vast number of personnel groups has led to the setting-up of a number of new educational courses and to the introduction of computer science in a number of others. Let us present a brief overview of education in this field:

In higher education, there are ten courses at the universities in the field. They all have a duration of 5-6 years and all involve one other or several other disciplines in addition to computer science. Computer science can now be studied together with any other discipline in the humanities or social sciences as individually chosen combination courses. Mention should also be made of the possibility of studying "humanistic computer science" as a minor subject in combination with a "major" in any other field. Apart from these courses for "datalogists" in universities, technical universities have set up five-year courses for "computer-engineers" (data-engineers) and technical colleges have set up similar 3 - 3 1/2 years courses. Schools of economics have also introduced courses in computer science in relation to business economics. In the technical and commercial schools, several medium-length courses are available in the field: "computer mechanic" (five years incl. "basic" craft training); "technician in electronics" (1 1/2 years) at the technical schools, and "edp-assistant" (3 years, but

1 year for A-level students), "datanom" (*) (further training after the edp-assistant diploma), "datamatiker" (*) (2 1/2 year advanced studies) and the shorter one year course as "micro-instructor". The last two courses have been introduced in order to satisfy the need for computer skills in companies which are important users or producers of hardware or software ("datamatics") and the requirements of smaller companies in the field of computer purchasing and computer consultancy ("micro-instructor").

5. Impact on Health and Safety

The development of software clearly involves a certain number of health and safety hazards. One could mention here the almost traditional elements of ergonomic problems related to desk work and especially to work on VDUs. These problems have been discussed in numerous other reports (1). Here we shall refer only to health and safety problems which are relevant to the specific professional group of programmers and system developers.

A recent survey on the working conditions of programmers and system developers (44 programmers and system developers from 14 companies were subject to intensive interviews) concluded that this specific professional group was strained by the constant pressure of time. The survey found examples of programmers with 40-50 hours of weekly overtime - the average levels were 12-20 hours of weekly overtime. Other stress factors were: continual disturbance and bad communication, information and management (most managers have no computer relevant background). These factors lead to stress among programmers and system developers. Frequent indications of stress are: stomach ache and colic, irritability, feelings of inadequacy, strained muscles, headaches, etc. Because of the total concentration required in this work, stressing working conditions will over time result in generalized mental fatigue. As mentioned in the report one can in fact die of stress. It is interesting to note that the programmers and system developers themselves do not consider their working conditions as dangerous to their health: the number of days lost through illness is relatively low for this professional group (5-6 days per year) (2).

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*) We have chosen not to try to translate Danish terms like : "datanom" and "datamatiker" into English.

1) See f.ex. Social Europe: Special Issue on Office Automation.

2) Kim Paris, Er det belastende , PROSA, Copenhagen, 1985.

III. GOVERNMENT POLICY IN THE FIELD OF SOFTWARE

1. Promotion of Research and Development

Software development plays an important role in the "Technological Development Programme" which was launched in January 1985. The programme will run until 1989 and be allocated DKR 1,525 thousand million. Let us briefly present the sub-programmes which are relevant to software development. Under the general heading of "programme for the promotion of information technology", reference is made to the need to develop "user-friendly computer systems". The programme suggests that financial support be given to pilot projects aimed at developing and testing demonstration computer systems. These systems should be developed on the basis of a cooperation between software users, producers and researchers. It also suggests that support be given to the development in private companies of "commercially interesting" software systems. In connection with the development of "user-friendly computer systems" it is also suggested that development projects be assisted within the field of "reliability, productivity, up-dating and maintenance of software" (1).

Another promotional scheme under the Agency of Technology now provides financial support for software development projects (2). The Product Development Fund could until recently only support the development of physical products. By a new law, which was passed on 8 February 1985, development activities relating to "systems, computer programmes, production processes, production methods and works" can be supported.

There are no available statistics on the financial resources currently allocated to software development.

IV. SOCIAL GROUPS

The Danish software and computer services market is clearly marked by genuine oligopolistic features: a few major companies controlling an important share of the market and a great number of very small companies with only few

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1) Teknologistyrelsen, Et Teknologisk Udviklingsprogram , Copenhagen 1983.

2) Nyhedsbrev, Teknologistyrelsen, No. 10, February 1985.

employees. This type of market creates conditions that can only be unfavourable for the activities of representative organizations. Hence, one observes that both the Danish employers' and the trade union organizations are mainly active in the relatively few bigger companies.

The trade unions were from a very early stage concerned about the type of computer systems and application software being developed and introduced into companies. Already in 1975 a research project was launched on the initiative of the LO-related Danish Trade Union Research Council. The project named "Democracy, Development and EDP" was carried out by three trade union federations in collaboration with computer scientists from the University of Aarhus (1) (2).

The results of this first Danish trade-union-initiated activity was mainly training material and some recommendations for employee influence on computer applications. But, more importantly, this first project showed the employees and trade unions that it was possible to develop (trade union-) interest-orientated computer systems. Secondly, it played a certain role in the development of a general employee awareness about the close relationship between the applied computer system architecture and general working and employment conditions.

A development project of more recent date which also was initiated by computer scientists and trade unions is the UTOPOA-project (3), aimed at setting up "alternative" hardware and software systems in the newspaper printing sector.

It would be difficult to evaluate to what degree these trade union activities and the general awareness among employees have influenced and marked the products and the services of the Danish software and service sector. However, it is a fact that the professional organizations of the sector consider that Scandinavian companies have developed significant know-how in the application of EDP technologies to decentralized and democratic service systems (4).

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1) DUE-Projektet, Klubarbejde of EDB , Datalogisk Afdeling, Aarhus Universitet, Fremad, 1981.

2) Ake Sandberg (ed.), Computers Dividing Man and Work, Arbetslivscentrum, Stockholm, 1979.

3) Ake Sandberg, Mellan Alternativ Produktion och Industriell FoU, Arbetslivcentrum, Stockholm, 1984.

4) Dansk Databehandlingsforening (1983), op. cit.

The Scandinavian "model" of working life has recently been referred to by the Nordic Council of Trade Unions which, as a part of a general Scandinavian industrial policy, is demanding that initiatives be taken in order to develop computer software which meets Nordic requirements in respect of working conditions, democracy and two-way-communication.

(October 1985)

FEDERAL REPUBLIC OF GERMANY *)

I. TECHNICAL AND ECONOMIC ASPECTS OF SOFTWARE

1. The Spreading of Software

The market volume for software will reach over DM 12 thousand million in 1985 (1). With an annual growth of between 20 and 25% the market is expanding rapidly. However, according to a study by the US consultancy firm Quantum Science Corp., the software market is smaller in Germany than in many other European countries (2). The study found that in 1982 the Federal Republic of Germany ranked third in sales of software, processing services and EDP in Europe. In relation to gross national product, the figure places Germany even further down the list: with 0.19% it is 13th, whereas Denmark (0.56%), Finland (0.50%), Norway (0.46%) and Switzerland (0.42%) head the list.

According to the VDMA (Verband Deutscher Maschinen- und Anlagenbau), standard software could improve its share of total turnover from 17.6% in 1980 to 21.2% in 1984, and bespoke software could also slightly improve its position from 47.0% (1980) to 48.5% (1984). The losers are the processing services which stepped down from 30.8% in 1980 to 25.9% in 1984. The association of the EDP computing centres in Germany (Verband Deutscher Rechenzentren, VDRZ) in Hannover, believes that the high charges for telecommunications are the reason for their relative decline.

Like elsewhere in the computer world, the trend in Germany is also moving from hardware to software. The "Computerwoche" recently estimated an increase in the software/hardware ratio from 48% in 1983 to almost 60% in 1989 (3). The journal forecasts an even more favourable future for standard software: its market share will reach 48% in 1989, whereas bespoke software will drop to 24% and service centres to 23% at the same time.

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*) Summary of a report prepared by Prof. Dr. J. REESE, Department of Economics, University of Kassel.

1) This estimate is based on a table of the "Verband Deutscher Maschinen- und Anlagenbau e.V." (VDMA), August 1985 (see table 1).

2) Computerwoche, October 21, 1983, p. 13.

3) Computerwoche, April 5, 1985, p. 10.

Table 1: The Market of Software and Computer Services in the F.R.G.

Types of Software and Service	Standard Software		Bespoke Software		Processing Service		Training		Facilities Management		Total	
Year	Mio. DM	%	Mio. DM	%	Mio. DM	%	Mio. DM	%	Mio. DM	%	Mio. DM	%
1980	603	17.6	1607	47.0	1053	30.8	120	3.5	38	1.1	3421	100.0
1981	968	18.7	2464	47.6	1522	29.4	170	3.3	54	1.0	5178	100.0
1982	1343	19.8	3258	48.1	1897	28.0	204	3.1	66	1.0	6768	100.0
1983	1756	21.1	4024	48.4	2203	26.5	249	3.0	83	1.0	8315	100.0
1984	2284	21.2	5225	48.5	2791	25.9	377	3.5	98	0.9	10775	100.0

Source: VDMA

2. Industry and Domestic Production

On the supply side, according to the VDMA statistics, 22.7% has to be subtracted from the total value of software production as non-market software (internal software programs) (1). The remaining 77.3% is divided into three parts: software and system houses with a share of 44.9%, hardware producers with a share of 29.8%, and the remaining 2.6% for other suppliers. (The data refer to 1984).

Rapid technical developments create a highly fluctuating software market. For the period from 1979 to 1983 a GMD study shows that more than 25% of independent program offices and 15% of software houses went out of the market. However, new firms were created, so that the size of these two groups did not change very much. But, as stated above, the service centres lost quite a bit, namely 25% of their number. The market shares of the different groups is as follows (2):

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1) This estimate is based on a Table of the "Verband Deutscher Maschinen- und Anlagenbau e.V." (VDMA), August 1985.

2) U. Neugebauer, J. Marock, G. Bujara, Der Markt für Software Systeme und DV-bezogene Dienstleistungen in der Bundesrepublik Deutschland , GMD-Studien Nr. 74, Sankt Augustin, December 1983, p. 57.

Group	Number of suppliers	Market share
Program bureaus	1500	13 %
Software houses	300	30 %
System houses	220	23 %
EDP consultancy	500	24 %
Service centres	200	10 %

It might be mentioned in this context that a well-known German software report lists 671 suppliers with a total of 3751 computer programs. Among the suppliers are 502 German firms (1). The largest of them is SCS (Scientific Control System GmbH) Hamburg, with sales of over DM 100 million and a staff of about 700 employees. The fifteen largest software house employed in total 4200 people in the beginning of 1985 with an overall sale of DM 640 million (2).

In comparison with the European software industry the German case is not average at all. A market analysis of the "IDC Deutschland GmbH" for the year 1983 offers some more information about the role of German producers (3). Nearly all market segments are dominated by IBM: standard software with a market share of 36.4% (here Siemens holds third position with 5.4%), computer services and so on. Only in sales of bespoke software is IBM in second position (12.8%) after Bull with 14.8%. In third position is the German Siemens AG with 5.4%.

Diebold in Frankfurt states that there were 2400 computer dealers in West Germany in 1984, of which 350 deal only in micro-computers; 230 are office equipment shops with sales from DM 5 to 25 million; another 500 office equipment shops have sales of between DM 1 and 5 million (4). These figures look promising. But there is still a serious problem, since most of the computer and office equipment shops are not able to give their clients accurate advice with respect to their special software needs. Some marketing

1) ISIS Software Report, quoted in Computerwoche, April 29, 1983, p. 12.

2) Computerwoche, July 5, 1985, p. 4.

3) Software and Services Marketplace , Eurocast Study of IDC Deutschland GmbH, Wiesbaden 1984.

4) Chip, Nr. 4, April 1984, p. 292.

experts predict a concentration on the market with the result of a few regional computer and software centres like the one planned in Frankfurt (Frankfurter Electronic Centre, FEC). Others say that the customers of micro-computers are not prepared to travel long distances to a centre.

II. SOCIAL IMPACTS

1. Employment

As regards the impact of software production and software quality on employment, two different causal connections have to be taken into account. First, employment in software production and distribution and, as an indirect consequence, the effects on the educational system. There are no official statistics on employment in these sectors. Even a rough estimate is difficult, since production as well as distribution range from well-organized software and hardware houses, to small computer shops, to an unknown number of one-man enterprises and to experts who produce or adapt software within the user firms.

While there are an estimated 30,000-40,000 software experts in Germany, there is no doubt that the employment effect of software production is still very limited (software accounts for little over 0.1% of total employment) (1). Secondly, software is used to increase productivity. Here the employment effects of computers are not disputed. With good technical equipment a single firm can produce a greater quantity of cheaper and more reliable products. If the market does not expand, competitors with worse equipment will go bankrupt and jobs will be lost. It is thus too early to estimate the overall net effects.

2. Skills, Qualifications and Training

In comparison with employment effects, it is far easier to analyse the impact of software on skills, qualifications and organization, although here too we face a number of difficulties. Generally speaking the production of software presupposes well-trained people, generally computer scientists with a university background. There are many universities in Germany with computer science departments and special courses of studies. But the demand of high

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1) Zwischenbericht der Enquete-Kommission, Neue Informations- und Kommunikationstechniken , Deutscher Bundestag, Drucksache 9/2442, March 28, 1983, p. 54.

school graduates for these training programmes and of industry for young computer scientists is much higher than the training capacities. Thus, the traditional studies in mathematics and physics are still the indirect approach to an education in software engineering.

Knowledge of software production is not only necessary for professional programmers. It is also needed by users of more complex systems. Since there are as many types of users as software systems, on-the-job training is becoming more and more important in the industry as well as in the services sector. This training is organized by numerous institutions. Larger firms have own training programmes for their employees, smaller ones send them to training centres run by the computer industry or chambers of commerce or to other institutions. Some universities are also going to offer special training programmes for persons already in employment, mostly at lower management level. Last but not least, there are the training centres of the Bundesanstalt für Arbeit. They offer programmes for the unemployed who have no chance of getting a job in their original occupation.

3. Working Conditions, Health and Safety

Software ergonomics is also a major problem. The impact of software on work organization and on the place of work depends to a high degree on the software structure. Many criticisms of the computers in the seventies resulted from bad software. Whereas the adaptation of standard software to the intellectual and behavioural needs of users is enforced by the market mechanism, software ergonomy is still an unsolved problem for the large individual programs. Software engineers follow the internal logic of the problem when programming. The special needs or habits of users as well as of clients in the periphery of the organization are not taken sufficiently into account.

III. GOVERNMENT POLICY IN THE FIELD OF SOFTWARE

1. Promotion of R & D

The Federal Government supports the development of tools for computer assisted design for computers and software with DM 160 million from 1984 to 1988 (1).

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1) Informationstechnik. Konzeption der Bundesregierung zur Förderung der Mikroelektronik, der Informations- und Kommunikationstechniken, ed. by the Bundesminister für Forschung und Technologie, Bonn 1984, p. 75.

This support is designed to contribute

" to the improvement of the competitiveness of German enterprises by enabling them to cooperate and by giving them financial support".

The same government programme includes a DM 200 million subsidy for the development of software in the fields of artificial intelligence and pattern recognition. The amount is available for the years 1984 to 1988. Furthermore, the Government announced that software houses would be included for the conventional subsidies for costs of personnel employed in R & D activities.

Finally, software development is supported by the Federal Government to accelerate industrial automation. But it is not possible to determine the financial share of software within this programme.

2. Regulation of Software Developments

The Government regulations regarding the spread and introduction of software are limited to misuse of data and to computer crime. Two governmental means are used: laws and regulations by the German (public) telephone company. The latter has more problems with data protection the more the data communication network is expanded and used. Spectacular cases of hackers who successfully broke into the data bank of a financial institute by using the Bildschirm-Text (BTX) service drew public attention to the security of BTX-software.

