IS EDUCATION AND TRAINING

INPUT

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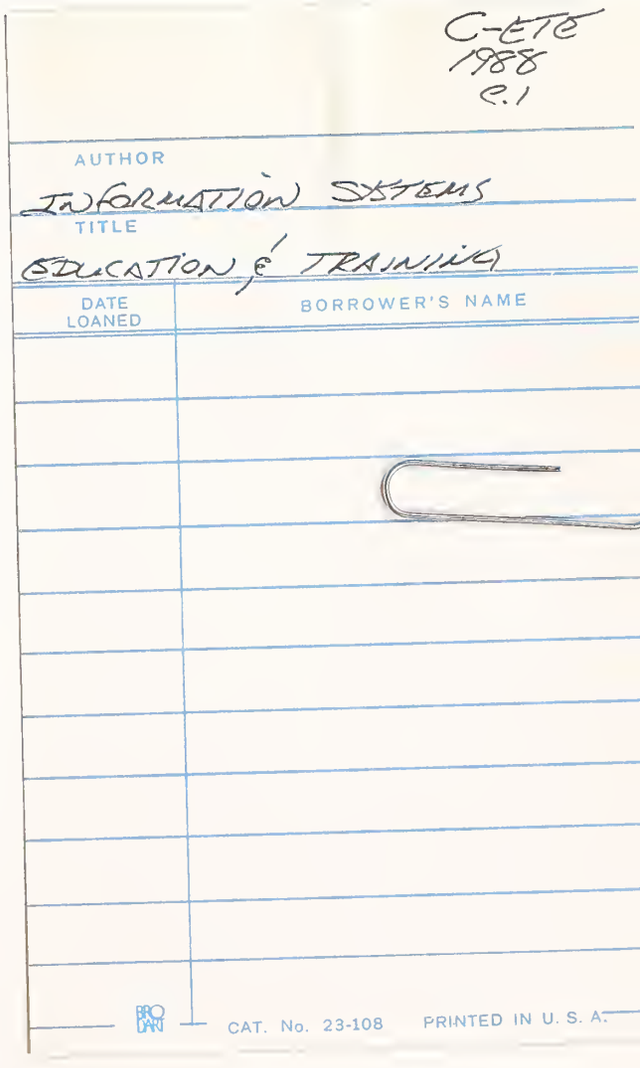
INFORMATION SYSTEMS EDUCATION AND TRAINING

WESTERN EUROPE 1988-1993



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Information Systems Education and Training—Western Europe 1988-1993

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Abstract

This report examines the market for education and training services in the Western European computer market. It discusses the range of computer skills required and the problem of skills shortages. User attitudes to training are examined, including an assessment of the need for training and the use of different training sources.

Commentary on the different attitudes to training and education in the separate country markets of Western Europe is provided. Market size assessments and five-year (1988-1993) growth projections are given for each country. A discussion of strategic considerations for the future of information systems training in Europe is also included.

The report contains 142 pages, including 67 exhibits.

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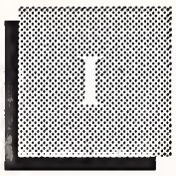


Introduction

A

Objectives of the Report

This study was produced by INPUT as part of its 1988 European research programme. The topic of Education and Training was chosen as a result of the high level of interest expressed by INPUT clients and the undoubted importance of the subject to the future development of the computer industry.

The terms *education*, *training,* and *education and training* are sometimes used interchangeably in this report. The reader should bear in mind that in English there is a subtle distinction between *education* and *training*; this distinction does not necessarily translate exactly into equivalent words in other languages. *Education* is used to imply the acquisition of general skills and capabilities as distinct from *training*, which is used with regard to the acquisition of skills and capabilities required for a particular task, job or position.

Adequate provision of a trained and capable workforce is of considerable importance to the computer industry as a whole, but is of critical concern to the provision of computer and information services. Education and training are crucial to the information services providers for their own manpower. Further, without adequate trained manpower, the users of information systems and services will not be able to apply systems and services to their business. This report has been specifically written with the principal objectives of:

- identifying who requires information systems skills, the range of those skills and the training they require;

- understanding the information systems skills shortage and analysing the wider demographic and environmental factors that will affect the supply of skilled human resources in the future in this area;

- identifying the attitudes of information systems and service vendors, users, job seekers, governments and unions to education and training in information systems;

- identifying the factors that bear on the future demand and supply of training;

- defining the market for computer-related education and training services, and its size, structure and expected growth characteristics over the five-year period 1988-1993;

- reviewing the related strategies that companies may consider in the formulation of their own corporate policies and plans.

B

Scope and Methodology

The geographic coverage of this report is limited to Western Europe and deals, in particular, with the three largest national markets that were examined in most detail, namely:

- France
- West Germany
- United Kingdom.

In addition, the report includes reference to the most important related initiatives undertaken by the European Community through the European Commission.

The study was concerned principally with the market for education and training services that are provided to third parties in the computer industry. The types of education and training given are reviewed, comprising classroom, on-the-job and computer-based training. The provision of computer-based training for subjects other than computer-related topics was specifically excluded.

Primary research that contributed to the study was derived from five main sources:

- in-depth interviews, conducted either face-to-face or by telephone, with leading vendors of training services and with public- and private-sector users of information systems;

- in-depth personal interviews with senior executives of national governmental and other official bodies concerned with national trends and policies in education and training, and with officials at the European Commission in Brussels;

- scripted telephone interviews with senior managers in organisations using computers in ten separate European countries;

- data on education and training derived from INPUT's annual survey of information systems managers carried out as part of the 1988 Customer Services Programme—Europe;

- published and unpublished material in the major-country markets, including government documents and such public-domain sources as newspapers and trade magazines.

In the domain of published material, on the subject of potential skills shortages within the Information Systems business, particular reference should be made to the Institute of Manpower Studies. This is a UK Government-funded research unit based at the University of Sussex. Reference in this report is made to the work of this organisation, in particular its report *Information Technology Manpower into the 1990s.*

Exhibit I-1 shows the analysis of the in-depth personal interviews conducted with leading vendors of training services and representatives of government or other official bodies. Of these 38 interviews, 20 were conducted face-to-face, the remaining 18 by telephone.

EXHIBIT I-1

IN-DEPTH INTERVIEW PROGRAMME ANALYSIS

MAJOR GROUP	EDUCATION/ TRAINING VENDOR	GOVERNMENT	OFFICIAL BODIES	MAJOR USERS	TOTAL
France	-	-	5	-	5
West Germany	-	1	3	-	4
United Kingdom	7	5	8	6	26
European Commission	-	-	3	-	3
Total Europe	7	6	19	6	38

INPUT interviewed just over 100 general management personnel, managers responsible for functions such as accounting, production, marketing etc. These managers need to utilise information systems to support their

activities and are increasingly responsible for personal computers, departmental systems and workstations that are situated physically within their area of responsibility. The organisations approached all had more than 500 employees.

Exhibit I-2 shows the analysis of the scripted telephone interview programme with senior managers in user organisations in Western Europe, analysed across the major industry and country market sectors. The questionnaire used for this research is included in Appendix A of this report.

EXHIBIT I-2

ANALYSIS OF RESPONDENTS— GENERAL MANAGEMENT

INDUSTRY SECTOR	NUMBER OF INTERVIEWS	COUNTRY	NUMBER OF INTERVIEWS
Manufacturing		France	21
- Discrete	18		
- Process	12		
Distribution		West Germany	21
- Retail	5		
- Wholesale	14		
Transportation	4	United Kingdom	22
Utilities	10	Italy	10
Banking and Finance	23	Netherlands	2
Insurance	1	Belgium	8
Government		Sweden	6
- National	2	Denmark	3
- Local	8	Norway	1
Other	6	Spain	9
Total	103	Total	103

Exhibit I-3 shows the analysis of respondents to INPUT's annual survey of information systems management. The data show the split by broad industry sector and the respondent totals for each individual country.

EXHIBIT I-3

ANALYSIS OF RESPONDENTS— INFORMATION SYSTEMS MANAGEMENT

INDUSTRY SECTOR	NUMBER OF INTERVIEWS	COUNTRY	NUMBER OF INTERVIEWS
Manufacturing	659	France	205
		West Germany	207
Distribution	135	United Kingdom	293
		Italy	145
Services	215	Netherlands	86
		Belgium	98
Finance	148	Sweden	78
		Norway	27
Public Sector & Government	149	Spain	72
		Switzerland	135
Other	40		
Total	1,346	Total	1,346

C

Report Structure

The remaining chapters of this report are organised as follows:

- Chapter II is an Executive Overview that provides a summary of the cardinal points of the entire report.
- Chapter III provides the market forecast and analysis including definitions of the types and methods of training available in the industry.
- Chapter IV describes the information skills challenge: firstly, the range of information systems skills and where they are required and, secondly, the factors that condition the skills shortage.

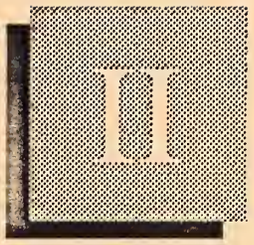
- Chapter V discusses general attitudes towards training in Western Europe that condition the market environment that has emerged in INPUT's market analysis of user opinion.

- Chapter VI deals individually with the very different country market environments in West Germany, France and the United Kingdom and describes some aspects of the environment in Italy, Denmark, the Netherlands, Spain and Sweden. Also included is a review of the relevant initiatives being undertaken by the European Commission.

- Chapter VII provides a forward look into the relevant developments in information systems, in particular the technical changes that will affect training programmes and occupational forecasts. Reference is also made to possible actions for the managements of companies to deal with the problems brought about by the skills shortage and the demographic profiles.

- Chapter VIII sets out those related strategic factors that companies should consider in formulating their corporate policies and plans.

- The Appendices contain the user general management questionnaire, a short list of related INPUT reports and a list of INPUT's overall industry definitions.



Executive Overview

II

Executive Overview

A

The Training Challenge

As computer technology has continued its rapid advance, information systems and services have penetrated ever more deeply into every aspect of industry, commerce and government. This is resulting in a training challenge for the Western European software and service industry, which can be discussed under four main headings listed in Exhibit II-1.

The integration of computer technology with both products and processes is placing even greater demands on the need for people skilled and knowledgeable about information systems.

Since this great demand for specialised skills is, however, not being effectively met from the supply side, the result is an impending skills crisis. This demand represents both a threat and an opportunity. A lack of trained personnel represents a potential inhibitor to the take-up of information systems and their applications and an opportunity in respect of the evident need for education and training services.

Computer hardware vendors and services companies have always placed strong emphasis on training, primarily to feed their own requirements for skilled staff. Amongst the user community, particularly smaller organisations, there has been some indifference to training and a lack of commitment to investing in the development of personnel.

Within Europe these attitudes vary considerably from country to country. Both West Germany and France have typically a much stronger commitment to education and training than the United Kingdom.

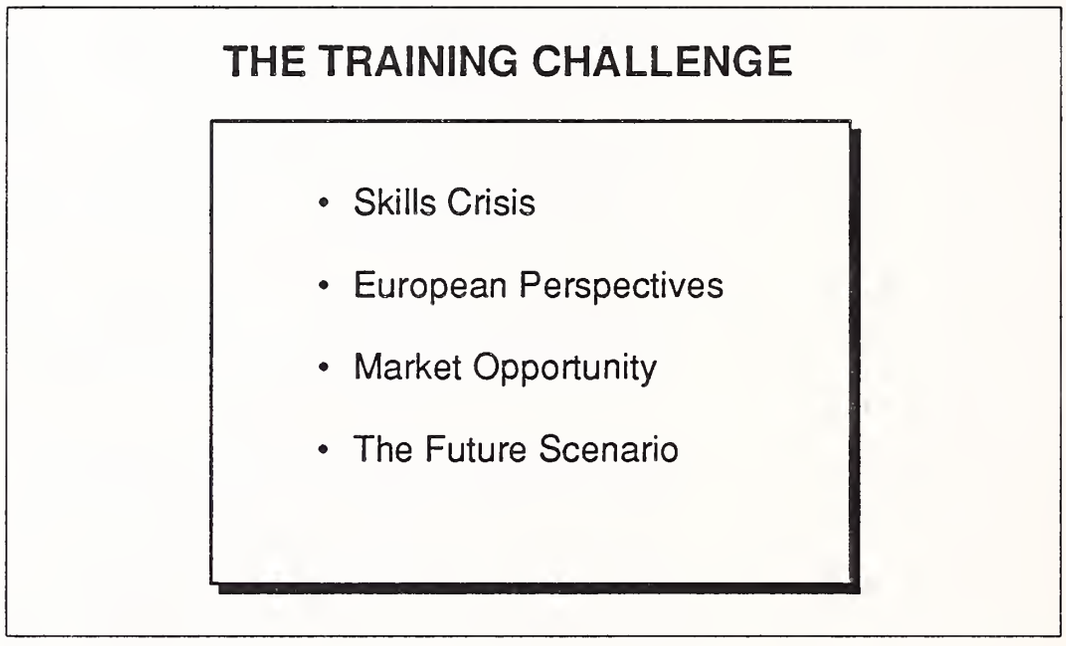
Europe overall represents a significant market opportunity for the provision of training and education services. In total this sector is in excess of $1 billion in revenues for third-party services in 1988. This sector is expected by INPUT to grow at a rate around 19% per annum in the five-year period 1988-1993. The highest level of growth is likely to be

achieved by the independent training companies and the training divisions of the independent service companies.

Future needs for training will be affected by such developments as CASE (Computer-Aided Software Engineering) and the shift towards increased standardisation, notably UNIX. These developments will create their own training and retraining requirements.

For the future much can be achieved by the industry as a whole through greater levels of cooperation amongst industry participants and with academic institutions. There is no question of the singular role that education and training services must play in the future development of the computer industry and the application of its products and services to the development of the whole economy. Trained people are the most important economic asset.

EXHIBIT II-1



B

The Training Opportunity

Exhibit II-2 shows INPUT's estimates of the 1988 Western European Education and Training market for Information Systems by country. The dominant position of the largest country economies can be clearly seen, with West Germany representing one quarter of the total market and France and the United Kingdom 23% and 20% respectively.

INPUT is forecasting annual average growth for the overall European market at 19%, which would represent a total market opportunity of $3.3 billion by 1993. Growth rates vary between the different countries; West Germany is forecast to grow at only 17% per annum, in contrast to France at 19% and the United Kingdom at 20% over this period. The lowest annual growth rate is anticipated in Norway and Denmark (16%) and the highest in Italy (23%).

EXHIBIT II-2

THE EDUCATION AND TRAINING MARKET—WESTERN EUROPE COUNTRY ANALYSIS

Country	Estimated Market Size $ Millions 1988
West Germany	360
France	320
United Kingdom	280
Italy	96
Netherlands	88
Switzerland	70
Sweden	57
Spain	24
Rest of Europe	95
Total	1,390

The market can be analysed into three broad sectors of activity: operational training, systems analysis and programmer training, and management education. Operational training is that most closely identified with the customer services function and currently represents about 13% of the total market. Management education represents about 8% of the total, the remaining 79% constituting the dominant area of training in programming, systems analysis and other specialised information system skills.

Growth rates are expected to differ between these three sectors, with operational training growing at 18%, management education at 15% and systems analysis and programmer training growing at the above-average market rate of 20% per annum.

The competitive environment can be typified by categorisation into two broad groups, the hardware manufacturers and the independent vendors. Currently the hardware vendors represent the dominant force, estimated at a market share of $760 million (or 55% of the total market). However, INPUT anticipates that this position will be reversed over the next few years as the independent sector grows more rapidly, at 23% per annum in

comparison with the hardware vendor sector at 15%. As a result, INPUT forecasts that the independent sector will account for over 50% of the market by 1993.

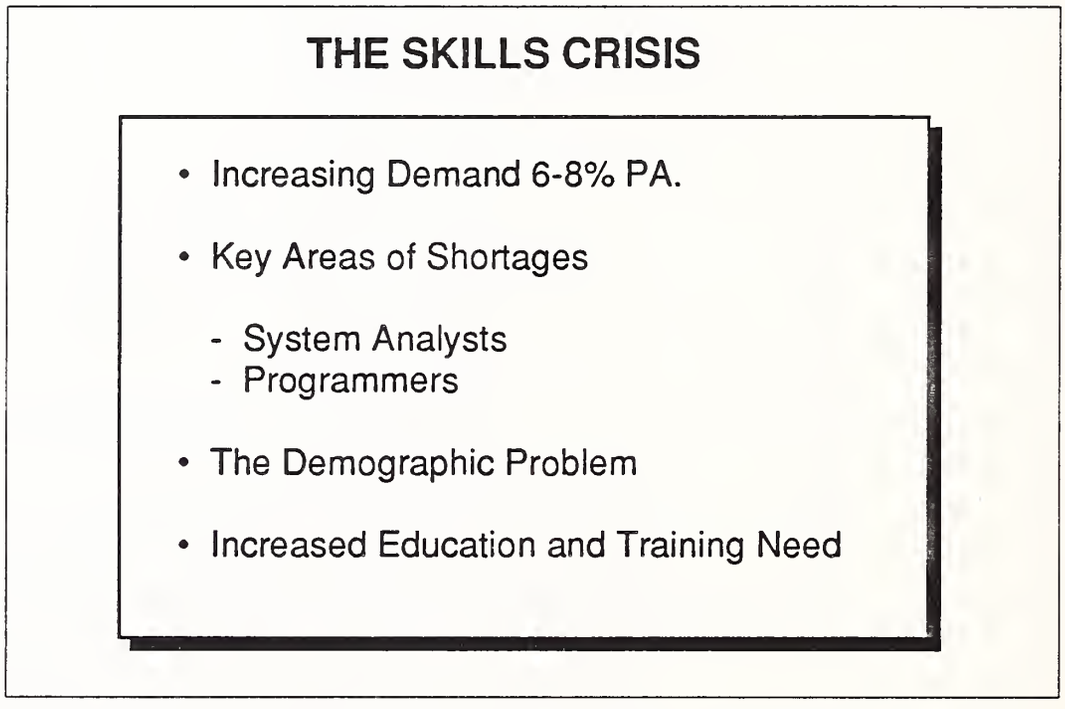
Not surprisingly, IBM currently dominates the manufacturer sector, with other leading vendors like Digital, Unisys and Honeywell-Bull accounting for substantial revenues.

The leading independent vendor is CAP Gemini Formations with the specialist training company ALI (Applied Learning International), Datev and BIS having significant training businesses.

C
The Skills Crisis

The principal factors behind the skills crisis are summarised in Exhibit II-3.

EXHIBIT II-3



The European computer industry, both vendors of equipment and services and their users, is increasing its demand for skilled staff by some 6-8% per annum. This increase is propelled by the continuing development of the information revolution. It places more and more emphasis on both the need for an understanding of how information systems can be applied and for the necessary skilled staff to design and implement the applications.

More and more computers are being installed, and their applications are penetrating ever more deeply in business, commercial and governmental organisations. This penetration in turn is continuously changing the relative demand for different job categories within the economy as a whole. The areas of greatest demand are for programmers and systems analysts.

The changes in the relative job mix and the ensuing skill shortages have to date generally been kept to manageable levels through the recruitment of large numbers of young people as trainees into the industry. However, the demographic forecast in Western Europe indicates that for most countries (France is the exception) there will be a significant fall (of the order of 30-35%) in the number of young people coming into the job market in the early 1990s.

Consequently it will be necessary for participants to consider all other possible avenues for attracting, developing and retaining the necessary skills base. This is likely to imply the recruitment of more women and the recruitment and retaining of more-mature people into the industry. Above all, it places significant emphasis on the growing need and thus the opportunity for education and training services. The developing impact of computer-aided software engineering techniques and tools, although significant, is not expected to diminish the overall need for training over the next five years. Indeed training in the use of tools and methodologies will represent a rapidly developing opportunity on its own.

D

European Perspectives

General attitudes towards the need for education and training services vary considerably from country to country across Europe. In West Germany, for example, the educational culture has a long-established tradition. Professionalism and qualifications are admired and *Technik* (technology) is rated in the public image at least as highly as are the arts and sciences.

Despite an elitist tradition there has been a strong movement in France in the last few years towards the role of industry and commerce as the provider of wealth and jobs. The computer industry in France has been very much shaped by the conclusions of the Nora and Minc Report, which in 1978 brought wide attention to the country's future dependence on information systems. As a result of this and subsequent initiatives involving organisations like SYNTEC, the French association of computer services companies, considerable emphasis has been placed on the supply of trained personnel.

The United Kingdom has for a long time not placed much emphasis or accorded prestige to the engineering profession. Combined with a tendency to admire amateurism, it is not surprising that there exists a continued shortage of trained and skilled people, both in the economy at large and in particular within the computer industry.

Despite a variety of government-sponsored studies and such initiatives as Information Technology year in 1982, there is a general perception of a crisis situation in the U.K. There is, however, a wide divergence of opinion; the high-quality private-sector employer that can offer a career

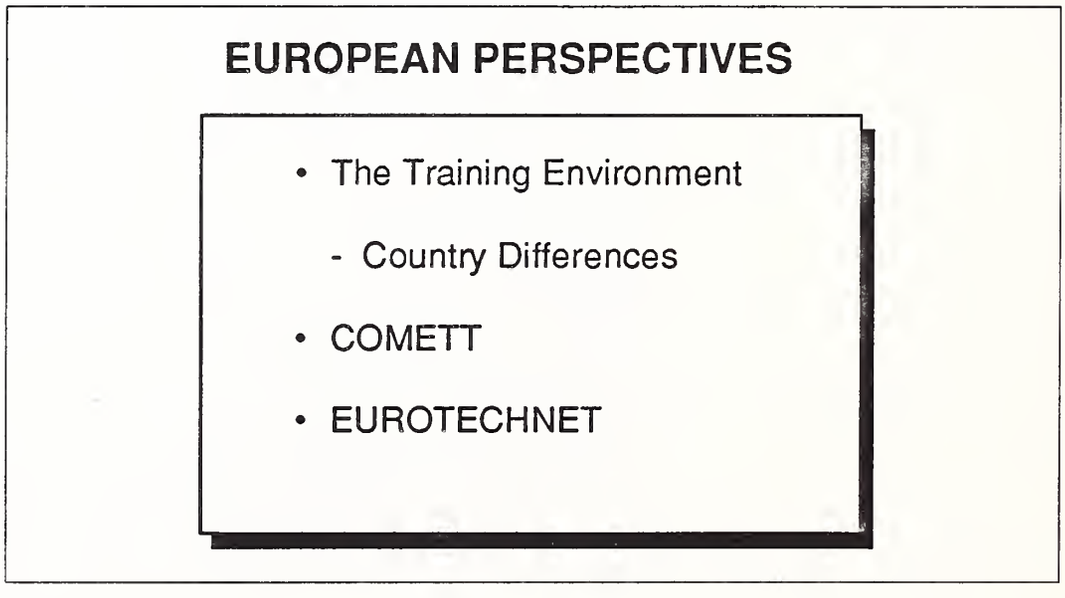
path with the opportunity for relevant training and the acquisition of experience does not appear to have a problem in attracting the necessary staff.

A number of official organisations exist in the UK to address the skills shortage issue, and note should be made of COSIT (The Computing Services Industry Training Council), which is aimed specifically at supporting the training needs of the computer services industry.

With the high profile currently being accorded to the European 1992 initiative, certain European Commission initiatives must also be included. The principal actor in the field of education and training is Directorate General 5. There are two major programmes that impact on training for the computer industry—COMETT and EUROTECHNET, as shown in Exhibit II-4.

COMETT, started on January 1st, 1987, aims to stimulate and reinforce effective European cooperation between business enterprises and higher education institutions. EUROTECHNET is a network of demonstration projects on vocational training measures related to the introduction of new technologies.

EXHIBIT II-4



E

Attitudes to Training

Attitudes to training were researched in this survey from the points of view of general management and information systems management. General management indicated a widespread use of training by outside organisations, primarily professional services vendors but also hardware manufacturers and independent training companies. The data processing managers as a group reported much greater emphasis on the use of training obtained from the hardware vendor. Exhibit II-5 summarises the key points concerning user attitudes to training.

EXHIBIT II-5

ATTITUDES TO TRAINING

- Methods of Training
  - Instuctor-Led/CBT
  - Instructor-Led
  - CBT/IV
- Satisfaction Good
- Government Grants
- Accreditation

The general management group was researched in respect of the methods of training preferred. The most favoured form indicated was a combination of instructor-led and CBT (computer-based training). Instructor-led was considered on its own to be the next most popular form, with both CBT and Interactive Video the least favoured. There are some problems with the acceptance of these new methodologies—for example, the lack of commitment without an instructor and the difficulty of assessing progress on the part of students. Despite these problems, the acceptance of these methods is fast gaining ground.

Very nearly 80% of the general management respondents expressed general satisfaction with the information-systems-related training they received. The major cause of dissatisfaction with training indicated by this group was the failure to make the training as specific and relevant as possible to the clients' real-life needs. For information services management, levels of satisfaction with all types of training were greater than the corresponding levels of importance attached to them.

Other user issues researched covered government grants and training accreditation. France, the Benelux and Spain emerged as the three country markets where government grants are available. However, quite high proportions of respondents (40% in France and Benelux, 80% in Spain) indicated that they did not take advantage of these grants. It is presumed that administrative difficulty is the main cause of grant neglect.

There was only a relatively low level of interest in the question of training accreditation, with over half the general management respondents to this issue indicating that they considered them to be of no use. It should

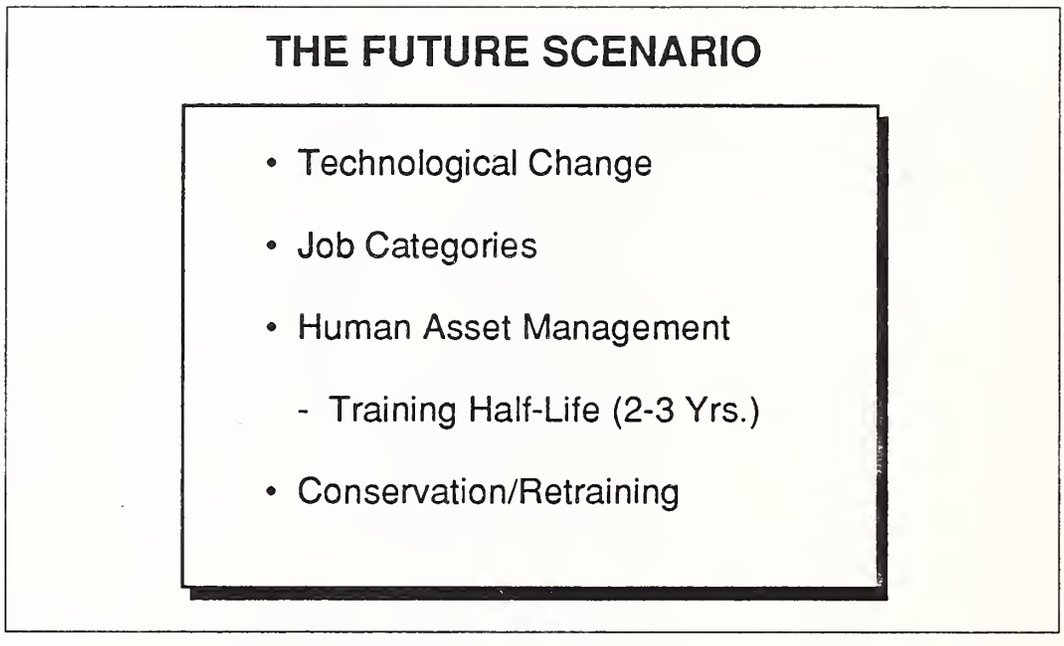
be borne in mind that there exists considerable country differences here—for example, the West German market has a high respect for qualifications and the West German respondents were largely responsible for the quarter of the sample who rated accreditation as important.

F

The Future Scenario

Some key features of the future scenario are listed in Exhibit II-6. Technological developments will continue to affect the requirements for skilled manpower. The falling cost of hardware in parallel with increasing power and capacity open up ever-widening vistas for integration. The convergence of hardware and software design implies the need for increasing software skill requirements. Software development environments are being introduced that aim to make the development of software more efficient and of higher quality.

EXHIBIT II-6



Standardized software regimes (most notably UNIX) will create the need for new technical skills and thus new training and retraining requirements. Developments in natural languages and artificial intelligence systems will also create new training needs.

As these developments evolve, there will be changes in the need for different types of job category and skill level, and all of these changes will happen in an environment overshadowed by a general skills shortage. Changes and their consequent demand levels will vary between different industry sectors and types of organisations. For hardware manufacturers, the principal areas of growth are expected in software and systems engineers and in technical sales staff. Amongst information services companies, programmers and analysts are expected to be the key requirement areas.

The supply of graduates is currently a vital source of recruitment for the information systems industry, and for the information services vendors in particular. The demographic profile indicates that the supply of graduates is going to diminish markedly in both West Germany and the United Kingdom.

In consequence the industry—both vendors and users—must adopt other sources of manpower. Graduate conversion, upgrading, and updating training strategies will need to be developed. Additionally organisations in need of more trained and skilled people will need to pay more attention to their management of human assets. If the half-life of training is only two to three years, then human asset depreciation may exceed the depreciation of other business assets. Organisations must pay attention to the conservation and renewal of their information systems skills base.

In response to these changes INPUT expects to see moves made to effect better conservation of scarce skills through modified terms and conditions, and through greater employment of older people, women workers and possibly immigrants. Above all, the need for education and training courses will remain of the highest priority.

G

Strategic Considerations

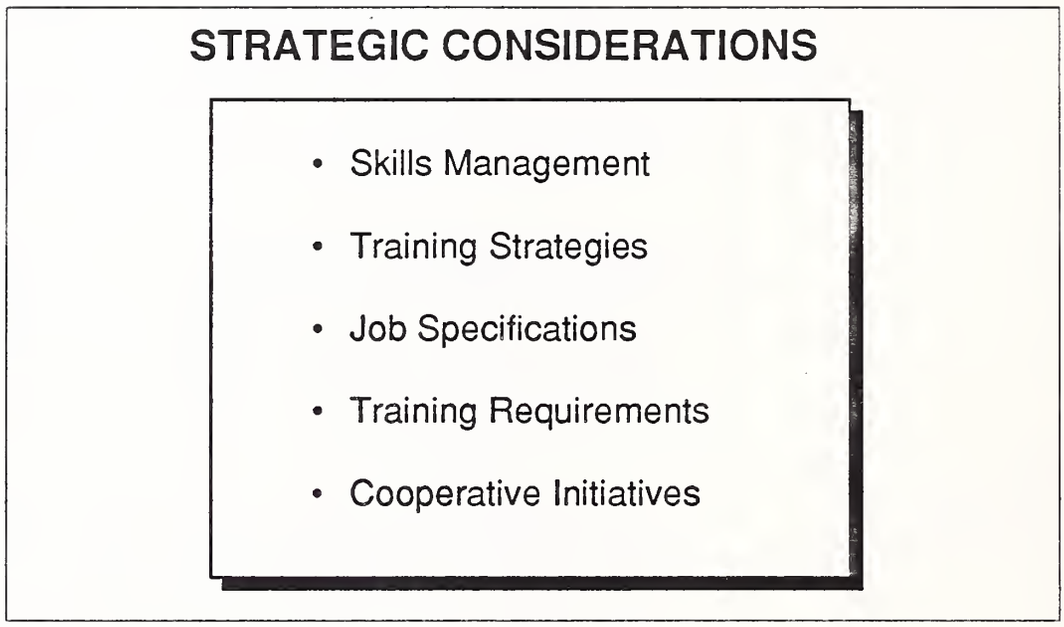
This study has highlighted a number of important issues concerning the future development of the information systems business and of the Education and Training market in particular. Firstly, and as already highlighted, all industry participants will need to place much greater emphasis on the management of human resources. Humanware is thought, and right thinking is the single most important ingredient for productivity and success. Strategic action will be needed in respect of:

- Skill needs identification.
- Skill acquisition strategies, including employee inducements at recruitment and, more importantly, on a continuing basis.
- Strategies to maximise underutilised pools of labour, specifically women and older people.
- Reviews of terms and conditions of employment, including agreements to provide training.