Since final technical solutions of the data protection problem are not in sight, the Government is concentrating on new legal rules, particularly as regards prosecution. The Federal Minister of Justice has stated that criminal law would not be satisfactory in handling many cases of computer manipulation. The Committee of Justice of the German Bundestag passed a bill on business crime (2. Gesetz zur Bekämpfung der Wirtschaftskriminalität) in October 1985 which includes a number of amendments concerning computing crime, in particular:

- the manipulation of computers which results in capital transfers will be punished by up to 5 years' imprisonment;

- different forms and methods of hacking will be prohibited;
- the manipulation of data and the sabotage of software will also be prohibited.

The law will be promulgated in 1986 (1).

There is no doubt that the German software market is affected by computer crime. All sorts of crime in this sector are common but little is known about the amount of losses. It is estimated that manipulations, espionage and software theft could reach DM 15 thousand million (2). The average loss rose from DM 250,000 in 1979 to more than a million DM in 1982 (3).

Regarding software theft, the German courts had a lot of trouble with the definition of software in terms of patent law and copyright. The Federal Court of Justice has since decided that a software program is legally protected by the copyright. But the protection depends on the complexity of the program. There is no protection for a program the design of which meets only average programming capabilities.

The uncertainty about computer software copyright, which has led to many decisions by the courts, was eliminated with an amendment of the copyright law on 1 July 1985 (4).

IV. SOCIAL GROUPS

There are no relevant statements by social groups specifically mentioning software or software production. Only the computer crime issue has evoked demands for an adjustment of different laws to the new technical challenges. But they are not really controversial.

However, software houses, smaller programming bureaus, service centres and other producers of software are becoming more and more aware of the necessity of cooperation in favour of the interests of the branch. This has led to the founding of two recent associations:

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1) Frankfurter Allgemeine Zeitung, October 7, 1985, p. 15.
2) Chip, Nr. 7, July 1984, p. 22.
3) Computerwoche , December 2, 1983, p. 27.
4) Hessisch-Niedersächsische Allgemeine, July 17, 1985.

- The "Vereinigung Deutscher Software-Hersteller e.V." (VDS) in Mannheim.

- The "Bundesverband Computer-Software e.V." in Hamburg.

These associations still represent only a small part of all software producers, but it might well be that the common interests of the producers will lead to a rapid enlargement of the associations.

(October 1985)

FRANCE *)

I. TECHNICAL AND ECONOMIC ASPECTS OF SOFTWARE

1. Diffusion of Software

Systems engineering is growing very rapidly in France (42% on average between 1977 and 1981), as the result of increasing complexity in computer hardware. This growth should continue with the entry of small and medium-size users onto the market and the development of remote DP systems. Intellectual services (studies, software development) grew by an average of 33% a year in the period 1977 to 1981, and since 1981 have outstripped machine services (bureau processing). The major software and systems houses (SSII in French for Sociétés de Services et d'Ingénierie en Informatique) have given priority to support activities and training, and are developing their production of specialized software and applications packages (1). The appearance of mini- and micro-based DP systems and the fall in equipment costs have made it progressively easier for users to acquire their own hardware and dispense with bureau services.

In 1983, the share of software in French expenditure on DP systems as a whole was 37.3 thousand million FF (or twice the expenditure on hardware), of which 10% went on applications packages (3.7 thousand millions).

Table 1: Expenditure on Software by Type and Origin
(thousand millions of FF - 1983)

	Internal	External			Total
		Software/ systems houses	Manufac- turers	Distri- butors	
Customized/ turnkey	27	5.2	1.2	0.1	33.5
Applications packages	-	0.8	0.7	0.2	1.7
Users systems	-	0.3	1.8	-	2.1
Total	27	6.3	3.7	0.3	37.3

Source: P.A.C.

*) Summary of a report prepared by B. QUELIN, Industrial Economics Research Centre (CREI), University of Paris (North).

1) A. Cazale: Les SSCI, (Software/systems houses), Sphères No. 39, 3rd quarter, 1983.

In the package market (standard solutions), the two main types are systems and applications packages. The former is virtually dominated by the manufacturers; while as far as the latter is concerned, the software/systems houses have the lead over manufacturers (350 million FF, as against 200 million FF).

French software/systems houses are relatively weak in terms of software development productivity, software accounting for only 14% of their turnover. However, their position on world markets shows one basic fact: faced with American manufacturers and software/systems houses, the battle for basic applications is lost. French software/systems houses are not masters in their own domestic market (20 million FF, out of a market estimated at 1.1 thousand million). Foreign manufacturers account for nearly 700 million francs. Developing a presence on the applications package market require massive investment to meet new openings in the computer-assistance and automated production, office automation and credit card markets.

Selling hardware with integrated software (firmware) enables computer manufacturers to dominate part of the software market and compete on strong terms with the software/systems houses. From 1990 onwards, applications packages will probably account for a quarter of software expenditure; the size of manufacturing companies means that they must reconquer the domestic market.

Table 2: New Products and Services from software/systems houses (SSCI)

	Estimated turnover (mio FF)		
	1981	1982	1983
Software engineering and related activities	210	290	320
Microcomputer packages	) 220	) 220	110
Microelectronics	)	)	190
Computer assisted instruction	25	35	30/40
Automated production	150	225	350
Office automation	90	170	210
Distributed systems	) 290	) 400	380
Databases and databanks	)	)	110
Credit card systems	N/A	N/A	430

Table 2 (continued)

	Estimated turnover (mio FF)		
	1981	1982	1983
Voice/Image processing	55	40	40
Other	30	120	80
Total	1070	1500	2250

Source: SYNTEC

The rapid growth in specific as well as basic markets, such as databases and databanks or microcomputer packages, should provide software/systems houses with new opportunities.

Amongst new activities in 1983, there was a very strong increase in automated production (CAD, CAD/CAM, CAPM (*)), where billing rose by 55.5% between 1982 and 1983. Office automation services also increased (up 23.5%). Remote systems showed a temporary drop of 5%.

2. Industry and Domestic Production

Thanks to its rapid growth, the French information technology services industry is now in second place behind the United States. In Europe, the market is fragmented, but still growing, and large groups are being formed. France is still the major market, but the British and German markets are catching up in terms of turnover.

As far as the turnover of the major companies is concerned, five French companies were among the ten top companies in 1982. In the first fifty companies in Europe, in addition to 12 French companies there were 8 American, 10 British and 4 German firms (1).

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*) Computer Aided Design; Computer Aided Design/Computer Aided Manufacturing; Computer Assisted Production Management.

1) Letter 2000 - SSCI (Software/systems houses): Inflexions stratégiques et mutations techniques (Strategy modification and technological change), No. 20, April 1984.

Five groups have a turnover over one thousand million FF. French software/ systems houses continued to grow in 1984: turnover at 16 thousand million FF was nearly 24% up on 1983. At the top of the list for the past two years, Cap Sogeti has seen its expansion promoted by a rapid increase in its foreign business.

The analysis of the branch shows a large number of small companies with a turnover below 20 million FF. The last decade has seen widespread restructuring leading to increased concentration and segmentation: despite a mushrooming of small systems/software houses, more than 66% of turnover in 1984 was accounted for by the 10 largest companies.

Table 3: The Top Twelve French Software/Systems Houses (SSII)

Companies (1984 order)	Turnover (millions of FF)			
	1984	1983	1982	1981
1. Cap Gemini Sogeti	1800	1404	1027	823
2. CISI	1400	1300	1072	890
3. SG2	-	1200	1090	840
4. GSI	1150	970	910	828
5. SEMA	950	778	585	528
6. CCMC	730	635	534	418
7. TELESYSTEMES	700	585	484	425
8. SLIGOS	734	567	450	403
9. SESA	-	464	393	287
10. STERIA	515 (forecast)	411	381	325
11. GFI	400	337	322	283
12. CGI	350	270	197	-

Source: SYNTEC

3. Trade and Commercial Balance

The main feature of 1983 was the weakness of the growth in export production (+ 14.3% only), particularly in direct exports (+ 7.1%). This relative weakness is to some extent part of a general pattern connected with a slump in major international calls to tender. There are signs of a certain weakening of the French position in Europe, however (1).

On the other hand, branch operations in North America have shown good results due to the strength of the dollar, without this being reflected in an increased market share. As far as direct exports are concerned, there has been a clear increase in operations aimed at South America and the Eastern countries, coupled with an appreciable drop in European operations. Even so, direct exports rose by only 15% in 1983, while branches abroad grew by over 35%, which reflects the trend in setting up establishments abroad (of which the United States accounted for 12%, Europe for 77%). Lastly, the package turnover generated abroad accounts for a mere 5% of total package output in 1982. A breakdown of operations in the sector shows a number of weaknesses, in terms of financial structure, human resources and the tailoring of software to specific needs.

Table 4: The Five Top Software/Systems Houses Abroad in 1984 - %

Company	Turnover in FF	Turnover abroad	Export turnover
Cap Sogeti	44 %	56 %	-
Cisi	62 %	32 %	6
Sema-Metra	54 %	46 %	-
GSI	65 %	35 %	-
Sesa	69 %	10 %	21

Source: SYNTEC

1) SYNTEC - Les SSCI: Résultats 1983 (The software/system houses: 1983 results), Paris.

II. SOCIAL IMPACTS

1. Employment

Software/systems houses have created more than 23,000 jobs since 1975. In 1982, the increase in the workforce (+ 10%) was the result of acquisitions and developments abroad; in 1983, on the other hand, there was a major increase in the workforce in France (+ 10.8%), while the number of people employed abroad fell sharply (8.9%) particularly as a result of various disinvestments.

Table 5: Analysis of Workforce in Software/Systems Houses (France, 1983)

	Workforce	%
Managers	24 000	56
- Admin./Executive	2 500	5,8
- Sales	1 900	4'4
- Computer specialists	19 600	45,6
Non-managers	19 000	44
- Data Processing Spec.	12 600	29,3
- Data Input	1 200	2,8
- Office workers	5 200	12,1
Total	43 000	100
of which in France	36 800	86
abroad	6 200	14

Source: SYNTEC

As in the past, the growth in jobs benefitted the managers, who accounted for slightly over half of the global workforce (56% in 1983 as against 53% in 1982). Analysis of the employment figures shows the importance of information scientists (75% of the total).

2. Qualifications and Training

Many IT service companies belong to a professional body (SYNTEC-Informatique), which in 1984 carried out a survey of the demand for computer specialists (1).

SYNTEC's estimates provide the following breakdown of computer specialists by level of formal education:

- BAC + 2 years higher education	(grade III)	38%	(BAC= A level)
- BAC + 4 years higher education	(grade II)	40%	
- BAC + 5 years higher education	(grade I)	22%	

Software/systems houses expect that numbers at grades I and II will increase more than that of grade III. Nevertheless, they are currently recruiting engineers and graduates and giving them further information technology training (3 months to 1 year) in an effort to make up for the current shortfall in numbers at grades I and II. In the market for computer specialists, the software/systems houses face strong competition for recruits from manufacturers, distributors and users. Software/systems houses account for around 14% of all employment in information technology, and should create nearly 32% of new jobs.

In 1983, the software/systems houses recruited about 40% of their workforce at grades I and II from among those with IT training and the other 60% from among engineers of all disciplines.

SYNTEC claims that training untrained beginners is a heavy burden: more than 180 million FF a year, or 1.1% of the industry's turnover, are spent on training newcomers to the profession. Since the software/systems houses are the main recruitment channel for beginners, the total training budget comes to nearly 3.5% of turnover. Software/systems houses recruit more trainee computer specialists every year than the rest of the sector put together; but the workforce is not always happy with the training they receive or working conditions.

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1) SYNTEC: Rapport sur les besoins en informaticiens des SSII (Report on software/systems house information worker requirements), Paris 1984.

3. Working Conditions

Working conditions in software/systems houses are unusual, particularly in the case of "intellectual services". In many cases, employees work at the client's office rather than the company's: the software/systems houses also frequently have no control over the work performed by their employees; and finally, the employee is dependent on the client, in both technical and reporting terms.

This technical support is at the root of the major "turnover" in personnel to which software/systems houses are prone (some 15% per year). A premium on salaries and a shortage of computer specialists reinforces the tendency to high mobility amongst software/systems house personnel, to the advantage of users' DP services (around half the personnel engaged in applications development came via software/systems houses).

This mobility is more pronounced in Paris than in the provinces, and is particularly strong amongst employees with 2 to 3 years' service. It is also more pronounced amongst those involved in development work. Long-term assignments are not well liked, and the software/systems houses are seen as a springboard to other openings.

III. GOVERNMENT POLICY IN THE FIELD OF SOFTWARE

1. Research and Development

Companies in the software sector cannot support the cost of basic research on their own, or that of training and establishing the industry on an international footing. The public sector therefore plays an important role in the software/systems house sector through subsidies (both direct and indirect), awarding contracts and the effects of political and social decisions.

Government policy has tended to favour concentration and market segmentation. The state has assisted the major companies, with one field allocated to each: SEMA in distributed processing, GSI, SLIGOS, CICI etc. in databases. The government aid and support programme for the information technology industry

has helped in giving the major software/systems houses an international status. Contract awards enable them to build up references for exports: the administrative market accounts for nearly 15% of turnover, the banking and insurance market for 16%. Lastly, under the Electronics Industry Plan (Plan d'Action Filière Electronique), 4.5 thousand million FF have been set aside for investment, research and development in the period 1982-1986.

2. Software Protection and the Law

In July 1985, legal protection against reproduction, pirating and unauthorized use of software came into force, in the form of an amendment to the 1957 copyright law relating exactly to information technology.

This clarified the position on a number of basic matters:

- beneficiaries of protection: the text stipulates that the ownership of a programme created by one or more employees of a company in the course of their work is vested in the employer, unless otherwise stipulated in the contract in favour of the employee;

- basic conditions of protection: the software must show proof of originality to enjoy protection under the new law;

- beneficiary's prerogatives: the beneficiary has private rights in financial terms on his creation but not the right of repentance or retraction, and there is a provision preventing the author opposing modification of software by anyone to whom he has surrendered his rights in their entirety;

- protection extends for 25 years.

This law has closed a legal gap which until now has only been covered by case law (1).

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1) Le Monde Informatique (IT supplement) No. 193, June 1985.

IV. SOCIAL GROUPS

SYNTEC's complaint is essentially about the "heavy burden" of training personnel at a time when computer specialists are in short supply. The software/systems houses also claim that this affects their financial results, and urge a more equitable distribution. Their professional body therefore proposes a ten-point programme, the main points of which are as follows:

- setting up a permanent monitoring body on computer specialist training;
- creating a training coordination commission;
- training 200 high-level training personnel;
- developing teaching programmes based on CAI (Computer Aided Instruction);
- setting up a continuing education programme;
- setting up a National College of Information Technology.

The report bas been sent to the four Ministries concerned (National Education, Professional Training, Research and Industry, and the Post Office) who, after discussion, should reply with a series of measures to counteract the desperate shortage of qualified manpower.

Software/systems house employee unions are also concerned about training. A survey carried out in 1981 by CFDT-BETOR showed that professional training and information technology are of great importance to employees, 73.6% of whom want training (1). The training received appears to be unsatisfactory. The other source of discontent is exercising trade union rights, given the technical characteristics of IT work, which frequently demands the presence of software/systems house workers on site. They spend a great deal of their time at clients' offices, but this can in no way be compared with temporary labour hire (2).

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1) CFDT-BETOR: Enquête sur les SSCI (Software /systems house survey) Autumn 1981, Paris.

2) CGC: Les sociétés de services et de conseil en informatique (Software houses), 1980, Paris.

On the other hand, the majority of bureaux and retrieval organizations, mainly small companies, are not covered by collective bargaining agreements of any kind: in addition, many software/systems houses further up the size scale have a branching policy which cuts out the workforce's right to representation and union rights in the company. All these factors together mean than union activity is centred on large companies which have signed extended labour agreements. In other companies, the small ones in particular, the fragmentation of the workplace does not support unionization or collective action.

(June 1985)

GREECE *)

I. TECHNICAL AND ECONOMIC ASPECTS OF SOFTWARE

1. The Spreading of Software

The installed capacity of EDP systems is estimated at US$ 120 million in 1985. The share of the U.S. companies or their subsidiaries of the installed capacity is 70%, whereas that of the European companies is 30%. Japan has not entered the computer market yet. It is estimated that the number of installed systems by size is as follows:

mini-systems	85%
microcomputers	9%
medium size computers	4%
large computers	2%.

There are more than 2,000 microsystems (8-bit) installed in the private sector that are not included in the above distribution.

The distribution of the installed systems between the public and private sector is as follows:

	Public	Private
Mini	17%	83%
Micro	26%	74%
Medium	22%	78%
Large	62%	38%

The absence of any hardware production determined the development in the software area. All hardware equipment sold in Greece was accompanied by manufacturer's software. This means that every computer which is imported into Greece, regardless of its size and class (home micro, micro, supermicro, mini, mainframe), is accompanied by a variety of software programmes.

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*) Summary of a report prepared by Prof. M. NIKOLINAKOS, Institute for the Study of the Greek Economy (I.M.E.O.), Athens.

The imported software has a serious disadvantage, although its quality in many cases is excellent; it is very difficult or impossible to adapt it to the needs of the local user.

2. Industry and Domestic Production

Up to recently hardware was at the focus of the computer system. The absence of any Greek manufacturing activity in this area determined the development of software production.

In the area of hardware manufacturing the only attempt that took off is that of Gigatronics. The company was founded in April 1980 and in its first year of operation its sales reached 1 million DRA. In 1983 its sales reached 70 million DRA. It has a personnel of 35-40 people. Gigatronics produces the following models: Hermes, G-200, Ekati and Europa. The company expects to finish Europa sometime within 1985.

Gigatronics designs its own software. It has developed its own language SUPER BASIC. It is something between compiler and interpreter. It uses the notation of BASIC.

As mentioned above the imported software has a serious disadvantage which is that of adaptation. In a majority of cases, foreign software cannot cover the real needs of the local user. It is designed in such a way that it is difficult to reconcile it to the user's language, structure of thought and philosophy.

To cover this gap a number of Greek software houses were organized. Staffed with Greeks, these software houses had full knowledge of the general and special problems Greek firms are faced with. Knowing the mentality of the people it was much easier for Greek software houses to determine the need for computerization in each individual case. This has been the reason why their packages are consumer-oriented or case-oriented. One of the achievements of Greek software is the development of the "workwriter" which is the solution for word processing with IBM Personal Computers. The programme has the ability to communicate with the user in perfect Greek. It has an operation manual in Greek; it is the first time such a manual is available in Greek.

Today there are more than thirty software houses in Greece. A number of these houses offer other services such as consulting and commercial representation.

According to estimates made by professionals in the field, in 1980 sales of software were 500,000 DRA, in 1984 they reached the level of 300 million DRA.

3. Trade and Commercial Balance

The hardware and software trade is in private hands with the exception of two companies which are subsidiaries of state-controlled banks (Pyramis and Geranos). Only a few large foreign companies maintain branches in Greece. The vast majority of foreign producers of hardware and software promote their products and services on the Greek market through distributors and dealers. This is due to the ease of entry.

One of the serious problems for this plethora of representatives, distributors and dealers is that they frequently do not fulfil their fundamental obligation to their customers. There have been many cases where representatives, distributors and dealers have shut down and disappeared leaving users without support and maintenance. There have also been cases where foreign manufacturers discontinued production in their country leaving Greek purchasers without service.

For the national economy the cost of these fly-by-night companies is quite high and additionally it obstructs efforts aimed at compatibility and standardization at all levels (hardware, software, data communication).

There are a few cases of exports of software. One is that of Gigatronics which is trying to enter the U.S. market.

Other companies have exported software to Eastern Europe, North Africa and the Middle East. M-DATA has entered the Middle East market and today it has 33 customers.

Another software house which has entered the French market is SOFRAGEM co-operating with the French software house CINA. Finally, Computer Logic, ABC and STEP are exporting software quite successfully.

II. SOCIAL IMPACTS OF SOFTWARE PRODUCTION

1. Skills and Qualifications

One of the most serious problems for the future growth of informatics in Greece is the acute shortage of properly trained and experienced computer personnel. This will be a constraint on growth for some time ahead.

The reason for this development has been the absence of any organized national formal higher education. All companies whether in trade or production have been staffed by Greeks who have studied abroad and returned. The number has not been sufficient and these computer specialists became the elite class among university graduates, most of them serving the interests of multi-national companies. These computer specialists divert most of their effort to sales rather than the production of software or any other professional activity.

Education and training offered by multinational firms to their middle level computer personnel is product-oriented designed to serve their short-term needs rather than broad-based designed to create infrastructure.

The first Greek software houses made their appearance in the second half of the seventies. It was a case of risk-taking and entrepreneurial talent. Groups of young people in different areas of specialization made their first effort to create their own software. Their only capital was their "brains". Their success was a challenge to the declining interest in business endeavours.

2. Education and Vocational Training

In the area of higher education the country can be ranked very low by European standards. The first attempts to establish self-contained courses on Computer Science and Informatics at university level began in the early eighties, and it is hoped that the gap between Western Europe and Greece will tend to close.

Degree courses in Computer Science and Informatics are presently available at the University of Patras and the University of Crete; courses in System Analysis and Operations Research are being introduced at the Athens School of Economics and Business and at the Athens Technological Education Institute.

In the area of vocational training a number of private liberal studies' laboratories offer non-degree education and training. These laboratories address themselves to people who want to prepare themselves for lower level positions in the computer field.

There are also non-profit organizations involved in vocational training and continuing education through seminars. These are the Greek Productivity Centre, the Greek Management Association, the Greek Operation Research Society, the Greek Mathematics Society and the Greek Informatics Society.

A recent development has been the introduction of informatics courses in four high schools in Athens. A task force with its members coming from two Ministries - Education and Research and Technology - is to study and evaluate the results of the experimental programme in the above-mentioned four high schools.

III. GOVERNMENT POLICY IN THE FIELD OF SOFTWARE

1. Promotion of R & D

Up to very recently there was no government policy for the promotion of Research and Development in the area of software. In 1985 a law was passed that set the direction of government policy on informatics as it "concerns research, education and training, introduction of relevant technology, incentives and conditions for technological development of the Greek informatics industry".

The law provides for the establishment of a "Government Council on Informatics". The Council will be responsible for implementing and overseeing the realization of the objective of the law.

2. Government Regulation of Software Development

At the end of 1984 a law was passed that prohibits the storage of information regarding citizens' political and religious affiliation as well as their racial origin. The law provides for penalties for violation of the law. Violators may be liable to imprisonment and/or a fine.

IV. SOCIAL GROUPS

The software companies founded their own association to promote the interests of Greek software companies. The title of the association is broader than just software design. The association was registered under the name of "Association of Greek Informatics Companies".

The primary purpose of this association is the inclusion of software companies in Law 1262/82 regarding investment incentives. The Association has already become a member of the European Association of Informatics.

(June 1985)

IRELAND *)

I. TECHNICAL AND ECONOMIC ASPECTS OF SOFTWARE

1. The Spreading of Software

Software companies or houses have flourished in Ireland over the past ten years. Initially people buying the software which accompanied their computers realized that the software was not always suited to Irish conditions. There definitely was a market for Irish software products. Numerous small software companies were set up to develop the required software for specific Irish applications. The market for this custom software declined, however, when microcomputers became popular and the associated software was widely available. To cope with this fall in demand Irish software companies diversified. Today these companies are involved in consultancy, training and maintenance.

The IPC (Irish Productivity Centre) conducted a survey in 1984 into the utilization of computers in the six major manufacturing sectors of Irish industry (1).

As may be seen from Table 1 the most common sources of software in firms owning and leasing computers were computer manufacturers and software agencies, 47% and 43% respectively use these sources.

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*) Summary of a report prepared by Prof. M.E.J. O'KELLY and Ms. F. FINNAN, Department of Industrial Engineering, University College, Galway.

1) Irish Productivity Centre, The Utilization of Computers in the Manufacturing Sector of Irish Industry, August 1984. Sectors concerned: Engineering, Clothing and Footware, Textile, Printing and Paper, Chemicals, Food, Drink and Tobacco.

Table 1: Source of Software - all firms who own or lease computers

	% giving a particular response
Computer manufacturers	47%
Computer distributors	14%
Software agency	43%
In-house	9%
Other	5%
	N = 153

Source: Irish Productivity Centre (1984)

Of firms leasing or owning computers about 40% reported that they employed software staff on a full time or part time basis - 24% employed full time and a further 17% part time staff.

As can be seen from Table 2 companies tend to buy standard packages of software (60%) with almost equal proportions to buying modified (37%) and specially designed packages (35%). The fourth category packages bought in and adapted are of course dependent on having either the requisite part time or full time software staff.

Table 2: Type of software being bought

	% giving a particular response
Standard package	60%
Standard package modified	37%
Package specially designed outside the firm	35%
Package bought in and adapted internally	12%
	N = 153

Source: Irish Productivity Centre (1984)

2. Industry and Domestic Production

At present it is particularly difficult to determine the size of the Irish software sector. The principle reason for this is that most software houses are also engaged in other related activities. There is also the problem of trying to quantify the large number of one and two man businesses.

The CII (Confederation of Irish Industry) estimated that in 1983 the market sector in which software is placed, computer services, was worth about 85 million IRL. The CII believe that approximately 30% of this figure relates to software. The current employment total among the 44 members of the Irish Computer Services Association (ICSA) is approximately 1000 and there are perhaps 300 jobs in other software companies (1).

II. SOCIAL IMPACTS OF SOFTWARE PRODUCTION

An important requirement for the development of a software industry is a high level of computing skills. Today Irish schools provide an introduction to basic computing and systems concepts. The third level institutes provide degree and diploma courses in computer science and related subjects.

AnCO, the Industrial Training Authority, is also concerned with computer training. AnCO's main role is to identify areas of employment, locate people with the required basic skills and add on whatever specialist qualifications are required to enable them to avail of the employment opportunities. Their flexibility in being able to adapt quickly to changing circumstances is their major asset in this regard. In the context of computer training AnCO responded to the first CIJEC (Computer Industry Joint Education Committee) report (2) which correctly identified a chronic shortage of trained computer people as a major restriction on the development of the computer industry in Ireland. AnCO's external training division provided the suitable courses. Now it is recognized that there are more qualified trainee programmers than the computer industry can absorb and so AnCO no longer offer programming courses but have switched to more specialized subjects like system software design and communications.

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1) What is the National Software Centre , Management, 1984.
2) Computer Industry Joint Education Committee (CIJEC), Report, 1979.

III. GOVERNMENT POLICY IN THE FIELD OF SOFTWARE

1. Promotion of R and D

The Government recognized the problems faced by small software companies, which make up the largest part of the sector in Ireland, and set up the National Software Centre (NSC) to help in the development of the industry.

The National Software Centre (NSC), capitalized by the Industrial Development Authority (IDA), was incorporated as a private limited corporation in May 1984 and began operations in July 1984. The brief of the NSC as Ireland's "software centre of excellence" is to expand the competitive pace of the Irish software industry by providing whatever added value services might be necessary to attain this objective. There has always existed the intent that the NSC would eventually be self funding and hopefully profit making. In order to determine what activities the NSC should provide and how it should be organized the following tasks were untertaken in 1984:

- a survey of the Irish software industry, the companies, their products and their marketing strategies;

- visits to software centres and software associations in order to identify role models for the NSC;

- a survey of foreign joint venture partners for technology transfer through joint product development with Irish software houses;

- the identification of the additional services that the NSC should provide;

- the specification of the centres business and medium range plans;

The services that the NSC provide include;

- marketing of products from Irish software firms;

- marketing research provided to industry as a whole, as well as to specific companies;

- product development for client software, equipment, vendor and end-user companies. Where feasible the NSC engage other companies in collaborative ventures either as partners or as subcontractors;

- software R & D projects;

- consulting and evaluative services for private, semi-state and governmental organizations;

- seminars on such topics as software engineering, expert systems and fifth generation architectures;

- certification testing of software products in accordance with prescribed EEC testing processors and in conjunction with other Irish testing organizations, eg. IIRS (Industrial Institute of Research and Standards).

In all of the above the NSC deems it essential to liaise with the third level educational institutions in Ireland and abroad.

2. Government Support for Software Production

The cost of developing a new business in Ireland is reduced significantly by the availability of generous cash grants from the IDA (Industrial Development Authority). The range of grants include: training grants (up to 100% of the cost of an agreed training programme); employment grants (obtainable as the number of employees expands in line with the demand for extra capital investment); rent subsidies (business parks for software houses have also been developed); equipment grants. Moreover, the rate of profits tax for companies engaged in computer services is only 10%, considerably lower than the rate in other industrial sectors. Ireland has thus become an attractive location for both U.S. and European companies, which utilize their Irish sites to penetrate each other's markets.

(October 1985)

ITALY *)

I. TECHNICAL AND ECONOMIC ASPECTS OF SOFTWARE

1. The Spreading of Software

The market for software and information technologies services has had a very rapid growth over the last five years. A large percentage of firms in the market were only very recently created; numerous new firms have entered the market every year.

Computer services were historically the first segment of the market to have been developed by independent suppliers. Up to now this segment of the market has also had the highest share of total sales, both in Europe and the United States; but this position is rapidly changing. Computer services include services such as data entry services, batch computing services, remote computing services and a variety of other services: supplying hardware and software facilities to the user, renting hardware or software resources at the software house, back-up services in the event of malfunctioning or at peak work-load times.

The diffusion of home and professional micro-computers gave a new impetus to the market for software products. This sector includes the production and marketing of standardized software packages to be marketed to a fairly large number of potential final users. Both in Europe and the United States this segment of the market is expected to expand its quota to over 30% of total sales by the end of the eighties.

Professional services include all those consulting services where the consultant firm suggest specific solutions to the customer: for example the development of software programs specific to the user's needs, the evaluation or design of software architectures, the auditing of information systems. Professional services also include the training of technical staff and activities in research.

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*) Summary of a report prepared by Dr. Bruna INGRAO, Department of Economics, University of Rome.

Integrated systems' services offer a full integrated solution, both hardware and software, for building up information systems for specific purposes or needs of the customer.

The 1985 Report by Assinform (1), the national association of firms active in office automation and information technologies, gives precise estimates of the extent of the market.

The sales on the Italian market, including all the four main types of services, have been evaluated at LIT 2,450 thousand million in 1984. Of these total sales, around LIT 550 thousand million was realized by hardware producers in their activities as suppliers of software and information technologies services; the remaining LIT 1,900 thousand million of sales were effected by software houses. By 1986 sales are forecasted to grow to more than LIT 4,200 thousand million, Up to 1986 the forecasted average annual rate of increase is 31%.

Table 1: The Italian Market for Software and Information Technologies services (thousand million LIT)

				% increase p.a.	
	1983	1984	1986	1984/83	1986/84
Data processing services	654.5	758	1075	+16%	+19%
Software products	418.9	588	1096	+40%	+37%
Professional services	439.5	606	1154	+38%	+38%
Integrated systems	357.1	498	894	+39%	+34%
Total	1870.0	2450	4219	+31%	+31%

Source: Assinform 1985

Noute: The figures do not include captive sales inside large groups. The figures under the last heading include the hardware component of sales. Estimates are by NOMOS Sistema.

1) Assinform, Rapporto sulla Situazione dell'Informatica in Italia, Assinform, Milan, June 1985.