Above all, the key strategic consideration must be to increase the level of training and thus the value of the organisation's human resources. Users must develop sound training strategies, and should seek training consultancy from professional services firms to audit and plan their requirements. The vendors of information systems and services should seize the opportunity to more clearly identify and market training needs.

The information systems and services community should take a more proactive role in the specification of job titles and descriptions, thus aiding the specification of qualifications and the training structures needed to support them. Directorate General 5 of the European Community is taking steps towards harmonisation at a European level. Whilst France and West Germany have made considerable progress in this area, in contrast to the United Kingdom, there exists the need for constant updating to match future requirements.

EXHIBIT II-7



Thus the challenge for education and training vendors is to understand and plan for these changes, in particular the amount of training and retraining that will be required for the adult population. There also exists a need for training providers to adapt to the need for skills training in other areas, such as marketing, commercial studies and the applications to which information systems and services are applied.

Vendors of information systems training should also actively consider any cooperative initiatives that would enhance service and their business. There have been recent developments in this area, for example in France on the Minitel system. Cooperative initiatives with academia may also prove fruitful, particularly in ensuring the best possible public image for the industry and perhaps from the standpoint of obtaining independent quality certification for training courses.

Above everything else the message that must be most clearly understood and acted upon concerns the economic significance of trained, skilled people. In short:

- People are the most important economic asset.
- Education and training, and technical and scientific knowledge are more important than any natural resources.

There thus exists a tremendous opportunity for the education and training sector within the information systems and services business. It is, however, an opportunity that must be positively exploited through effective marketing at every level of the user community.

Market Analysis and Forecast

III

Market Analysis and Forecast

The first part of this chapter contains an overview of the types of education and training that are required within the computer industry. It further provides a description of the types of organisation that provide computer-related education and training services, the subjects covered and the types of training methods used.

The second part provides INPUT's assessment of the market size of education and training services in Western Europe and a forecast of the likely development of that market for the period 1988 to 1993.

A

Types and Methods of Training

1. The Range of Training Required

Those who need training can be categorised into seven classes, as listed in Exhibit III-1.

EXHIBIT III-1

THE RANGE OF TRAINING REQUIRED

- Data Processing Professionals
- Managers Who Make Investment Decisions for Information Systems.
- Managers Who Use Information
- Staff Who Use Information Systems in Their Work
- Staff Who Require Training in New Languages or Technologies
- Technicians for Maintenance of Hardware
- Teachers of Training

- those who are entering the data processing profession, either as a DP professional or as a professional in a user business who is required to have a detailed knowledge and understanding of information technology.

- directors and business managers who require an awareness of the power and applications of information technology to the extent that it enables them to make management and investment decisions relating to the use of information technology in their businesses.

- senior and middle managers who are users of information.

- staff needing some knowledge of data processing techniques in their work—for example, middle managers who are applying data processing to their businesses under the guidance of a centralised data processing department or of outside suppliers (and additionally, secretaries in the use of word processing or operatives and clerical workers who are required to use computer terminals).

- staff who are already trained and experienced in some aspects of information technology but who require further training in order to equip them for future assignments. Such assignments might require training in new operating systems or high-level languages, or in new technologies such as network management or expert systems.

- technicians required for the maintenance and servicing of hardware.

- training teachers, both for training courses and for academic institutions, who, as well as being conversant with the technology, need to be trained in the methodology of teaching and in course material.

Those entering the data processing profession may have received an initial education in technical subjects and many will have attended computer courses or be qualified in computer science. Some may have already attended training courses provided by a computer manufacturer.

Very few senior managers, middle managers, secretaries or operatives will have had any training whatsoever in computer studies or will understand the concepts involved. Many will be hesitant to become involved and will be afraid to put the disclosure of their own capabilities at risk.

2. Providers of Training

Exhibit III-2 lists the main categories of organisations that are involved in the provision of computer-related education and training.

EXHIBIT III-2

PROVIDERS OF TRAINING

- Schools, Universities and Colleges
- Providers of Hardware and Software for Their Own Needs
- Suppliers of Hardware and Software Systems
- User Companies Organising Their Own Training
- Specialist Suppliers of Training

Basic training is of course provided by schools, universities and polytechnics, and many of these provide specialist training in computer science. The United Kingdom, for example, has over 100 universities, polytechnics and other colleges providing courses. Such courses can, however, cover only the fundamentals and cannot provide fully the training required for a particular job or be orientated to a particular application. This training is financed by the government, but contributions to funding are made by larger computer companies.

U.S. companies in particular allocate substantial sums to universities and schools with the benefit that training can be given on proprietary systems. As an example in the United Kingdom, Digital Equipment Corporation recently allocated £1M ($1.7M) under an initiative called 'DECollege' that is aimed at schools, further educational establishments and the unemployed (those made redundant and mothers who are considering returning to work). This amount is in addition to the £10M ($17M) spent annually on internal training of its own staff.

The University of Salford, in the U.K., has also established an Information Technology Institute as a collaborative venture with industry and is receiving £1.43M ($2.4M) of public funds supported by funding from such companies as Rank Xerox, IBM, UNISYS, Prime, GEC, Ferranti, DEC and the SEMA Group as well as users such as ICI, British Aerospace, British Gas, BNFL, Littlewoods and Unipart.

Most providers of information systems or services provide for the training of their own staffs, and ICL recently announced funding of £100M ($170M) for this purpose over five years. Some companies such as the SEMA Group provide excellent training for their own staffs, in particular

for the intake of graduates. This amounts to around 10% of their staff complements, but they do not offer training as a service to third parties. All suppliers of hardware and software must provide training in the use of their products, and for the larger companies this represents a significant business.

Some user companies organise their own training and in some cases on a considerable scale. One personal credit organisation recently trained 490 branch managers, 900 assistant managers and 900 clerks in the use of microcomputer systems in a period of eight weeks and at modest cost. However, such courses are usually based on material supplied by the computer service companies.

The biggest suppliers of training, outside the suppliers of hardware and software, are, however, the computer services companies, some of which specialise in training. The quality of courses offered, however, varies considerably: the largest companies offer a range of courses of high quality to the long-established clientele, often large user companies.

3. Subjects Covered

The topics covered by courses are voluminous, and many suppliers of training provide well-prepared manuals listing the subject matter of the course, the content, who will benefit, the duration, venues, dates and cost of the courses. In some countries these are brought together in comprehensive consolidated publications, including in France via the Minitel system.

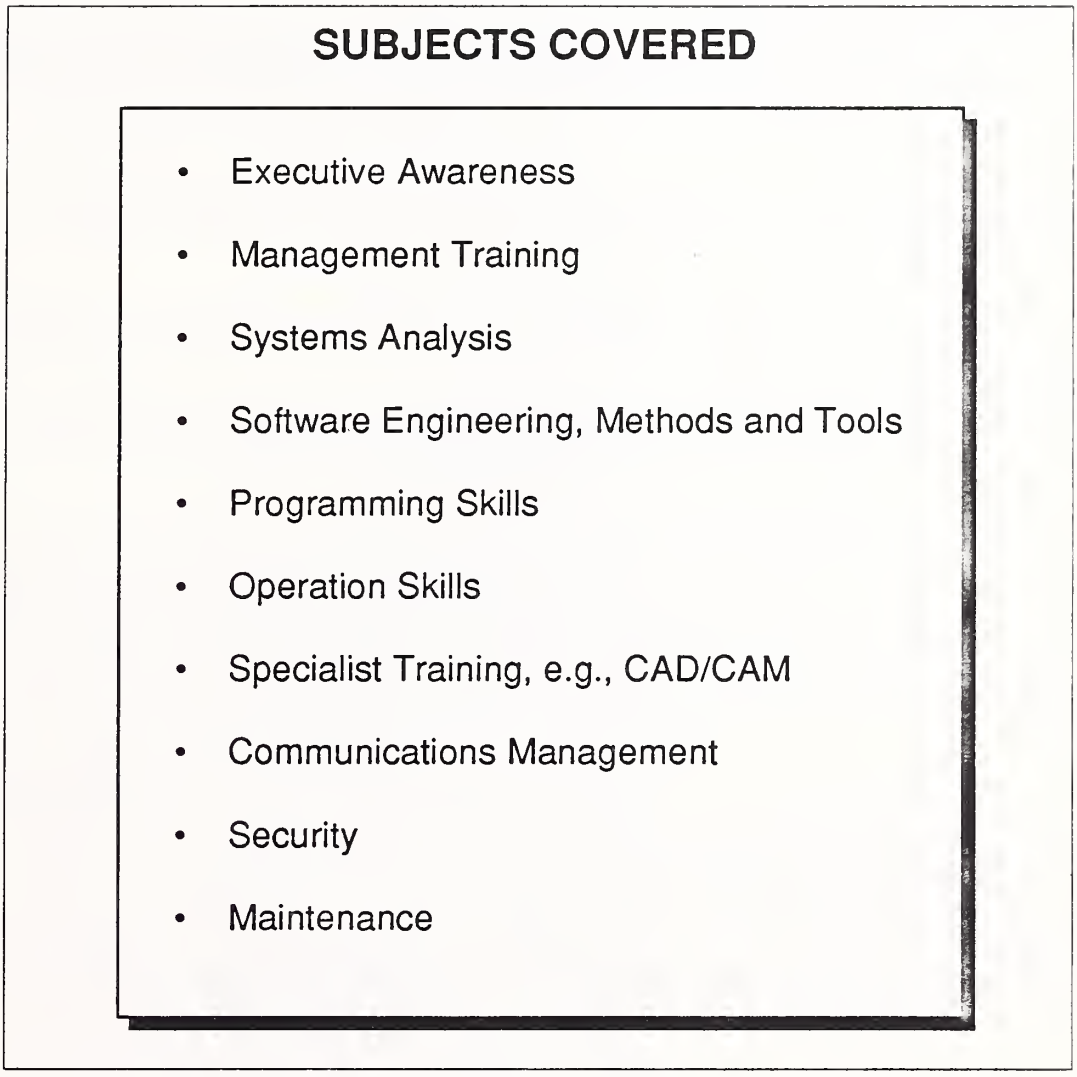
The principal subjects covered by courses are categorised in Exhibit III-3 and described below:

- executive awareness education, aimed at equipping directors and managers in the private and public sectors with a thorough understanding of how information systems can be strategically managed to achieve greater business effectiveness and to understand the technical and managerial issues involved in applying information systems to support corporate business strategy.

- management training, providing for the training of supervisory and management staff in an operations centre as well as the rather different environments of applications development teams that are producing new systems or are required to adopt a new system designed by the operations centre or by an external contractor.

- systems analysis, aimed at teaching the techniques of structured systems analysis, including the analysis phase, the production of a system specification, the production of program specifications/database schemes for the selected hardware/software and user and operations procedure specifications.

EXHIBIT III-3



- software engineering, methods and tools, particularly designed to aid the adoption of a professional approach to both the technical and managerial aspects of software development, including the range and variety of methods, skills and disciplines needed, project planning and control, and software quality assurance.

- programming skills, including data-structured program design, programming management and introductions to new languages.

- operation skills, including operations supervision and management.

- specialist training in applications such as computer-aided design and manufacturing.

- communications management, including the nature, significance and potential applications of local- and wide-area networks, office automation, electronic mail, industrial control and access to external and internal databases.

- security, including file protection, security auditing, data encryption methods, and the utilities and system services involved in monitoring and controlling system security.

- maintenance, including the training of technicians to service hardware.

4. Training Categories

Training can be categorised into three broad groups:

- initial training
- external public training courses
- in-house training

Initial training, which is given to new recruits on joining a company (note the different meaning of the French expression 'formation initiale', which refers to training in schools, universities and technical colleges) and continuing trainings ('formation continue'), which refers to training provided during employment as a means of extending or updating the technical and project management skills of employees as and when they are perceived necessary by the work at hand. In some cases continuing training may be linked to career development of the individual.

Initial training includes induction courses on what an employee needs to know about company operations in order to work effectively, and also specialist training for skills the recruit requires to do the job. The best method for initial training is a dual system (as is widely practiced in Germany) of in-house, on-the-job training complemented by class-room studies.

Continuing training may take place in external public training courses offered by information systems and services suppliers or by computer service companies; or, if the number of trainees makes it economic, by internal training under the teaching of company staff; or, as is more likely in the case of users, by professional teachers from the computer service companies engaged for the purpose. Training material may then be standard, or specially adapted for the company whose employees are acquiring training, normally at the cost of that company.

The use of publicly available training courses has the advantages that:

- trainees will mix with other trainees from a range of installations, often working with them in syndicate teams, and will thus benefit from experiences somewhat wider than the course material.

- trainees can be provided with training at times and with a frequency that is compatible with individual requirements and may, for example, be linked with individual career progressions.

- courses may be more intensive than those conducted in an in-company environment; trainees cannot so readily be disturbed by demands, queries and problems that arise from within the company, a common feature of in-company training.

- a mix of training suppliers can be used, thus providing a wider experience.

The use of in-house training has the advantages that:

- the course being presented can be adapted to meet the individual needs of the organisation.

- the course can be used to train a large number of staff with the same material, which has the effect of compressing the elapsed time.

- the training cost per trainee can be reduced below that of external training, particularly when there is a large number of staff to be trained.

5. Computer-Based Training

Computer-Based Training (CBT) has now been developed so that it is effective in combining the presentation and management capabilities of computer-based systems with the characteristics essential to effective learning, such as active student participation and the immediate feedback of results. CBT also caters to individual differences such as prior knowledge, learning speed and ability.

Computer services companies are well-equipped in the latest available computer technology as well as highly skilled in education, training and communication. As a consequence the training provided is not only up-to-date from a technical standpoint but also incorporates the best educational methods. Not unexpectedly the computer services companies lead in this field.

The largest in Europe is ALI (Applied Learning International), which recently merged with Deltak to form the largest player in this field in the European market. Hoskyns, now a subsidiary of Plessey and Mentor Interactive, is an example of another company active in this field. The hardware vendors also offer CBT services, for example ICL.

Computer-Based Training is also used to train operators in many fields such as plant operation and maintenance, shop floor robotics and simulated vehicle driving instruction. WICAT Systems is a leading company that provides this type of CBT. Revenues generated in this area are not, of course, included within INPUT's market size assessment.

Software tools for developing CBT materials also exist, thus enabling the client to build purpose-built training systems that can run parallel to the 'live' system and thus obviate simulation. Some examples are:

- Automator mi from Direct Technology.
- CAS and GLOS from Evergreen Technology, a Canadian company.
- DG from Trillian Computer, a U.S.-based company.

Complete integrated hardware and software systems for Computer-Based Training can be supplied, often incorporating visual systems built round video discs. Such systems have been purchased by large organisations for in-house use, including telephone administrations, medical services and the military.

Computer-Based Training has the advantage that it can be applied at the most convenient times to suit the trainee, and administration costs are reduced to the bare minimum. However, although a computer can check that the correct result has been given, it cannot check as well as a teacher can that a matter has been properly understood. Some other drawbacks of CBT that should be fully evaluated are:

- The computer logic cannot yet match human flexibility or the varying and different needs of different students.

- It is difficult to adapt a CBT package to ensure 'relevancy', and thus increase the amount learned by individual students.

- The CBT package is just too complex.

- The CBT package is so simple that students can guess their way through the package.

- The difficulty of establishing the commitment to training amongst students that is inherent in formal classroom training.

6. Other Training Opportunities

Other possible opportunities or avenues for training exist within the computer industry environment and these are discussed below. They can be described as falling into two main areas:

- career-structured training;
- training as part of project management.

It is also interesting to note the opportunity provided by the 'Open University' in the United Kingdom. The 'Open University', which provides training on the national television network, has recently introduced a course in software development, which it is hoped will produce 2,500

'graduates' a year. The course includes instruction in the programming language Pascal, data structures, operating systems, software engineering, and artificial intelligence.

a. Career-Structured Training

Training should not be regarded as a unique event in an employee's career but should rather be perceived as a progressive series of planned steps. Training is usually arranged as a consequence of appraisals conducted within the framework of a personnel development programme. Thus the staff of main data processing departments should be moved through a planned sequence of training courses that provide the staff with the necessary skills to discharge the various roles within the department.

The essence of such a scheme is a recognition that the more demanding and complex work is necessarily allocated to members of the staff with the appropriate experience and training. The preparation of human resources to meet this demand is a matter of steady and planned growth in order to ensure that all appropriate ground is covered.

As well as enabling management to plan the development and deployment of staff in a way that is commensurate with the technical demands made upon the staff, career-structured training has the further advantages that individuals are progressed at a steady rate as experience is gained, employees can see a career path and staff recruitment and retention will thereby be improved, and the control of training budgets is made easier.

b. Training as Part of Project Management

In some companies a project manager is required to include a budget for training as part of the project plan and budget. The need for training can therefore be identified and be financed as part of the project. Venture capitalists who fund a business against a project plan could well investigate more deeply whether proper provision has been made in business plans for training.

B

Education and Training Market Forecast

1. Market Definition

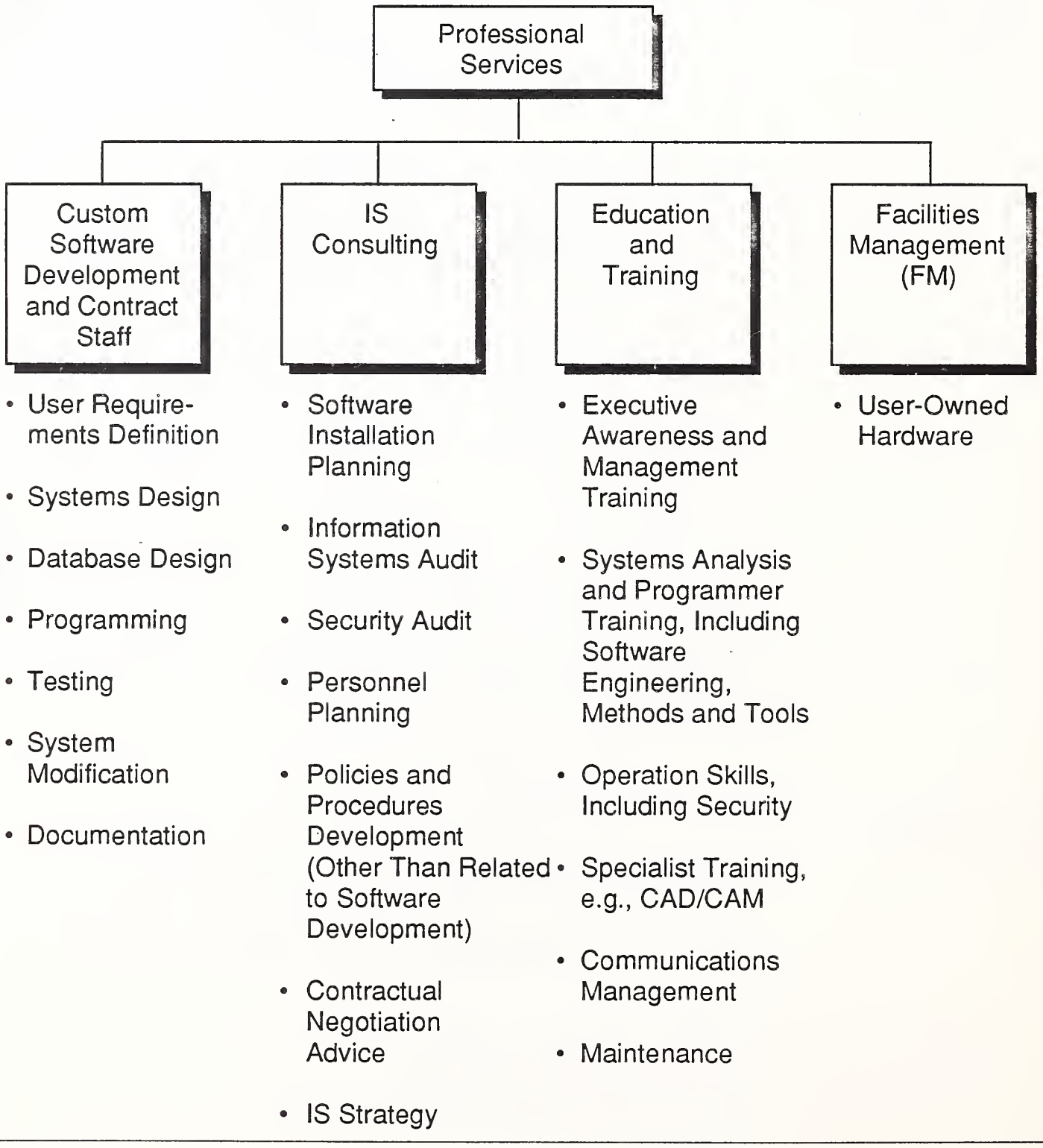
The computer-related education and training market is considered by INPUT to be a part of the overall market for computer-related professional services. The professional services sector of the information services market is defined by INPUT as making up the following activities:

- custom software development and contract staff;
- information systems consulting;
- education and training services;
- facilities management (or systems operations) services on client-owned equipment.

Exhibit III-4 provides a graphic representation of this market sector. Section A of this chapter provides a fuller discussion of the activity in this sector. A full description of INPUT's definitions for the total Information Services market is provided in Appendix C.

EXHIBIT III-4

PROFESSIONAL SERVICES MARKET STRUCTURE



2. Forecast Definition

The market assessment and forecast given below for the education and training sector of the professional services market were developed from an evaluation of current and projected activity.

The market assessment is provided for the base year 1987 and forecast over the five-year period 1988–1993. INPUT's market assessment is of end-user revenues. Forecasts are made in local currency for individual-country markets and converted into U.S. dollars for aggregation and comparative purposes.

The U.S. dollar rates used are shown in Exhibit III-5. These rates were the average exchange rates extant on 1 July 1988. The forecasts are expressed in current rates: consequently allowance must be made for the rate of inflation. The inflation assumptions made by INPUT are also shown in Exhibit III-5.

EXHIBIT III-5

U.S. DOLLAR CONVERSION AND INFLATION RATES

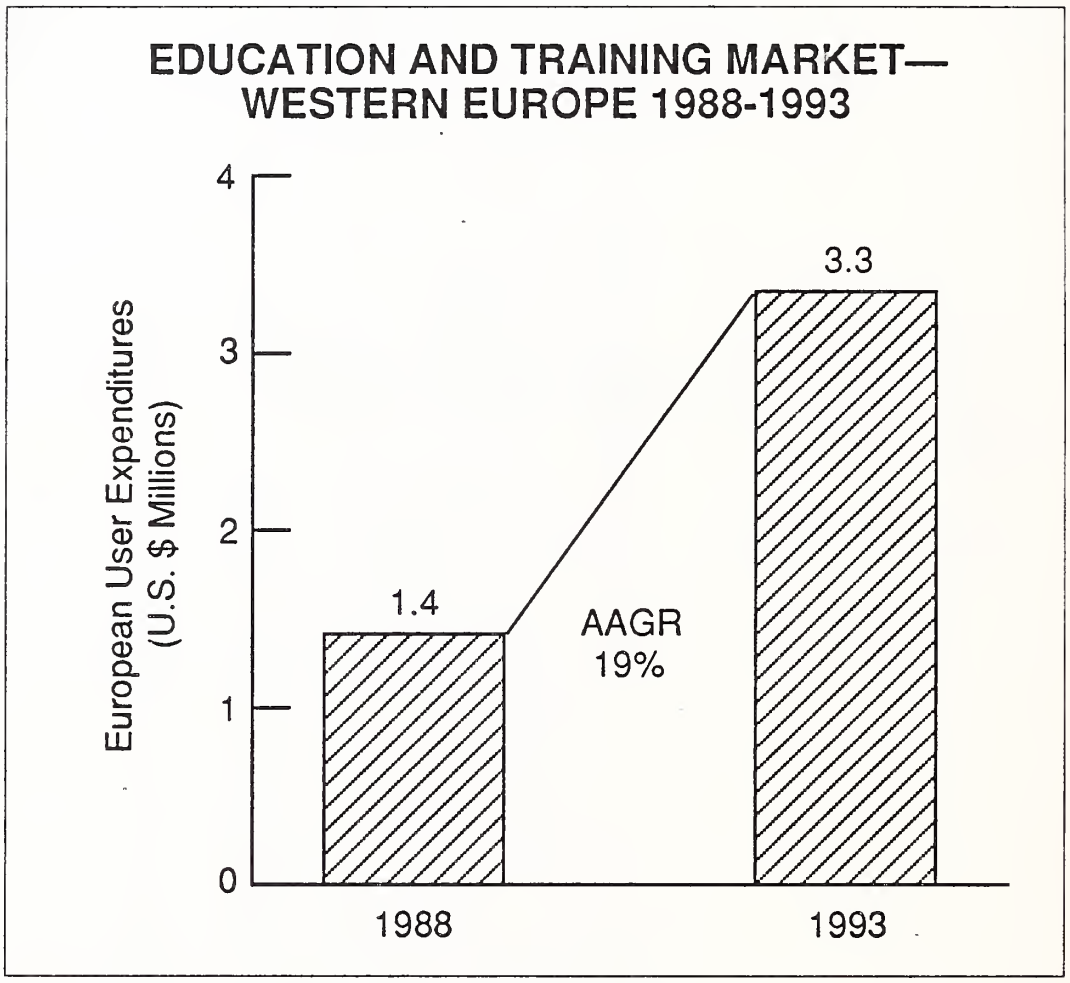
COUNTRY	CURRENCY	DOLLAR CONVERSION RATE	INFLATION
Belgium	BF	38.10	+1.0
Denmark	DK	6.90	+5.0
Finland	FM	4.34	+5.5
France	FF	6.13	+2.6
Italy	Lira	1,351.00	+4.9
Netherlands	Dfl	2.05	+0.7
Norway	NK	6.66	+7.5
Spain	Pta.	121.40	+4.3
Sweden	SK	6.29	+6.9
Switzerland	SF	1.51	+2.1
United Kingdom	£	0.59	+4.6
West Germany	DM	1.82	+1.0

Source: Swiss Bank Corporation and
National Westminster Bank

3. Market Forecast

INPUT's overall forecast for the growth of the information systems education and training market in Western Europe is shown in Exhibit III-6. From a market that is estimated to be worth around $1.4 billion in 1988, the market is expected to grow at an average annual rate of around 19% to reach $3.3 billion by 1993.

EXHIBIT III-6



The major factor driving this growth is the expected continued expansion of the information systems business. Information systems continue to penetrate user organisations more deeply and to become more critical to organizations' efficiency and profitability. Training staff at an operational level and educating people to have a good understanding of how information systems can be most effectively utilised are becoming key objectives.

To provide further interpretation of the market composition, INPUT has estimated the breakdown of the market between the following three main components:

- Operational management and skills training, including maintenance training;

- Systems Analysis, programming and other specialist training;

- Executive awareness and management education.

Operational management and skills training is that part of the education and training market most closely associated with the customer services function. It is therefore included as a separately identified business stream in INPUT's assessments and forecasts of the Customer Services market. For further analysis of this market, readers should consult INPUT's *Customer Services in Europe 1988 Annual Report.*

This operational management and skills sector is defined as including all education and training courses concerned with:

- Computer hardware;
- Operating system software;
- Telecommunications hardware and software.

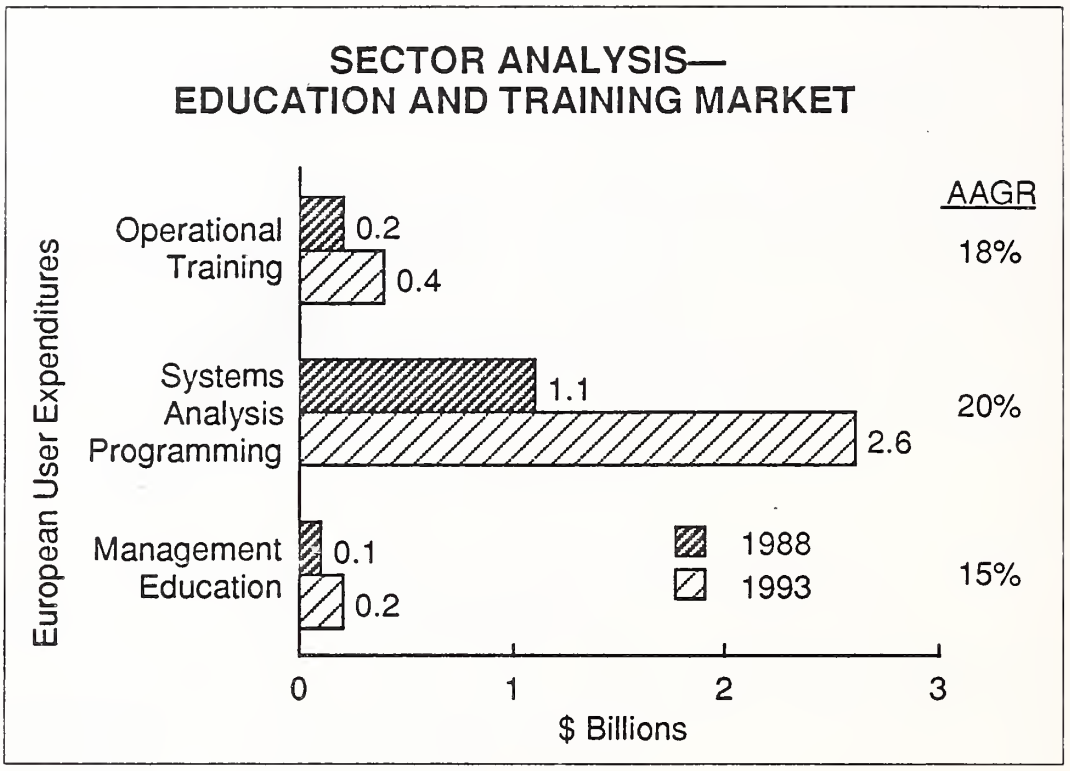
The systems analysis and programming sector is the dominant part of the market and can essentially be defined as the provision of any kind of practical training concerned with computers and telecommunications equipment not included in the operational sector. The majority of demand is made up of courses in basic skills such as programming languages and systems analysis.

Executive awareness and management education represent essentially the education-oriented sector of this market. This sector includes all information-systems-related courses designed to promote a better understanding and appreciation of computers, their software and their application to business, commerce, industry and administration.

Exhibit III-7 shows the analysis of the Western European Education and Training market across these three sectors. It can be seen from this exhibit that the fastest growth is expected in the dominant sector of systems analysis and programming training. Twenty percent annual average growth is forecast to take this sector to $2.6 billion by 1993, when it will account for an estimated 80% of the total market.

The operational training and management education sectors are both expected to grow less quickly, at 18% and 15% per annum respectively. In the operational sector, growth will be impeded by moves to smaller, more powerful equipment configurations requiring lower operational support, but will be counterbalanced by the rapidly growing need for operational support on networks.

EXHIBIT III-7



Exhibits III-8 and III-9 provide a detailed analysis of the individual country markets for information systems education and training. These analyses cover the period 1987 through 1993. Exhibit III-9 shows these forecasts in local currency for each individual country. Exhibit III-9 shows these forecasts converted to U.S. dollars using the conversion rates shown in Exhibit III-5, which allows for consolidation to a European total, including an estimate for the total of the smaller countries not separately identified.

Using Exhibit III-9 on a comparative basis, it can be seen that West Germany, France and the United Kingdom represent the largest individual country markets with percentage shares of:

- West Germany 25%
- France 23%
- United Kingdom 21%

All other countries have significantly smaller proportions of the overall European total market. The next most significant individual country markets and their percentage share of the European total are:

- Italy 8%
- Holland 6%
- Switzerland 5%
- Sweden 4%

EXHIBIT III-8

EDUCATION AND TRAINING— COUNTRY MARKET ANALYSIS (LOCAL CURRENCY)

Country (Currency)	Market Size (User Expenditure) Local Currency							1988-93 AAGR (Percent)
	1987	1988	1989	1990	1991	1992	1993	
France (M FF)	1,600	1,950	2,350	2,850	3,400	4,000	4,650	19
United Kingdom (M £)	135	165	200	240	290	345	410	20
West Germany (M DM)	550	660	790	935	1,100	1,280	1,480	17
Italy (B L)	100	130	165	210	260	315	370	23
Belgium (M BF)	1,000	1,200	1,440	1,715	2,020	2,360	2,730	18
Netherlands (M Dfl)	150	180	215	255	300	350	400	17
Denmark (M DK)	70	85	100	115	135	160	180	16
Finland (M FM)	45	55	65	75	90	105	120	17
Norway (M NK)	65	75	85	100	115	135	155	16
Sweden (M SK)	300	360	430	510	600	700	800	17
Spain (M Pta)	2,400	2,950	3,630	4430	5,400	6,530	7,900	22
Switzerland (M SF)	85	105	125	150	175	210	240	18

EXHIBIT III-9

EDUCATION AND TRAINING— COUNTRY MARKET ANALYSIS ($)

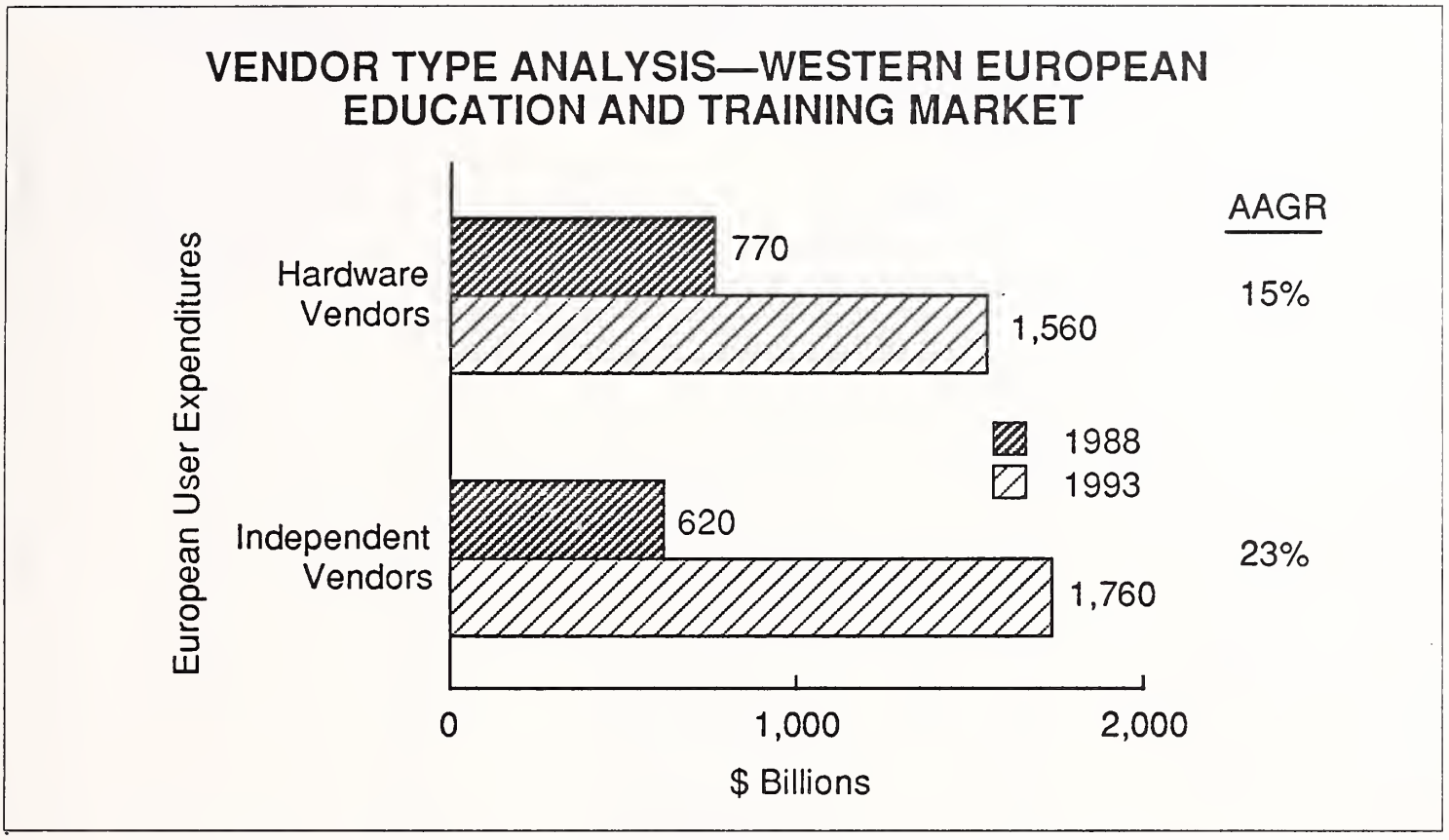
Country	Market Size (User Expenditure) $ Millions							1988-93 AAGR (Percent)
	1987	1988	1989	1990	1991	1992	1993	
France	260	320	385	465	555	650	760	19
United Kingdom	230	280	340	405	490	585	695	20
West Germany	300	360	435	515	605	705	815	17
Italy	75	96	120	155	190	235	275	23
Belgium	26	31	38	45	53	62	72	18
Netherlands	73	88	105	125	145	170	195	17
Denmark	10	12	14	16	19	23	26	16
Finland	10	12	15	17	21	24	27	17
Norway	10	11	13	15	17	20	23	16
Sweden	48	57	68	81	95	111	127	17
Spain	20	24	30	36	44	54	65	22
Switzerland	56	70	83	99	116	139	159	18
Rest of Europe	25	30	35	45	55	65	80	22
Total (Rounded)	1,145	1,390	1,680	2,020	2,400	2,840	3,320	19

C

Competitive Environment

As is common in Information Services markets, the competitive environment can be analysed into two broad groups, the hardware manufacturers and the independent vendors of education and training services. Exhibit III-10 shows INPUT's estimate of the current split in the market between these two groups and their expected shares by 1993.

EXHIBIT III-10



It can clearly be seen from this Exhibit that INPUT is forecasting significantly higher growth for the independent sector (23%) in comparison with the hardware vendors' sector (15%). These different rates of growth will have a significant impact on the proportional shares of these two sectors between 1988 and 1993. This analysis indicates that the manufacturers' share will fall from around 55% of the market in 1988 to only about 40% by 1993.

This change is forecast on the basis that more independent organisations are likely to enter this market and offer specialisation in education and training services. Further, it is expected that greater emphasis on software and software applications will fuel demand for training not tied specifically to the hardware platform.

The leading competitors in these two sectors of the market are linked in Exhibits III-11 and III-12. Exhibit III-11 lists the leading independent vendors operating in the European market. ALI (Applied Learning International) is by far the largest vendor specifically providing training services. The subsidiary of a U.S.-based organisation, the National Education Corporation, ALI specialises in the provision of interactive video instruction and computer-based training. It describes itself as the world's leading multimedia training organisation. ALI was formed in January 1988 when ASI merged with Deltak Training Corporation.

EXHIBIT III-11

LEADING INDEPENDENT EDUCATION AND TRAINING VENDORS—WESTERN EUROPE

Rank	Vendor	Estimated Education & Training Revenue 1987 ($ Millions)
1	Cap Gemini Formation	37
2	ALI	36
3	DATEV	12
4	BIS	11
5	Hoskyns	10
6	Datasolve	7
7	Integrata	7
8	Sligos	5
9	The Instruction Set	4
10	GEI	3

IOther organisations that hold significant positions in the market are Cap Gemini Formation (the training function of the dominant Cap Gemini Sogeti Group) and Datev (the large West German information services company).

Three U.K.-based organisations that have significant revenues from education and training are BIS (owned by Nynex), Hoskyns (now owned by Plessey) and Datasolve (part of Thorn Software). Hoskyns recently acquired Fidalco Ltd., a Dublin-based holding company for Computer Based Training Ltd., to strengthen its position in this area.

Exhibit III-12 lists the leading hardware vendors in the education and training market. Not surprisingly IBM dominates this list with 1987 revenues estimated at around $200 million. All the other leading hard-

EXHIBIT III-12

LEADING HARDWARE VENDORS— WESTERN EUROPE EDUCATION AND TRAINING REVENUES

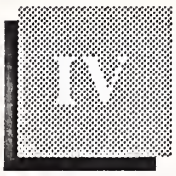
Rank	Vendor	Estimated Education & Training Revenue 1987 ($ Millions)
1	IBM	200
2	Digital	80
3	Unisys	50
4	Honeywell-Bull*	40
5	Siemens	35
6	ICL	25
7	Control Data	14
8	NCR	13
9	Nixdorf	10
10	Amdahl	7

* Includes all Groupe Bull and Honeywell-Bull activities in Western Europe.

ware manufacturers have significant education and training revenues, particularly in comparison with the list of leading independents.

In terms of overall competitive ranking, a combination of these two lists would place Cap Gemini Formation in fifth place and ALI in sixth place. Thus only two independent vendors would be represented in an overall table of the top-ten vendors. As already indicated, INPUT anticipates that this position could change over the next five years as the independents gain relative market share to the detriment of the manufacturing sector.

The Information Skills Challenge



The Information Skills Challenge

The importance of education and training within the computer industry is highly dependent upon both the need and potential supply of people educated and trained in the relevant disciplines. These factors will also affect the growth of the opportunity for providing third-party education and training services.

There is now growing evidence, fundamentally from a demographic viewpoint, but also for reasons of government policy and national approaches to education, that certain countries in Western Europe are facing a significant challenge in this area: namely that a skills shortage of significant proportions is impending in the first half of the next decade.

This chapter of the report addresses this particular question. Firstly, in section A below, a review is provided of the range of computer skills that are required. Specifically this section discusses:

- the information revolution;
- categories of computer skills and the users of those skills;
- demand and supply factors;
- the use of contract staff and other contracted services.

Secondly, in section B, the general question of skills shortage is addressed. Specifically this section covers:

- the origins of the skills shortage;
- the nature and location of skills shortage;
- factors likely to increase the problem;
- factors likely to decrease the problem.

A

The Range of Computer Skills

1. The Information Revolution

Just as the industrial revolution in the major countries of Europe during the nineteenth century created the need for skilled mechanics and mill operators, the information revolution that is impacting European manufacturing and service industries today is creating a demand for awareness on the part of management as to what part information technology can play in the execution of their businesses and about how to go about harnessing the power of information systems.

Information systems are also creating a demand for persons with the many types of skills required:

- to identify how information technology can be utilised in a particular business activity;
- to specify in detail how this shall be done;
- to identify the requirements of hardware and software to fulfill those requirements;
- to procure that hardware and software;
- to introduce and operate the various machines that will collect, store, process, retrieve, and present the information that is required in the conduct of business.

In addition, specialist companies that create and/or supply hardware, software, integrated systems, and training and maintenance, need persons with the skills to design, manufacture and service such systems and to assist the nonspecialist users in understanding and implementing the use of such systems in their businesses.

As systems become easier for nonspecialists to use—or user-friendly, as the jargon calls it—more and more users have access through workstations or micros to mainframe applications, and the number of support staff required increases relentlessly.

It is estimated that more than 50% of all workers now handle information in one form or another. To many, information handling will be an unfamiliar task and in some cases will require overcoming prejudice and even fear in adapting to their work. It is not surprising that there is a skills shortage that government and industry must plan to meet by suitable education and industrial training.

Individual countries in Europe are tackling this problem to varying degrees and in their own way. However, national characteristics and

disciplines vary and it is evident that some are succeeding better than others in meeting the demand for the skills required.

2. Categories of Computer Skill Users

The term *information technology* is generally understood to mean technology that deals with the recording, processing, storage, transmission and presentation of information in its various forms and has evolved from the recent confluence of the technology of computers and telecommunications. *Data* is generally held to mean a set of symbols or characters whose meaning or significance is not specifically stated, but the transformation into *information* requires prior knowledge by the recipient that is not present in the data themselves.

The word *knowledge* has taken on a special meaning in information technology; namely it means information of sufficient generality that other information can be deduced from it. The preparation and management of knowledge bases is now considered part of information technology, and the future application of 'artificial intelligence' and of expert systems in particular is a sector that will place increasing demands on the skills market in the future.

Users of computer skills can be divided into four main groupings:

- providers of data processing systems, hardware and software components and maintenance services;
- providers of services, such as processing and network services, software products and professional services such as custom system development and consultancy;
- public and private sector users of information systems in the primary industries, manufacturing industries, construction, public utilities, transport and communications and distributive trades;
- public- and private-sector service industries such as insurance, banking, finance, public administration, hospital, medical, police, fire and other public services.

This classification is not unique in that many organisations cross these boundaries; for example, many electronics companies are both suppliers and users of information systems. However, from the point of view of training in information systems, the first two categories have the capability of identifying their own training needs and of arranging for that training providing there are enough candidates.

The second two categories on the whole rely on the first two categories to provide the training they require, the principal exception being govern-

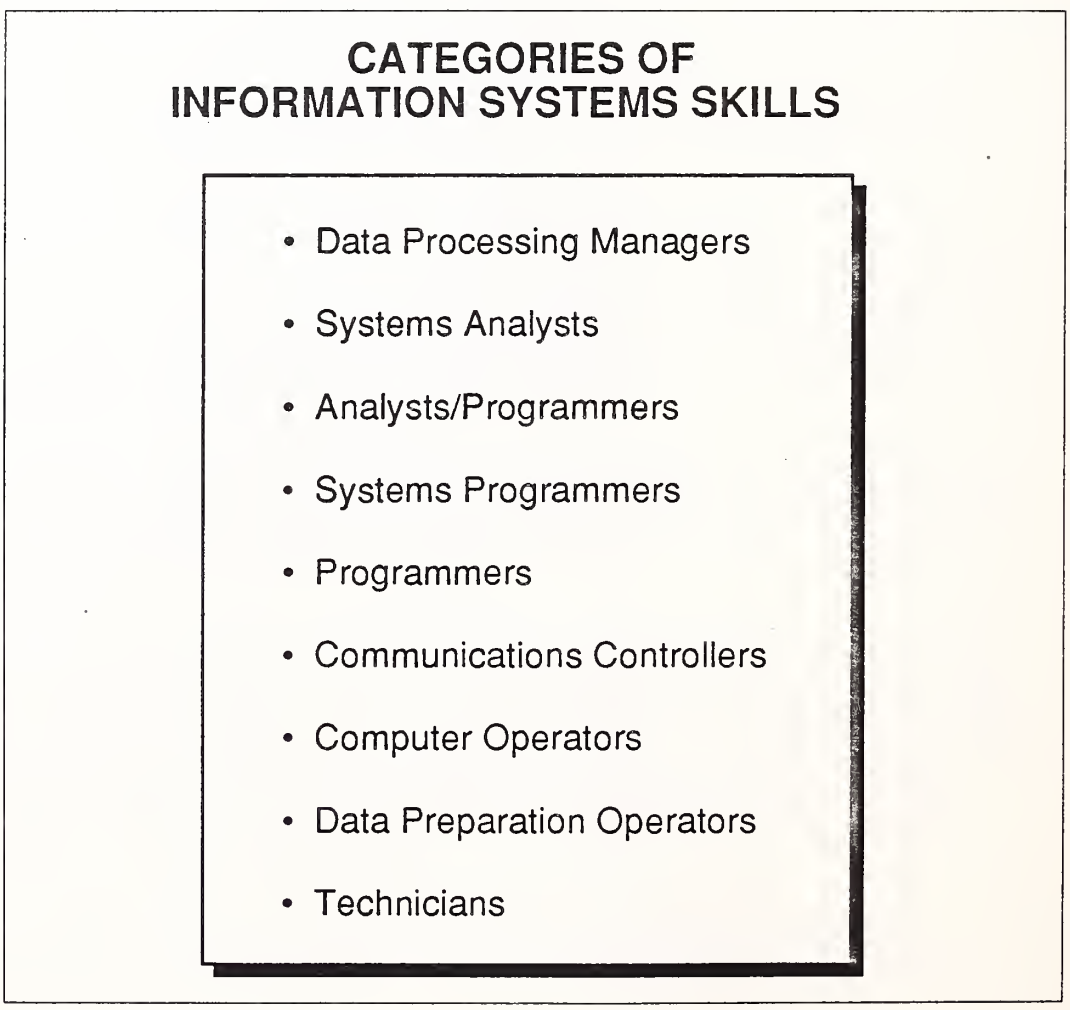
ment, which to a limited extent provides its own training through its own colleges. Governments do, however, look to the private sector for training in specialist areas and to meet requirements where their own organisations do not have sufficient capacity.

Some companies in the computer services sector are amongst the leaders in the quality of the training they provide, but reserve this service for their own staffs and do not provide training to third parties as a business activity. The military has a vast need for training and is well versed at providing it. In defence contracts the role of industry is generally limited to training the military trainers, a service that is normally provided as part of the contract of supply.

3. Categories of Information Systems Skills

More than 80% of manpower skilled in information systems are now employed with information systems users. It is possible that this proportion is now approaching 90%. The balance is employed by information systems vendors and information services vendors, with the principal growth being in the computer services sector. The principal job categories in information systems manpower amongst users are listed in Exhibit IV-1.

EXHIBIT IV-1



The number of information systems staff employed in any one organisation varies greatly. Most users (excluding electronics manufacturers) have fewer than five skilled computer staff members. In contrast, providers of information systems and services employ larger numbers of staff, the average being in the range of 50-100 employees. In all sectors staff are generally young; most are under 35.

Women are almost exclusively used in tasks requiring good keyboard skills (data preparation operators). However, the appointment of women into the categories requiring training in computer science only reaches the 10-20% region, and in some cases is as low as 2%. There is a marked difference in Europe as compared with the United States, where women are reported to have achieved a greater penetration, particularly in the electronics and aerospace industries.

The Institute of Manpower Studies has analysed employment specifically in the information systems sector in the United Kingdom. It provides a broad analysis for the four different types of computer-skilled users described above, namely:

- equipment vendors;
- information services vendors;
- private and public nonservices sector computer users;
- private and public computer services sector.

Exhibit IV-2 shows the analysis for the equipment systems vendor sector of the United Kingdom. Not surprisingly, the vast majority of employment is accounted for by design, development, and engineering work, whether in microelectronics software or systems.

Customer services accounts for some 11% of employment with around 9% in marketing and technical sales. The two largest groups are software and systems engineering and electronics and product engineering.

In the U.K. information services industry, as shown in Exhibit IV-3, the emphasis is almost entirely on software skills, principally systems analysts, analyst/ programmers and programmers. Rather few software and systems engineers are employed and even fewer electronic engineers, although the latter requirement has increased a little with their involvement in microelectronics hardware. Staff in this sector have positions or job descriptions relating to their applications experience or to the manufacturers' products or languages with which they are familiar. There is a strong requirement also for specific industry experience.

EXHIBIT IV-2

EMPLOYMENT OF PROFESSIONAL INFORMATION SYSTEMS STAFF— U.K. INFORMATION SYSTEMS EQUIPMENT VENDORS

EMPLOYMENT CATEGORY	PROPORTION OF TOTAL INFORMATION SYSTEM STAFF (Percent)
Software/Systems Engineering	28
Electronics and Product Engineering	25
Computer Programmers	11
Customer Service	11
Research/Design Specialists	9
Marketing/Technical Sales	9
Communications Engineering	6

Source: Institute of Manpower Studies

EXHIBIT IV-3

EMPLOYMENT OF PROFESSIONAL INFORMATION SYSTEMS STAFF— U.K. INFORMATION SERVICES VENDORS

EMPLOYMENT CATEGORY	PROPORTION OF TOTAL INFORMATION SYSTEM STAFF (Percent)
Programmers	45
Systems Analysts	25
Analysts/Programmers	24
Software/Systems Engineers	4
Electronic Engineers	2

Source: Institute of Manpower Studies

The private and public sector employment profile for the U.K., shown as Exhibit IV-4, is dominated rather more in the areas of data processing and management services, followed by research and design and then production and finance. By far the largest skills required are for traditional computing skills, including programming and systems analysis. Demand for communications specialists, customer service engineers and marketing/technical sales people is relatively small.

The employment profile in the U.K. services user sector is shown in Exhibit IV-5. The major requirement here is for computing skills to be used in development work. The predominant demand is for programmers followed by systems analysts, analyst/programmers and software and systems engineers. The take-up of networked workstations and of personal computers is tending to move organisations away from central data processing departments to decentralised information centres with the usual traumas that follow basic organisational changes.

EXHIBIT IV-4

EMPLOYMENT OF PROFESSIONAL INFORMATION SYSTEMS STAFF— U.K. NONSERVICES SECTOR COMPUTER USERS

EMPLOYMENT CATEGORY	PROPORTION OF TOTAL INFORMATION SYSTEM STAFF (Percent)
Computer Programmers	46
Software/Systems Engineering	20
Electronics and Product Engineering	11
Customer Service	9
Communications Engineering	6
Research/Design Specialists	5
Marketing/Technical Sales	3

Source: Institute of Manpower Studies

EXHIBIT IV-5

EMPLOYMENT OF PROFESSIONAL INFORMATION SYSTEMS STAFF— U.K. SERVICES SECTOR COMPUTER USERS

EMPLOYMENT CATEGORY	PROPORTION OF TOTAL INFORMATION SYSTEM STAFF (Percent)
Programmers	39
Systems Analysts	22
Analysts/Programmers	21
Software/Systems Engineers	16
Electronic Engineers	2

Source: Institute of Manpower Studies

4. Demand and Supply

The demand for computer staff (probably increasing overall in Europe in the range of 6-8% per annum) is being driven by a number of commercial factors that manifest themselves in:

- The increasing numbers of installed computer systems, particularly minicomputers, workstations and personal computer;
- The increase in computer applications running on these systems, and, despite increasing use of application system products, the continuing demand for individual solutions and the general requirement for applications support personnel;
- The changing mix of job requirements that will exacerbate the situation in certain skill categories. This factor is elaborated upon in section B below.

The actual shortage of staff is difficult to determine numerically since any assessment depends on the definition adopted. Some employers

define the staff shortage as the number of vacancies that have been identified. Others define it as the number of vacancies advertised that have not been filled within, say, six months. In any case any assessment of quantity relates also to the quality being sought.

The job market for highly qualified graduates and for experienced staff is an employees' market; these people will select where they go in the context principally of applicable salary. For graduates the career progression and training and experience opportunities offered will also be very important. These factors will determine the extent to which an employer will offer a high-quality image to prospective employees.

For the high-quality employer there is no skills shortage, and what there is will be remedied by training. However, for those less qualified or for those seeking experience, the available jobs are mostly with employers who do not offer these attractions, and it is these employers who experience essentially a job shortage of quality rather than of quantity for a well-defined commodity.

5. Use of Contract Staff

The use of contract staff has always been widespread amongst the electronics industry and the pattern has been followed by users of information systems. In some cases as many as 30-40% of appointments are being filled by contract staff. Contract staff are often employed because of the difficulty of recruiting permanent employees and can with value be used to meet peak requirements where the work load is not a continuing one.

However, companies are often reluctant to use contract staff because of the resentment caused amongst existing staff who are doing similar work for apparently much lower rates of pay. Further, companies are unwilling to become overdependent on short-term employees on an activity on which their businesses critically depend, because of their vulnerability to such staff leaving.

6. Contracted Services

Much of the business of the computer services industry is derived from companies who wish to make use of information systems but are unable to carry out the work with their own resources or are unable to recruit the necessary staff. It must be recognised that this has the effect of confusing the numerical estimates of the skills shortage because of double counting—a vacancy may be logged by a user, but the work load may be met by a computer services company that then seeks further staff to support an expanding business.

B

The Skills Shortage

1. Origins

An awareness of the impending problems in the supply of information technology skills first arose in Europe in the period 1977-1982. In the United Kingdom, the Manpower Sub-committee of the Electronic Computers Sector Working Party of the National Economic Development Office appears to have been the first government body to evaluate the situation. This working party identified that the skills shortage in the United Kingdom was even more acute than had previously been understood. Even at this stage it was recognised that the problem would likely remain until the end of the century.

In France, where the need for qualifications in information systems had been recognised as early as 1966, France's future dependence on computers and on 'telematique' was identified in the report addressed to the president of France entitled *l'Informatisation de la Societe* by Simon Nora and Alain Minc, first published in 1978. This report did not clearly identify a shortfall in labour resources and for a time the educational system failed to recognise that the supply of trained people was unable to match the demand.

However, following questions relating to the shortage of specialists in information systems directed at the Minister for Education in the National Assembly and subsequent debates, academia began to put its house in order and established a structured system of qualifications in these disciplines.

In West Germany, the future impact of information systems on manufacturing industries, and therefore on the future need for information systems skills, was not clearly recognised until the early 1980s. However, with the well-organised training structure in West Germany, it was simply a matter of slotting information systems into existing training programmes.

The U.K. government established 1982 as Information Technology Year, 'I.T. 82'. The government undertook the imaginative programme of supplying all schools with a micro-computer, and this action was followed in other countries, including in West Germany where the hardware was donated by industry.

Unfortunately the supply of hardware was not complemented by the supply of suitable applications software or by suitable training to the teachers as to how to use this equipment as part of a training programme. The result in all major countries in Europe was that the teachers were being taught by the pupils, or at least by the one or two pupils who had an aptitude for picking up how to load programs and by rather more who were adept at playing games.

Meanwhile, companies failed to recognise their future needs for trained personnel. The enlistment of graduates into training for the professions and of school leavers into university courses continued to be influenced by the public image of the professions in the various countries.

In West Germany professionalism is admired, amateurism is scorned and a knowledge and understanding of the work to be done at all levels is a prerequisite to advancement. Study at the higher levels has to be relevant as well as broad and a large percentage of senior managers have doctorates in a relevant field of study. In addition the Germans value 'Technik' as highly as the arts and the sciences, so the movement into 'Computertechnik' was a natural development, although the political climate in West Germany has fostered a reaction in the public mind against high technology.

France has traditionally relied on a relatively small number of highly educated professionals produced by the 'Grandes Ecoles' whose training has been dominated by mathematics, although most of these have moved into the large companies or the public sector. There is recognition in France that the analytical skills that are so well developed by the French educational system need increasingly to be balanced by training for the skills of implementation. France's problem is therefore one of quantity rather than quality. However, the engineering profession has high standing as do doctors and lawyers, but curiously the number of accountants is small by British standards.

The United Kingdom traditionally suffers from the image of an engineer as someone using a hammer and spanner, whereas the word *ingenieur* in both German and French conveys an association with the same root as the English word *ingenuity*. This was brought out in the Finniston Report on the engineering profession in 1980. As a result there are not enough students in the U.K. applying for the existing courses in mathematics and physics, and the same response has been experienced as the courses in information technology are increased.

Classics enjoyed the highest rating in the U.K. public image for public school education in the first half of the century, and the civil service is built on this tradition, but classics have been phased out during the second half. Curiously, those searching for recruits in the major information technology companies report that classics may in fact provide a better basic training for skills in information technology than do traditional physics and mathematics courses. Accountancy remains the top profession in the public image in the United Kingdom, with lawyers and doctors following.

The principal cause of the skills shortage has been the failure of employers to recognise and forecast the skills they will need in their businesses and to take appropriate steps to acquire skills by providing training. This

failure has been compounded by the failure of companies offering products and training to assist the information systems user to identify training needs in a language that users can understand, and on the educational establishments to provide qualified personnel with the capabilities that can be identified and that match the requirement.

The main reason why employers are reluctant to provide training to their employees is the time lost rather than the cost, which for most companies in most countries is recoverable to a limited extent by tax concessions or other means. In the United Kingdom the main disincentive towards allocating time to training is the fear of poaching. Many companies have wasted enormous amounts of time and money on staff only to see them lured away by other companies offering higher salaries and fringe benefits. For a period France had the same problem, but in West Germany, where skilled people are more liberally available and mobility of labour is at a considerably lower level, the problem does not seem to have arisen to any great extent.

The main response of employers to their difficulties in recruiting professional information systems staff has been to introduce higher salaries to attract recruits and/or more fringe benefits; for example, company cars. This increase in salary levels has followed particularly in the areas of high employment such as the southeast of England, the Ile de France area around Paris and the area around Munich in West Germany.

Employers' reluctance to provide training to their existing staffs is compounded by the fear of computers, keyboards and the jargon of information technology experienced by workers in nontechnical fields, particularly those of middle age and above. Many employers have to recognise that many of their employees do not, in fact, have the capacity for retraining into new types of work.

Around one-third of employers are estimated to take on no trainees and only recruit experienced staff, which exacerbates the problem of poaching for companies that do provide training to employees.

2. The Nature of the Skills Shortage

The skills shortage appears to be mainly in the area of software, systems analysts and programmers, and project managers. It is notoriously difficult, for reasons referred to previously, to compile accurate statistics on such a complex problem as 'skills shortage'. However, as a guide to the possible profile of where skills shortages are most serious, INPUT has compiled broad estimates of the scale of the problem in Western Europe. This profile is shown in Exhibit IV-6.

EXHIBIT IV-6

AN ASSESSMENT OF THE SKILLS SHORTAGE—WESTERN EUROPEAN INFORMATION SYSTEMS, 1988

STAFF CATEGORY	RELATIVE PERCENTAGE SHORTAGE (Range)
Managers	2–3%
Systems Analysts	10–15%
Programmers	12–17%
Systems Programmers	10–15%
Communications Operations Staff	8–12%
Operations Staff	4–5%

The shortage reflects a deficiency in experienced staff rather than in inexperienced recruits, which again emphasises the lack of willingness to train on the part of the employer. Smaller companies have a larger problem than the larger companies because the smaller ones cannot offer the competitive advancement progression in the information systems field that larger companies can offer, and further because not many smaller companies are prepared to offer training.