ANASIN, the National Association of Software Houses, provided other figures compared to which the figures just quoted look underestimated. Sales by independent software firms are evaluated at LIT 2,200 thousand million in 1984 to which LIT 550 thousand million of sales by the hardware producers should be added (1).

All sources agree that while data processing services at the moment still hold a large share of the Italian market, they will in the coming years lose their pre-eminence. In 1983 these services were, according to Assinform, 35% of total sales and this percentage has already been reduced to 30.9% in 1984. By 1986 their share should be around 25% of sales on the market. The share of integrated systems' services is almost stable at around one-fifth of the market. The importance of professional services and software products is growing. Professional services, particularly, are forecast to become the largest share of the total market by 1986 (27.4%).

All sources also point to a remarkable gap between the qualified demand of some specific, although important, segments of the market, such as banks and Public Administration bodies, and the demand of the very large number of small firms, which is typical of the Italian economy. The SIRMI "Statistical Report on the Software Houses in Italy" emphasized the similarity between the customers' side of the market including small or very small firms sensitive to local conditions and local needs, and the conformation of the supply side, where a large population of small local units is also present (2).

The above-mentioned Assinform report noted that small or medium-sized firms have a stronger need to have recourse to the market for software services, since they lack internal resources to employ and train qualified personnel (3).

Up to 1984 the less sophisticated data processing services were still an important share of the market. The high demand for professional services also reflected a preference by customers for personal software solutions, adapted to specific needs, instead of a wider diffusion of standardized packages. In

1) Anasin, Accordi, consorzi, partecipazioni di capitale tra società di servizi d'informatica. Le forme e le strategie di collaborazione nel contesto italiano, Survey conducted by PGP Sistema, Milan, February 1985, mimeo.

2) SIRMI, Rapporto statistico sulle società di software operanti in Italia , SIRMI S.p.A., Milan, November 1983, mimeo.

3) Assinform (1985), op. cit.

fact, in forecast sales of professional services the share of software development on commission is the largest component of demand (around 60%).

Notwithstanding this, the market seems to be about to undergo deep changes. The yearly Honeywell Report noted that among small EDP users, the rate of EDP diffusion is increasing. A wider diffusion of micro and mini computers among these users should increase the demand for applicable software products, also because of the cost advantages of these products as compared to customer specific solutions (1).

As mentioned, the sales of software products are forecast to expand. The role of independent software houses on this market has also increased and it will grow even more in the near future. A new demand is emerging for standard software products, including both productivity tools and administration packages. A recent survey by SISDO CONSULT on the sales of standard software for Professional Personal Computers evaluated that more than 78,000 such packages were sold in 1984, of which more than 48,000 were productivity tools. For 1985 first estimates suggest that more than 130,000 packages will be sold, of which 85,000 will be productivity tools.

Table 2: The Italian Market for Professional Services (thousand million LIT)

	1983	%	1984	%	1985	%
Consulting	57	13,0	75	12,4	139	12,0
Software development on commission	263,7	60,0	366	60,4	710	61,5
Maintenance	87,9	20,0	118	19,5	215	18,6
Training and others	30,8	7,0	46	7,5	90	7,8
Total	439	100	606	100	1154	100

Source: NOMOS Sistema, in Assinform (1985)

1) HONEYWELL, L'evoluzione del mercato EDP in Italia nel 1984, Milan, September 1985, mimeo.

2. Industry and Domestic Production

On the basis of the census data, it has been estimated that in 1981 there were around 5,400 firms producing software services in Italy. A high percentage (27.1%) was concentrated in Lombardy, the northern region whose main city is Milan (1). By the same estimates around 25% of total employment was in firms with less than 5 employees. At the opposite end around 18% of total employment was in firms with more than 100 employees. Over 75% of local units, whose total number was estimated at 6,275, were comprised in the class from 1 to 9 employees. Total employment was estimated at 42,775 with a very heavy concentration at the two extremes of the distribution: many local units, very small in size with a few employees each and only a few units of large size.

These data seem to exaggerate the number of firms in the sector evaluated by Assinform at around 2,800 in 1981 (2). All later estimates based on market surveys give substantially lower figures for the number of firms and, in some cases, also for the total number of employees. All the same the basic picture does not change: a large population of very small local firms (with high establishment and closure rates in the eighties) and very few major well-known firms, with a nation-wide market. Medium-sized firms are a minor presence in the market.

The detailed analysis by SIRMI gave a figure of around 2,220 firms with around 30,000 employees in the year 1983 (3). A previous report noted that around 50% of the firms started their activity during 1976 to 1980. The distribution by sales showed a high concentration in the class with sales of less than LIT 500 million (4).

In a more recent report SIRMI evaluated that the total number of firms in 1984 had grown to 2,412. Employment was estimated at 34,000 employees (5).

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1) NOMOS SISTEMA, in Assinform (1985), op. cit.

2) Assinform (1985), op. cit.

3) SIRMI, Rapporto sul mercato dell'informatica nel 1983, SIRMI S.p.A., Milan 1984, mimeo.

4) SIRMI (1983), op. cit.

5) SMAU, Il mercato dei prodotti per ufficio nel 1984 e previsioni per il 1985, Report prepared for the SMAU 1985 edition, Milan, June 1985, mimeo.

In 1983 only two Italian firms were included in the list of the Top Twenty European firms in EDP: Olivetti and Finsiel. The Finsiel corporation was the only Italian firm which appeared in the list of the Top Twenty European firms in information technologies services (1).

Finsiel is a financial holding controlled by IRI, the conglomerate under public control; it controls a number of companies, all producing information technology services. Among the other major software houses, a number have been set up by large industrial corporations or banks; they work predominantly for the companies belonging to the same group.

A case-study on Lombardy points very clearly to the weaknesses of the sector and to the bottlenecks which may impede its future development (2). One of these is the lack of financial resources for the prevailing population of small firms. Only 67% of firms in the information technologies sector are corporations, most of which are limited companies. Only 17% are joint-stock companies and around 20% are simply individual businesses. The same characteristics were surveyed in firms in the Piedmont region. Most often small firms started their activities thanks to the personal resources of the staff and then continued with internal resources.

The attitude of Italian banks seems to be quite cautious, even conservative towards financing businesses which offer no real guarantee and whose main resource is human capital. This constitutes a quite substantial obstruction to the future development of the sector, since it sharply reduces the amount of funds available for investment in research on a sensible scale.

3. Trade and Commercial Balance

It is interesting to note how even major Italian software houses have been absent from international markets (3). This has been explained with reference to the lack of resources for research considering also the fact that research efforts usually have cumulative effects, which build up over the years.

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1) The ranking was by Datamation in the first case, by ECSA (European Computer Services Association) in the second.

2) RESEAU, La produzione di servizi di informatica in Lombardia, Report prepared for the "Regione Lombardia", Milan, 1984, mimeo.

3) CRORA (Centro di Ricerca sulla Organizzazione Aziendale Università L.Bocconi), L'organizzazione e la gestione delle risorse nelle aziende di servizi informatici di grande dimensione, Milan, December 1984, mimeo.

Moreover, the very limited extent of the Italian market for software provides neither incentives nor financial means to those sustained, large scale research efforts, which are necessary to enter international markets. Up to now Italian firms seem to have been mainly content to operate within the national market, exploiting the opportunities offered by the knowledge of local conditions (including legislation and administrative practice and structures).

II. SOCIAL IMPACTS

1. Employment

The evaluation of employment figures varies widely according to different sources: from more than 40,000 to around 30,000. This last figure is the ANASIN estimate, which forecasts an average growth rate of 5% per year for employment. To these figures for direct employment the figures for workers employed as full or part time external consultants or subcontractors should be added. These have been estimated at some 5,000 units in 1984.

From the detailed analysis of Lombardy, subcontracting is a widespread practice: in terms of work hours it ranges from 5% to up to 50% of total hours worked inside the firm. More often subcontracting seems to be due to overloading in the work which the firm is unable to cope with using only employed personnel. Subcontracting is a common practice for commercial firms who market software packages produced by subcontractors. Usually subcontractors do not operate independently with their own trade mark on the market.

In Lombardy employment has grown at very high rates during the past five years. In 1984, for instance, employment rose by 22% in firms producing software. In professional services and data processing services the increase was less, mainly because employment in data processing is not increasing. Therefore firms may experience difficulties in finding employees with the required skills and experience.

2. Skills Qualifications and Training

The report on Lombardy (1) offers some hints on training and skills for which national data are not available.

It estimated the following composition of employment by skills in the software producing firms: 35% of software designers and programmers, 29% system analysts, 12% punch-card operators. In more service oriented firms, punch-card operators are still 31% against 18% for system analysts and 18% for programmers.

It is also important to note that the software and information technologies services require a high percentage of employment with university or technical high school degree (from around 50% to 70%).

In training, as the same Report noted, the major hardware producers, the large users of EDP and the public administration share the main burden of completing the after-school training and providing on-the-job training. The number and types of bodies which offer training courses is now expanding, since this activity too has become a share of the market where firms compete in offering services.

Table 3: The Structure of Employment in Lombardy - 1983 (in %)

Employees with	University degree	High School degree	Professional school degree	Total
Hardware producers	16	45	39	100
Software producers	20	51	29	100
Professional and other services	13	40	47	100
Commercial firms (Hardware and Software)	21	45	34	100

Source: RESEAU (1984), op. cit.

1) RESEAU (1984), op. cit.

The internal courses are a very important channel for training, while some discontent is expressed in regard to public vocational training schools, as also emerged in other surveys (1). A substantial improvement could be realized in this area by better channels for training and a more adequate response in terms of skills supplied by the courses to the needs of firms.

This problem is but one aspect of a wider one: the limited communication among firms in the sector and local public administration (on which public training courses depend) and also the limited contacts with universities and the area of academic research. In these wider fields, too, substantial improvements should be realized (2).

III: GOVERNMENT POLICY IN THE FIELD OF SOFTWARE

There are three main areas which directly involve and require public policies, excluding training, since under Italian law training policies are controlled by Regional Governments. These are: regulations, especially necessary in such a new sector which has yet to receive proper consideration in legislation; financial support and facilities for research activity, aiming at the development and consolidation of the still weak constitution of Italian software houses; last but not least, demand policies, the importance of which soon becomes clear when considering the large incidence of sales to public administration on the small Italian market for software services.

Public demand has been estimated to be 25% of total sales in the software services market. A more sustained effort by public administration to accelerate the long needed automation of central administration could be a powerful lever for the development of the sector.

The Ministries of Finance, Health and Agriculture have been authorized to acquire services without an open invitation for tender, whenever those services are to be provided by a corporation under public control. This practice has been questioned.

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1) Assinform, Rapporto sulla situazione dell'informatica in Italia, Milan, 1983.

2) RESEAU (1984), op. cit.

In fact, the commitment between the public administration and the corporations in the Finsiel holding has been of crucial importance to the acceleration of the computerization of the central administration and to an adequate, coherent structuring of the projects. But is seems more questionable after the first pioneering stage and more market oriented procurement policies could be useful for the future. A petition on this subject has been presented to the Commission of the European Communities by ANASIN.

A more specific problem is the lack of adequate legislation to protect the production of software. Up to now, no specific bill has been passed by Parliament. It is still debated whether the protection should be through patents or through copyright.

Both associations of information technologies firms have expressed a preference for protection by copyright, also because of the long delays in the award of patents. The copyright laws already include the authors of engineering projects and designs and this clause naturally seems to cover the design of software programs as well. All the same more specific legislation is needed and a bill is now pending in the Chamber of Deputees.

(October 1985)

THE NETHERLANDS *)

I. TECHNICAL AND ECONOMIC ASPECTS OF SOFTWARE

1. The Spreading of Software

The chief market for European software products is Europe itself. As is shown by an overview of Dutch software products, written as an introduction for the exhibition "European Software Plus", this goes for the Netherlands too (1). Software producers directed their attention almost solely to the development of application packages, branch-specific software mainly for use in medium-sized and smaller companies. There is a lot of general software for financial administration. Moreover, a large quantity of so-called "branch-packages" have been developed in a great variety, for instance for accountants, farmers, garage-keepers and dentists.

What is known about the use of software? As other reports have noted, still only a minority of the medium-sized and smaller companies use micro- and personal computers. Those who do have a computer often use it for book-keeping, financial administration and stock control (2). But who produces the software?

As will be seen from Table 1 below, 74% of companies have in-house production of application software.

Table 1: Who produces the Application Software?

- own personnel	74%
- standard packages by hardware producers and independent software houses	37%
- specially hired personnel	21%
- special programs by hardware producers	11%

Source: Computable, 5 October 1984.

*) Summary of a report prepared by Ms. C. ROTTLÄNDER-MEIJER, The Hague.

1) See Administrative Software , a special by PC+, Spring 1985.

2) See for instance Results of an inquiry in the use of administrative software (Resultaten van de enquete naar het gebruik van administratieve software), in PC+ Special, Spring 1985.

The users appear to be satisfied with the delivered hardware, but disappointed in the manuals and the support. This applies as much to users of micro-computers as to users of mainframes.

Database management systems are becoming more usable for micro-computers, but there are a lot of problems with fitting the micro's into a network. The problems are: lack of support of software, the micro fits badly into the existing network, difficulty in integrating the computer in the office, and finally, the employees lack relevant training.

Table 2: Problems encountered in the Application of Database Management Systems

	August 1983*)	December 1984*)
Software support	48%	44%
The fit of micro's	27%	38%
Integration of computer in office	37%	37%
Education of employees	28%	31%

*) Number of respondents: 1983: 642, 1984: 901

Source: Computable, 22 February 1985.

The companies expect to spend more money on software in the following year. Because of the shortage of automation experts and the growing demand for dataprocessing systems, it is expected that the demand for software-tools (programming languages of the fourth generation) will rise quickly. The larger companies (> 500 employees) expect to spend much more money (in percentages) on the development and purchasing of software than the medium-sized and small companies.

The Dutch market for software and computer services amounted to HFL 5,500 million in 1983, which was 75% of the total sum spent on automation. Fifteen years ago the ratio of money spent on hardware or software was the other way around: 75% on hardware versus 25% on software and services.

Software is still often produced in Cobol. 71,2% of mainframe-users apply this language and 41.5% of the users of mini's (1).

2. Industry and Domestic Production

There are approximately 150 software houses in the Netherlands, while the total number of firms active in the field of software development is estimated at about 500. Most software producers are small (i.e. firms having less than 5 employees).

Since Dutch software producers are directing their attention to the medium-sized and small companies, one of their main concerns, and at the same time main problems, is the distribution of their products. The smaller companies have always had their direct contacts with clients; some of the larger producing firms started a chain of shops recently, or are planning to do so in the near future.

Table 3: The Major Dutch Software Producers

Software producer	Turnover in million HFL 1983	1984	Number of Employees
Volmac	142	156	910
Assyst-Reat	86	90	650
CB Autom	83	85	700
IBM	68	70	420
CVI	62	65	430
CMG	50	55	300
BSO	46	46	320

Source: Computable, 22 March and 12 April 1985.

1) More than fifty percent use Cobol, (Ruim vijftig procent werkt nog met Cobol), in Computable, 21 December 1984.

The total turnover of the members of COSSO (Association for Computer Service and Software Agencies - Vereniging Computer Service- en Software Bureaus) in 1983 amounted to 838 million HFL. This means an annual growth of ten percent, which is less than the growth achieved in 1982 (14%). In 1984, however, an annual growth of almost 20% was realized (see Table 4).

Table 4: Turnover of COSSO members (in million HFL)

Year	Turnover	Growth (%)	Number of employees
1978	370	-	-
1979	463	25	3865
1980	568	23	4445
1981	670	18	4955
1982	762	14	5073
1983	838	10	5424
1984	1003	19.6	5960

Source: Computable, 23 March 1984.