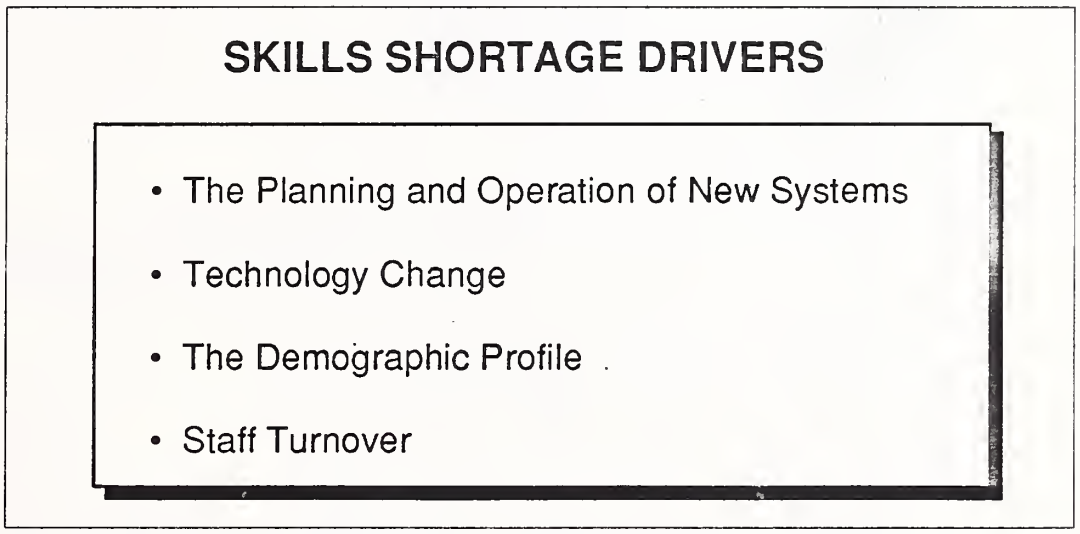
There are also regional differences in the skills shortage. In the United Kingdom, in the private sector, there are peak regional problems in Scotland and East Anglia, whereas the public sector experiences its major problems in the metropolis where competition from the private sector, particularly in respect of salary levels, is greatest. Patterns in other major countries are similar.

In the United Kingdom the shortage in the public sector runs at a similar level in both central and local government departments. The availability of training through the Civil Service colleges is offset by the straight-jacket constraint on salaries imposed by the Civil Service pay structure. The greatest problem is at the lower levels, which are traditionally the entry levels for the Civil Service.

3. Skills Shortage Drivers

The principal driving forces behind the skills shortage are listed in Exhibit IV-7. The requirement for computer staff is of course related to the requirement for the application of computer systems, starting at the stage at which the applications are identified and specified. It is at this stage that a skills shortage may cause the implementation to be abandoned.

EXHIBIT IV-7



Technology change also brings about the requirement for new skills. Of greatest significance has been the move towards networked systems and open-system communication; in the manufacturing sector the take-up of computer-aided design and manufacturing; and, with the lowering of the cost of computer power, the increasing application of expert systems. As operating systems become standardised and new languages are more widely used, more information systems staff must be trained in them. For example UNIX is now becoming a world standard and LISP and PROLOG are used extensively outside the academic communities.

A factor, perhaps of greater importance in both West Germany and the United Kingdom (but not in France), is the demographic profile. The number of 18-year-olds will drop from its peak in 1980 by 35-45% in 1995. The number of 18-year-olds is expected to take many decades to recover its previous level. This means that not only are fewer students at 18 years taking up physics and mathematics or computer science, but that the number of students available to take up these courses will drop by one third.

This fact is certainly not widely known in the United Kingdom where the skills shortage is most critical overall. It may well stimulate the British educational system into attracting more students away from other disciplines into information technology studies, and British industry into being more open-minded regarding basic education, more active in making better use of its existing skilled staff and more aggressive in making

training available. In West Germany it may well cause the long academic training to be shortened, and in both countries to make better use of persons in the older age brackets.

Population data for the age group 15-19 years for the four largest European countries is provided in Exhibits IV-8 through 11. For comparative interest this demographic data for the United States and Japan are also included as Exhibits IV-12 and 13 respectively. The histograms representing the long-term trend for this sector of the population can be easily compared. The problem faced in West Germany, the United Kingdom and Italy—in comparison with the demographic trend in France—is clear.

EXHIBIT IV-8

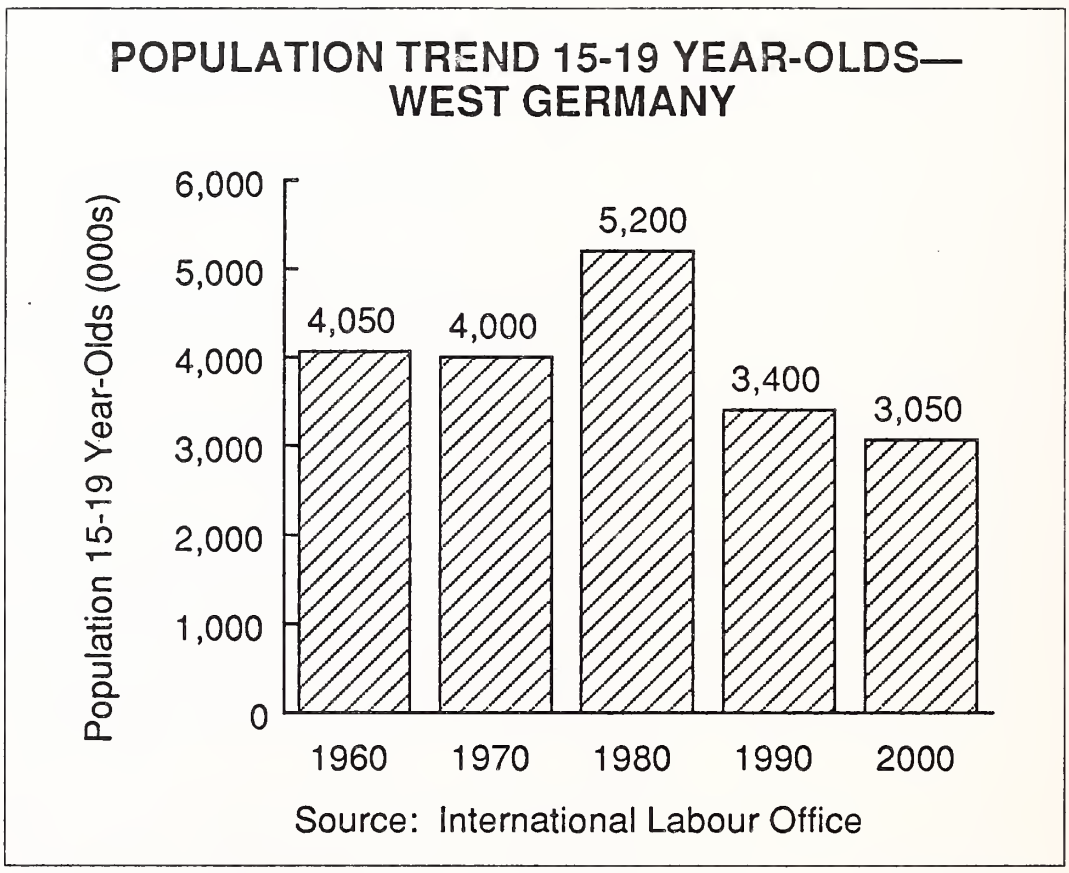


EXHIBIT VI-9

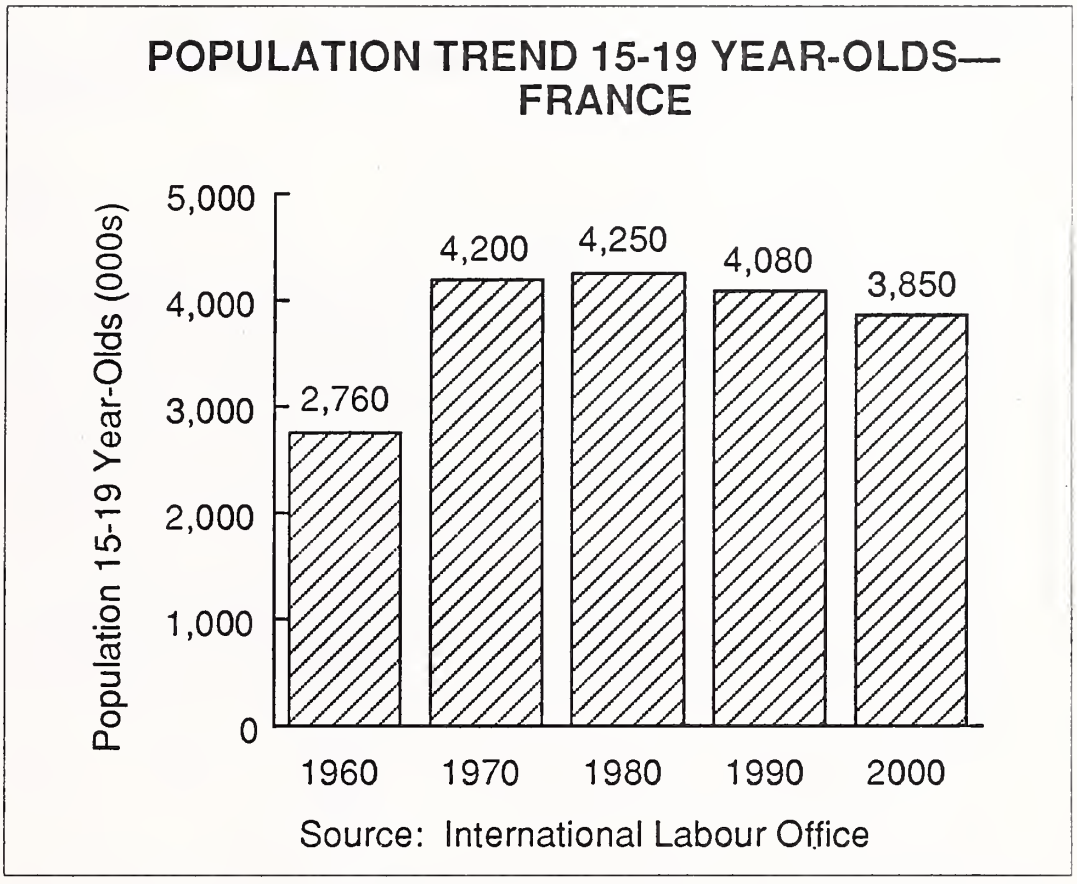


EXHIBIT VI-10

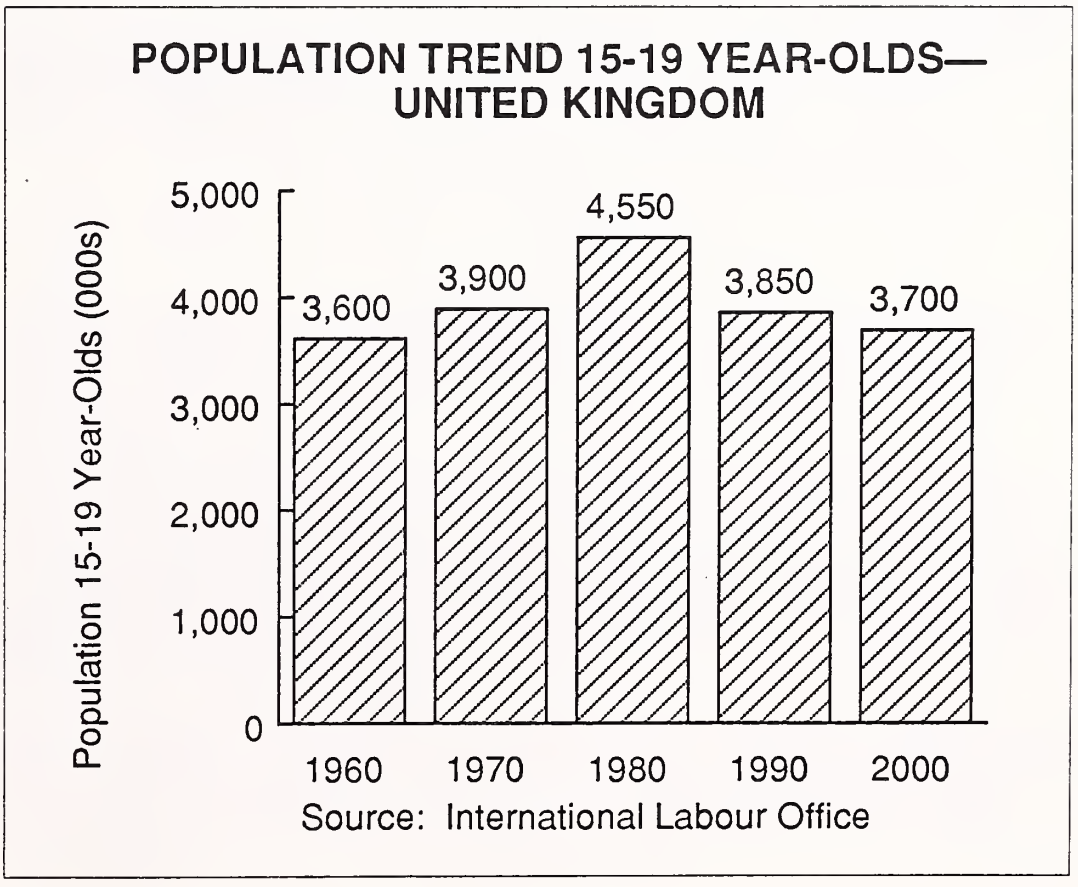


EXHIBIT IV-11

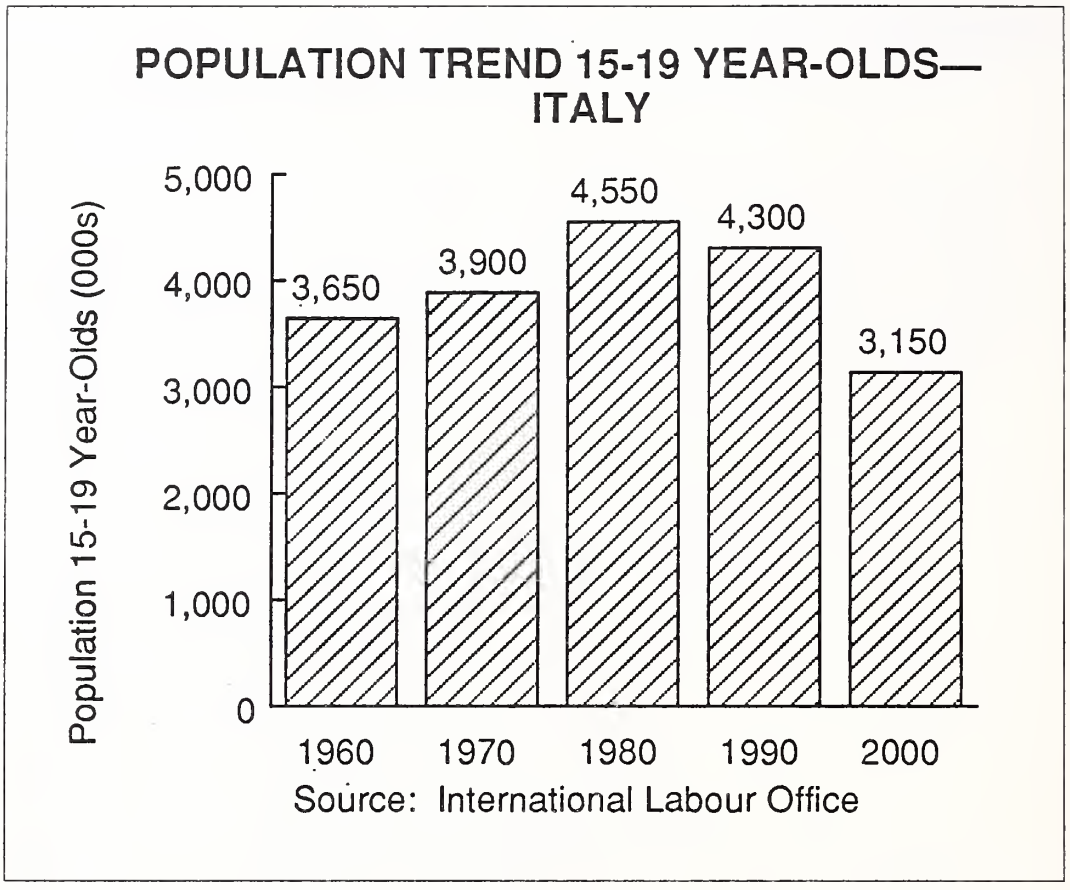


EXHIBIT IV-12

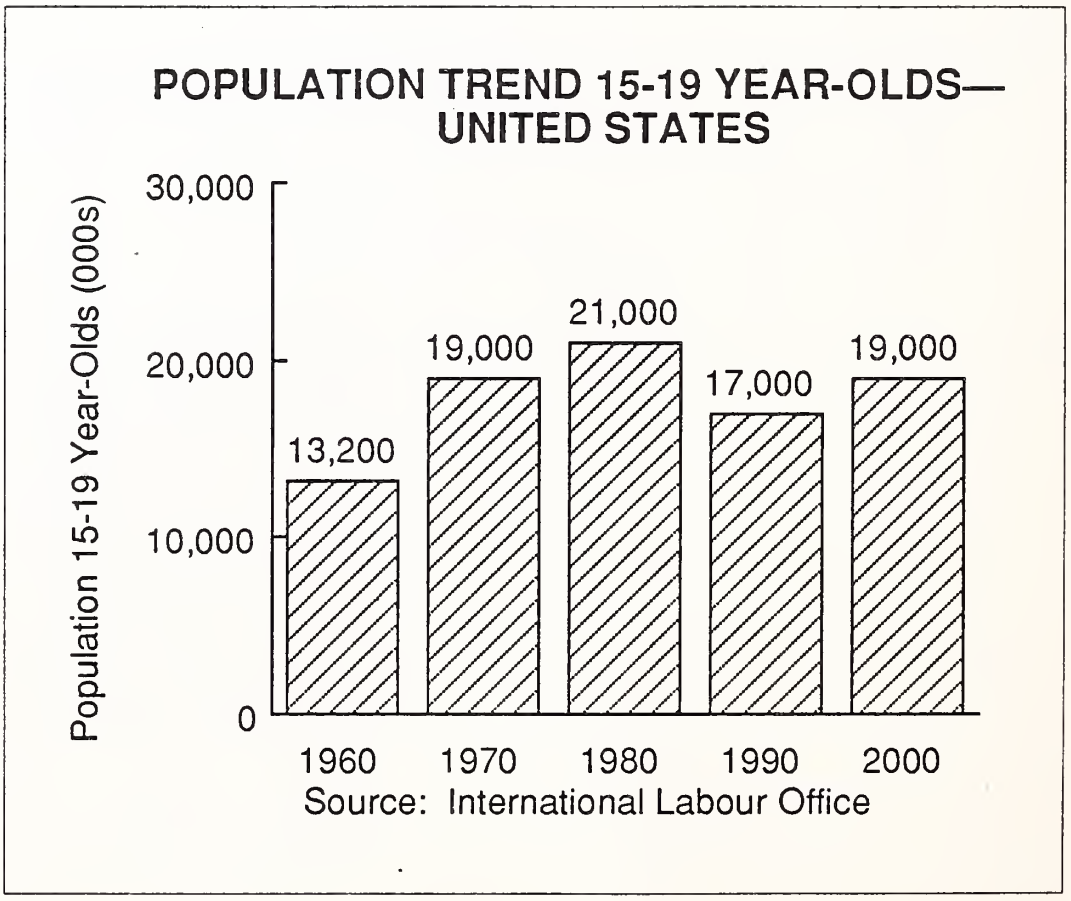
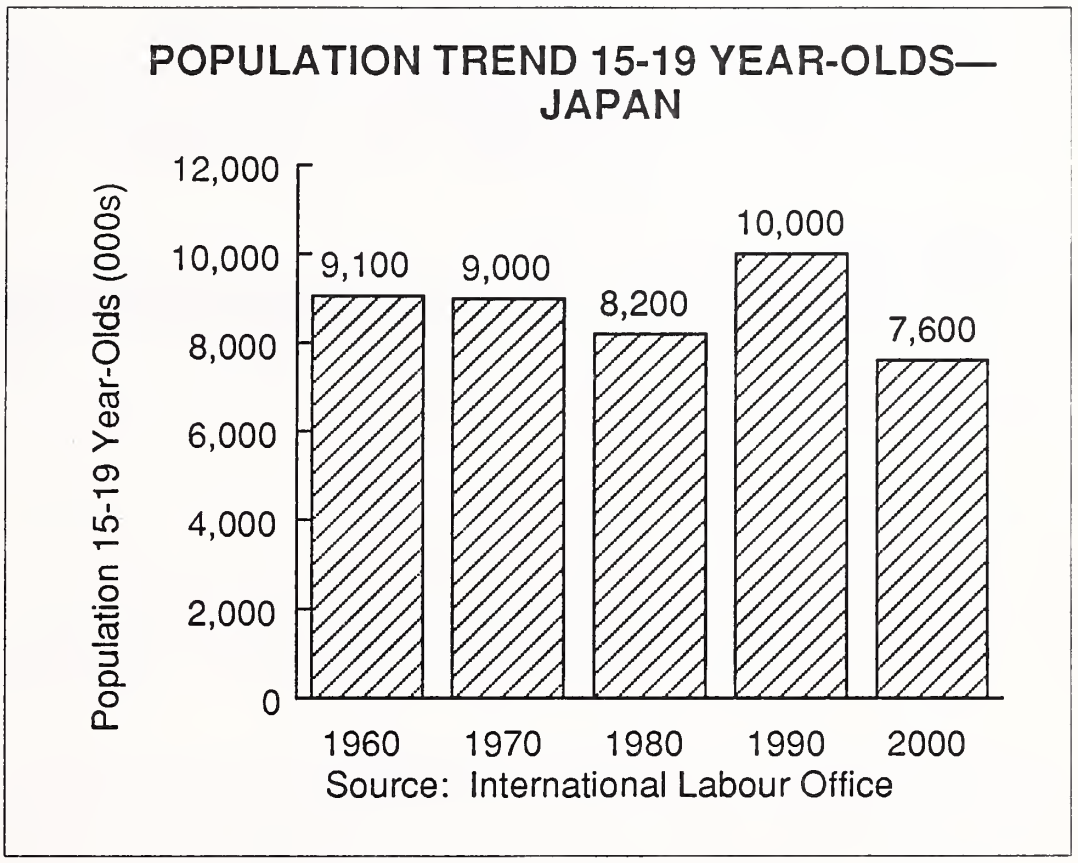


EXHIBIT IV-13



Staff turnover is an important factor in the U.K. and is now estimated to have exceeded 20% per annum amongst programmers and analyst/programmers. Turnover is highest amongst small installations and lowest amongst larger installations. In the U.K. the turnover of staff is greatest in the London area where the average turnover amongst smaller companies can be as high as 40% per annum. Further, half of all graduate recruits into information systems jobs have left their first employer within three years, which is more than double the average for all classes of graduate intake.

The information services companies, which have the highest concentrations of skills in short supply and which show the highest wastage rates, namely analysts and programmers, experience the highest turnover.

Amongst users, the engineering and manufacturing industries have the highest loss rates. In the financial services area, apart from the recent thinning in the City of London, organisations recruit more and lose fewer. There is evidence that a skills shortage itself precipitates turnover of staff due to overloading. There is also some evidence that wastage rates have begun to drop in recent years.

In the public sector, wastage takes place mostly amongst the lower grades that have received training. They then can command greater salaries outside than they can within, and prospects for career development are often greater.

4. Skills Shortage Inhibitors

There are many possible ways in which information skills shortages could be reduced or inhibited in the future. The principal factors, with the exception of the principal remedy training, are listed in Exhibit IV-14.

EXHIBIT IV-14

SKILLS SHORTAGE INHIBITORS

- The Recruiting of Graduates Trained in Computing
- Recruitment from Graduate Conversion Courses
- Recruitment of Nongraduates
- More-Efficient Use of Existing Resources
- Recruiting Experienced People
- Transfer from Defense Contracts
- The Increasing Use of Computer-Aided Software Engineering Environments and Software Tools
- The Re-employment of Older Experienced People
- The Increased Employment of Women

The intake of graduates is the prime source for reducing the skills shortage, and many companies, particularly the larger ones and those in the computer services area, provide good training and good promotion prospects for able candidates and therefore attract the cream of those available.

Some computer service companies are expanding so fast that they take in 10% of their personnel strength every year, amounting to several hundred graduates. Often the training, although of excellent quality, is provided solely for their own staff requirements and not run as a business. In fact it can be suggested that some of these companies take the view that to market their training would be counterproductive to and in competition with their main business activity of providing services to others. Around one-third of employers are estimated by INPUT to take in no trainees at all.

In some countries less than 20% of the graduate intake have qualifications in computer science. This suggests that employers do not necessarily relate qualifications in computer science as being relevant to their needs. Employers still prefer training in the basic sciences. However, this situation does not apply universally, particularly in West Germany.

A major, relatively new source of information-systems-skilled employees has been conversion courses for graduates with a first qualification in a different discipline such as science, the arts or the social sciences. Such courses are run by the public sector and a few by companies, and are generally regarded as having been a great success in the United Kingdom and in West Germany (in particular, in the redeployment of teachers).

Student demand for places has been high; most students had little difficulty in obtaining jobs and joined a wide range of information systems companies and users. More recently there has been a move to train nongraduates with lower-level qualifications in engineering since they better suit the requirements of engineering companies.

With the large number of graduates taken into some companies, personnel managers sometimes wonder whether their skilled resources are fully and efficiently used. There is evidence that as demand changes, as well as some people being underprovided with skills for the job they are assigned, there are some whose jobs could be done by personnel with lesser skills, thus freeing experienced and qualified people who already have the background of working within a particular organisation. The identification of such resources becomes more important as the skills shortage increases and demands a regular personnel stock-take and control.

Recruiting experienced people from other companies is of course a major activity and a major business for recruiting agencies, as can be seen by the scale of advertising in the principal press in any country. Recruiting contract staff has been a regular feature of employment in the electronics industry for many years, and this pattern has grown in the area of information systems skills. While the use of such staff is expedient to cover peak demands, the higher rates paid tend to be unsettling to permanent staff who are required to work alongside.

Most countries are cutting back their defence budgets, and this means that electronics companies whose business is in defence as well as in the commercial sector have people with experience becoming available. Such people can be hardware or software engineers, and often those with experience in both, which makes them particularly valuable. Their experience is, however, offset by the rather different requirements and standards of design on the hardware side, and in application on the software side, so that a reorientation into a different environment is necessary before people can become fully productive.

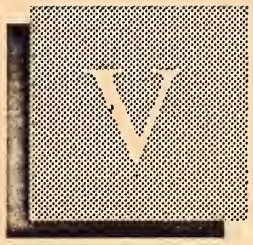
The increasing use of computer-aided software engineering environments and of other software tools will materially reduce the demand for programmers and will thus release the best of programmers for training in analysis and systems design.

One of the relatively untapped reservoirs of skills rests in older people who are near retirement or even retired from industry. The tendency in recent years has been to seek younger and younger people for more senior positions with the result that experience and maturity have become rather undervalued. There are moves—particularly in the public sector—to, instead of stating maximum ages for appointment in those tasks where mobility is not a basic requirement, state a minimum age. The private sector could well take up this new outlook.

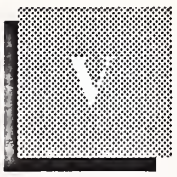
Women are perhaps the largest latent source of skills available to both the providers and users of information systems. Women have long been recognised as being well-matched to software as a profession and many have the intellectual ability and attention to detail required for work in software, which is not demanding on physical capability. Furthermore, systems analysis and programming is a task that can be done at home as well as in the office, and the developments in communications mean that a terminal in the home can be used as effectively as a terminal in the office.

Yet the number of women involved in the information industry is falling. Many women opt for work with less interest or responsibility, or give up work altogether because of the seeming impossibility of reconciling the demands of job and family. This is a challenge to personnel directors to provide terms and conditions of employment that are more attractive to women, in particular permitting part-time employment and work from home. Statistics show that the percentage of women employed as programmers in France is about 23%, whereas in Britain it is somewhat lower, more like 15-20%. As data preparation operators, of course, women have a monopoly.

It is perhaps interesting to note that the FI Group (formerly F International), which was founded by Steve Shirley with the specific aim of utilising freelance female labour, and currently has a labour force that is 90% female and 85% freelance, recently declared its aim to recruit more men and lower its freelance proportion to around 75% of all employees.



User Experience of Training



User Experience of Training

The provision of effective and adequate training for information systems skills is likely to become an area of key concern for European managers over the next five years. The penetration of information systems into every aspect of business, commerce, and administration will continue inexorably over this time period.

INPUT interviewed just over 100 general management personnel; managers responsible for functions like accounting, production, marketing, etc. These managers need to utilise information systems to support their activities and are increasingly responsible for personal computers, departmental systems, and workstations that are situated physically within their area of responsibility. These managers were questioned about a number of aspects concerning education and training in information systems. The results of this research are presented in this chapter.

Additionally, training is a key concern of information systems management. As part of INPUT's *1988 Customer Services Programme in Europe*, in excess of 1,300 information systems managers were contacted for the purpose of polling their views on the maintenance, support, and other services that they receive for their installation.

The areas covered and reported upon in this chapter are:

- Perception of the level of importance and satisfaction with training services;
- Types of training courses used; and
- Sources of training services.

A
The Need for Training

There are wide differences between companies of different backgrounds, different sizes, and in different countries as to their attitude to training and, in particular, to training in information systems. For example, firms in the information systems business recognise that training is part of their life-blood and spend a very high proportion of their resources on training.

User companies differ widely. Larger firms are more inclined to spend time training employees (some of them averaging around 10 days a year or more per employee). Many smaller companies spend nothing on training. Many entrepreneurs do not entertain training because they feel self-sufficient in their own ability and apply the same rules to their subordinates.

Attitudes also vary widely across Europe. Training expenditures in West Germany are higher than in Britain, partly because of the much higher accord West Germany gives to qualifications and training in general, and partly because of the statutory right—backed by legally enforceable employment agreements—of employees to receive a number of training days per year at full pay.

In France, a training levy is deducted from profits if it has not already been spent on training, and the amount is more than twice the training levy deducted in the United Kingdom.