As can be observed in many other countries the market for "Computer Services" ("Activities for Computer Agencies") is decreasing, while the software market for "Software Houses" is increasing in the Netherlands (see Table 5).

Table 5: Annual Turnover of Software and Computer Services

Specific activity	Annual turnover (million HFL)		
	1982	1983	1984
Activities for computer agencies	312	319	307
Software house services	284	323	402
Consultancy	51	53	79
Education and training	28	27	33
Other activities	87	116	182
Total	762	838	1003

Source: De Automatiserings Gids, 21 March 1984.

3. Trade and Commercial Balance

The software industry in the Netherlands is not very export-minded, the Government anticipating export worth 300 million HFL in 1985.

There is a reason for this, as stated before. The production of software is oriented towards the Dutch market itself, mainly towards the medium-sized and smaller companies. It may well be true that the software houses just do not produce software which is suitable for export.

II. SOCIAL IMPACTS

1. Employment

The social impact of new developments in software cannot be separated from the social impact of technological innovation in general. Specific information on the employment impact of software development is very limited.

As shown in Table 4, employment in the software industry is rising from year to year: the sector now has some 6000 employees (the data refer only to the member firms of the Association for Computer Service and Software Agencies, COSSO).

2. Education and Vocational Training

The need for experienced personnel in the field of automation, software development and new technology has led to three trends in education:

- The training of the unemployed. Several experiments are under way, among which the experimental project in the province of North-Holland. The Foundation Society and Automation (SMA: Stichting Maatschappij en Automatisering) has set up a plan to train 11,500 unemployed men and women, which costs 100 million HFL. If the plan, which requires financial support from government and industry, is approved, it will also provide education for 7000 government officials and 3,500 industrial workers.

- The Department for Education and Science launched a plan for further education for people who leave regular educational institutions. This plan, drawn up in cooperation with the Department for Economic Affairs and the Department for Social Affairs and Employment, is named Inflow School-leavers in Occupations in the Information Industry (ISI: Instroom-projekt Schoolverlaters Informatiseringsberoepen). Its aim is to reduce youth unemployment by providing further education in information technology for 5000 people. Fourteen regional centres have been created to provide courses in system management and in application software.

- The training of employees. Various companies have chosen to surprise (some of) their employees by giving them a computer to take home. Other companies choose to provide special vocational training. Philips, for instance, decided to provide in-service training for 30% of the employees: 20,000 people. And a number of Dutch banks created special courses for various groups of employees.

III. GOVERNMENT POLICY IN THE FIELD OF SOFTWARE

In a speech given at the opening of the "Europe Software" exhibition in Utrecht (May 1985) the Minister of Education and Science stated that the branch of software manufacturing necessarily practises a short term policy. There are no resources for research and development, and also the shortage of skilled people is felt. He declared that the Dutch government will pay attention to this, help to improve the conditions for a long-term policy and survival of the software industry.

Apart from the general governmental policy already described in earlier general reports for EPOS, this means that a possibility is created of financing research in the field of "fifth generation software" and artificial intelligence, man-machine interface and speech technology.

Other recent items of government policy are:

- The attempt to stimulate the export of Dutch software products and computer services.

- A policy to stimulate the further development of the computer services branch, amongst other by innovative purchasing of technology for government agencies.

IV. SOCIAL GROUPS

Social groups, active in the field of software manufacturing, are limited to general employers' organizations and to associations of software producers. Since this industrial branch is very young and unsettled, trade unions do not have much influence in it. The employees are for the most part unorganized. In politics considerable attention is paid to information technology in general, but not to software production in particular.

We will therefore limit our discussion on social groups to the activities and position of the employers' organizations in the field.

1. Policies of the Employers' Organizations

A year ago, three associations of software producers were active: COSSO, VIFKA (section software) and NSV. The NSV, however, combined with the VIFKA-section, since 24% of its members (15 out of 63) left in one year. This means that two associations are left: COSSO, which represents the bigger firms, and VIFKA, which represents the smaller ones.

COSSO was created in 1971 to promote cooperation between software producers. It aims to protect the interests of its members, and tries to develop the branch of computer services.

To achieve this aim, it has taken the following steps:

- It helps to present software products, stimulates innovation and helps to strengthen the position of software manufacturers.

- It stimulates technology policy.

- It is one of the founders of ECSA, the European Computer Services Association, through which it supports an exchange of knowledge and experiences.

- It has formulated service quality criteria and a behavioural code for its members. This code contains rules on the following items: skill requirements, continuity in service, quality-control, conditions for sales and delivery, etc.

VIFKA has published a book on the societal possibilities of computer technology (1). The book contains chapters on all relevant applications of information technology, and should be seen as an invitation to politicians to try and shape the new society in which automation and informatics play a central part.

(June 1985)

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1) Nine aspects of computer technology and society (Negen aspecten van computertechnologie en maatshapij), VIFKA, Kluwer BV, 1985.

UNITED KINGDOM *)

I. TECHNICAL AND ECOMONIC ASPECTS OF SOFTWARE

1. The Spreading of Software

The developments in the computer hardware market have had a considerable effect on the production of software. There are many differences between mainframe, mini- and microcomputer systems, each having different requirements as far as software is concerned.

Following the advent of the microcomputer, there are really two software markets now. The first is the traditional software market, directed towards mainframe and minicomputer users with large data processing departments - typically businesses, government financial institutions or defence. The second is the microcomputer oriented software for personal computers - either those in business or for entertainment at home.

Much of the software for the traditional mainframe and minicomputer business was custom-built or bespoke software. However, more recently software firms have been selling packaged software for these systems.

The market consultants International Data Corporation (IDC) claim that in 1981 29 per cent of the market was held by bespoke software with 28 per cent for packages. By 1984 the figures were 27 per cent for bespoke and 38 per cent for packages. By 1989 IDC expect bespoke to hold only 20 per cent while packages could take 57 per cent of the market.

The UK packaged software market was estimated at US$ 552m (1983), of which US$ 127,7m were for the microcomputer market.

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*) Summary of a report prepared by Mr. TIM BRADY, Science Policy Research Unit, University of Sussex.

Table 1: Sales of Packaged Software in the UK

1983 (US$m)

Hardware Manufacturers	361.00
Independent Package Software Suppliers	191.00
Total	552.00

Source: IDC

The estimates for diffusion of this form of software in the UK are given in Table 2.

Table 2: UK Micro Package Market (US$m)

1983	av growth %	1986	av. growth %	1989
127.7	55	447.0	35	1164.2

Source: IDC

Another consultancy, Creative Strategies International, expects the sale of business microcomputer application software - i.e. packages for word processing, database management systems, accounting packages and spreadsheets - to grow from 120,000 units in 1983 to about 1,000,000 by 1988, of which 400,000 plus will be accounting packages.

An analysis of recent sales of its members by the UK Computing Services Association (CSA) broadly agrees with these forecasts. Their 1984 annual survey of members shows that the software packages sector is the fastest growth sector with a 50 per cent growth in sales over 1983. Sales of bespoke software fell in relation to the software packages.

2. Industry and Domestic Production

There are literally thousands of companies offering computer services in the UK. The VAT-based register of companies in 1983 included over 12,000 firms classifiable to the computer services industry. Of these the 200 largest businesses accounted for over half of the estimated total turnover. A large number of firms would be sole proprietors or partnerships. It is thought that these firms contributed approximately UKL 700m in 1983 in systems analysis and software although a further UKL 175m turnover was attributable to firms specializing in consultancy which could include software elements. Total turnover of all computer services companies was estimated to be UKL 1,750m in 1983 with a forecast of UKL 2,120m for 1984. In addition computer manufacturers' software sales were thought to be about UKL 100m in 1983 and UKL 124m in 1984 (1).

The 1984 Computing Services Association (CSA) survey estimates that total turnover of CSA companies (which include some 214 members, accounting for about 80% of the total computing service market in the UK) was about UKL 1,065m - which is in line with the DTI estimates for the top 200 companies in the VAT register. 76 per cent of CSA members are British-owned companies. There is evidence of continued maturing of the computer services industry with the larger companies becoming much larger and accounting for over 75 per cent of revenue and 77 per cent of staff employed. In 1984 there were 5 CSA companies employing more than 1000 staff compared with only 2 in 1983. Multi-service vendors now account for over 45 per cent of total revenue. Another trend is for independent companies employing around 100 people to become absorbed by larger companies - there were no respondents in the survey employing 100-200 which have remained independent.

Another source of information on the UK computer services industry is the European Computer Services Association Survey. Table 3 below shows the leading UK computing services companies, the range of services they offer, their employment and revenue in 1982.

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1) Source: Computer Services Statistics 1983 and 1984 from the Department of Trade and Industry.

Table 3: Leading UK Computing Services Companies in 1982

Company	Country of majority Shareholding	Ownership	Services A	B	C	D	No of Employees (1982)	Revenue in US$m
Scicon Group	UK	BP	X	X	X	X	3,500	100 +
IBM	US	Public Corp	X	X	X	X	N/A	80-100
ICL Consultancy & Training	UK	ICL			X	X	1,100	40-60
Logica	UK	Staff/ Institutional Investors			X	X	900	40-60
Thorn EMI	UK	Public Co.	X	X	X	X	900	40-60
Hoskyns	US	Martin Marietta	X	X	X	X	850	40-60
Geisco	US	General Electric	X		X	X	350	40-60
Data Logic	US	Ray Theon Company				X	680	30-40
Systime	UK	Ivory & Sine/Staff/ BTG	X		X	X	600	30-40
Centre File	UK	Nat West Bank	X	X			805	30-40
CMG	UK	Staff	X	X		X	628	30-40
UCSL	UK	Unilever	X	X			720	30-40
CAP	UK	BTG/Staff /Inst.Inv.			X	X	898	30-40
BIS	UK	Inst.Inv./ Staff			X	X	482	20-30
Comshare UK	US	Public Corp	X		X	X	400	20-30
Baric	UK	ICL/Barclays Bank	X	X		X	516	20-30

A = Remote Computing Services
B = Batch
C = Software Products
D = Software Services

Source: 7th Annual Survey of the Computing Services Industry in Europe 1983

The larger firms in a DTI survey were asked what were their most important end markets. These are shown below in Table 4.

Table 4: Primary markets for Larger Computer Services Companies

Manufacturing	30%
Wholesale and Retail Trade	20%
Financial Services	20%
Public Sector	15%
Other	15%

Source: DTI, Computer Services Statistics, 1983-1984

3. Trade and Commercial Balance

The market for packaged software is dominated by the computer hardware manufacturers which are mostly US-owned. However, UK-owned or part-owned companies do better in the third party vendor market, accounting for most of the top 15 companies in 1983.

Despite the UK's reputation for producing high quality software there is little evidence to show that UK companies are very successful at marketing their products abroad. According to figures from the CSA 1984 annual survey, an average of 14 per cent of sales was derived from export sales compared to 13 per cent in the previous year. These figures include revenue derived from non-software related services.

II. SOCIAL IMPACTS

1. Employment

It is very difficult to get estimates of manpower employed in software-related activities. The survey carried out by Anderson & Hersleb for NEDO (1) made estimates of computer-skilled manpower in 1978 with forecasts for 1980 and 1985.

1) Anderson A. & Hersleb A., Computer Manpower in the 80's: The Supply and Demand for Computer Related Manpower to 1985, NEDO, 1980.

For computer users their estimates were:

end 1978		235,000 (including 99,000 professionals)*
end 1980		288,000 (including 127,000 professionals)
end 1985	min	263,000 (including 142,000 professionals)
	max	402,000 (including 216,000 professionals)

*) Professionals include programmers, analysts and electrical engineers.

Their estimates for computer services were:

at 1st qtr 1979	24,000 (including 17,000 professionals)
end 1980	31,000 (including 22,000 professionals)
end 1985	64,000 (including 35,000 professionals)

The recent surveys by the DTI (Department of Trade and Industry) suggest that these estimates are rather low. In mid-March 1984 it is thought there were about 70,000 employees in the computer services industry itself. In the larger firms nearly all employees are full-time (95 per cent) and approximately 70 per cent have dp skills - analysis/design/programming, consultancy, computer operations, data control and data programming. The DTI was unable to provide estimates of employment solely on software development in the computer industry or for computer games or CAD/CAM software.

A small survey conducted by the National Computing Centre in 1984 for the DTI examined "in-house" computing activity for all industries plus the government (except for the Ministry of Defence and Educational Industries). This survey indicated that 600,000 man years were expended on in-house computer services in 1983. There were 16,000 staff fully engaged in computing in Central Government in 1983.

2. Skills and Qualifications

One of the main concerns of all data processing installations is the shortage of skilled staff. The NEDO study "Computer Manpower in the 80's" revealed a shortage of computer skilled manpower of over 25,000 in 1978. Many of these were in programming/analyst areas but the most severe shortages were thought to be in engineering professionals - software engineers, design engineers.

The recent IT Skills Shortages Committee Final Report (1) includes the following figures showing skills requirements in various IT users.

Table 5: Examples of IT Users

	IT Systems Supplier	Hardware Supplier	Software Supplier	Manufacturing	Commerce	Government	Financial Services	Airlines
1. Systems Project Manager	X		X	X		X		X
2. Systems Designer	X		X	X	X	X	X	X
3. Systems Engineer	X	X		X				
4. Systems Analyst			X		X	X	X	X
5. Systems Programmer	X		X	X	X	X	X	X
6. Installation Engineer	X	X						
7. Installation Technician	X	X						
8. Maintenance Technician -								
- hardware	X	X		X				
- software	X		X	X	X	X	X	X
9. Operator				X	X	X	X	X

Source: Signpost for the Future, DTI, 1985

Burgess (1985) notes that "while those working as specialist contractors or for independent service providers such as software houses may find themselves relatively insulated from current changes, in-house information workers will be increasingly subject to either deskilling or displacement" (2).

This is confirmed to some extent by the trends towards the use of packaged software rather than customized software and the developments in hardware technology whereby more of the programming is becoming embedded in the architecture of the computer.

The trend is towards the development of more user-friendly software so that there is no need for users to master complex high level languages.

1) DTI, Signpost for the Future, HMSO, 1985.

2) Burgess, C.J., The Impact of New Technology on Skills in Manufacturing, MSC, 1985.

However, there is one area where skills are definitely in short supply and that is in the development of real-time software. A NEDO electronic capital equipment sector working party report (1) in 1982 noted that "companies worldwide are experiencing difficulty in producing complex real-time systems efficiently and economically, and are investing heavily in the development of software tools and methods to improve their capability. British suppliers of these systems, small by world standards, are finding it increasingly difficult to invest sufficiently to keep up with the state of the art".

The report was based on a survey of in-depth interviews in eleven companies covering 4400 software staff including some of the largest real-time software producers in the UK. Real-time software is required to run the real-time control systems in applications like automatic radar and navigation systems in ships, planes, missiles and torpedos, process plan control, telephone exchange equipment, printing, industry automation equipment, command and control systems for military and police use, and air traffic control.

The importance of developing software engineering tools was further examined in a study for the DTI carried out by consultants PA Computers and Telecommunications (PACTEL) in 1984 (2). The survey indicated that a likely minimum of 82,000 software engineers were employed in the UK in 1983 and that this would grow to 84,000 by 1985. The UK market for software engineering tools was expected to grow to UKL 90m in 1985 from a level of UKL 74m in 1983. The study claimed that the total potential benefits across the UK software industry could come to as much as UKL 360m a year in savings - equivalent to releasing about 24,000 software engineering staff to undertake additional work. One depressing finding was that use of software engineering tools was very low.

This finding is confirmed by a separate study conducted by ACARD (the Advisory Council on Applied Research and Development) (3). They found that many companies were still using Assembler as a language despite the existence of far more advanced languages. There has been rapid development of languages

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1) NEDO, Electronic Capital Equipment Sector Working Party: Real-time Software, R & D in the UK, NEDO 1982.

2) PA Computers and Telecommunications, Software Engineering Methods and Tools, The Benefits of Pactel, October 1984.

3) Forthcoming June 1986.

for machine code, from Assembler to Basic and then to higher languages like Fortran, Cobol, Algol, and Pascal. There are now fifth generation languages. ACARD found that there were a lot of tools available now but they were not in general use.

In another survey Incubon Consultants found that only 171 out of 600 companies were using fourth generation languages (4GLs) to assist software developments, but a recent Urwick/Computing survey found that 45 per cent of the DP Managers asked were already using 4GLs in their departments and another 32 per cent planned to do so in the near future (1).

The development of these 4GLs plus the trend towards producing high level user-friendly software allowing users to do their own programming has led to a change in the skills required in data processing departments. The changes have led to the emergence of the analyst/programmer whereas previously the two roles were separated. A survey carried out by the NCC and Bristol University in 1983 found that analyst/programmers were expected to outnumber programmers by 13 per cent in 1987 whereas in 1980 programmers outnumbered analysts by 17 per cent.

3. Impact on Work Organization

The developments in new software products and new software languages have led to changes in work organization in data processing departments. A recent survey of 95 data processing installations in New York and Boston was carried out as part of a project directed by the DP research group based at the Economics Department in Bristol University (2). This showed how it was becoming common practice for there to be flexible work teams, wide individual job descriptions and frequent organizational shuffles.

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1) Grindley K.. Something for Everyone , Computing Magazine, July 4, 1984.

2) See, for example, FRIEDMAN A.L. and CORNFORD D.S., Strategies for Meeting User Demand, an International Perspective , University of Bristol, Working Paper, mimeo, 1985.

In the 1960's the organization most common in cobol-using DP departments was the "programming pool". In this set-up large jobs could be cut into smaller discrete modules by the chief or senior programmer and these small jobs could be handled by the low-level programmers. These programmers would have no concept of the whole project or how their piece fitted into the project.

The recent survey found only one fifth of the sample still had this organizational structure (and these were generally small departments with fewer than 10 analysts and programmers). The present favoured structure was of teams of analysts and programmers together (37 per cent) or teams of analyst/programmers (31 per cent). The rest were using a matrix structure.

Most of the project teams were found to be small (80 per cent had five or less members in the US compared to 66 per cent in the UK). They also stayed with the project through development into maintenance in the majority of cases (only 22 per cent kept separate organization structures for development and maintenance).

4. Education and Vocational Training

A recent report prepared for the MSC (Training and Selection of Computer Personnel) gives details of a survey of 500 computer users and their methods of recruitment and training of data processing staff (1). The report found that employers expected that their programmers, analyst programmers and systems analysts would need far broader knowledge and skills in the future, but most had no appropriate means for selecting and training the necessary skilled people. Nearly 40 per cent of the employing organizations offered no formal training at all to software staff.

III. GOVERNMENT POLICY IN THE FIELD OF SOFTWARE

1. Promotion of R & D

The main plank of Government support for software in the UK is the Software Products Scheme, run by the Department of Trade and Industry (DTI) as part

1) Occupational Services Ltd., Training and Selection of Computer Personnel, OSL, 1984.

of the Support for Innovation Scheme. The scheme was first launched in 1973 but was revamped in 1982 as part of IT82 (Information Technology Year), the Government's effort to increase awareness of information technology. During the initial 9 years from 1973-1982 grants worth UKL 9m were awarded. The new scheme announced in 1982 was allocated UKL 10m over a three year period. This was further increased by an allocation of UKL 25m in the 1983 Budget. The scheme is administered by the National Computing Centre. Applicants for grants have to come from within the computer services industry - computer manufacturers are ineligible for support under this particular scheme.

Answering a parliamentary question on 18 March 1985, John Butcher of the DTI informed the House of Commons that 571 proposals had been received under the Software Products Scheme. Of these 180 have been rejected and 20 were currently being processed. The total value of the grants for the 371 approved projects was around UKL 41m. Grants worth a further UKL 3m were under negotiation at the time.

Total government expenditure on the Software Products Scheme was given in a table in British Business. The information is reproduced in Table 6 below.

Table 6: Government Expenditure in the Software Products Scheme

1979-85 (UKLm)

Year	79-80	80-81	81-82	82-83	83-84	84-85
Expenditure	0.7	1.0	1.5	1.8	3.6	9.0

Source: British Business, 22 March 1985.

If total grants worth UKL 41m have been allocated and if expenditure up to 1982 was UKL 9m this implies that a further UKL 17.6m is to be paid out to firms under the Software Products Scheme.

The other major area of Government expenditure on software is to be found within the Alvey programme of research into fifth generation computers. The total government budget for the Alvey programme is UKL 225m for the period 1983-1988.

The software engineering part of the Alvey programme aims to assist the development of tools to produce IT systems using software engineering techniques. Among the activities of the Alvey programme the IKBS (Intelligent Knowledge Based System) component is mostly software development although some hardware development was involved. MMI (man-machine interface) includes some software input and a small part of CAD for VLSI is software based. Perhaps between UKL 50m and UKL 70m of the government funds to Alvey will be spent on software related research and development.

2. Government Regulation of Software Development

One area which is very close to software producers' hearts is the protection of software from "software pirates" - people who illegally copy packaged software in much the same way as "video pirates" copy video films. Moves, supported by the industry, to put a Private Members Bill through Parliament, to gain similar protection from piracy as has been given to the video industry by a similar Private Members Bill, have succeeded. New legislation called the Copyright (Computer Software) Amendment 1985 received royal assent during the summer and will become law in the early autumn. Under the legislation software pirates will face prison terms of up to two years.

There are similar concerns about computer fraud. A survey was carried out by the Audit Commission (1), examining the incidence of computer fraud in Britain. The commission investigated 77 notified cases of fraud although they emphasized that this represented a very small fraction of the actual cases of fraud that were perpetrated. Many frauds are undiscovered and others go unreported because of embarrassment and the fear of loss of confidence - particularly in financial institutions.

V. SOCIAL GROUPS

1. Policies of Employers' Organizations

The main employers' organization for software companies in the UK is the Computer Services Association. Among their recent policy aims has been to try to persuade the Government to extend the Software Product Scheme after its original UKL 25m budget had been allocated. They were successful in this aim and the SPS was given a further UKL 12m by March 1984.

1) Computer Fraud Survey, Audit Commission for Local Authorities in England and Wales, HMSO, 1985.

The CSA also played an active role, with its Privacy Working Party, in proposing a number of amendments to the Data Protection Bill.

The CSA has a policy of actively supporting FAST (the Federation Against Software Theft) which is the industry body campaigning against software piracy. FAST is an organization composed of 50 computer firms and 12 trade associations. It has been the main body behind moves to amend copyright legislation so as to make it less attractive to make illegal copies of software.

2. Trade Unions' Policies

Trade Union organization in IT companies as a whole has proved to be difficult. Where there is union representation it tends to be in hardware manufacturing divisions or where there is a historical reason. It is well-known that some of the large US-owned computer manufacturers such as IMB, DEC, and H-P do not recognize unions. ICL, the UK-based computer manufacturer, does recognize unions. Many other computer hardware manufacturers do not.

A similar situation exists in the software houses. Trade union representation is related to whether there is a historical reason. For instance, Centre File is a subsidiary of Nat West Bank and has an organized workforce whose members are in BIFU (Banking, Insurance and Finance Union). Similarly software workers in Compower are members of NUM (National Union of Mineworkers) since Compower is a subsidiary of the National Coal Board.

The two unions most concerned with trying to organize computing workers are ASTMS (the Association of Scientific, Technical and Managerial Staff) and APEX (Association of Professional and Executive Officers). ASTMS has a national office with responsibility for the electronics and computer industries, and APEX has a section called Computech specifically for recruitment in this area.

Software workers in user firms are more likely to be unionized than those in software producing firms. However, a survey for NEDO on new technology agreements conducted by the Technology Policy Unit at Aston University found that "in contrast to many production and clerical workers, computer and electronic specialists, whose work has been concerned with the design and programming of electronic equipment, were not generally covered by collective procedures for introducing technological change" (1).

(October 1985)

1) NEDO, The Introduction of New Technology, NEDO, June 1983.

SELECTED BIBLIOGRAPHY

INTERNATIONAL

ECSA (1984) — Eighth Annual Survey of the Computing Services Industry in Europe, INSEA

OECD (1985) — Software: An Emerging Industry, Paris

Computing Services: Financial Times Survey . Financial Times, 4 October, 1985

BELGIQUE

ASAB/VEBI-EURODATUM (1984) — "L'informatique en Belgique. Les chiffres-clés" Computer Organ Inform, n° 62, octobre

BODART, FR. (1984) — "Pour une utilisation efficiente, par l'administration publique, des technologies d'information". Rapport au Ministre de la Fonction Publique, Pub. INBEL, avril

Conseil National de la Politique Scientifique (1983) — Politique de Recherche en Micro-Electronique et ses Conséquences Sociales, Bruxelles

CROTT, R. et HOUARD, J. — "L'industrie du logiciel - situation et perspectives en Belgique", communication à la journée d'étude belge du réseau européen FAST (services et communications) du 7.2.1985, mimeo

INSEA — Guide Pratique des Services Informatiques en Belgique

Ministre de la Politique Scientifique (1982) — Programme d'Actions dans les Technologies Basées sur la Micro-Electronique, Bruxelles, octobre

PETE, André L. (1985) — L'industrie du Logiciel, Université Libre de Bruxelles. Faculté des Sciences Sociales, Politiques et Economiques. Centre Régional Wallon, Nivelles

TINANT, B. (1984) — "Les usines de software", Computer Organ Inform, n° 59, avril

"Dossier: Les sociétés de services", Data DECISION, n° 56, juin 1985

"Logiciels. Made in Belgium", Industrie, n° 8, octobre 1984

"Nouvelles technologies. Document de travail préparatoire au congrès de la CSC", Syndicaliste CSC, n° 191, décembre 1982

DANMARK

Dansk Databehandlingsforening (1983) — Edb-Branchens Hovedproblemer, København

EDB-Rådet (1980) — Edb-Serviceydelser - et Undersøgelsesresultat, Rapport nr. 24, København

Elmark & Christensen Marketing Aps (1983) — Edb-Udviklingen. En Undersøgelse af Anvendelsen af Edb i Danmark

Paris, K. (1985) — "Er det belastende", PROSA, København

BUNDESREPUBLIK DEUTSCHLAND

ADV/Orga Research (Hrsg.) (1985) — Software Trends, Wilhelmshaven

BREUER, R. (1984) — Computer-Schutz durch Sicherung und Versicherung, Neubiberg/München

Bundesministerium für Forschung und Technologie (Hrsg.) (1976) — Stand und Entwicklung des Marktes für mehrfach verwendbare Anwendersoftware in der gewerblichen Wirtschaft, Forschungsbericht DV 76-04, Bonn, August

DIEBOLD-Deutschland GmbH (Hrsg.) (1978) — Der Markt für Softwareprodukte in der Bundesrepublik Deutschland, Diebold-Studie, Frankfurt

GROCHLA, E., et al. (1985) — Kosten des Datenschutzes in der Unternehmung. Qualitative und quantitative Ergebnisse einer empirischen Untersuchung in der BRD, Braunschweig/Wiesbaden

KIRSCH, W., et al (1975) — Der Einsatz von standardisierten Anwenderprogrammen in der industriellen Praxis, Verwenderbericht, München

LIEBL, K. und ZIMMERLI, E. (Hrsg.) (1984) — Computermißbrauch - Computersicherheit, Ingelheim

NEUGEBAUER, U., et al. — Der Markt für Software, Systeme und DV-bezogene Dienstleistungen in der Bundesrepublik Deutschland, GMD-Studien Nr. 74, Sankt Augustin, Dezember

PLEIL, G.J. (1982) — Büro und Personalcomputer in Klein- und Mittelbetrieben, Leinfelden

RAULEFS, P. (1982) — Expertensysteme, Informatik-Fachberichte Bd. 29: Künstliche Intelligenz, Berlin/Heidelberg/New York

SPIEGEL-Verlag (Hrsg.) (1979) — Märkte im Wandel, Bd. 9: Datentechnik und Informationsverarbeitung, Hamburg

STEINKE, D. (1979) — Standard-Anwender-Software, Berlin

VDRZ - Verband Deutscher Rechenzentren e.V. (Hrsg.) — Handbuch Deutscher Datendienste, Hannover (erscheint jährlich)

ZAHRNT, C. (1984) — DV-Rechtsprechung, München

Künstliche Intelligenze und Expertensysteme, Forschungsbericht der Nixdorf AG, München 1985

FRANCE

CFDT-BETOR (1981) — Enquête sur les SSCI, Automne

SYNTEC (1983) — Développement du Progiciel Français

SYNTEC (1983) — Rapport Annuel d'Activité des SSCI

SYNTEC (1984) — Rapport sur les Besoins en Informaticiens des SSCI, Paris

Inflexions Stratégiques et Mutations Techniques, Lettre 2000-SSCI, n° 20, avril 1984

Le Monde Informatique, n° 193, 3 juin 1985

GREECE

Manpower Employment Organization (1982) — Production of Microelectronics in Greece

A Proposal for a National Strategy for the Development of Informatics in Greece, 1983, unpublished

"Gigatronics", Electroniki & Computers, September 1984

"The Greek Reply to Text Processing", Electroniki & Computers, November 1984

"Software Houses", Electroniki & Computers, March 1985

"Interview with the Minister of Research and Technology", Electroniki & Computers, March 1985

"Application of Informatics as a Social Tool", Electroniki & Computers, April 1985

IRELAND

Computer Industry Joint Education Committee (CIJEC) (1979) — Report

Computer Industry Joint Education Committee (CIJEC) (1984) — Report

DALTON, O. (1985) — "The Changing Face of Software", Business and Finance, 31 January

Irish Productivity Centre (1984) — The Utilisation of Computers in the Manufacturing Sector of Irish Industry, August

KELLY, J. (1984) "Ireland - The Soft Option", Management

WALSH, A. (1984) "Is your Computer Leaking", Management

"Education and Training", Irish Computer, July/August 1984

"A Park for Growing Software", Irish Computer, Vol. 9, No. 2

"Defining a Role for the National Software Centre", Irish Computer, Vol. 9, No. 4

"What is the National Software Centre", Management 1984

ITALIA

ANASIN (1985) Accordi, consorzi, partecipazioni di capitale tra società di servizi di informatica. Le forme e le strategie di collaborazione nel contesto italiano, survey conducted by PCP Sistema, mimeo, Milano, February

ASSINFORM (1983) Rapporto sulla situazione dell'informatica in Italia, Milano

ASSINFORM (1985) Rapporto sulla situazione dell'informatica in Italia, Milano, June

CAMERA DEI DEPUTATI (Servizio Studi) (1982) "Relazione sulla politica industriale", XII Commission, October

CENSIS (Centro Studi Investimenti Sociali) (1984) — L'informatica nella società italiana, First Report edited under the sponsorship of Finsiel, Franco Angeli, Milano

CRORA (Cento di Ricerca sulla Organizzazione Aziendale. Università L. Bocconi) (1984) — L'organizzazione e la gestione delle risorse nelle aziende di servizi informatici di grande dimensione mimeo, December

DADDA, L. (1985) — Il livello tecnologico dell'area metro-politana milanese nel quadro tecnologico internazionale, mimeo, Milano

HONEYWELL (Honeywell Information Systems Italia) (1985) — L'evoluzione del mercato EDP in Italia nel 1984, mimeo, Milano, September

IRES (Istituto per le Ricerche Economico-Sociali del Piemonte) (1984) — Il settore dell'informatica in Piemonte, Quaderni di ricerca IRES, n. 24, Torino