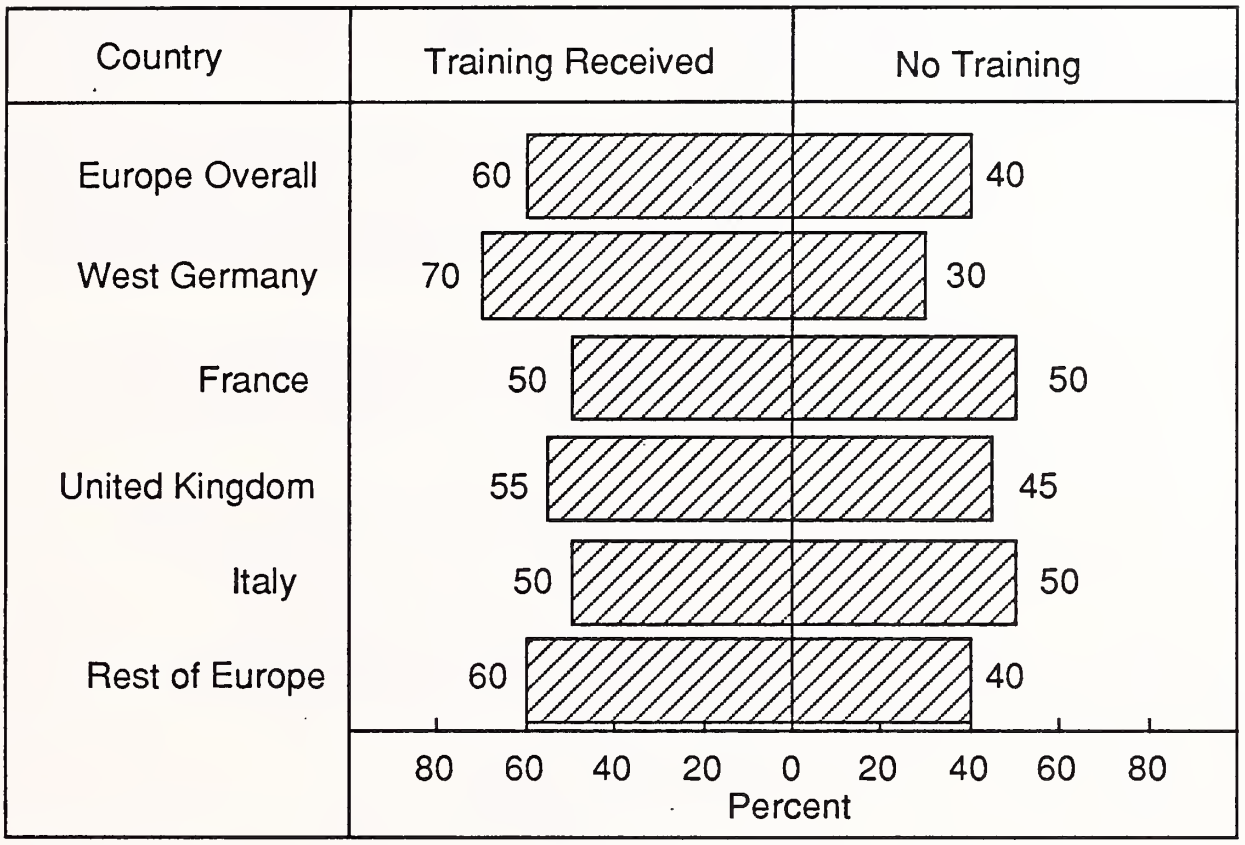
It can be seen from Exhibit V-1 that the highest percentage of data processing managers reporting the use of some training services is for the West German sample. Only 30% of West German data processing managers interviewed recorded no training received at their installation.

This contrasts with the European sample average, where 60% reported the use of training; and individual country samples from France, the United Kingdom, and Italy, which showed levels of between 50 and 55%.

Companies' reluctance to train is based primarily on the time lost on the job by the employee and only secondly by the expense of the training (including the salary of the employee while in training). A factor of equal importance is the perception that a trained employee will have a higher market value and will be attracted away by other employers. This risk is very much a regional factor depending on the density of employment in the area. The main business and industrial centres of Paris, London, and Munich are particularly fluid in the movement of personnel.

EXHIBIT V-1

WESTERN EUROPEAN TRAINING IMPLEMENTATION LEVELS INFORMATION SYSTEMS MANAGEMENT



(Totals Rounded)

Total Sample 1,346

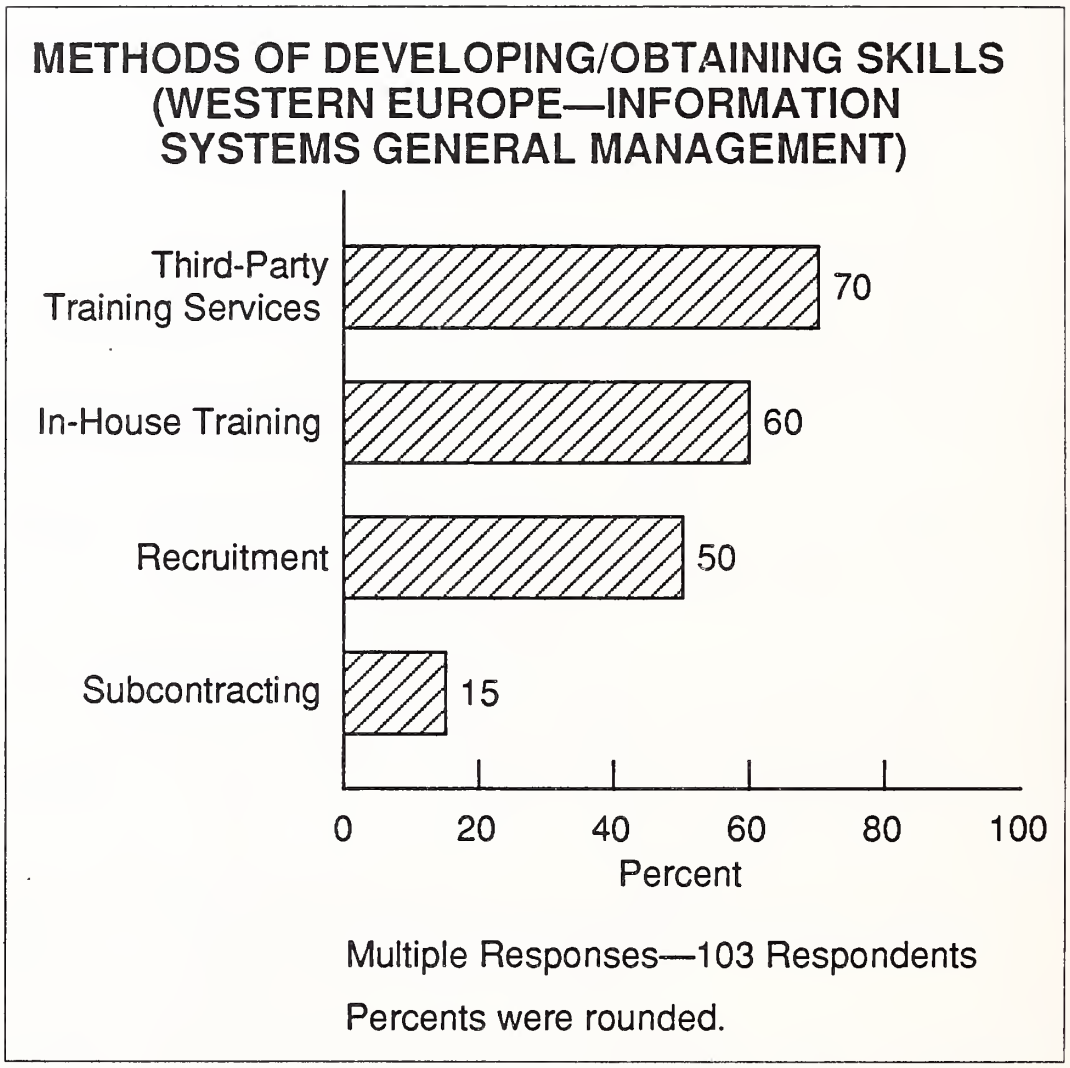
Average Standard Error: 1.3%

Many employers do not think training is sufficiently central to their business for it to be a main component in their corporate strategy; in fact they do not think it of particular importance. This complacency is reinforced by a wide-spread ignorance of how their company's performance in training compares with that of their competitors.

Decisions on training are often delegated to line managers who in many cases have short-term horizons when considering investments. In fact training is rarely seen as an investment but either as an overhead that would be cut if profits are under pressure, or as a burden imposed as a result of other developments. The resulting reluctance of many companies to invest in training is reinforced by uncertainties about future markets, prospects, and technological developments.

Exhibit V-2 indicates the profile of methods used by the general management respondent group for developing or obtaining skills. Training, whether obtained from outside services or provided in-house, was the most frequently mentioned at 70% and 60%, respectively. Recruitment was the third most-frequently mentioned method at 50%. This figure emphasises the recognition that new people with the appropriate skills are needed in order to fully implement new information system applications. Exhibit V-2 also indicates the relatively low priority accorded to the service solution to skills shortage, that is subcontracting.

EXHIBIT V-2



The individual country group analysis is shown in Exhibit V-3. The division of the sample does not allow conclusions to be drawn with great confidence on a country-by-country basis. Nevertheless, it is interesting to note the low incidence of subcontracting in the West German, Italian, and Scandinavian groups. However, the use of third-party training services shows up strongly in West Germany, the United Kingdom, and in Benelux.

EXHIBIT V-3

METHODS OF DEVELOPING/OBTAINING SKILLS COUNTRY GROUP ANALYSIS—GENERAL MANAGEMENT

Country	Number of Respondents			
	Third-Party Training Services	Recruit-ment	In-House Training	Subcon-tracting
France	12	7	15	4
West Germany	17	11	8	1
United Kingdom	17	10	14	3
Italy	4	3	10	0
Scandinavia	4	6	8	0
Benelux	9	4	4	4
Spain	6	8	5	2
Total	69	50	64	14

(Multiple Responses)

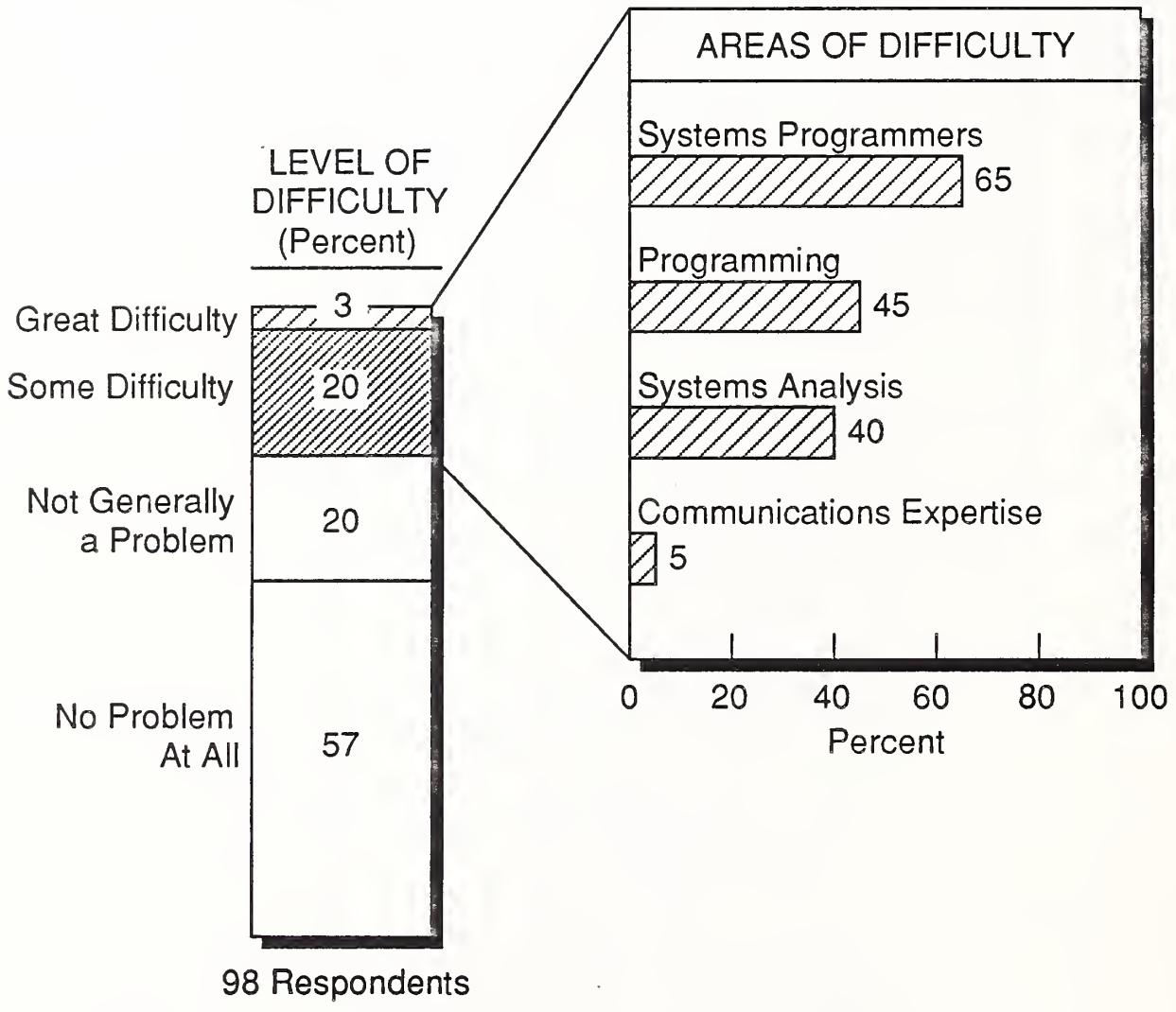
General managers were questioned as to the degree of difficulty they experienced in the recruitment of professional data processing staff to support their operations. Exhibit V-4 shows the profile that emerged from the total survey, essentially one that indicates that staff shortages are not yet a dominant feature of the European market as perceived by general management.

It can be seen in Exhibit V-4 that very nearly 80% of all managers interviewed either saw recruitment as no problem at all, or to a lesser extent not generally a problem. A further 20% reported only some difficulty in recruiting staff with only 3% reporting great difficulty.

Also shown in Exhibit V-4 are the specific job skills in which respondents indicated difficulty in recruitment. Of the categories mentioned the largest degree of difficulty was met with Systems Programmers—some 65% of European respondents cited this category.

EXHIBIT V-4

AREAS OF RECRUITMENT DIFFICULTY
WESTERN EUROPE—GENERAL MANAGEMENT



Programmers and Systems Analysts were also indicated as areas of recruitment difficulty (by some 45% and 40% of the sample respectively.) Communications expertise was not mentioned frequently, recording only a 5% mention rate.

Exhibit V-5 and V-6 provide the country group survey results that are summarised in Exhibit V-4. The size of the individual samples makes it difficult to draw strong conclusions from this data, but the following observations are indicated.

- West Germany and the U.K. have the highest level of recorded recruitment difficulty.
- France and Benelux are the areas of lowest recorded recruitment difficulty.

EXHIBIT V-5

DIFFICULTY IN RECRUITING I.S. PROFESSIONALS— GENERAL MANAGEMENT VIEW

Country	Number of Respondents			
	Great Difficulty	Some Difficulty	Not Generally a Problem	No Problem at All
France	0	1	2	17
West Germany	2	7	1	10
United Kingdom	1	4	6	9
Italy	0	0	3	7
Scandinavia	0	3	2	5
Benelux	0	1	0	8
Spain	0	4	5	0
Total	3	20	19	56

EXHIBIT V-6

AREAS OF RECRUITMENT DIFFICULTY COUNTRY GROUP ANALYSIS GENERAL MANAGEMENT VIEW

Country	Number of Respondents			
	Systems Programmers	Programming Staff	Systems Analysts	Communications Expertise
France	1	0	1	0
West Germany	7	3	0	0
United Kingdom	4	5	4	2
Italy	0	0	0	0
Scandinavia	1	2	2	1
Benelux	0	0	0	1
Spain	2	0	2	1
Total	15	10	9	5

- West Germany appears to have a significant shortage of systems programmers.

B
Sources of Training

Data concerning the sources from which computer users obtain their training services was obtained from the sample of general management and the sample of information systems management researched.

1. General Management

General management showed a widespread use of training by outside organisations quite apart from any in-house training that they may also utilise. Exhibit V-7 provides an analysis of the training sources used by the general management respondents.

EXHIBIT V-7

OUTSIDE SOURCES OF I.S. TRAINING—GENERAL MANAGEMENT RESPONDENTS

Country	Number of Respondents					
	Hardware Manufacturer	Independent Training Vendor	Professional Services Vendor	Accountancy Firm	Government Institute	Academic Institution
France	6	3	10	0	1	1
West Germany	10	5	9	0	2	2
United Kingdom	3	5	11	0	0	0
Italy	2	1	2	0	0	0
Scandinavia	2	3	2	0	0	0
Benelux	2	3	8	0	0	1
Spain	3	1	4	0	0	0
Total	28	21	46	0	3	4

(Multiple Responses)

It can be seen that the most widely used source was professional services companies. The full analysis of the sources of information systems training, by percentage of the total sample is:

- Professional Service Vendors, 45%
- Hardware Manufacturers, 27%
- Independent Training Vendor, 20%
- Academic Institutions, 4%
- Government Institutions, 3%
- Accountancy Firm, 0%

Exhibit V-7 also shows the analysis on an individual country group basis. West Germany is particularly notable for its relatively high reliance on the hardware manufacturers as a source of training. The use of independent training companies shows most penetration in West Germany, the U.K., and Benelux. It is interesting to note that although a few respondents reported using training courses provided by governments or academic institutions, no respondent reported training from an accountancy firm. The incidence of government and academic institution training is almost totally accounted for by the West German and French sample.

Exhibit V-8 shows the analysis of training subjects covered for the sample of general management respondents.

EXHIBIT V-8

ANALYSIS OF TRAINING SUBJECTS WESTERN EUROPEAN GENERAL MANAGEMENT

Training Subject	Number Using	Proportion of Total % (Rounded)
Programming	37	30
Hardware and Operations	35	30
Applications Packages	16	15
Systems Analysis	15	15
Management Awareness	6	5
Miscellaneous	5	5
Total	114	100

The most frequently mentioned were programming and hardware and operations. This statistic emphasises the importance of hardware and operations training and underlines the spread of responsibility beyond the specialised information systems department. The growth of departmental and distributed computing resources have forced general management to take responsibility for the hardware that supports their applications.

2. Information Systems Management

In the survey of information systems management, respondents were requested to list the various types of training used at their installation and to identify the category of vendor from which it was purchased. The training categories covered were:

- Operator
- Operations Management
- Systems Analysis
- Applications

In addition to identifying a possible vendor source of training respondents were also given the opportunity to identify the provision of either in-house or no training used. The categories covered were:

- In-House
- Hardware Manufacturer
- Independent Training Company
- Other
- No Training

Exhibits V-9 through V-13 show the analysis of the training sources used and the types of training used by IS management. The analysis is shown for the total Western European sample and for the four largest country markets of West Germany, France, the United Kingdom, and Italy.

EXHIBIT V-9

TRAINING USAGE AND SOURCES— WESTERN EUROPEAN I.S. MANAGEMENT

Training Source	Type of Training—Percent Using			
	Operator	Operations Management	Systems Analysis	Applications Specific
In-House	21	18	20	22
Hardware Manufacturer	35	21	19	19
Independent	7	6	12	7
Other	5	7	8	8
No Training	32	48	41	44

Sample Size: 1,346. Average Standard Error: 1%
Source: INPUT 1988 User Study

EXHIBIT V-10

TRAINING USAGE AND SOURCES— WEST GERMAN I.S. MANAGEMENT

Training Source	Type of Training—Percent Using			
	Operator	Operations Management	Systems Analysis	Applications Specific
In-House	27	25	27	22
Hardware Manufacturer	63	29	34	38
Independent	2	4	6	7
Other	2	2	1	-
No Training	16	40	32	33

Sample Size: 207 Average Standard Error: 3%
Source: INPUT 1988 User Study

EXHIBIT V-11

TRAINING USAGE AND SOURCES— FRENCH I.S. MANAGEMENT

Training Source	Type of Training—Percent Using			
	Operator	Operations Management	Systems Analysis	Applications Specific
In-House	21	12	15	22
Hardware Manufacturer	28	12	13	14
Independent	8	5	14	8
Other	9	5	3	5
No Training	34	66	55	51

Sample Size: 205 Average Standard Error: 3%
Source: INPUT 1988 User Study

EXHIBIT V-12

TRAINING USAGE AND SOURCES— UNITED KINGDOM I.S. MANAGEMENT

Training Source	Type of Training—Percent Using			
	Operator	Operations Management	Systems Analysis	Applications Specific
In-House	26	17	21	24
Hardware Manufacturer	34	26	12	16
Independent	5	6	17	7
Other	2	4	5	4
No Training	33	47	45	49

Sample Size: 293 Average Standard Error: 2%
Source: INPUT 1988 User Study

EXHIBIT V-13

TRAINING USAGE AND SOURCES— ITALIAN I.S. MANAGEMENT

Training Source	Type of Training—Percent Using			
	Operator	Operations Management	Systems Analysis	Applications Specific
In-House	12	8	11	11
Hardware Manufacturer	22	21	25	19
Independent	5	4	5	3
Other	9	12	15	15
No Training	52	55	44	52

Sample Size: 146 Average Standard Error: 3%
Source: INPUT 1988 User Study

Overall, respondents report no training in approximately 30% of all cases for operators and in excess of 40% of all cases for the other categories analysed. The West German sample shows a distinctly lower profile for no training than the average level, for example, only recording 16% for no training for operators. France and Italy show a relatively high level of no training for operations management.

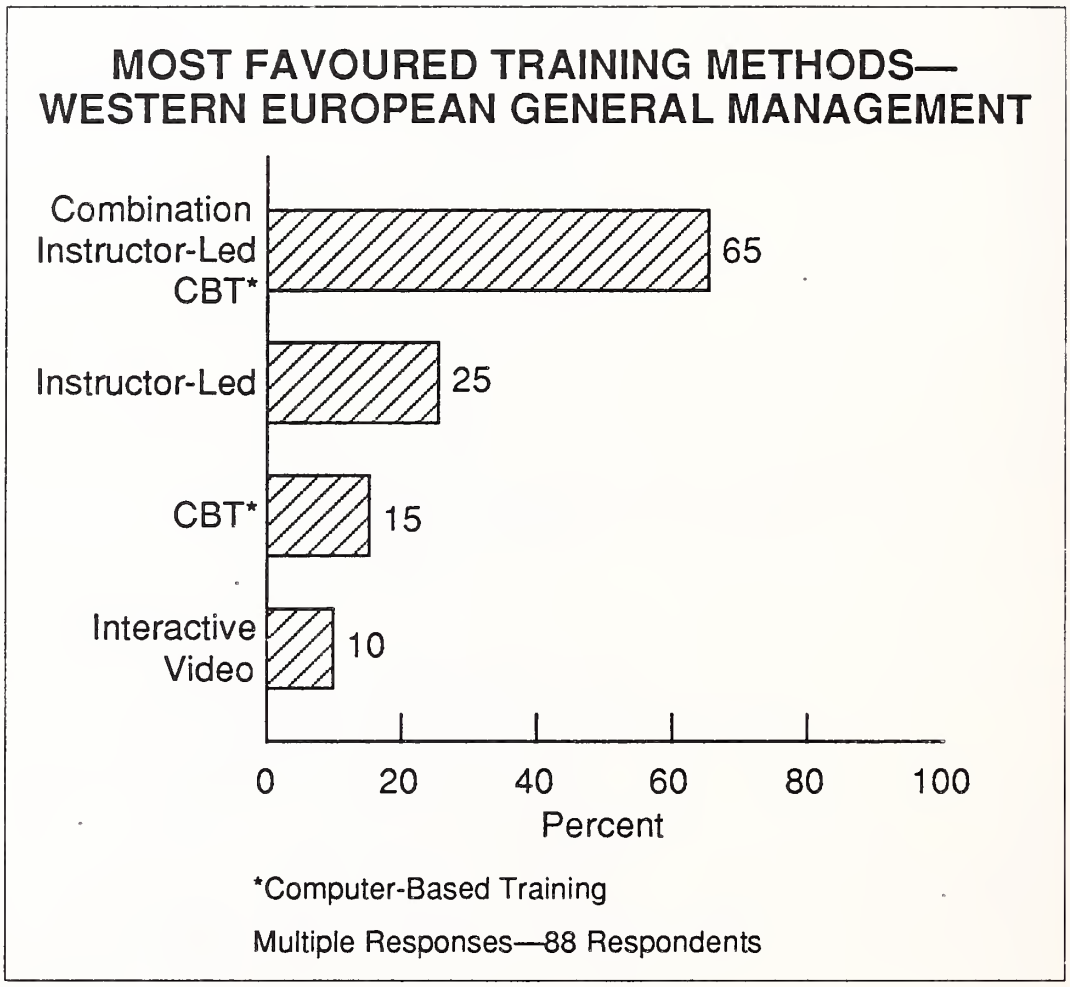
Around on-fifth of all training is carried out in-house, the survey results indicating country levels varying from around the 10% to around the 25% level. The West German sample shows generally higher levels of in-house training than for the total European sample average, thus underlining a tendency to seek self-sufficiency.

The West German sample also shows a greater than average propensity to seek training services from the hardware manufacturers rather than the independent vendors. This supports the view of the West German market as being strong for the hardware companies (West Germany is the largest hardware market in Europe) and relatively weak, given the size of the economy, for independent service companies.

C
Training Methods

General management respondents were invited to indicate their preference for the method of training on the courses that they purchased for their staff. The analysis of results is shown in Exhibit V-14. It is quite clear that a combination of instructor- and computer-based training (CBT) is considered to be by far the most popular approach, with around two-thirds of the sample favouring this approach.

EXHIBIT V-14



The relatively low incidence (15%) accorded to CBT is perhaps not surprising in view of the very real drawbacks of using this methodology exclusively. As has already been discussed (Chapter III, Section A 5), CBT can present more problems than it solves, and it is the introduction of the instructor into the scene which ameliorates many of the problems. The instructor implies commitment on the part of the students in terms of both time and effort and introduces vital feedback.

Exhibit V-15 provides a country group analysis of the total sample data presented in the previous Exhibit. The CBT users are almost entirely within the French and United Kingdom samples, although some 7 West German respondents reported using a combination of instructor-led and CBT courses. No CBT or interactive video training was recorded for Italy or Spain.

EXHIBIT V-15

COUNTRY GROUP ANALYSIS—MOST FAVOURED TRAINING METHODS WESTERN EUROPEAN GENERAL MANAGEMENT

Country	Number of Respondents			
	Interactive Video	Computer-Based Training	Instructor-Led	Combination Instructor-Led and CBT
France	1	8	5	12
West Germany	2	1	6	7
United Kingdom	5	5	6	7
Italy	0	0	0	8
Scandinavia	2	1	2	8
Benelux	1	0	3	7
Spain	0	0	1	8
Total	11	15	23	57

D

Satisfaction with Training

1. General Management

Some indication of the level of satisfaction with the training courses used as perceived by the general management respondents can be gained from Exhibit V-16. Respondents were requested to indicate areas in which they felt could benefit from further attention in the future, and the analysis of their responses is shown in this Exhibit. For most categories of training around one-fifth of the respondents reported a desire for some level of improvement. Exhibit V-17 provides the detailed country group analysis of this data.

EXHIBIT V-16

TYPES OF EDUCATION/TRAINING REQUIRING MORE ATTENTION— WESTERN EUROPE GENERAL MANAGEMENT

TYPE OF IS-RELATED EDUCATION/TRAINING	SAMPLE (Percent)	SAMPLE (Number)
Custom-Built Courses In-House	22	13
IS Awareness	22	13
Programmer Training	21	12
Project Management	21	12
Applications	20	11
Systems Analysis	17	10
Operator	17	10
Computer-Based Training (CBT)	15	9
Technical Product	12	7
Telecommunications/Networks	2	1

Number of Respondents = 58
Multiple Responses

EXHIBIT V-17

TYPES OF EDUCATION/TRAINING REQUIRING MORE ATTENTION

Country	Number of Respondents									
	CBT	In-House Custom	Applications	IS Awareness	Systems Analysis	Programmer	Operator	Project Management	Technical Product	Telecomms/Network
France	2	1	1	3	0	0	0	1	2	0
West Germany	2	1	1	1	1	3	3	3	0	1
United Kingdom	1	1	1	2	0	0	0	0	1	0
Italy	2	4	0	0	0	1	2	2	0	0
Scandinavia	2	5	2	0	1	5	5	5	2	0
Benelux	0	1	3	6	3	1	0	1	1	0
Spain	0	0	3	1	5	2	0	0	1	0
Total	9	13	11	13	10	12	10	12	7	1

This profile is in line with the responses given to the direct question as to whether respondents were satisfied with their organisation's current arrangements for IS-related training. The vast majority of respondents—very nearly 80% of the total sample expressed satisfaction with the IS-related training they were currently using. A minority, about 10%, expressed dissatisfaction; the remainder did not respond to this particular issue.

Some indications of the reasons why training policies or arrangements were considered successful or unsuccessful can be gained from the

comments included as Exhibits V-18 and V-19. Exhibit V-18 lists a selection of comments made by general management with regard to the success of training programmes.

EXHIBIT V-18

REASONS GIVEN FOR A SUCCESSFUL TRAINING POLICY—WESTERN EUROPEAN GENERAL MANAGEMENT

- 'As it is all in-house, we can ensure the quality.'
- 'Because it is a combination of outside and inside resources.'
- 'Being a small company ensures a high instructor/student ratio.'
- 'The instructor must have a good knowledge of the internal problems of the company and the training must be done on the equipment to be used.'
- 'We do it ourselves so we can control it.'
- 'Using experienced instructors.'
- 'Using the hardware manufacturers who are very experienced in training.'
- 'Seeking trainees that have both home micro and personnel skills.'
- 'We design the training to be exactly tailored to our needs.'
- 'The overall effect is successful—out training never really stops.'
- 'By informing people very clearly about the problems they will be dealing with.'
- 'Training people who do not have much experience makes it easier for them to adapt to the needs of the company.'

Exhibit V-19 lists a selection of indications as to why respondents felt they had problems with their training programmes.

EXHIBIT V-19

REASONS GIVEN FOR TRAINING PROBLEMS—WESTERN EUROPEAN GENERAL MANAGEMENT

- 'Ineffective methods—just lectures.'
- 'The training was not specifically targeted to our requirements.'
- 'The range of courses is not wide enough.'
- 'The level of staff we have to recruit are too inexperienced because of salary problems.'
- 'The training was too general and not directed at the problems of the company.'
- 'Too much theory and not enough on the job training.'
- 'Too much to be studied in too little time, not enough time for practice.'
- 'Outside training should be adaptable to our special needs.'
- 'Training should cover more areas in computer technology.'

2. Information Systems Management

In the user sample of information systems management, respondents were requested to rate the level of importance and the level of satisfaction that they attributed to four types of training:

- Operator
- Operations Management
- Systems Analysis
- Applications

Both importance and satisfaction were rated against a scale of 0 to 10, where 0 would indicate either:

- Of no importance at all
- Completely dissatisfied

And 10 would represent either:

- Very important
- Completely satisfied

The results of the research on this particular question are tabulated in Exhibit V-20. Where the level of satisfaction exceeds the importance rating, there exists some indication that clients are being oversatisfied, that the resources input to this area exceed that which is necessary. The opposite conclusion will apply in areas where the level of importance exceeds the recorded level of satisfaction. Interestingly there is not one occurrence of this within Exhibit V-20.

3. The Qualification of Courses

Training courses available on the open market can be of variable quality and it is difficult for persons not familiar with the market or the companies operating in it to distinguish between courses of higher and lesser quality; the principal selection criterion is often price.

There would thus be considerable value in having some form of qualification of training courses by an independent authority that would be helpful to less-informed users. The United Kingdom has made a start on such a scheme with the Information Technology Training Accreditation Council (ITTAC), which was set up for the purpose of creating approved lists of U.K. suppliers of information technology training to assist delegates from overseas, particularly from Commonwealth countries.

It can also be a problem for users to know what sort of training is required by its staff, or to be able to validate requests for training from staff. Providers of information systems and services could well specify the training required by user staffs in a form with which users could more readily identify.

EXHIBIT V-20

LEVELS OF IMPORTANCE AND SATISFACTION FOR TRAINING— WESTERN EUROPEAN INFORMATION SERVICES MANAGEMENT

Country/Group (Sample Size)	Type of Training				Average Standard Error
	Operator	Operations Management	Systems Analysis	Applications	
Total Sample (1,346)	7.5 / 8.0	7.0 / 8.1	7.2 / 8.2	7.2 / 7.8	0.06
West Germany (207)	7.9 / 8.6	6.8 / 7.8	7.4 / 7.9	7.2 / 8.4	0.15
France (205)	7.5 / 8.1	6.4 / 8.6	6.8 / 7.5	7.2 / 7.6	0.16
United Kingdom (293)	7.6 / 7.7	7.4 / 8.0	7.3 / 8.8	7.3 / 7.2	0.13
Italy (146)	7.3 / 8.1	7.3 / 8.0	7.6 / 8.0	7.5 / 8.4	0.18

Key: Importance / Satisfaction

Scale 0-10

Importance 0 = Of No Importance
10 = Very Important

Satisfaction 0 = Completely Dissatisfied
10 = Completely Satisfied

E

Other User Issues

1. Government Grants

The availability of government grants for training in information-systems-related subjects is discussed in respect of individual government policy in Chapter VI. The user issue is whether they are available and if available the degree to which they are taken up. Exhibit V-21 shows the results obtained from the general management group of respondents.

EXHIBIT V-21

AVAILABILITY OF GOVERNMENT GRANTS FOR TRAINING—GENERAL MANAGEMENT

Country	Number of Respondents			
	Available	Not Available	If Available	
			Take Advantage	Do Not Take Advantage
France	21	0	12	9
West Germany	0	20	-	-
United Kingdom	2	17	NR	NR
Italy	0	9	-	-
Scandinavia	1	8	NR	NR
Benelux	10	0	6	4
Spain	6	1	1	5
Total	40	55	19	18

NR = No Response

There were some 'don't knows', but apart from them very clear differences exist between the different country groups. France, Benelux and Spain are the areas with grant availability, in contrast to West Germany, the United Kingdom, Italy and Scandinavia where generally grants are not available.

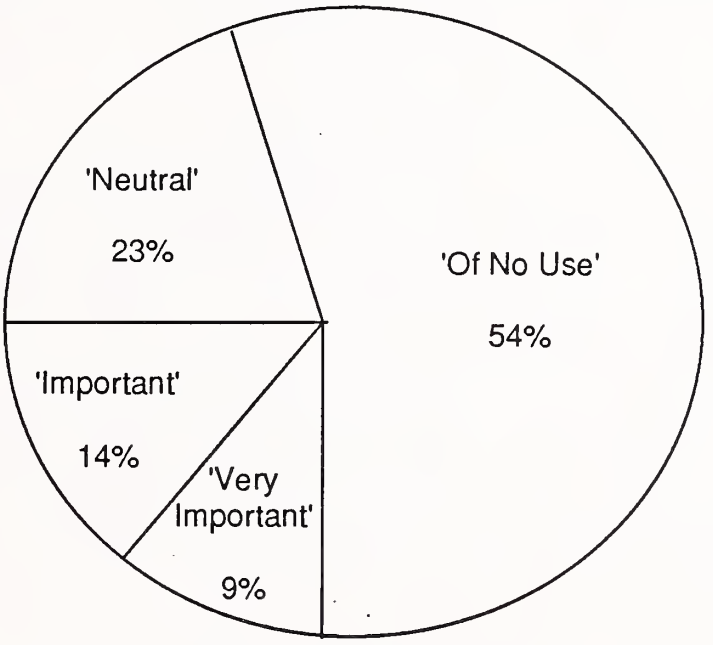
It is also interesting to note the take-up of grants where they are available. Some 40% of respondents in France and the Benelux, and 80% in the Spanish sample, reported that they did not take advantage of these grants. One is left to speculate on the degree to which bureaucratic difficulties lead to this situation.

2. Training Accreditation

A further issue that is raised from time to time by official bodies and government organisations is that of accreditation for IS-related training. Exhibit V-22 shows the spectrum of opinion on this topic expressed by the user sample. Exhibit V-23 shows the country group analysis that makes up the European analysis shown in the previous exhibit.

EXHIBIT V-22

USER ATTITUDE TOWARDS ACCREDITATION FOR I.S. TRAINING— WESTERN EUROPEAN GENERAL MANAGEMENT



Number of Respondents = 95

EXHIBIT V-23

COUNTRY GROUP ANALYSIS—ATTITUDES TO ACCREDITATION FOR I.S. TRAINING

	Number of Respondents			
Country	Very Important	Important	Neutral Opinion	Of No Use
France	0	5	2	14
West Germany	4	3	7	1
United Kingdom	0	1	6	14
Italy	0	0	4	6
Scandinavia	2	0	2	6
Benelux	1	1	0	8
Spain	2	3	1	2
Total	9	13	22	51

It can be seen that a significant proportion of respondents (55%) considers that training accreditation is of no use at all. This opinion is very marked for the French, United Kingdom and Benelux samples. In contrast only one quarter of the total respondents noted training accreditation either as important or very important. West Germany, not surprisingly, and Spain were the two countries that showed most strongly on this question in the sample.

This profile is mirrored in the attitudes, in the different countries, towards university qualifications. In the United Kingdom employers do not seem to regard the training in information systems offered by universities and technical colleges as particularly well matched to that required for entrants into industry.

Computer science courses can be expected to be general in nature, whereas jobs in industry are mostly highly selective. However, some employees do not place a high regard on the training given in computer science. There is less evidence of this is France and West Germany where criticism of the products of the universities and technical colleges is less often heard.

3. Trade Unions

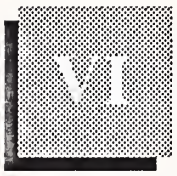
In some countries, in particular West Germany and the United States, unions take a lead in training in the interests of their members. Funds that industry is required by law to make available to the Chambers of Commerce are administered jointly by the unions and industry, and a significant amount is spent on training. Industry accepts the burden because the Chambers of Commerce offer significant services to industry in other ways.

In some Lander (West German states), unions negotiate employment agreements on behalf of their members. These agreements provide, *inter alia*, for the provision of training, and are legally enforceable. In certain of the northern Lander the unions have been successful in negotiating 'Bildungsurlaub', which is entitlement to several days a year of leave for training.

Employers regard these entitlements with suspicion since there is no guarantee that the training taken up by the employee will be technical training associated with the job, rather than training of a less constructive nature.

Unions in the United Kingdom have hitherto taken little interest in the technical advancement of their members, but recently the A.S.T.M.S. (The Association of Scientific, Technical and Managerial Staff) has been promoting a campaign to make training and retraining a contractual right of employment.

Country Market Characteristics



Country Market Characteristics

This chapter of the report provides a commentary on the types of attitudes towards education and training that are found in the individual country markets of Western Europe. Also included is a brief commentary concerning relevant initiatives undertaken by the European Commission. This chapter is structured under the following headings:

- West German market environment
- French market environment
- United Kingdom market environment
- Other European country market environments
- European community initiatives

A West German Market Environment

1. The Educational Culture

The Federal Republic of Germany has a long-established tradition in education and training. Professionalism is admired, and a thorough knowledge and understanding of the work to be done in all respects is regarded as an essential requirement of advancement.

Furthermore, technology ('Technik') is rated high in the public image, maybe even higher than the arts and sciences. In contrast to the United Kingdom, where there is a ceiling on advancement in a purely technical position and a person must be rated as a manager in order to advance in salary, in Germany technical attributes are recognised and rewarded in equality with managerial attributes.

Even a potential high flyer who comes to a company with good academic qualifications must expect to pass through an apprenticeship period in the selected field, and many in the top echelons of industry and government have a technical doctoral degree. Even in manufacturing divisions a manager will be well qualified academically, often with a doctorate: in the chemical industry it is almost a necessary passport to promotion.

As a result, an employee in a West German company is seldom appointed to a management position before the age of 30. Furthermore, a graduate in a nontechnical subject is unlikely to find a place in a West German manufacturing or service industry.

2. The Management of Training

The responsibilities for education and training are rather fragmented in West Germany. Education in the sense of schools and universities is the province of the regional states (the 'Lander'), whereas training in the sense of apprenticeship and the training of technicians is the province of the Federal government (the 'Bund'). Training carried out in industry and the retraining of the unemployed is carried out again in a regional manner, a very significant part being played by the Chambers of Commerce (Industrie u. Handelskammer) with the cooperation of industry and the unions.

The core element of the German vocational education system is the dual training system ('duale Ausbildung'), which consists of practical on-the-job training in a specific occupation accompanied by complementary classroom work in a part-time vocational school. The on-the-job training is provided by companies, many of them small companies, in accordance with national training regulations that specify minimum skill requirements for categorised job specifications developed jointly by management and unions.

Thus there is a very scientific approach to the definition of job specifications and job requirements, and a large amount of resources is applied to updating and refining these. Information systems jobs have not yet been fully brought within these training regulations.

Cost of this training is funded by the companies concerned, of which approximately two-thirds of the places are with small companies of fewer than fifty employees. The training provided by the schools is carried out in accordance with curricula issued by the individual states and harmonised by training regulations. Training is funded by the regional states.

Industrial training ('Weiterbildung') is provided by a large number of different organisations; the regulations are issued in each case by the responsible authority, very often a Chamber of Commerce. These regulations are developed in each case jointly by management and unions, often with representatives of the federal authorities to catalyse and sometimes to mediate. In some regional states, particularly those in the north, regulations are the subject of employment agreements between employers and unions.

These agreements often provide for a 'Bildungsurlaub' (leave of absence for training) whereby employees are entitled to a number of days per year for training on subjects of their own discretion. The Chambers of Commerce are funded by obligatory levies on industry, for which there are certain reduced rates and exemptions. The cost of these levies is not generally regarded as a burden by industry, because in addition to their work in training, the Chambers of Commerce are primarily concerned with promoting the economic interests of the region and provide other and varied services to their members.

However, the availability of substantial funds for training through corporate bodies such as the Chambers of Commerce has been accompanied by insufficient quality assurance on the part of those who assign the funds, and the levies are unpopular in some areas for this reason. Furthermore, employees who take a 'Bildungsurlaub' to study political subjects would not be well received.

As a result of the highly fragmented responsibilities, there are a number of federal institutions that have the role of promoting cooperation between the private and public sectors. Notable amongst these are the Federal Institute for Vocational Education ('Bundes Institute für Berufsbildung') and the Federal Employment Institute ('Bundesanstalt für Arbeit'). The cooperation between federal and regional state governments is institutionalised through the Federal State Commission for Educational Planning and the Promotion of Research ('Bund-Lander-Kommission für Bildungsplanung und Forschungsforderung').

3. Information Systems within the Training System

In the early 1970s, the state governments began to introduce computer studies into secondary education but to varying extents. In 1981 the Federal Ministry for Research and Technology ('Bundesministerium für Forschung u. Technik') issued a fundamental report entitled 'Informationstechnik', which analysed the impact of information technology on industry, employment, public services, entertainment and education, and put forward proposals for measures to improve general market conditions, public awareness, motivation and education, the modernisation of communications networks, applications in defence and a programme in research and development. In 1983 these proposals were adopted and a plan for funding to the extent of DM 4 billion ($2.2 billion) over the period 1984-88 was approved. In the field of education in information technology the plan provided for:

- The development and proving of courses for teaching information technology in secondary schools;

- The training of trainers and teachers in information technology;
- The equipping of all schools with apparatus (donated by industry);
- The development of the specification of qualifications in information technology;
- A new pilot project programme on initial training in information technology suitable for use in industry and in training centres in order to assist industry and also provide for the development of training regulations;
- The funding of workstations and networks for universities;
- The provision, having in mind especially small- and medium-sized enterprises, of in-house training schemes based on remote learning and modular courses;
- The participation of the media in increasing public awareness.

Concurrently the Federal Ministry for Education and Science ('Bundesministerium für Bildung u. Wissenschaft') and Federal Ministry for Economics ('Bundesministerium für Wirtschaft') are providing supplementary funds to equip noncompany vocational training centres with the new technologies.

As a result of these comprehensive training programmes, West Germany has been, in fact, overprovided with skilled workers. The result has been that trained workers have had to carry out duties corresponding to a lower level of training (for example toolmakers working on production assembly lines). This has not been generally so in information systems skills where job vacancies have been reported at the peaks of economic activity, only to be smoothed at times of economic depression. Current shortages are mainly for those with systems integration and application-specific experience.

In some professions there has been pronounced unemployment (for example, school teachers, particularly in the north). The West German system does not welcome graduates who switch professions, but Siemens A.G., in particular, has been successful in running conversion courses for teachers of arts subjects.

4. Tax Incentives

Although some funding for vocational training comes through the obligatory levy paid to the Chambers of Commerce, tax concessions for training are available from federal tax legislation, and regional state and local taxes are a fixed proportion of federal income tax. Trade taxes are levied

on company profits by local authorities, in addition to corporation tax, which is levied centrally.

Employers are entitled to deduct from taxable income any expenditure relating to adult training, and employees are entitled to deduct expenses necessary to realise, perpetuate or protect their gross income, provided they are connected with current or future earnings in the same occupation. Fees for conversion courses therefore do not qualify.

5. Future Trends

Funding of training is derived approximately 56% from industry, 22% from the public sector (i.e., federal, regional and local government), and 22% from the Federal Employment Institute (mostly derived from the unemployment insurance levy). Although government expenditure is increasing, it is used for priming new arrangements for training. Increasing expenditure by the private sector is expected to follow.

West Germany is faced with a tougher demographic problem than even the United Kingdom, and the crunch will be happening at a time when older managers are due to retire in substantial numbers. West Germany is well positioned to cope with this situation because of its current overprovision of skills. In addition, it is likely that steps will be taken to reduce the length of academic training, which will cause an increase in training by industry.

Furthermore, West Germany has a large reserve of well-educated and trained women, many of whom do not work in paid employment. Although the prejudices and difficulties experienced by women in West Germany are not unlike those in other countries, women will be expected to play an increasingly important role, particularly over the next few years.

Although a large proportion of the training undertaken by industry takes place in small- and medium-sized enterprises, the smaller companies have had a special difficulty in absorbing information systems. The government is aware of this and is taking special steps towards assisting small companies.

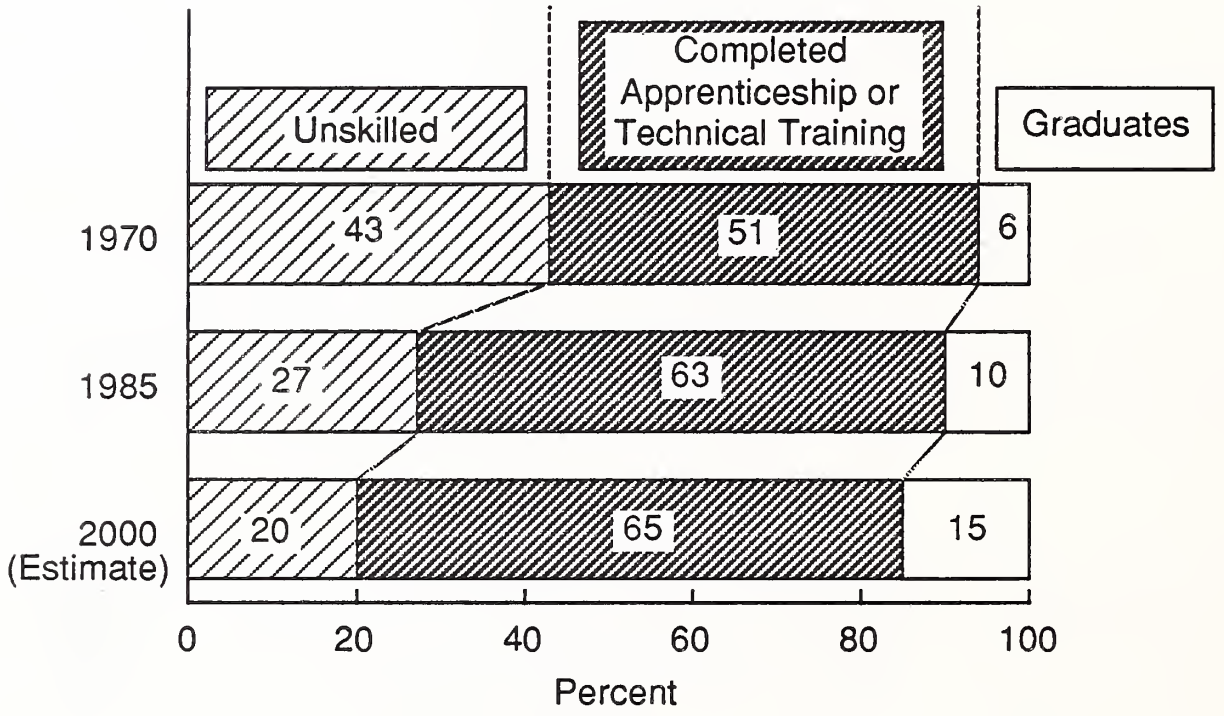
Compared with the United Kingdom, the rate of movement of personnel between companies has been relatively small and has been a major factor in reducing the replacement demand. However, replacement demand may be expected to rise in the 1990s as a result of the ageing profile of the labour force.

As for the future, the West German public expects "the future to belong to the qualified".

This trend is manifest in projections made by the West German government with regard to the proportions of the working population that either complete apprenticeships or technical training or graduate from university. Exhibit VI-1 provides the comparison between the years 1970, 1985 and 2000 projected for the principal forms of qualification. The understanding of the economic significance of training can be summarised by the following three statements:

EXHIBIT VI-1

**QUALIFICATION PROFILE—
WEST GERMAN WORKING POPULATION**



Source: West German Federal Government

- People are the most important economic asset.
- Education and training and technical and scientific knowledge are more important than any natural resource.
- Untrained people face disadvantages in many ways; for example, unemployment, lower incomes and, later, lower pensions.

B

French Market Environment

1. The Educational Culture

Educational thinking in France has long been dominated by the Cartesian tradition in which rationality and logical thinking are greatly valued. Thus proficiency in mathematics is the basis of the most highly prized

baccalaureat C certificate. The difficulty of this examination tends to make all but the best candidates shy away from it.

The emphasis for the entry into the engineering and business schools of the 'grandes ecoles' is proficiency in mathematics. Thus, the top echelons in the state and private enterprises consist of a rather small elite from a narrowly based social class. This elitist tradition has existed against a background of antipathy to industry and the notion of profit.

In the changing economic climate of the last few years, however, there has been a marked change and enthusiasm for industry as the provider of wealth and of jobs. Many educators have felt that analytical skills need to be balanced by implementation skills. There is also a marked increase in the regard for business as a career. The business schools have increased their public image (approaching the image accorded to the engineering schools), and management training, including specialist training in information technology, has become recognised as an essential part of career advancement.

It is expected that this new vocationalism will put increasing pressures on the larger companies to provide educational opportunities to operatives and management who entered these companies without having appropriate qualifications.

2. Recognition and Management of the Skills Crisis

The Nora & Minc Report in 1978 brought wide attention to the country's future dependence on information systems, and this was followed by an early recognition, particularly in the small-business area, of the deficiency in skills. However, the educational system refused to recognise this deficiency in the 'formation initiale' it provided.

Furthermore, there was no shortage of candidates to industry and business, but no 'formation continue' or on-the-job training to render these candidates useful in their work. As a result a competition in salaries developed to attract the few with experience.

In 1982, the association of computer service companies, SYNTEC, was particularly active in lobbying government: attention was concentrated on a report prepared by a M. Sarnoux. As a result, an action plan for a new start, called *Plan filiere electronique*, was set up jointly by the Ministry of National Education and the Ministry for Professional Training to remedy the shortage of professional grades and technicians in the computer systems industry, as well as the electronics industry, as identified through the national planning process. The objective was to train 5,000 engineers in 3 years by upgrading the skill of qualified technicians.

The syllabus of each of the relevant degrees and qualifications was revised and an additional two years *formation initiale* was introduced for less-academic students to take them from the CAP (Certificate d'Aptitude Professionelle) and the more broadly based BEP (Brevet d'Etudes Professionelles) to the equivalent level of the baccalaureat. The goal was increase the current 40% of all students reaching the baccalaureat level to 80%.

The industries and universities were brought into closer partnership through concepts such as TECHNOPOLE, and progress was lubricated by government money. The plan is reported to have worked well in quantitative terms, with a throughput of 1,500 trainees a year, but there is some doubt about quality. This doubt may be attributed to the failure of the organisers to consult fully with employers before funding the training places.

The successor to the *Plan filiere electronique* is now underway. The Industry Ministry has moved away from a sectorially based approach to a recognition of a need for a more general upgrading of high-level skills. The new programme will be cross-sectorial and will include upgrading training for managers as well as for technical grades. The objective is a 25% increase over the 1,500 trainees a year achieved under the original *Plan filiere electronique.* The new programme calls for more active participation from industry. Training organisations will be only partly funded by government money for the additional places; the balance will be obtained from industry. There is concern, however, that there may be shortages of trainees due to a recent sharp drop in the allowances paid to unemployed participants, and also a shortage of places.

The result is that today there are sufficient numbers of applicants for jobs in information technology, but a recognition that the quality needs to be further increased. The principal actors in the government sector are the Centre d'Etudes et de Recherches sur les Qualifications (CEREQ), which carries out studies and research in qualifications, and the Centre pour le Developpement de l'Information sur la Formation Permanente (Centre INFFO), which publishes lists of training courses.

Others involved are the Office National d'Information sur les Enseignements et les Professions (ONISEP), which does similar work in respect to school and university courses, and the Agencie Nationale pour l'Emploi, which deals with employment and unemployment.

3. Tax Incentives

Under the provisions of an act passed in 1971 (Participation des Employeurs au Developpement de la Formation Continue), all firms employing ten people or more were required to spend 0.5% of the amount of their salary bill on 'formation initiale' and 1.1% on 'formation continue', and this amount was subsequently increased to the current 2.3%.

It is not exactly a tax, but is a sum that when approved is deducted from pretax profits. The former takes the form effectively of grants to the educational system, whereas the latter includes internal and external expenditure on training courses.

Most larger companies actually contribute more than the set amount, and in the information technology business the amount is more like 6-8% of the total salary bill. The amounts published by one leading company in the information systems business increased from 1.75% of payroll in 1983 to 3% in 1987. In both cases the majority of training was provided in-house.

4. Future Trends

Women are playing an increasing role in France. A survey undertaken in 1982 by CEREQ showed that 23% of programmers were women and as many as 15% in middle management were women. More recently, the complement of women in business schools is as high as 40-50%, but still in the 15-20% range at engineering schools.

The annual installation rate of information systems in France in absolute terms is second only to West Germany. Most of the training in information systems in France is provided internally by the providers of systems and services for their own staffs, or externally by vendors for customers. The open market for information systems training is provided mainly by the large information services companies and is not developed on the same scale as in the United Kingdom. This open market may be expected to increase in the future.

C

United Kingdom Market Environment

1. The Educational Culture

The traditional elitist education in the United Kingdom has been centred on the public school followed by a progression to one of the major universities. Studies of the classical languages played an important role at school because the civil service drew its entrants largely from those with classics degrees at universities.

The prestige output from the university system included those who had read such things as politics and economics, and those from certain specialist universities: i.e., medicine. The best scientists tended to stay within the university system and create more scientists, or, since the 1950s, enter the extensive government scientific establishments.

The 1950s saw the growth of a large number of provincial universities and technical colleges, many of which specialised in more applied subjects such as engineering, and many of which are of high quality, but many older universities that carried the prestige rather neglected the

applied sciences and engineering. Noteable exceptions were Cambridge and Manchester universities in their contribution to the early development of computers and computer science.

Public perception has always ranked the engineer much lower on the professional scale than civil servant, doctor, lawyer and accountant. As a result the engineering industries, particularly in manufacturing, did not attract graduates. Whereas in West Germany management personnel in manufacturing would have as many doctorates as in development, in the United Kingdom management level employees would mostly have obtained their skills by working their way up from the shop floor, having relatively little formal training.

Even the word *engineer* in the public mind is associated with the nineteenth century concepts of engineering and does not rank with the accord given to the engineering professions in France, West Germany and other continental countries in which the title *Ingeneur* carries distinction. The engineering institutions were well aware of this, and in 1980 recommendations were made in the *Finniston Report* (most of which were ignored by the government) towards upgrading the engineering professions.

As a result, in the United Kingdom training has never been accorded the prestige it has in West Germany, the United States and Japan.

During the 1970s the output of graduates and researchers in applied science and engineering increased, only to be cut back by the financial constraints of the early 1980s. At the same time the economic climate caused industry to cut recruiting and training, exacerbating the shortage in the computer sector.

2. The Skills Crisis

The impending crisis in the United Kingdom was first recognised in 1977 and a pilot study was undertaken by the Manpower Subcommittee of the Electronic Computers Sector Working Party of the National Economic Development Office.

The pilot study led to a major study report issued in 1980. Included in the report was a study on Computer Manpower in the 80s by the Institute of Manpower Studies at the University of Sussex. Even at this time it was recognised that the deficit in skilled computer manpower could not be made good in this century.

At this time the development of microelectronics technology allowed small computers to be constructed at lower and lower cost, and the United Kingdom took a leading position in the manufacturing and marketing of 'home' computers. The government saw this as an opportunity to increase the level of public and industrial awareness of computers and

declared the year 1982 to be 'I.T. 82'. One of the main activities was an effort by the Department of Trade & Industry to increase awareness in industry, in particular in respect of office automation, and the issuing to all schools of a microcomputer. Unfortunately the hardware issued to the schools was not backed by suitable software nor by adequate training for the teachers.

Subsequent years saw an escalation of the salaries paid to information systems specialists, particularly in the systems analysis area. This salary increase was compounded by the rapid take-up of information systems by the financial community, in particular by the city money markets prior to deregulation and by the main accountant organisations. The former, however, were relieved somewhat by the effects of the stock market collapse in 1987.

The salary escalation increased the movement of personnel between companies, which in itself discouraged training because companies were not willing to train recruits at the company's expense only to increase the market value of the employee and the likelihood that he or she would move to another company for a higher salary. Thus companies preferred to employ trained or experienced staff at high salaries rather than to invest in training.

Today there is a perceived skills crisis, although there is a wide range of opinion as to its magnitude. For the high-quality private sector employer who offers a career path with the opportunity for relevant training and the acquisition of experience, there is no skills crisis. However, for the employer who can or does not offer comparable opportunities, the price of experience may be too high. The skills shortage is therefore felt mainly in companies that cannot offer job progression within information systems and services, and, in particular, in small companies. To some extent, the skills shortage is regional.

In the public sector there is a crisis of equivalent magnitude, particularly in the London area, because the rigid pay scales of the civil service are unable to match the competition in the private sector. There is also the limitation in job progression for an information systems specialist. The Treasury is well aware of the problem and is considering proposals towards raising the ceiling that limits the advancement of information systems professionals.

Information technology has had a high profile in government thinking in recent years, in particular because of the beneficial knock-on effect into manufacturing industry as a result of the use of computer systems. There are as a result many government, quasi-government, academic, industrial, professional and other organisations that are concerned, *inter alia*, with information systems, and many are concerned with information systems exclusively.

Government is presented with a paradox because there is a skills crisis at the same time that there is a high level of unemployment. However, the unemployment level amongst persons with training in information systems is relatively low, and some government schemes for redeployment, in particular the conversion courses for graduates in other disciplines including the arts, have been reasonably successful. It is interesting that an education in the classical languages, which had been run down during the 1970s, is now thought to be a good basic training for the type of logical thinking required for information systems skills, in particular systems analysis.

3. The Principal Actors

The principal organisations concerned with information systems and services within the United Kingdom are listed in Exhibit VI-2.

The Computing Services Associations represents the United Kingdom computer services vendor community. It has always taken a strong interest in the need for training within the industry, which was manifested in the setting up of the Computing Services Industry Training Council (COSIT) in 1983. This organisation has the legal status of a charity with the following aims:

- to identify and quantify current and future staff/skill requirements in the Computing Services Sector;
- to work with employers to develop recruitment and training plans to overcome immediate manpower shortages;
- where possible, to procure grant aid to offset training costs.

Working *inter alia* with grants from the Manpower Services Commission, COSIT's principal initiative has been the Industry Standard Development Programme (ISDP), which is a practitioner's training and career development programme and covers a period of three to six years. It is aimed at standardising training on recognised good practice and ends toward the issuance of an ISDP certificate, which is recognised throughout the computer services industry.

In 1986 COSIT extended its collaborative training programmes into the field of third-party computer maintenance by specifying and developing common methods and modules of training.

The National Computer Centre (NCC), originally established with government funding to aid industry in applying computers, is now established as a limited company and operated as a business. It has always taken an interest in training and more recently has published a number of papers on the information technology skills shortage, including attempting to quantify the shortage.

EXHIBIT VI-2

U.K. ORGANISATIONS CONCERNED WITH INFORMATION SYSTEMS AND SERVICES

- The Computing Services Association (CSA)
- The Computing Services Industry Training Council (COSIT)
- The National Computer Centre (NCC)
- The British Computer Society (BCS)
- The National Economic Development Office (NEDO)
- The Engineering Industry Training Board (EITB)
- The Training Commission (formerly the Manpower Services Commission)
- Information Technology Centres (ITeCs)
- The National Council for Vocational Qualifications (NCVQ)
- The Information Technology Training Accreditation Council (ITTAC)
- The Information Technology Skills Agency (ITSA)
- The Institute of Manpower Studies (IMS)

As well as offering extensive training courses, the NCC has established basic certificates in systems analysis and threshold certificates for school leavers. The NCC develops and manages training programmes in the United Kingdom and overseas in cooperation with professional organisations and independent training establishments.

The British Computer Society (BCS), one of the longest-standing computer professional societies in the world, has a mission in education and training through its Professional Development Scheme.

The BCS promotes education and training in two ways: firstly, by influencing teaching in schools; and secondly, by encouraging employees to take an interest in their own training by following a recommended pattern and keeping disciplined records in the form of a logbook. The BCS does not attempt to influence industry except, through the employee, to provide suitable training that complies with the requirements of the scheme. The scheme covers seven major activities:

- consultancy;
- development;
- operations;
- quality assurance;
- data management;
- education and training;
- user support.

The National Economic Development Office (NEDO) provides the professional staff for the National Economic Development Council (NEDC) and its working parties. This is the national forum for economic consultation between government, management and the unions on the efficiency and prospects of individual industries. The original work on quantifying the U.K. skills shortage was initiated by the NEDC in 1977 and is currently carrying out comparative studies on education and training strategies in electronics and information technology in the principal industrialised countries.

The Engineering Industry Training Board (EITB) was established as the largest one of 27 industry training boards under the Industrial Training Act, 1964, at a time when it was clear that industry was failing to provide the training necessary to ensure the supply of trained men and women it required. The Act had the objectives of:

- ensuring an adequate supply of trained persons at all levels;
- securing an improvement in the quality and efficiency of training;
- sharing the cost of training more evenly between firms.