ITALSIEL (1984) — Relazioni e bilancio, mimeo

RESEAU (1984) — La produzione di servizi di informatica in Lombardia, Report prepared for the "Regione Lombardia", mimeo, Milano, December

SIRMI (1984) — Rapporto sul mercato dell'informatica nel 1983, mimeo SIRMI S.p.a., Milano, July

SIRMI (1983) — Rapporto statistico sulle società di software operanti in Italia, mimeo SIRMI S.p.A., Milano, November

SMAU (1985) — Il mercato dei prodotti per ufficio nel 1984 e previsioni per il 1985, Report prepared for the SMAU 1985 edition, mimeo, Milano, June

NEDERLAND

COSSO (1985) — Vademecum '85, Amsterdam

GONENC, R. (1984) — "Software - A New Industry", OECD Observer, November

JACOBS, J. (1984) — "In the shade of 'Big Blue'; Software in Western Europe" ("In de schaduw van 'Big Blue'"), Intermediair 20/19, 11 May

LOF, E. (1984) — "How many jobs disappear in the banks?" ("Hoeveel banen verdwijnen er bij de banken?", Intermediair, 5 October

VIFKA (1985) — Nine Aspects of Information Technology and Society (Negen aspecten van computertechnologie en maatschappij), Kluwer BV

"Support is often the weakest point" ("Ondersteuning vormt meestal zwakste punt"), Computable, 5 October 1984

"More than fifty percent uses Cobol" ("Ruim vijftig procent werkt nog met Cobol"), Computable, 21 December 1984

"To fit in micros is not so easy" ("Micro inpassen toch niet zo gemakkelijk"), Computable, 22 February 1985

"Administrative Software", PC+, special, Spring 1985

UNITED KINGDOM

ANDERSON, A.; HERSLEB, A. (1980) — Computer Manpower in the 80's: The Supply and Demand for Computer Related Manpower to 1985, NEDO

Computing Services Association (1984) — Annual Report, CSA

DTI (1985) — Signposts for the Future, HMSO, London

NEDO (1982) — Electronic Capital Equipment Sector Working Party: Real Time Software R&D in the U.K., London

PA Computers and Telecommunications (1984) — Software Engineering Methods and Tools, The Benefits of PACTEL, October

Computing Services Association (1984) — Members Survey, CSA

Occupational Services Ltd (1984) — Training and Selection of Computer Personnel, OSL

PART II

"The Social Aspects of the Introduction of New Technology and Proposals for a more Fundamental Approach to the Social Dialogue"

by W. KOK

REPORT FROM W. KOK TO MR J. DELORS, PRESIDENT OF THE EUROPEAN COMMISSION, ON "THE SOCIAL ASPECTS OF THE INTRODUCTION OF NEW TECHNOLOGY AND PROPOSALS FOR A MORE FUNDAMENTAL APPROACH TO THE SOCIAL DIALOGUE".

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I PREFACE

In June 1985, Mr J. Delors, President of the European Commission, asked me whether, after retiring as chairman of the FNV (Dutch Federation of Trade Unions) and vice-chairman of the ETUC, I would advise him on the social aspects of the introduction of new technology and possible ways of achieving a more fundamental approach to the social dialogue.
This involved advisory work on a half-time basis for a period of six months, from October 1985 to March 1986 inclusive.

During the first two months, I spent most of my time talking to people and organizations, so as to deepen my understanding of their view of the problems involved. During the same period, I was also involved in the background with the preparation of the second Val Duchesse meeting and subsequent meetings arranged there.
In that context, I have already given my advice as regards achieving a more fundamental approach to the social dialogue.
I shall not refer to this further in this report.

In the second half of January 1986 I visited the United States in the context of my brief, some of my impressions are included in the Annex to this report.

My brief was not to draw up a scientific report : I had neither the time nor the technical support to do so. Moreover, there is already a great body of research material available on the effects of the introduction of new technology, both in the social context and otherwise.

I asked myself how the European Community could both promote and accelerate the process of technological and economic renewal as well as devoting more attention to the wider social aspects of these changes.

In this report I have attempted to put forward - briefly - some points for discussion.

Its contents are entirely my responsibility and were not discussed beforehand with Mr Delors. In between working on this report, I did have various contacts with both Mr Delors and Mr J.M. Baer of his bureau during which the President of the European Commisssion expressed his views and enabled me to draw up this final report.

Although I cannot name here all the many people whom I have met in the context of this report, I should like to express my gratitude for the part they have played in helping me to form my views.

Finally, my thanks are also due to Johan van Rens and Tonny de Rijk for their valuable assistance to me when preparing and drawing up this report.

WIM KOK

Amsterdam, 1 April 1986.

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II A SUMMARY OF THE FINDINGS

Why a European approach ?

1) The development and implementation of new technology is essential if the countries of the European Community are to achieve continuing social and economic renewal.
It will extend our capacity for achieving lasting economic growth, for creating new products and services, new and better job oportunities, strengthening the competitive position of European enterprises and improving the working and living conditions of the population.

For these results to be achieved, technological, economic and social innovation must go hand in hand.
While it remains essential that the individual Member States pursue an active policy in this respect, there are also good reasons for advocating a joint European approach. The advantages of this could be :

- promotion of the creation of a common market
- taking advantage of the economic potential and the possible economies of scale in the European Community
- promoting a cooperative strategy for more growth and more jobs, which will help the various sectors to adapt and create a favourable climate for product innovation
- strengthening our competitive position, especially as regards the United States and Japan

- o enabling the European Community to present more unanimous views to the outside world, and giving a new dimension to international cooperation, both with the developing countries and others

- o reducing unnecessary internal competition by, for instance, more combined effort in research and development as an alternative to the present situation where competition between Member States is a drain on our capital resources

- o support for the European concept and European cooperation both within the Community and in the wider context of Western Europe

- o achievement of common social aims, including the reduction of unemployment and the improvement of working and living conditions.

The economy and technological developments

2) Within the European Community there is widespread agreement on the need to make positive use of the possibilities offered by the continuing technological evolution. Europe should try to optimize the social and economic advantages of implementing new technology.
There is wide scope for development here.

Over the last years, the modernization of parts of the European economy has led to a considerable increase in productivity. Process innovation has had a favourable influence on the competitive strength of Western Europe. But this wave of technological renewal was inspired too much by a desire to preserve the competitive position and the need to keep costs down.

However important these considerations may be, they easily lead to very limited applications of modern technology, where a more agressive approach would be more fruitful.

3) Technological innovation has not yet been developed systematically enough as an instrument of economic innovation, leading to new forms of production, new services and thereby new jobs. The field of product innovation is still under-developed in comparison with that of process innovation. One of the reasons for this is that it has not been provided for adequatelly in the structural and industrial policy of the European Community, though the effects of the macro-economic policy should also be taken into account.
A higher level of expenditure in Europe (particularly on investment) could contribute to a more balanced policy mix and an economic climate in which technological progress can really flourish.

4) There is scope for a joint and well-aimed effort to stimulate the economy, in view of the excess manufacturing capacity lying unused and the sharp increase in the surplus in the balance of payments of the European Community as a whole.
As expected, the recent drop in the price of oil is proving to have a favourable effect on the further economic growth of the Community. However, this does not detract from the need to mount a coordinated effort to strengthen the basis for a continuation of the economic recovery. Given the present economic situation, we need not fear any sudden increase in inflation.
Over the last few years, the economic policy of most Member States of the European Community has placed too much emphasis on supply rather than demand.

It is encouraging that the social partners (UNICE and the ETUC) are supporting the European Commission in working out a more balanced policy mix of supply and demand. Precedence should be given here to stimulating demand by increasing both public and private investment.

5) There has been a noticable increase in the call from employers for an increase in the low level of public investment. Like the trade union movement, employers are emphasizing the need for investment to reinforce the economic and social infrastructure in the widest sense : telecommunication and communications in general, the environment, roads, railways etc.

Since OECD also considers that investment in research and development is lagging behind investment in other fields in the European Community, more emphasis is urgently needed here. The same is true of efforts to raise the level of knowledge, and investments in human resources (education and training), all of which are in need of a powerful thrust.

6) The conclusion would seem to be that the time is ripe for putting a joint strategy for more growth and more jobs into action.
In this context, it could be useful to arrive at a joint European understanding adapted to the needs of the Member States, on the main points of a policy for economic growth, employment and technology.
Conversations with top officials at the European Commission, as well as other factors, indicate that an awareness is growing in Commission circles too that socio-economic policies and the implementation of new technology should be more closely integrated.

Europe can and should make a bigger contribution to the tempo of international growth, in view of international developments. This matter deserves priority attention at the forthcoming European and world top conferences.

Employment and new technology

7) It is generally agreed that the relationship between the number of jobs available and the rate of technological renewal is rather complex, and that generalizations are therefore risky. Even if it were possible to distinguish clearly between the direct and indirect effects on employment of the introduction of new technology, it would still be a very complicated matter to judge the short, medium and long-term effects. Moreover, the quantitative effects depend to a large extent on the stage of technological development reached (for example, robotization saves far less labour than some forms of computer integrated manufacturing), and on the nature of the technology (information technology, material science or biotechnology). The predominant view is that the present level of unemployment in the European Community is only to a limited extent due to the introduction of new technology.
It should also not be forgotten that obsolescent production methods will also lead to job losses in the long run.

8) In view of the fact that economic growth in the Community is only yielding a limited increase in employment, it is encouraging to note that there is a concerted call from the social partners for more labour-using investments.

The conclusion of the Annual Economic Report 1985/86 of the European Commission regarding policy for the promotion of investment (§ 3.3.) indicates that it would be desirable to direct more investment subsidies towards reinforcing the more labour-intensive sectors of the economy.
A similarly favourable effect on the capital/labour cost ratio could be achieved by financing social security premiums from value-added tax or other levies which help to increase the magnitude of the capital factor.

9) Even if the recommendations of the above paragraphs are followed up, economic growth alone will not be enough to solve the problem of present mass unemployment. Redistribution of work by reducing and reorganizing working hours will be just as essential. Unfortunately, the views of the social partners on this matter are widely divergent. Many industrialists will not go further than reorganizing working hours to optimize efficiency in their companies.

To achieve both the essential (redistribution of paid and unpaid work) and the useful (technological challenge and a better qualified workforce),the social partners should work out concrete proposals for a long-term plan for technological renewal, training and reduction of working hours.
The financing of this triple plan will have to be negotiated among the parties to the collective labour agreement, who should bear in mind that they must adhere to the condition of wage restraint, which the Commission has also urged most strongly.

Creative solutions are what we need for this approach, and they can be found. If they are not found, the battle against unemployment will suffer.
And we should not forget that the social acceptability of new technology will then also be endangered.
Both of these factors will slow down or even halt the process of economic recovery all together.

10) In view of the desirability of the successful introduction of new technology and the establishment of a common market, it is important that steps be undertaken at Community level with priority for activities in the following fields :

- o analysis of the evolution of the volume and structure of employment and of the changing qualification requirements this entails
- o consultation on these matters with the social partners and in the sectors
- o provision of information, orientation and guidance from the Community to Member States and sectors
- o determination, in consultation with Member States and social partners, of the main points of a forward-looking policy for employment and the labour market, and the promotion of experimentation in the field of training and labour pools, as well as in other areas
- o better harmonization between industrial policy and technological innovation, with consultation of the social partners
- o renewed and intensified efforts in the field of education and practical and theoretical training

- o allocation of resources from the European Social Fund for technological and social innovation.

11) Small businesses have an important part to play in this process of technological renewal.
The significance of this category of businesses for the future of the European economy and employment is often underestimated, and this must change.
The availability of sufficient venture capital at attractive terms, both for starting up new businesses and for other projects, is of great importance here.
New initiatives would be welcome in this context, and the proposals drawn up by the Round Table of European Industrialists are one source of ideas which could be considered here.

Technology as a social challenge

12) The European Community has entered a new phase in the stimulation of new applications of technology.
In addition to the harmonization of socio-economic and technological renewal advocated above, drawing up plans for concrete targets and then achieving them will also prove to be a source of inspiration. The countries of the European Community and of Western Europe in general are fortunately not restricted to the military-industrial sphere as a context for promoting technological progress. An "Apollo Programme" with targets in the social sector would capture the imagination of the people of Europe and at the same time give a new dimension to the process of technological innovation.
We can do more than we think.

And there is so much to be done in Europe and elsewhere. Setting joint targets for the improvement of the quality of the air and water, the environment (acid rain), health, the standard of living and welfare will have a favourable effect on the direction of research and development, and will motivate our scientists.

A larger proportion of the resources devoted to research and development need to be channelled to these aims of the future, which should be backed and stimulated at European level. In this way, science and technology could win more appreciation in society, which would strengthen the basis on which forms of "creative engineering" could build.

The traditional aims of economic progress should now also include the following :

* the allocation of more funds for targets in the field of peace, development and meeting social needs, particularly in the Third World,

* the promotion of health, safety and social welfare,

* education and development in tune with the needs of tomorrow,

* consideration of the needs of future generations through more economical use of raw materials, for instance, and care to preserve an environment fit to be lived in.

In short, a world with better working and living conditions, not as a secondary effect, but as a target to be aimed for in its own right!

The European development model should not stay in the planning stage. The development and implementation of new technology can be a means of putting it into practice.

13) Developing a common information market is not enough.
For a computer society to function well in all respects, a far more extensive programme of work is needed than is now being deployed. Starting from the whole body of economic and social targets and the principle of more involvement of the social partners, a European computer society that is prepared for the future should be built up as quickly as possible. The favourable development of the ESPRIT programme does not detract from the urgency of this need.

In addition to attending to the social aspects of future programmes, the European Community should also set itself the task of adding a broader and more visible social dimension to current technical programmes. Consultation with both sides of industry would be desirable here.
Existing European programmes (such as ESPRIT, BRITE, RACE, etc.), are, like EUREKA, non-military. The EUREKA project is not merely a civilian alternative to SDI, but could also be developed further as a means of closing the technological gap between the EEC and EFTA and promoting closer cooperation.

14) Specific attention for the requirements and needs of developing countries (where three-quarters of the world population live) is a means of helping these countries in the short term, and will at the same time offer our countries new potential markets and investments in the future.

International cooperation, including that between North and South, must prevent a further disintegration of the world economy and ensure that countries and groups of countries remain or develop into economic partners, instead of political or military opponents.

In the international context, technology must come to function as a means of bringing the countries closer together, rather than dividing them. Technology is regarded too much as an instrument in the hands of bloc interests. Technology for the achievement of development targets, and technology developed in cooperation with developing countries can exert a stabilizing influence on world economic relations.

More intensive cooperation between Eastern and Western Europe in the field of technology could also lead to favourable results. And more cooperation on ecology and energy also deserves consideration, especially in the context of getting the Helsinki agreement underway again.
Being not merely better neighbours but good neighbours should be the concern of all of us.
In view of the non-military nature of EUREKA, it would be desirable to make participation in this project open to Eastern European countries as well as Western.

Education and training

15) In the context of the qualitative changes brought about through the implementation of new technology, the European Commission has rightly devoted a great deal of attention to possible improvements in the field of education and training.

New policies are also urgently needed regarding retraining, additional training, refresher courses etc.

There is a call from all sides for more action and for a better framework in which to undertake this action.
The Community should look more closely at the universities and institutes of higher education, and greater effort is also needed in the field of theoretical and practical training of the working population (both employed and unemployed).

The discussions between UNICE and the ETUC held in the course of 1985 indicated clearly that this is an area of great importance and common interest, and is recognized as such. CEDEFOP (European Centre for the Development of Vocational Training) has already carried out a substantial amount of useful preliminary work in this field.