The EITB is financed by means of a levy equal to 1% of payroll imposed on all firms with a payroll above £50,000 ($85,000) (in earlier years the levy was higher). Exemption from this levy may be obtained by companies that can demonstrate to the training board that their arrangements for training and further education associated with training are adequate by reference to certain reviewed criteria. The EITB provides grants to promote the development and initial running of new programmes of training and education of adult employees in the engineering industry whose jobs are being affected by new technology. It also funds adult trainee grants, administers certain grants funded by the Manpower Services Commission and assists companies to obtain grants towards training and retraining from the European Social Fund operated by the Commission of the European Community.

The Manpower Services Commission (MSC), now called the Training Commission, was formed in 1974 with a somewhat wider role, now specified as fostering the creation of a better-trained and more adaptable work force and to encourage small businesses with potential for job creation.

In particular the Training Commission assists those who by reason of their sex, ethnic origin, disability or length of unemployment had difficulty in obtaining suitable work or training. The Training Commission now operates on a budget of over £3 billion ($5 billion) and incorporates the work of the training boards.

Particularly important in the information systems area are the Information Technology Centres (ITeCs). These were originally set up under the MSC's Youth Training Scheme, and act as a focus for training, advice and services to all sections of the local communities and give appreciable stimulation to local businesses.

There are 180 centres scattered across Britain roughly corresponding to areas of high density in population and unemployment. They specialise in imparting information systems skills to those who have achieved little or nothing academically and to those who have had no previous aptitude with machines. These centres have not only been effective in producing candidates who subsequently were able to win employment, but also in reestablishing previously unemployed people to gain confidence in their abilities.

ITeCs are now profit centres marketing their own services, have an annual turnover of around £50 million ($85 million), and train about 13,000 people a year. They have their own Viewdata (videotex) network, and there are plans to extend the centres into other European countries.

The National Council for Vocational Qualifications (NCVQ) was set up by the government in 1985 after a study showed that only 40% of the nation's workforce held qualifications relevant to their jobs. NCVQ has called upon the British Computer Society to set up a consortium including COSIT to expand and develop performance standards in information technology over the next two years.

The Information Technology Training Accreditation Council (ITTAC) was formed in 1985 to create a list of approved U.K. suppliers of information systems training for overseas delegates. In the past, overseas companies have had no ready means of knowing whether the courses they selected met professional or vocational training standards.

ITTAC provides a mechanism for assessing the operations of U.K. providers of training in information systems. ITTAC is supported by various existing bodies connected with information systems, including those mentioned above.

The Information Technology Skills Agency (ITSA) had its origin in the Butcher Committee, which was set up in 1984 to recommend a programme of action to overcome skills shortages in information technology. ITSA was established in 1985 under the auspices of the CBI Education Foundation, which has some 45 member companies.

ITSA first assisted the government to plan and administer the further £43 million ($73 million) of cash injected under the Education & Training Programme to increase the number of places for information technology students within universities.

More recently ITSA has established a study group, funded jointly by ITSA and the Department of Trade & Industry, to predict the impact of developments in information systems on future manpower resources. The objective of the study is to establish a database of developments in information systems on a continuing basis and relate this database to the supply of, and demand for, staff competent in the design and use of information systems projects and services for two, five and ten years.

The Institute of Manpower Studies (IMS), part of the University of Sussex, has specialised in manpower research of all kinds. The first study of computer manpower took place in 1980. Its most recent report, *Information Technology Manpower into the 1990s,* was published in 1986 in conjunction with the Butcher Committee, and the study was funded jointly by the Departments of Trade & Industry, Education & Science and Employment, the Manpower Services Commission and the Science and Engineering Research Council. This report is being updated biannually.

4. Government Action

Government action in the United Kingdom has largely been aimed at increasing the output of graduates and students trained in information systems, a task made more exacting by the increasing shortage of students as a result of the demographic profile. The situation is made worse by the increasing lack of interest on the part of school and university leavers in computer studies, especially amongst women. The government is now considering tackling this problem by attempting to improve the image of information technology in the eyes of students.

The government also does much towards redeploying the unemployed but little to encourage training by industry. As has been said, the levy of 1% of the salary bill imposed on industry encourages training to an extent, although similar schemes in other countries, in particular France, exact somewhat higher percentages.

Employees, however, find considerable difficulty in obtaining relief from income tax since allowances against tax are only made in respect of

expenses necessarily incurred and defrayed out of emoluments. There are, however, concessions available in certain specific circumstances. As has already been said, the first identification of the information systems skills shortage was from NEDO, which is funded by government.

The most recent initiative taken by government has been the Butcher Committee, which issued three reports: the first in 1984 dealt with the supply of graduates with information systems skills; the second with shortages at the technician level; and the third with recommendations to companies, professional institutions and trade associations and the education system.

Also resulting from the recommendations of the Butcher Committee, the Information Technology Skills Agency (ITSA) was established within the CBI Education Foundation, and a further £43 million ($73 million) of cash was injected under the Education & Training Programme to increase the number of places for computer studies students within universities.

5. Future Trends

There is much conjecture on what could be done to encourage training and discourage the excessive movement of experienced people. Proposals that have been made include the following:

- enable employers to treat training costs as a loan to the employee that is liable for repayment to the employer in the event of premature departure, but otherwise written off without any tax penalty;

- make the cost of vocational and educational training courses to prepare for future employment possibilities allowable against personal tax.

The possibility of attaching transfer fees to employees in recognition of their value, much like those seen in association football, has also been discussed. However, it is unlikely in the present climate that the government will intervene in an area that the government believes is the province of industry. This policy has been demonstrated by the abolition in 1987 of the ministerial portfolio for information technology.

There are a number of moves designed to more closely integrate the efforts of industry and academia. One amongst these is the consortium between leading companies, universities and polytechnics centred on Brunel University (called Jupiter) which was established to provide industry with information on advanced updating courses in selected leading-edge areas of technology critical to the United Kingdom's competitive advantage. The areas covered are technology management, software engineering and advanced manufacturing systems. The service sets out to:

- provide management information on leading-edge courses;
- advise and counsel both industry and education on the skills and management training necessitated by new technology applications;
- identify gaps in the existing course provision and help fill these gaps;
- develop joint activities in areas where resources are scarce;
- identify and promote good practices.

D

Other European Country Market Environments

1. Italy

Although the percentage take-up of information systems has been lower in Italy, the growth rate in absolute terms is higher than in most other countries. The attention of the Italian government is directed in particular at increasing the penetration of information systems into small- and medium-sized enterprises through management awareness and training programmes, including training in the technologies of factory automation and professional training for information systems staff.

2. Denmark

Training in Denmark is of a high standard, with a complementary approach of general professional training at universities and technical colleges matched by specialist training provided in industry. However, the system has not been able to keep pace in terms of quantity. In 1985, the government submitted a five-year action plan known as the Teknologisk Udviklingsprogram (TUP) (Technological Development Programme). The programme is primarily aimed at businesses in order to encourage the application of information systems, but also promotes improved cooperation between industry and the public sector to provide training in electronics and information systems.

Special recognition has been given by Statens Erhvervspaedagogiske Laereruddanneise (SEL) (State Business-Pedagogical Teachers Training) to the need to train teachers of information technology, and special action has been taken to increase the involvement of girls and women in computer training programmes.

Employers and employees are allowed to deduct from taxable income expenses that acquire, safeguard or maintain income, but not those that extend it. Conversion courses, for example, are therefore not treated as tax-deductible expenses.

3. Netherlands

The Netherlands is similar to West Germany in many respects in its approach to training, but is characterised by the predominance of a small number of large internationally operated companies that provide well for the training of their staffs and that have adequately managed the supply of skilled staff.

Outside these large companies there have been fluctuations of demand linked to economic circumstances, but the Netherlands is unique in being able to draw skilled labour from the U.K. market. The higher salary levels in the Netherlands provide an incentive to a modest brain drain, and the competence of the Dutch in the English language makes this a feasible proposition.

Although such movements are initially short-term ventures, many persons have stayed longer. The approach of the Dutch government has been to bring together the interests of the Ministry of Education & Science in training policy the Ministry of Social Affairs and Employment in labour market policy and the Ministry of Economic Affairs in technology in order to improve the connection between training and the labour market.

Employers may deduct from taxable income all costs relating to the training of employees. For employees who fund their own training, there is a small standard allowance for general expenses related to the employee's job, and expenses above this level are claimable but must be validated with itemised statements. In Belgium the arrangements are rather similar.

4. Spain

In Spain, the teaching of computer studies has received little attention, and since it has only recently become a member of the European Community, its participation in community programmes has only just begun. At the same time, there is an extensive reform process taking place in the whole educational system from universities to schools.

5. Sweden

In Sweden, employers may deduct costs of adult training as a business expense. In certain recent years (1974, 1980, 1983 and 1985), Swedish corporations were obliged to deposit a portion of their pretax profits (10% in 1985) in compulsory reserves with the Swedish Central Bank. These amounts were only permitted to be used for training and research and development (in previous years for building and planning costs). Such an expenditure has to be approved by the government and trade unions, and, if not utilised after five years, can be recovered by the

company as taxable income. Employees' expenses are allowable for maintaining an income but not for income improvement.

E

The European Community

1. Opportunities—1992

With the advent of the "completion" of the Internal Market in the European Community in 1992, all barriers to the movement of persons, goods, services and capital within the Community are aimed to be removed. In principle this means that companies offering services will be able to offer them throughout the Community without constraint, but in practice national languages, cultures, customs et al. will make this impracticable.

Perhaps training in information systems is one of the few exceptions where language will be less of a barrier since the working language of the computer industry in publications, contracts, technical manuals and the like is English, largely as a result of the American domination of the market and of the technology.

However, the use of English will give an additional opportunity to companies in the United Kingdom (and any companies in Holland, Denmark or West Germany whose working language is English) to extend their business into other countries of the Community.

2. Community Action

The broad lines for community action in the field of vocational training in information technology for the period 1985-88 is set out in the Communication by the Commission to the Council, *Vocational Training and the New Information Technologies' COM(85) 167 Final.*

This document states that community action should complement and enhance member states' actions to promote the development of a common approach to the introduction of new information technologies that is simultaneously responsive to economic and technical needs and to the social effects such technologies generate.

The aim, as underlined in the general guidelines of the Council Resolution, is to integrate information technology and the specific skills they involve into broadly based training programmes. The goal is to facilitate access to continued employment, and to improve employment opportunities.

3. The Role of Directorate General 5

The principal actor in the European Commission in the field of education and training is Directorate General 5. However, many institutions

throughout the Community receive funding from the European Social Fund. Some of this is directed towards training, including training in information technology. Directorate General 5 of the European Commission has responsibility for employment, social affairs and education. Divisions of DG 5 deal with education and training, and youth policy.

There are two major programmes that affect training in information systems, namely COMETT and EUROTECHNET, which are described below. In addition, DG 5 is sponsoring the ERASMUS programme, which encourages and assists academic staff to obtain temporary appointments in other member states within the Community. In addition, the DELTA programme promotes the development of emerging technologies to assist in the field of learning.

4. COMETT

The main objectives of the COMETT programme, approved in 1986 and starting on January 1, 1987, are to stimulate and reinforce effective European cooperation between diverse business enterprises and higher education institutions with the aim of:

- giving a European dimension to cooperation between universities and enterprises in training relating to innovation and the development and application of new technologies, and related social adjustment;

- fostering the joint development of training programmes, the exchange of experience and the optimum use of resources at the community level;

- improving the supply of training at local, regional and national levels with the assistance of the public authorities concerned, thus contributing to the balanced economic development of the Community;

- developing the level of training in response to technological and related social changes by identifying the resulting priorities in existing training arrangements, which call for supplementary action both within Member States and at Community level, and by promoting equal opportunities for men and women.

The COMETT programme consists of four strands corresponding to the programme objectives as above; priority is given to projects that relate to more than one strand:

Strand A—the development of university enterprise training partnerships (UETPs). UETPs can be regional or sectorial and should bring together several companies and several universities to collaborate in meeting specific needs for qualified personnel:

- through the organisation of student placement in companies;
- through the exchange of personnel, trainees and trainers;
- through the joint development and production of innovative training programmes and materials;
- through the implementation of updated programmes for qualified staff in industry and for trainers.

Strand B—the transnational exchange of students and personnel between universities and enterprises. COMETT provides for the organisation and placement of students and new graduates for several months' duration in enterprises in another member state:

- to encourage greater awareness of employment prospects in sectors of technological development;
- to bring a European dimension to training and to foster European identity;
- to stimulate the entrepreneurial spirit of students.

For university personnel, fellowships are provided for the organisation of secondments of university staff to enterprises in other member states for a 3-12 month period:

- to develop their industrial experience in a European context;
- to enrich their training activities;
- to create possibilities for future cooperation.

For personnel of enterprises, fellowships are provided to enable personnel from industry to spend a period of secondment to a university in another member state for 3 to 12 months:

- to contribute to the diversification of training;
- to enrich their knowledge, promote technology transfer, and encourage their participation in training activities;
- to assist in the development of university-enterprise links on a European scale.

Strand C—the design and testing of joint university-enterprise projects in the field of continuing education and new technologies. These projects are intended to:

- allow rapid dissemination of the most recent research and development results;
- meet the needs of industry by developing the highest levels of technological qualifications;
- make maximum use of the European potential for the development of advanced skills required by industry.

Such projects include:

- development in the fields of technology of new training materials for continuing education for large-scale dissemination amongst management, engineering and technical staff, and trainers;
- programmes of high-level, short intensive courses of proven quality.

Strand D—for multimedia training systems for the new technologies. The object of this strand is to improve the quality and content of education and advanced training within the perspective of a European multimedia training system. Projects must be based on the new information and communication technologies: radio, television, cable networks, interactive computing and teachware, video cassettes and videodisc, direct broadcasting by satellite, etc. COMETT will promote projects:

- directed particularly at the personnel of enterprises and for the training of trainers;
- involving the participation of enterprises;
- having a European dimension.

Financial support from the European Community is available as a contribution to the overall funding of a project and may cover up to 50% of the total project costs (for strands A, C and D). The European Council allocated a budget of ECU 45 million for the total programme, of which ECU 16 million was applied in 1987.

Applications for projects were made in two rounds. A total of 1,035 applications was made in 1987, representing 2,600 individual projects. Over 1,600 enterprises (900 universities and 750 other organisations, both public and private) indicated an interest in the programme, and the total funding applied was around ECU 200 million.

A total of 97 projects were selected in the following fields:

data processing	97
software technologies	75
advanced information processing	104
office systems	45
computer-integrated manufacture	71

Participation in all projects by individual member states is shown in Exhibit VI-3.

EXHIBIT VI-3

COMETT—MEMBER STATES PARTICIPATION

COUNTRY	NUMBER OF PROJECTS
Belgium	18
Denmark	25
France	47
German Federal Republic	25
Greece	13
Netherlands	14
Italy	22
Ireland	22
Luxembourg	1
Portugal	10
Spain	21
United Kingdom	44
West Germany	25

5. EUROTECHNET

EUROTECHNET is a network of demonstration projects on vocational training measures related to the introduction of new technologies. It focuses on four priority themes:

- the role of training in information systems in the development of small- and medium-sized enterprises;
- information systems in the training and retraining of adult skilled workers;
- the need for women returning to work to benefit from training and retraining in information systems;
- the training of young people in new technologies, especially people with a low educational level.

Each of the projects is a national one and projects do not receive financial support from the Community, but Community funds are available to catalyse the cooperation and exchange experience between the projects. Projects listed under the network are numbered by country as shown in Exhibit VI-4.

EXHIBIT VI-4

EUROTECHNET—MEMBER STATES PARTICIPATION

COUNTRY	NUMBER OF PROJECTS
Belgium	14
Denmark	9
France	18
German Federal Republic	6
Greece	8
Netherlands	12
Italy	11
Ireland	15
Luxembourg	5
Portugal	8
Spain	15
United Kingdom	12

VII

The Future Scenario

The Future Scenario

A

Developments in Information Systems

In the 1970s companies wishing to apply computers to their business were faced with either purchasing a large, high-cost centralised system or contracting the work out to a computing bureau. With the rapid plunge of prices and the increase in the computing power/price ratio—due to the revolutionary developments in semiconductor technology—it then became economic to bring more data processing in-house. Today, workers who process text or data can have a personal computer of a power far greater than the mainframes of old, but at a price equal to perhaps 10% of the annual overhead.

Computer systems used in business have thus been grouped into three categories:

- Large mainframes and minicomputer systems, usually multiuser systems, often connected with other large mainframes or terminals through wide-area networks, and running proprietary operating systems;
- Workstations that consist of a microprocessor with high computing power and a sophisticated display, often connected either through local-area networks to other workstations, file servers, print servers, and specialist processors for fast computation, or through array processors for image analysis—in turn connected through gateways into wide-area networks—and usually supporting UNIX;
- Personal computers, mostly used for text processing and spreadsheets, mostly supporting MS-DOS or equivalent.

Workstations are also used for specialist applications in industry such as computer-aided design (CAD).

In addition, there are specialist fault-tolerant systems for applications where the consequential cost of a breakdown is high, such as in real-time systems for financial transactions, transaction processing, traffic control, industrial process control, and the like.

As microprocessors' costs have been reduced while their power has increased, they have been used extensively as components to control processes and are used in many types of electrical appliance.

As more and more companies have installed computers in-house, they have become more closely integrated into the business activity. Many businesses are totally dependant on the smooth working of their information systems, and many managers see the skilled application of information systems to be the key to the future success of their business and to gaining advantages over their competition.

B

Technical Change

The technological developments that will influence the requirements for skilled manpower—and therefore the incidence of training—are forever accelerating. The extent of their application in industry and business will depend on the success that users will have in developing new methods of organisation and operation. This in turn depends on the available skills, many of which will need to be acquired by training. The more important technological developments expected to become widely used over the next few years are given below:

- Increasing computer communications convergence
- Falling cost and increasing power of hardware
- The use of software development environments
- Standardisation
- The application of computer-aided design techniques
- Computer-aided manufacturing
- Electronic funds transfer and other network application services
- Knowledge based systems and inference computing
- Natural language systems

The increasing convergence of computer and communications technologies has developed the application of telecommunications and networking to computer systems. The importance of this will increase over the forthcoming years, which will require a higher percentage of staff that is proficient in network management.

The falling cost of hardware and the rapidly increasing power and capacity of systems are increasing the importance of and the investment in software that matches the application to the user's needs. The declining cost also allows more parts of a system to be fully integrated, opening up possibilities for a wider range of uses.

The convergence of hardware and software design means that designers of hardware, from military systems down to domestic appliances, need to have software skills. Applications software is now coming primarily from computer service companies, although system providers are embedding more software in the hardware.

Software development environments and tools currently are being more widely used. Further development and use will increase the quality and efficiency. However, the design of such environments and tools requires large resources in software design itself, so the payback period of the investment will be a few years ahead.

The moves towards increased standardisation in software will necessitate retraining of staff already trained in other environments. Particularly important is the increasing support for UNIX, now spear headed by the recent announcement of collaboration between IBM, DEC, Hewlett-Packard, Nixdorf, Siemens, and Honeywell-Bull. This is followed by the leadership of Apollo and is a reaction to the alignment of Sun Microsystems with AT&T.

The growing use of computer-aided design (CAD) by system providers and information systems users, particularly in the area of integrated circuit design will move this skill from the specialist to generalist category.

The application of information systems in the manufacturing industries has been particularly slow in some countries and limited. This phenomenon is due to the lack of awareness in information systems and in the availability of staff already familiar with the particular manufacturing technology. As manufacturing companies begin to integrate all stages of their manufacturing operations, the need for manufacturing systems engineers with a broader range of skills will emerge. They will need to encompass production engineering, systems analysis and, organisational design skills.

Similarly, the applications of electronic funds transfer systems have developed somewhat more slowly than predicted. The wider adoption of such systems will significantly increase the requirement for skilled information systems personnel in retail and distribution.

With the increasing power in workstations and personal computers, the application of intelligent knowledge-based systems and inference computing will become more efficient and economic and will create new markets. Applications in industry will be limited only by the available manpower with relevant skills. Similarly, the availability of higher computing power and in particular the design of array processors and other special designs will increase the application of image processing to a much wider range of fields.

As systems get more complicated and the standards for safety and security more critical, the task of system specification will become more exacting and lead to a more formal logical approach to the specification of software. The developments in the field of natural language will continue to cause convergence in the arts and the sciences and will reduce the level of specialisation required by information systems users.

C

Occupational Forecasts

Some indication of changing patterns of employment and skills needs are given in Exhibits VII-1 through VII-4. These exhibits show INPUT's expectation of the percentage increase in various job categories in Europe for four categories of company:

- Vendors of computer systems (Exhibit VII-1)
- Information services vendors (Exhibit VII-2)
- User organisations, including industrial and commercial companies but excluding the services sector (Exhibit VII-3)
- User organisations operating in the services sector (Exhibit VII-4)

EXHIBIT VII-1

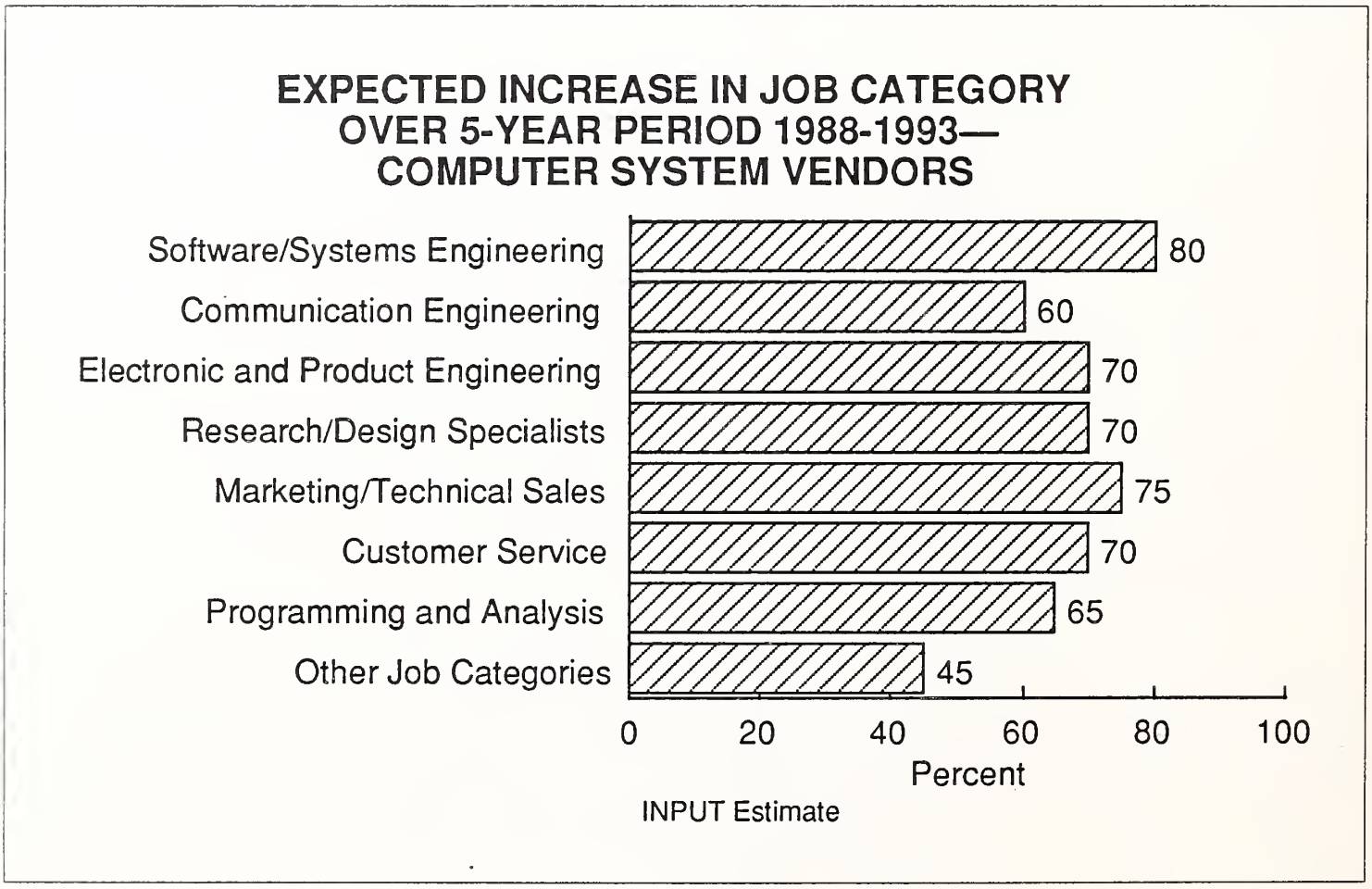


EXHIBIT VII-2

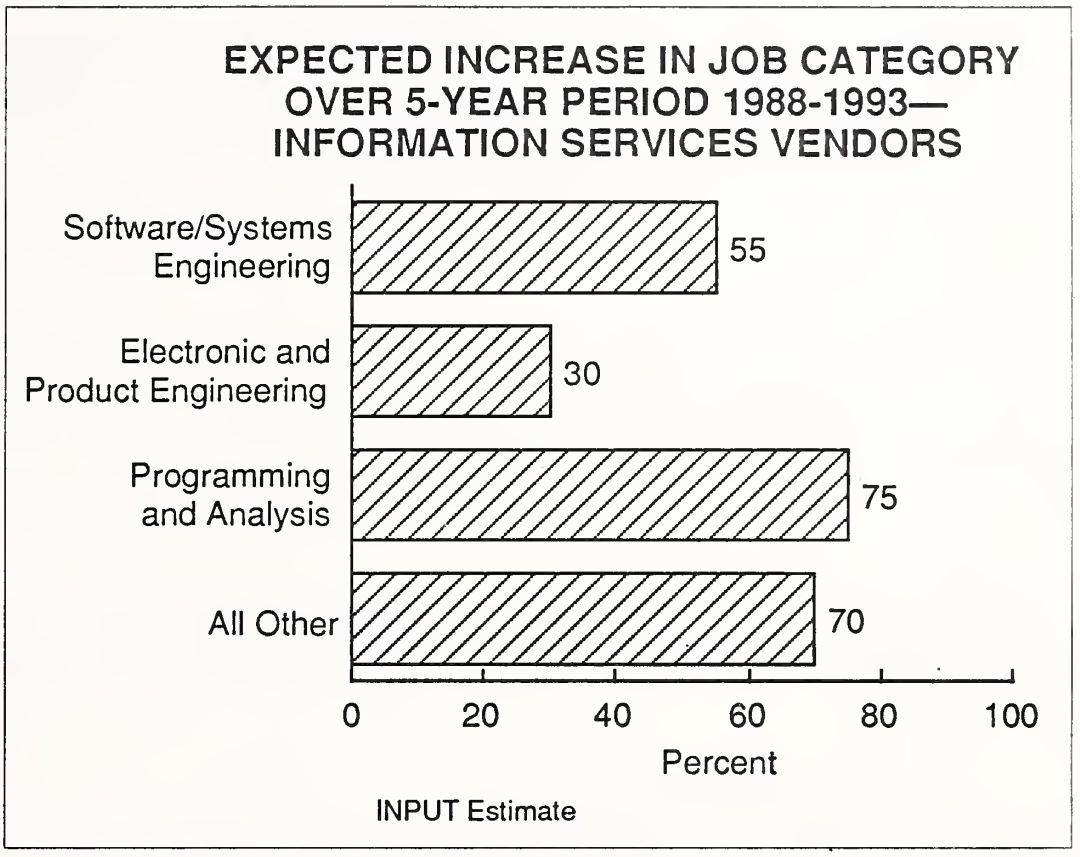


EXHIBIT VII-3

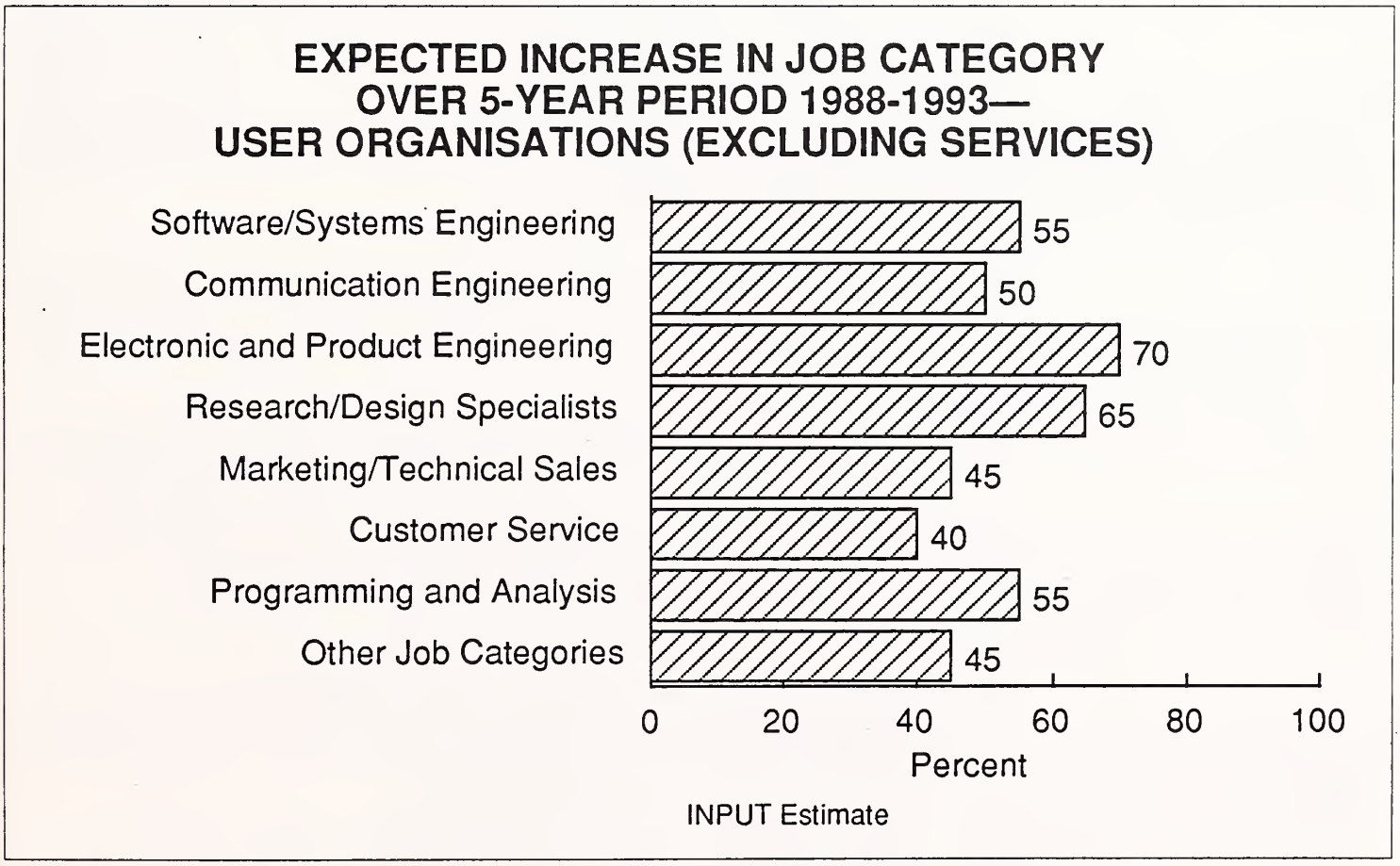
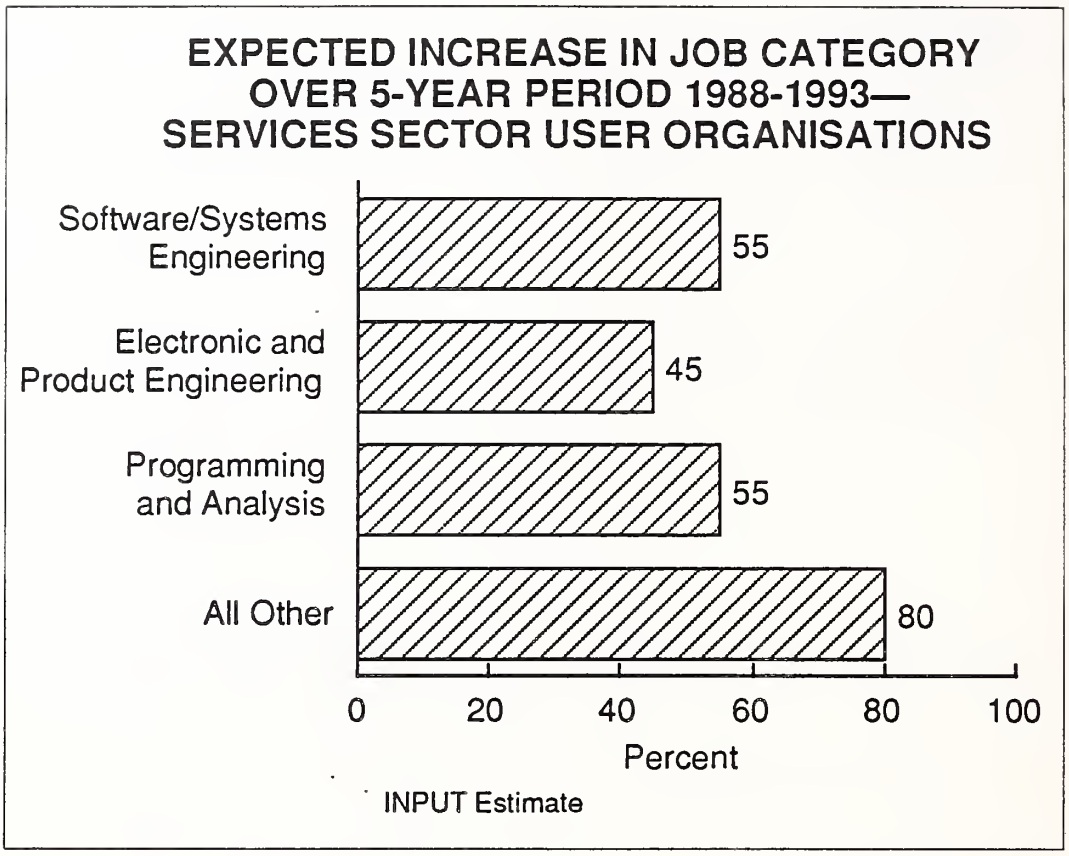


EXHIBIT VII-4



For the vendors of computers systems, the principal growth is expected to be in software and systems engineers and in marketing technical sales staff as a result of growth in business and development of new products and markets. These staff will be expected to have increased knowledge of the business and technology of the user, as well as an increased level of commercial awareness, something that is often new to those who have been working in the field of defence.