The intensification of vocational training would contribute towards :

- o increasing the adaptability of the working population, in the interests of the employees themselves and of the companies employing them
- o a better redistribution of work over various sections of the population with different employment perspectives
- o maintaining the competitive potential of the European Community and helping to increase productivity
- o building up more understanding among the working population of the rapid changes taking place.

16) Cooperation between the universities and industry needs to be improved and should involve both sides of industry.
Relations between society and science and technology should become closer. The scientific world should not shut itself up in an ivory tower, and the working population should further develop its understanding of and willingness to work with all disciplines.

In this context, the idea of building up the process of renewal and greater cooperation above all on a regional basis is worth serious consideration.
This would favour the evolution of universities and institutes of higher education as look-out posts for society and centres of innovation, and also enable them to make a better contribution to the integration of the technological, scientific, economic and social aspects of the processes of change of today and tomorrow.
The exchange of experience among universities and institutes of higher education is valuable and certainly worth stimulating through the European Community.

Moreover, there are excellent reasons for encouraging the exchange of experience among employees (or their representatives) and trade unions as a complement to programmes like COMETT and ERASMUS.

17) Generally speaking, there is a tendency to underestimate rather than overestimate the future need for skills and knowledge. A substantial intensification of practical vocational training oriented to the future for broad sectors of the working population would therefore be one of the best investments for the rest of this century. Knowledge is one of our most important raw materials.

Improving the level of qualifications is a target in its own right, but it also contributes towards increasing vocational mobility and internal flexibility. Employees will also benefit from acquiring more skills, which will improve the range of their performance of various tasks. The working population as a whole must be prepared for change and ready to play its part in the process of renewal. The level of training and qualification of managers deserves special attention. Taking the lead in the process of change anticipated requires skills far beyond those traditionally expected of a manager.

The labour market and the work situation

18) The discussion of the consequences of automation on the labour market and the new demands made of the working population is in full swing. One point is clear, and that is that the nature of work is changing substantially as a result of technological changes. And more fundamental changes can be expected yet.

To keep the segmentation of the labour market within reasonable bounds, it would be desirable to :

- o resist further segmentation as far as possible and stimulate the creation of jobs with a wide responsibility,
- o put the principles of job enrichment and job rotation into practice and reasses job structures,
- o promote decentralization and the achievement of broader qualifications on a permanent basis and not by means of instant courses,
- o raise the level of education and training in society,
- o give employees, especially women, every chance of moving up the company ladder,
- o introduce not only selective but also general forms of reduction of working hours with the redistribution of work.

19) The effects of automation on the employment of women are generally negative, because many women perform tasks which are obvious candidates for automation.

In view of the present high level of unemployment, it is particularly important to prevent more women being edged out of regular jobs or forced into the most inferior, marginal jobs without a proper contract, temporary or otherwise.
The technological revolution now underway will be judged in the future on the basis of various criteria, and one of these will be whether it has opened up favourable opportunities for women.
The principles of economic independence and equal opportunities for men and women should be two of the most prominent features of the European Community's policies.
The introduction of new technology will also have to offer new opportunities for women through positive action, as proposed by the European Commission, among others.

20) Despite variations from country to country, there is still a common European model of social and cultural conditions which are quite distinct from those of the work situation elsewhere in the world. It is important to hold on to the main aspects of this and develop them further.
The "Eurosocial" work situation can contribute towards :

- o achieving more social justice and equal opportunities, and thereby a more balanced and harmonious economic development,
- o creating real scope for the individual in society, which could be a means of getting closer to a real common market
- o increasing the involvement of employees and their representatives and conducting a meaningful social dialogue between the social partners at all levels,
- o democratizing economic life through more participation and influence for employees and unions,

- o more cooperation and solidarity among the Member States,
- o creating a new European development model designed to meet the challenge of the coming decades,
- o arriving at agreements on the European aspects of socio-economic and technological developments, and on socially acceptable and desirable developments in both sectors and Member States.

21) A modern computer-age society, built on the European model, needs the work situation that goes with it.
This means that there will have to be changes, both on the part of the employers and of the employees. And what is essential here is the will to arrive at suitable solutions.
The partners are not always sufficiently aware of their mutual dependence, and the gulf between their two worlds is still too wide.
Incentives will be needed from the European government to help bring the search for a suitable work situation to a successful conclusion.

Some practical suggestions

22) In view of the fact that both employers and employees need to be pushed a little before they move in the direction of innovation, the European Commission will have to support initiatives - in consultation with the governments of the Member States - designed to increase the social partners' knowledge and insight into the subject of technological changes and to enable them to speed up the introduction of new technology and guide it into the right channels through advice and guidance on innovation.

Responsible innovation depends on more than familiarity with the characteristics of a certain branch of technology. It also requires a wide understanding of all aspects of technical changes. Successful introduction of new technology must also lead to new concepts regarding, for instance, personal involvement and responsibilities, and taking account of future developments.
A lack of knowledge and acceptance are barriers to change.

23) The establishment of a European Office of Technology and Labour could be a dynamic instrument for technological and social renewal (see the short description of the Office of Technology Assessment in the United States in this context).
The aims of such an institution would be :

* to set up a system of technology assessment for common use and to collect and exchange practical experience and research activities (eg. in fields like that of the labour market, technology development and product innovation).

* to assess the social and training aspects of both current and future programmes and to ensure that more account is taken of these aspects in programmes, and to act as trend-setter in the field of qualifications.

A European Office with these responsibilities could perhaps be integrated into existing activities of the European Community. However, it should be emphasized that close involvement of the social partners (or representatives from these circles) is very much to be desired.

24) A public relations programme should be drawn up in cooperation with the Member States to bring the public up-to-date information about new technology, presenting both the European dimension and the technological, and at the same time helping the public to become familiar with new technology and able to use the potential advantages it offers them.

The role of the employees and consultation between the social partners

25) The studies that have been carried out so far indicate clearly that the process of technological renewal runs more smoothly and effectively if the employees are informed adequately and in good time, and if adequate consultation has taken place with the representatives of the employees on the consequences to be expected and the solution of problems.

Although, understandably, agreements sometimes serve to deal with the possible negative consequences, there is also a growing trend towards informing the employees before the event so that they can bring their influence to bear at an early stage. Moreover, a pro-active approach and early agreements have a positive effect on the economic potential of the company (as shown for instance by the Peugeot 205 project in Mulhouse in France).

The approach of the trade union movement is not confined merely to finding a solution for the consequences, but is directed more and more to finding socially acceptable ways of accelerating the rate of technological renewal.
An example of this type of approach emerged , for instance, during the Technologiepolitische Konferenz of the DGB (September 1985 in Bonn).

26) Employees and their representatives want to join the discussion and take part in the changes to be made in the organization of labour as a result of the introduction of new technology. There can be no uniform recipe for influencing technological changes at company level; circumstances and backgrounds differ too much from company to company.

But early participation in the discussion is essential to ensure that the human factor is the focal point in the selection of the technological changes to be introduced, to improve the quality of decision-making, optimize decentralization and improve job content.
The introduction of new technology is a multiple-choice question, and in selecting the solution we must ensure that it does not entail an unnecessary increase in job segmentation, specialization or centralization.
Technological renewal works most successfully in future-orientated companies.

27) More and more industrialists are coming to realise that it is also in the interests of continuity in their company to allow employees and their representatives to participate effectively in the process of renewal.
If does not happen, chances are being lost for both social renewal and beter economic results.

A very important factor is the improvement of the qualifications of employees through more and broader training, both practical and theoretical.
This gives the most flexible element in the labour organization - the employee - a chance to grow adequately to keep pace with the processes of change.
Employers often agree with the above arguments, but there is sometimes still a wide divergence between that insight and what they are prepared to lay down in labour agreements.

28) It is becoming increasingly clear that the level of the branch of industry is highly relevant to the form in which integrated technological, social and economic renewal will emerge (an example of this can be seen in the graphic industry in the Netherlands).
Joint analysis by both employers' and employees' organizations of the economic, technological and social developments in the branch of industry concerned can constitute a good basis on which to agree unanimously supported measures regarding restructuring, training and other provisions.In this context, some employers and representatives of employers' organizations hold up the experiences gained with the ECSC as an example of how things can be achieved.

Moulding the future needs a "management of change", as the secretary-general of UNICE Z. Tyszkiewicz has called it, in which the most important factors are support and incentives on a European level.
Employers have strong reservations about too much emphasis on a "top-down" approach, and their distrust has been increased by the sometimes over-hasty arguments put forward for European legislation on the part of the employees.

The employers' objections to the idea of legislation are in fact in contradiction with their desire to complete the creation of a common market through drawing up European regulations. The crucial question is which matters could best be discussed at which level, and how these different levels can best be fitted together.

29) Countries which have opted for a joint approach at the national level (eg. Denmark, Sweden, Norway and Austria) have found that this often proves to provide extra support for a social and economic policy of renewal.

Improving the climate of new technology was also to be stimulated through the European Community.

In June 1984, the Council of Ministers passed a resolution in favour of stimulating technological changes and social renewal. Together with the European employers' and employees' organizations, The European Commission has also taken the first step through the joint declaration of intention regarding the introduction of new technology, as laid down at the end of the second Val Duchesse meeting on 12 November 1985.
The follow-up of this meeting will have to lead to more concrete proposals; (in the next few paragraphs of this report, some constructive suggestions are offered for these discussions, on the basis of the views taken by the various parties over the last years). If the Val Duchesse meetings are to produce results, it is essential that the parties involved should set aside their old prejudices about each other.
Only through mutual trust and a readiness to undertake business-like consultations can acceptable results be achieved.
The European Commission can certainly help bridge the conflicts.
If this is to be achieved, a constructive sequel to the Val Duchesse agreements made in November is essential. A second condition is continuing political support from the Council of Ministers. The present chairman of the Social Council of Ministers (who is Dutch) has announced that he is in favour of dealing with this matter through a tripartite approach. This is not merely a factor to be borne in mind, but an invitation to act quickly and decisively.

III TOWARDS REACHING TRIPARTITE AGREEMENT

30) The growing consensus, both among the social partners and in the Member States, as to the necessity of taking up the technological challenge through consultation and discussion at various levels and through more cooperation, should quickly lead to the establishment of a joint approach.

Agreement on the introduction of new technology must be obtained at the lowest possible level. There are a great many good examples of positive and successful agreements. Cooperation and agreement have social and economic advantages. The lowest possible level need not always be in the company itself : sometimes the sectorial or regional level of consultation is needed for agreements to be made.

At national and European level, conditions can be created or stimulated, also with regard to the social and organizational aspects.
The Council of Ministers should give a better follow-up to energetic and constructive work in the field of new technology, such as that carried out by the European Commission, the European Parliament and the Economic and Social Committee. These initiatives and activities should also be passed on more efficiently to sectors and companies, in many cases.
Commerce and industry must start thinking and acting more in European terms. Deliberation in the sectors and joint presentation of guidelines for social, technological and economic development are now more urgently needed than ever before.

31) It would be desirable to deal with at least the following three subjects during discussions at micro, intermediate and macro level.

a. employment

- The influence of the introduction of new technology on employment, both quantitatively and qualitatively.

- An analysis of employment trends.
  Identifying trends specifically for the purpose of forecasting the future development of the employment situation with the introduction of new technology.

- Product innovation (new products and services) leading to high-quality employment opportunities and new markets. Capital-intensive / high-quality production must not be held back.

- Setting up a good system of technology assessment and common guidelines for a future-oriented employment policy

- Removing qualitative and quantitative discrepancies in the labour market by means of permanent economic growth and renewal and by introducing other measures which will reduce unemployment, such as reducing and redistributing the number of hours worked.

- Avoiding segmentation of the labour market and establishing a system of permanent vocational training which will enable employees to keep pace with technological changes.

- Increasing the professional mobility of employees, without a drop in professional status or loss of income.

o Measures to achieve greater internal flexibility and permission to extend periods of effective operation within socially-acceptable limits, in view of the often substantial investments involved.

b. qualifications and vocational training

* Better harmonization between educational structures and the introduction of new technology.

* Extensive programmes at all levels of vocational training and permanent education.

* Raising the level of the professional skill of employees and a simultaneous improvement of places of work.

* Increasing investments in "human capital" and joint financing of modern training facilities.

* A sectorial approach to the intensification of training, in which economic and social restructuring should be firmly linked together (see the ECSC Treaty).

* Offering employees' representatives an opportunity for training and education to prepare them for technological changes.

* Initiatives designed to increase the social partners' insight and knowledge in the field of technological renewal.

c. job quality

- Improving the quality of work and designing attractive jobs, and improving working and living conditions.

- Careful study of job content and the effects of the introduction of new technology on work organization, and the anticipation of such effects in the designing of new technology.

- Buying or designing systems based on decentralized methods of work as far as possible.

- Avoidance of repetitive and monotonous work. Stimulation of job-enrichment, job-rotation and broadening the scope of the tasks involved. Improving work structure.

- Adjusting the whole job-content and the concept of the tasks and techniques involved to be more in tune with human capacities.

- More responsibilities for employees, which will improve the level of health, safety and qualifications.

- Building up employees' understanding of how the production process functions, increasing their responsibility and optimizing the relative autonomy of employees.

- Examining the effects of technological progress on the decentralization of production, including home or distance-based work and regulating the legal position of these employees through the collective agreement.

- Introducing measures to provide the necessary guarantees in connection with electronic processing of personal data, assessments etc.

- The prompt and systematic analysis of the ergonomic effects of new technology so that working conditions can be improved.

32) EEC policies should also encourage companies to keep their employees informed and to involve the trade unions.
If we are to ensure that new technology is introduced in a socially acceptable manner - that is, under the best possible conditions and according to the rules of good company management -, employees must be informed in good time of the various aspects which affect them, and the trade unions and other representatives of the workforce must be consulted adequately at a relevant stage.

With due respect for the national structures and procedures and without wishing to undermine them in any way, it would be preferable for the parties involved to tackle the problems of technological renewal in a spirit of cooperation and a real desire to reach agreement through constructive negotiation on the above topics.

The introduction of new technology will run far more smoothly if employees and their representatives are informed and consulted beforehand with the purpose of reaching agreement. This process of informing and consulting should accompany each step in the decision-taking process, from the examination of various possibilities right up to and including the actual implementation and evaluation. It should also be as detailed as possible and as a general rule go hand in hand with the execution of technological decisions.
The parties involved should be able to take expert advice in this context.

IV CONCLUSION

35) The central conclusion of this report is as follows :

> The European Community can achieve far more in technological, social and economic areas if the Member States and the social partners work in closer cooperation and if progress in these fields is geared to move forward simultaneously and at a faster pace.

The European Community urgently needs to pursue and accelerate an innovation-oriented policy. More investment under an expansive economic policy is absolutely essential here. A European understanding covering the main points of a future technological and economic policy could increase the dynamism and self-confidence of the Community.

Formulating social targets for technological renewal (a "social space programme") would be a challenging framework for research and development and could also increase enthusiasm for change.

In view of the continuing high level of unemployment and the general desire to raise the level of training and knowledge drastically, a long-term plan is needed. Points to be covered in the plan should be the acceleration of the pace of technological development, which is essential, permanent education and the redistribution and reorganization of work.

Technological renewal means that companies will follow a future-oriented management policy which can only be successful in the long term if employees, boards of directors and trade unions are involved in these policies at an early stage - and continue to be involved.

Employee and trade union participation at all stages and at all levels, and socially responsible introduction of new technology is highly desirable for both social and economic reasons. The European Community can promote that process.

The time is ripe for a tripartite recommendation from employers, employees and the European Commission regarding technological and social renewal. Some concrete suggestions on this subject have been set out in this report.

Further, there is a case for creating a European office of technology and labour to deal with technology assessment and other matters.

The improvement of education and training is a key theme for the rest of this century. This derives from the new demands made of the working population by our quickly-changing society, and also from the desire of individuals to build their own future and contribute to prosperity and welfare in the world.

* * *

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