Information services companies will see an increase in programmers and analysts, almost entirely as a result of business growth; the growth of the business in offering training will be limited by the available manpower.

In industrial companies that are or will be users of information systems, the growth of staff with information skills will be brought about more by the training of existing engineering and production staff rather than by the recruiting of specialist staff. The motivation of this is the changing technology, not growth of the business. More engineers trained in electronics and in computer-aided design would also be needed.

Among the service users of information systems, including those in the public sector, the main requirement is again expected to be for training for persons who already have experience in the business and the application as new technologies are applied.

In the case of the public sector, it is likely that most of this training will be carried out internally, but assistance will be needed in respect to training in new technologies that will be more readily available from external computer service companies rather than from internal training departments. As more users become operators of workstations and of personal computers, the organisation of data processing moves from central data processing departments to user support groups.

D

The Supply of Graduates

The main sources of graduate-level information systems manpower are new graduates with a suitable educational background; postgraduates undertaking conversion courses; upgraded existing employees, including those from noninformation systems backgrounds; and updated workers with broadly relevant skills.

The supply of new graduates is expected to be a problem in West Germany (as a result of the demographic profile) and in the United Kingdom because of lack of popularity of the computer industry as a profession. In France this problem is much less marked.

Graduate conversion in the United Kingdom has been a successful method and will continue to be so, but in West Germany the culture is much less accommodating of individuals who wish to switch their profession paths. Upgrading and updating are important cornerstones of manpower strategies in all countries.

E

Human Asset Management

More management attention is being paid to human assets. In an area of rapid technological change, such as information systems, the half-life of the value of training is estimated to be between two and three years, and therefore after four years, the value of expertise is only a quarter of what it was originally.

The depreciation of human assets may be in excess of the depreciation of other assets; businesses may therefore be expected to take remedial action. The first action may be to stock-take their assets and the second may be to manage the assets more effectively by conservation and renewal.

As a result of the oil crisis in the late 1970s, Europe not only diversified into alternative fuels but also put its attention to the management of the fuels it uses, for example by improving the insulation of buildings and the use of petrol injection in internal combustion engines.

In countries where there is a skills shortage in information systems, companies will likely take remedial action by ensuring that the skills their employees have will be better and more-effectively utilised. In addition, terms and conditions of employment will likely be modified in such a way as to encourage longer service from employees.

F

Employment of Women and Older People

In West Germany and the United Kingdom, where the demographic plunge is going to reduce the number of young people by around 45% and 35% respectively, increased efforts will be made to employ women and older people. Women are a hidden resource to the information systems industry, which is particularly nondemanding in respect of strength or place of work, and many women adapt well to programming and systems analysis.

However, many prejudices must be overcome and are already being addressed by governments and the European Commission. As a resource, older people are underutilised, particularly in the United Kingdom, which has followed the American style of seeking younger executives, with youth valued more than experience.

In West Germany, however, the age pattern differs. Because of the extensive vocational training given at universities, it is unlikely that a doctorate will be obtained before the age of 30. Therefore, the average age of managers is somewhat greater in West Germany than in the United Kingdom. West Germany, then, may shorten the time taken to train graduates.

Extension of the required age for retirement is another possible solution to the personnel shortage. Furthermore, information systems is an area that is not restricted by limitations in mobility. Suggestions have been made that job advertisements should in appropriate cases specify a minimum age, instead of, as is often the case, a maximum age.

G

Overseas Trainees

Many companies are providing training to persons from countries where the application of information systems is in its early stages and training programmes are inadequate. Because English is the international language for the computer industry, U.K. suppliers of training and foreign training courses in the English language are at an advantage.

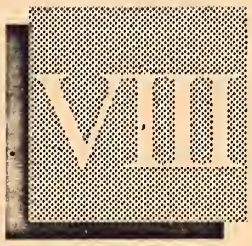
There has also been a recent noticeable interest on the part of the Soviet Union in receiving training in western business methods. The application of computers in the Soviet Union has been predominantly in the military at the expense of the civil, where the application of computers is at a relatively low level. With the reduction of tensions between east and west, there may be an increasing market for training in the Soviet Union and Eastern Europe.

H

Continued Growth in Training

With the continued international growth of expenditures on new computer installations, computer services, and the ever-increasing pace of technological change, it is likely that this growth will be matched by an increase in the demand for training. Even in the United Kingdom, where

the demand for training is relatively low in comparison with the usage of information systems, there is increasing awareness and lobbying in connection with the skills shortage, and the growth rate in training services is high.



Strategic Consideration

Strategic Considerations

A

The Effect of the Skills Shortage

This study of the education and training market in Western Europe has highlighted a number of important issues concerning the future development of the information systems business. These issues affect not only information systems and services vendors but the user community as well. They will have a significant effect on the demand for education and training services. These strategic considerations are summarised in this chapter.

Whatever the numerical value of the information systems skills shortage under any particular definition, the shortage is one of the major obstacles to the purchase and application of systems and software, probably more significant than funding. The shortage is also the major factor contributing to problems of quality and reliability in systems delivered. The situation in France and other countries is somewhat less critical than in the U.K. and in West Germany; it is much healthier, reflecting the more thorough attention paid to training in these countries.

Providers of information systems and computer service companies should note that skills shortages may be a major constraint to businesses. Industrial and service users of information systems and services should note that failure to apply computerisation to businesses may allow their competitors to increase their performance and efficiency and thus obtain a competitive edge.

B

Managing the Human Resources

The control of human assets must be accorded an importance not previously contemplated by the management of information systems suppliers and users. Companies are used to planning, budgeting, resourcing, stock-taking and controlling their capital assets, but many currently pay only lipservice to the old saying that "one's employees are one's most important assets". Action must now be taken throughout the administration of a company to do the following:

- Identify the skills required of employees;
- Provide suitable inducements to attract appropriate personnel;
- Ensure a proper match between the skills of employees and the work they are required to do—employees should be neither significantly underqualified or significantly overqualified;
- Provide suitable training to existing employees as technological requirements change; identify where the capacity for retraining exists and where it does not;
- Provide financial and other incentives for longer service, including project bonuses (or, in the case of designers, royalties) related to the completion of a project to a predefined level or of the successful marketing of a product;
- Ensure that there are no barriers to the employment of women;
- Review their employment of older people;
- Review the terms and conditions of employment, including agreements to provide training, in order to be in the most competitive position to attract the types of people required as employees.

The market for high-quality graduates and persons with experience is a buyers' market, and potential employees will look not only for high salaries but also for the opportunities to acquire training and experience and the ability of an employer to offer a promotion progression that will not be artificially limited.

Employers must therefore identify, and, if necessary, create opportunities for the employee to obtain experience and recognised qualifications.

Employers that are not in the information systems business but are users of information systems must ensure that new employees receive training in their business as well as information systems.

Employers must also ensure that new employees who join with experience in information systems but not with experience in the user's business have no barriers to advancement within the company other than ability.

C

Strategy for Increasing Training

Managers will authorise investment in training if they are convinced that it will give them a return in business terms. Many companies would benefit from an immediate review of their training requirements and the efficiency with which training is provided. Many leading companies

specialising in training also provide consultation; the commissioning of a training audit may be effective.

Companies offering training must improve the marketing of their products and services. Many prospective users of information systems not only do not understand the need for training, but do not understand the words and the jargon of the industry; thus there is no basis for communication either with a prospective training supplier or with a subordinate who proposes expenditures on training.

Providers of information systems and software must more clearly specify the type of expertise and training needed to support products and applications in the user's environment. Providers also must assist users to assess their own training requirements. This implies the development of a methodology for assessment, if it does not already exist, and in a language in which the user is conversant.

Governments can also provide an environment more conducive to training. In some countries companies are required to report their expenditure on training in their reports, and this practice could be more widely adopted. Reporting would encourage interest from peers in the industry, and eventually from financial analysts and investors. Eventually some measure could be established for the output from this investment in terms of qualifications.

Although most countries provide tax relief or impose levies as incentives to training, these are applied uniformly regardless of sector and are modest compared with the actual requirement for the supply or use of information technology. Governments should review the methods and magnitude of the incentives given in respect to training in computer skills, including a recognition of capital expenditures for training.

The pressure on companies may also be increased by harnessing the interests of employees and prospective employees. Already the top flyers will assess an employment opportunity not only in regard to emoluments and progression paths, but also in regards to training and qualification opportunities. Improved tax incentives to individuals will also help encourage prospective employees, but the most significant step would be for companies to link remuneration with the attainment qualifications or measured competences. This step implies a further development and harmonisation of job specifications and qualifications, two areas in which the professional organisations have a part to play. For employees who are members of unions or other similar corporate organisations, their interests will eventually be reflected in the attitudes of their organisations.

D

Job Specifications, Course Structures, and Qualifications

Industry should take a much greater interest in precisely defining the jobs employees do and will be required to do; in establishing more standardised job titles, descriptions and hierarchies so that the functions of individuals can be more readily understood outside the particular environment of a company. Furthermore, industry should pay close attention in specifying the qualifications employees need and the structure of courses that will lead to those qualifications.

In some countries, such as France, specifications, courses, and qualifications are promoted by government; in West Germany some grades are the province of the Federal Government (Bund) and some of the regional states (Lander); in the United Kingdom the task is underresourced and is undertaken only partially, principally by the professional institutions.

Directorate General 5 of the European Community is taking important steps to harmonise some aspects of these specifications on a European level, but industry must take the lead in motivating such activities. In a rapidly changing and developing technology such as information systems, specifications need constant updating as requirements change, and there must be a direct link from the front line in industry to the academic institutions as to current and forecast requirements.

E

Requirements for Training Courses

Suppliers of training courses need to pay more attention to the actual needs of users. The take-up of courses would be increased if courses more nearly matched the requirements of users, or if it can be made more apparent to users the extent to which courses meet requirements. The movement should be towards improved marketing of existing products and the provision of new products to fill existing gaps in the requirements.

The main demand for training is for managers, systems analysts, programmers, and communications specialists. Operators and technicians also need training, but to a lesser extent. The main gaps are currently in software engineering, expert systems, and fourth-generation languages.

Regarding the future, suppliers must be flexible and follow the requirements of the market. Present indications are that the significant growth areas will be software engineering, communications, inference computing, and image processing, with natural language processing following later. Designers of software packages should consider a more extensive use of embedded training facilities within the software supplied.

In planning courses, suppliers must recognise that the amount of training and retraining of the adult population will substantially increase and that suppliers must shape their courses accordingly.

Designers of training courses should also recognise that employees of information systems vendors need to be proficient in other skills in addition to information systems. For example, salespersons who normally come from an information systems background need to be proficient in marketing, commercial skills, and business, particularly in the business of the application they cover. Similarly, designers of courses for business skills must include an awareness and understanding of information systems as an integral part of these courses.

F

Cooperative Initiatives

There are a number of areas where suppliers of training courses could usefully cooperate. Companies offering training programmes should consider some integrated form of presentation. This integration is available in France on the Minitel system and also on a regional basis in West Germany. Views have been expressed in the United Kingdom that this integration might be a reasonable task for the government, but the industry would be wise to note the government attitude that it is up to industry to take care of its own problems, and to deal with the problem itself.

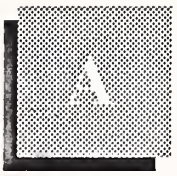
It is also difficult for users to determine the quality of courses offered by suppliers. Suppliers should consider some sort of independent quality certification system for training courses.

Users currently seem to be more prepared to fill their skills requirements by recruitment than by training or retraining existing employees. Suppliers could usefully cooperate to convince users that training can be a real solution to problems.

Industry must be aware that its influence on potential employees should start at the school and continue to the university and polytechnic levels. The first step, particularly in the United Kingdom—where the number of university course places in information systems studies has increased but the number of candidates has reduced—is to improve the public image of the engineer and computer scientist.

The second step is to influence the universities and technical colleges towards producing the material that industry wants. This change is best done by direct contact with the teaching staff and joint projects.

Appendix: General Management Questionnaire



Appendix: General Management Questionnaire

QU: 1a Does your organisation have difficulty in recruiting suitable DP professionals?

Great Difficulty	Some Difficulty	Not Generally a Problem	No Problem At All
____	____	____	____

QU: 1b If you have difficulty, in which skills areas?

____Systems Programmer
____Programming Staff
____Systems Analyst
____Communications Expertise
____Other (please state) _____

QU: 2 Is your department/organisation currently utilising/planning to utilise the services of an external supplier of IS-related education and training services?

Type of Training/ Education Service	Use	Plan	Recent Past	Type of Supplier
_____	____	____	____	____
_____	____	____	____	____
_____	____	____	____	____
_____	____	____	____	____

If NO, ask QU: 3.

Note:Types of Training/Education Services include hardware training, software packages, IT awareness, systems analysis skills, etc.

Types of Suppliers Are:
1. Hardware Manufacture
2. Independent Training Company
3. Systems Software House
4. Accountancy Firm
5. Government Institute
6. University/Polytechnic/Management School

QU: 3 How do you, therefore, plan to obtain the necessary IS skills for your organisation? (please check)

____Recruit Trained Staff
____In-House Training
____Subcontract
____Other (please state) _____

QU: 4 Are you satisfied with your organisation's current arrangements for IS-related training?
____Yes ____No

If yes, can you please briefly illuminate as to why your education and training policy is successful?

1. _____

2. _____

3. _____

If not a categoric yes, in what ways hasn't IS-related education and training been properly addressed in your organisation?

1. _____

2. _____

3. _____

QU: 5 Which delivery method do you favour when purchasing training courses?

____Interactive Video
____Computer-Based Training
____Instructor Led
____Combination Instructor Led/Computer-Based Training

Comments: _____

QU: 6 Are there any particular types of IS-related education and training courses/services that you feel should receive more attention in the future?

____Computer-Based Training
____In-House Custom-Built Courses
____Applications Training
____Product Training
____IS Awareness Training
____Systems Analyst Training
____Programmer Training
____Operator Training
____Project Management Training
____Technical Product Training
____Telecommunications/Network Training

QU: 7 When considering purchasing training courses how important is some sort of accreditation (certificate) to your organisation?

____Very Important
____Important
____Neutral Opinion
____Of No Use
Comment: _____

QU: 8a Are government grants readily available to assist your organisation in paying for training?

____Yes ____No

Comment: _____

QU: 8b If Yes, do you take advantage of them?

____Yes ____No

Comment: _____

QU: 9 Thinking about the externally provided IS-related education and training courses that you utilise, what do you perceive as being their principal weaknesses? i.e., in what way could their service be improved?

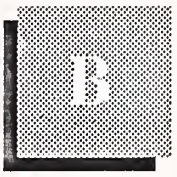
1. _____

2. _____

3. _____

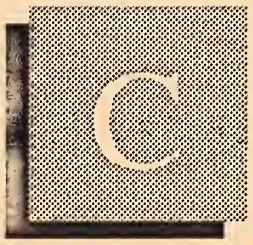
We appreciated your cooperation in our survey and will send you a short summary of the research findings.

Appendix: Related INPUT Reports

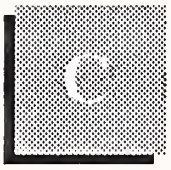


Appendix: Related INPUT Reports

- *The Western European Market for Information Services—Analysis and Forecasts, 1988-1993*
- *Customer Services in Europe—1988 Annual Report*
- *European Professional Services—Market Trends and Opportunities, 1987-1992*



Appendix: Definitions



Appendix: Definitions

Information Services -The provision of:

- Data processing functions using vendor computers (processing services).
- The provision of database access where computers perform an essential role in the processing or conveyance of data.
- Services that assist users to perform functions on their own computers (software products and/or professional services).
- A combination of hardware and software, integrated into a total system (standard turnkey systems).

A

Revenue

All revenue and user expenditures reported are available (i.e., noncaptive) revenue, as defined below.

Noncaptive Information Services Revenue - Revenue received for information services provided within the four Western European country markets of France, Italy, the U.K., and West Germany from users who are not part of the same parent corporation as the vendor.

Captive Information Services Revenue - Revenue received from users who are part of the same parent corporation as the vendors.

Other Revenue - Revenue derived from lines of business other than those defined above.

B

Service Modes

Processing Services - Remote computing services, batch services, and processing facilities management.

- *Remote Computing Services (RCS)* - Provision of data processing to a user by means of terminals at the user's site(s) connected by a data communications network to the vendor's central computer. There are four submodes of RCS:

  - *Interactive (timesharing)* - Characterised by the interaction of the user with the system, primarily for problem-solving timesharing but also for data entry and transaction processing; the user is online to the program/files.

  - *Remote Batch* - Where the user hands over control of a job to the vendor's computer, which schedules job execution according to priorities and resources requirements.

  - *Database* - Characterised by the retrieval and processing of information from a vendor-provided database. The database may be owned by the vendor or a third party.

  - *User Site Hardware Services (USHS)* - These offerings provided by RCS vendors place programmable hardware on the user's site (rather than in the EDP center). USHS offers:

    · Access to a communications network.
    · Access through the network to the RCS vendor's larger computers.
    · Significant software as part of the service.

- *Batch Services* - This includes data processing performed at vendor's sites of user programs and/or data that are physically transported (as opposed to electronically by telecommunications media) to and/or from those sites. Data entry and data output services, such as keypunching and computer output microfilm processing, are also included. Batch services include those expenditures by users who take their data to a vendor site that has a terminal connected to a remote computer for the actual processing.

- *Processing Facilities Management (PFM)* (Also referred to as 'resource management' or 'systems management') - The management of all or a major part of a user's data processing functions under a long-term contract (more than one year). This would include both remote computing and batch services. To qualify as PFM, the contractor must directly plan, control, operate, and own the facility provided to the user, either on-site, through communications lines, or in a mixed mode.

Processing services are further differentiated as follows:

- *Function-specific* services are the processing of applications that are targeted to specific user departments (e.g., finance, personnel, sales) but

cut across industry lines. Most general ledger, accounts receivable, payroll, and personnel applications fall into this category. Function-specific database services where the vendor supplies the database and controls access to it (although it may be owned by a third party) are included in this category. General-purpose tools such as financial planning systems, linear regression packages, and other statistical routines are also included. However, when the application, tool, or database is designed for specific industry use, then the service is industry specific.

- *Industry-specific* services provide processing for particular functions or problems unique to an industry or industry group. The software is provided by the vendor either as a complete package or as an applications 'tool' that the user employs to produce a unique solution. Specialty applications can be either business or scientific in orientation. Industry-specific database services, where the vendor supplies the database and controls access to it (although it may be owned by a third party), are also included under this category. Examples of industry-specific applications are seismic data processing, numerically controlled machine tool software development, and demand deposit accounting.

- *Utility* services are those where the vendor provides access to a computer and/or communications network with basic software that enables users to develop their own problem solutions or processing systems. These basic tools include terminal-handling software, sorts, language compilers, database management systems, information retrieval software, scientific library routines, and other systems software.

Software Products - This category includes users' purchases of applications and systems packages for use on in-house computer systems. Included are lease and purchase expenditures, as well as fees for work performed by the vendor to implement and maintain the package at the users' sites. Fees for work performed by organisations other than the package vendor are counted in professional services. There are several subcategories of software products.

- *Applications Products* - Software that performs processing to service user functions. They consist of:

  - *Cross-Industry Products* - Used in multiple-user industry sectors. Examples are payroll, inventory control, and financial planning.

  - *Industry-Specific Products* - Used in a specific industry sector such as banking and finance, transportation, or discrete manufacturing. Examples are demand deposit accounting and airline scheduling.

- *Systems Products* - Software that enables the computer/communications systems to perform basic function. They consist of:

  - *Systems Control Products* - Function during applications program execution to manage the computer system resource. Examples include operating systems, communication monitors, emulators, and spoolers.

  - *Data Center Management Products* - Used by operations personnel to manage the computer system resources and personnel more effectively. Examples include performance measurement, job accounting, computer operations scheduling, and utilities.

  - *Applications Development Products* - Used to prepare applications for execution by assisting in designing, programming, testing, and related functions. Examples include languages, sorts, productivity aids, data dictionaries, database management systems, report writers, project control systems, and retrieval systems.

Professional Services - Made up of services in the following categories:

- *Education Services* - EDP products and/or services - related to corporations, not individuals.

- *Consulting Services* - EDP management consulting and feasibility studies, for example.

- *Contract Staff* - User-managed temporary EDP staff supplied by service organisation.

- *Custom Software Development* - Including system design, programming, testing, documentation and project management.

- *Professional Services Facilities Management (PSFM)* - The counterpart to processing facilities management, except that in this case the computers are owned by the client, not the vendors; the vendor provides people to operate and manage the client facility.

Standard Turnkey Systems - An integration of systems and applications software with hardware, packaged as a single entity. The value added by the vendor is primarily in the software. Most CAD/CAM systems and many small business systems are standard turnkey systems. This does not include specialised hardware systems such as word processors, cash registers, and process control systems.

Standard turnkey systems revenue in this report is divided into two categories:

- *Industry-Specific* systems; i.e., systems that serve a specific function for a given industry sector such as seismic processing systems, automobile dealer parts inventory, CAD/CAM systems, discrete manufacturing control systems, etc.

- *Cross-Industry* systems; i.e., systems that provide a specific function that is applicable to a wide range of industry sectors such as financial planning systems, payroll systems, personnel management systems, etc.

Revenue includes hardware, software, and support functions.

Systems Integration - Services associated with systems design, integration of computing components, installation, and acceptance of computer/communications. Systems integration can include one or more of the major information services delivery modes—professional services, turnkey systems, and software products. System components may be furnished by separate vendors (not an an integrated system by one vendor, called the prime contractor); services may be furnished by a vendor or by a not-for-profit organisation. Integration services may be provided with related engineering activities, such as SE&I (Systems Engineering and Integration) or SETA (Systems Engineering and Technical Assistance).

C

Hardware/Hardware Systems

Hardware - Includes all computer communications equipment that can be separately acquired, with or without installation by the vendor, and not acquired as part of a system.

- *Peripherals* - Includes all input, output, communications, and storage devices, other than main memory, that can be locally connected to the main processor and generally cannot be included in other categories, such as terminals.

- *Input Devices* - Includes keyboards, numeric pads, card records, bar-code readers, lightpens and trackballs, tape readers, position and motion sensors, and A-to-D (analog-to-dialog) converters.

- *Output Devices* - Includes printers, CRTs, projection television screens, microfilm processors, digital graphics, and plotters.

- *Communication Devices* - Modems, encryption equipment, special interfaces, and error control.

- *Storage Devices* - Includes magnetic tape (reel, cartridge, and cassette), floppy and hard disks, solid state (integrated circuits), and bubble and optical memories.

Terminals - There are three types of terminals:

- *User Programmable* (Also called 'intelligent terminals'):

  - Single-station or standalone.
  - Multistation-shared processor.
  - Teleprinter.
  - Remote batch.

- *User Nonprogrammable*:

  - Single-station.
  - Multistation-shared processor.
  - Teleprinter.

- *Limited Function* - Originally developed for specific needs, such as POS (point of sale), inventory data collection, controlled access, etc.

Hardware Systems - Includes all processors, from microcomputers to super (scientific) computers. Hardware systems require type- or model-unique operating software to be functional, but the category excludes applications software and peripheral devices, other than main memory and processor or CPUs, not provided as part of an integrated (turnkey) system.

- *Microcomputer* (or personal computer or PC) - Combines all of the CPU, memory, and peripheral functions of an 8- or 16-bit computer on a chip, in the form of:

  - Integrated circuit package.
  - Plug-in board with more memory and peripheral circuits.
  - Console—including keyboard and interfacing connectors.
  - Personal computer with at least one external storage device directly addressable by CPU.

- *Minicomputer* - Usually a 12-, 16-, or 32-bit computer which may be provided with limited applications software and support and may represent a portion of a complete large system.

  - Personal business computer.

  - Small laboratory computer.

- Nodal computer in a distributed data network, remote data collection network, connected to remote microcomputers.

- *Mainframe* - Typically a 32- or 64-bit computer, with extensive applications software and a number of peripherals in standalone or multiple CPU configurations for business (administrative, personnel, and logistics) applications also called a general-purpose computer.

  - Large computer mainframes are presently centered around storage controllers but likely to become bus-oriented and to consist of multiple processors (CPUs) or parallel processors; they are intended for structured mathematical and signal processing and are generally used with general purpose von-Newmann-type processors for system control.

  - Supercomputer mainframes are high-powered processors with numerical processing throughout that is significantly greater than the largest general-purpose computers, with capacities in the 10-50 MFLOPS (million floating point operations per second) range, in two categories:

- *Real Time* - Generally used for signal processing.

- *Nonreal Time* - For scientific use, with maximum burst-mode (but sustained speed) capacities of up to 100 MFLOPS, in one of three configurations:

  - Parallel processors.

  - Pipeline processors.

  - Vector processors.

  - Newer supercomputers—with burst modes approaching 300 MFLOPS, main storage size up to 10 million words, and on-line storage in the one-to-three gigabyte class—are also becoming more common.

  - *Embedded Computer* - Dedicated computer system designed and implemented as an integral part of a weapon or weapon system, or platform that is critical to a military or intelligence mission, such as command and control, cryptological activities, or intelligence activities. Characterised by MIL SPEC (military specifications) appearance and operation, limited but reprogrammable applications software, and permanent or semipermanent interfaces. May vary in capacity from microcomputers to parallel processor computer systems. Information services forecasts in this report do not include applications for this type of computer.

D

Telecommunications

Networks - Interconnection services between computing resources, provided on a leased basis by a vendor to move data and/or textual information from one or more locations to one or more locations.

- *Common Carrier Network (CCN)* - Provided via conventional voice-grade circuits and through regular switching facilities (dial-up calling) with leased or user-owned modems (to convert digital information to voice-grade tones) for transfer rates between 150 and 1,200 baud.
- *Local Area Network (LAN)* - Restricted limited-access network between computing resources in a relatively small (but not necessarily contiguous) area, such as a building, complex of buildings, or buildings distributed within a metropolitan area. One of the two types:
  - *Baseband* - Voice bandwidth at voice frequencies (same as telephone, teletype system) limited to a single sender at any given moment and limited to speeds of 75 to 1,200 baud, in serial mode.
  - *Broadband* - Employs multiplexing techniques to increase carrier frequency between terminals, to provide:
    - Multiple (simultaneous) channels via FDM (Frequency Division Multiplexing).
    - Multiple (time-sequenced) channels via TDM (Time Division Multiplexing).
  - High-speed data transfer rate via parallel mode at rates of up to 96,000 baud (or higher, depending on media).

Transmission Media - Varies with the supplier (vendor) and with the distribution of the network on its access mode to the individual computing resource location.

- *Mode* - may be either:
  - *Analog* - Typified by the predominantly voice-grade network of AT&T's DDD (direct Distance Dialing) and by operating tele phone company distribution systems.
  - *Digital* - Where voice, data, and/or text are digitised into a binary stream.

- *Media* varies with distance, availability, and connectivity:

  - *Wire* - Varies from earlier single-line teletype networks to two-wire standard telephone (twisted pair) and balanced line to four-wire full-duplex balanced lines.

  - *Carrier* - Multiplexed signals on two-wire and four-wire net works to increase capacity by FDM.

  - *Coaxial Cable* - HF (High Frequency) and VHF (Very High Frequency), single frequency, or carrier-based system that re quires frequent reamplification (repeaters) to carry the signal any distance.

  - *Microwave* - UHF (Ultra High Frequency) multichannel, point-to-point, repeated radio transmission, also capable of wide frequency channels.

  - *Optical Fiber* - Local signal distribution systems employed in limited areas, using light-transmitting glass fibers and with TDM for multichannel applications.

  - *Satellites* - Synchronous earth-orbiting systems that provide point-to-point, two-way radios that are linked by a computer system to track mobile phone/data set units; each radio serves a small area called a cell. The computer switches service connection to the mobile unit from cell to cell as the unit moves among the cells.

  - *Cellular Radio* - Network of fixed, low-powered, two-way radios that are linked by a computer system to track mobile phone/data set units; each radio serves a small area called a cell. The computer switches service connection to the mobile unit from cell to cell as the unit moves among the cells.

E

Other Considerations

When questions arise about the proper place to count certain user expenditures, INPUT addresses them from the user viewpoint. Expenditures are then categorised according to what users perceive they are buying.