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IT Policies

ORGANISATION STRUCTURE IN MEMBER COUNTRIES

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INFORMATION TECHNOLOGY POLICIES: ORGANISATIONAL STRUCTURE IN MEMBER COUNTRIES

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

Paris 1995

FOREWORD

This report presents a comparative analysis of the survey on organisational structures through which information technology (IT) policies are formulated in OECD Member countries. The survey was carried out in preparation for the Special Session on Information Policy of the Committee on Information, Computer and Communications Policy of the OECD held on 12-13 October 1992.

The report was prepared by Yoshiko Kurisaki, then of the Secretariat, with the assistance of Marcel Waintrater (France) and K. Guild Nichols (United States), consultants. The Committee for Information, Computer and Communications Policy agreed, at its meeting on 14-15 October 1992, that the report should be made available to the public on the responsibility of the Secretary-General of the OECD.

Table of Contents

SUMMARY

Overview

Over the past ten years, some general trends have been observed in information technology (IT) policy developments in OECD Member countries. At the beginning of the 1980s, stimulated by a certain sense of "competition", a number of countries began to develop national IT programmes. They sought to enhance the competitiveness of national industry by using IT as an instrument for innovation in both production processes and products.

IT application increased in importance as a policy goal from the mid-1980s. While the importance of promoting the creation and development of IT-based equipment and systems remained stable, a wide range of policy initiatives was taken in the area of user support. At the same time, the number of ministries and government agencies involved in IT-related policy domains increased.

Government response to increasing IT use has varied widely. Member countries have developed different IT policies, depending on the level of IT use by industry and the general public, and on national policy goals.

IT expenditure data indicate very diverse backgrounds for IT policies. Although there is a correlation between IT spending as a percentage of gross domestic product (GDP) and per capita IT spending, the relationships between IT spending in relation to GDP and its annual growth rate reveal a variety of patterns.

IT policy coverage is wide and is expanding as the opportunities for using IT increase. IT policies therefore have a horizontal dimension. They often include elements of industrial, S&T, telecommunications, education, trade and legal policies. Other horizontal policies, such as regional economic development, often overlap with IT policies.

IT policies thus inevitably involve many ministries (and/or public authorities) in policy making, and this sometimes results in a lack of coherence in policies. The absence of coherence may result in inappropriate allocation of resources, but coherence may have to wait until IT policy priorities become clearer. The issue is not simple. Solutions may differ, depending on national policy priorities, social and economic background, and history.

The challenge to policy-makers

A challenge facing IT policy-makers is to ensure that IT continues to serve the needs of all sectors of society. Moreover, because the social and economic fabric of each nation is increasingly interwoven with that of other countries, national policies for IT have major international implications. International dialogue on IT-related issues is essential.

The national dimension

One aspect of the challenge facing all countries is how to organise IT policy-making efficiently, while accommodating the various interests of society. Two key questions that need to be addressed are: "How do we ensure coherence between policy goals and organisational structure in IT-related issues?" and "How do we organise policy-making to maximise the benefits from IT-related policies developed in different areas?"

The organisational structure of IT policy-making is shaped by the policy contexts of individual Member countries, a fact which needs to be fully taken into account in international dialogue. When analysing national organisational structures, the danger of simplistic comparisons and categories must be avoided. Although IT policy is often discussed using a common vocabulary -- "IT use" in industry, "IT R&D", "IT trade", "information systems" -- the meaning assigned to these terms may differ from country to country.

Nevertheless, despite their different IT policy contexts and organisational structures, Member countries have much valuable experience to share. IT policy variation in Member countries presents a wealth of experience for all countries to learn from.

International dimension

The importance of international factors in national IT policies is increasing. IT policies at the EC level are being incorporated into the policies of its Member states. This development has an impact on IT policy formulation in neighbouring EFTA countries. In the private sector, the IT activities of multinational enterprises (MNEs) need to be taken into account when formulating national policies because of the impact of MNEs on such issues as IT R&D, industry and employment. Thus, the very concept of national IT policies may have to be reconsidered in light of an ever-changing international environment.

Part 1

SYNTHESIS REPORT

I. INTRODUCTION

The purpose of this report is to compare and analyse the organisational structure of policies for information technology (IT) in OECD Member countries. The term "organisational structure" refers to the manner in which governments formulate and implement policies on IT-related issues.

Over the last ten years, many Member countries have seen the need to develop policies in response to the ever increasing impacts of IT. The rapid increase in the cost performance of IT equipment, such as personal computers (PCs), and of components, such as integrated circuits (ICs), has fostered widespread IT use in office management, manufacturing systems and products. At the same time, the liberalisation of telecommunication policies has stimulated the development of opportunities for using computer network systems to link different firms and sectors of the economy. These are but some of the phenomena behind the increased impacts that IT use has had on the economy and society of OECD Member countries.

How governments have sought to react to these IT-related issues is the subject of this report. To a large extent, the response to date has been incremental; no OECD Member country has devised a unified, comprehensive IT policy or established a single ministry or agency responsible for IT policy as a whole. Rather, sets of policies related to IT use have been developed in many government policy areas.

The great diversity of national policy contexts needs to be considered when examining and comparing the organisational structure of policies for IT. Although IT-related policies are commonly part of Member country industrial policies and science and technology (S&T) policies, this does not mean that there is a simple dichotomy between industry-oriented and S&T-oriented IT policies. In addition, while two countries may share the same IT policy goal, such as national economic growth through industrial development, they may take quite different approaches. One country may pursue this goal by promoting IT take-up in all industrial sectors, while another may seek the same goal through pre-eminence in just one industrial sector, such as leading-edge IT development. In yet other countries, such as Canada, France, Ireland, Norway, and Sweden, a policy goal such as regional development may overlap with the industrial development goal.[1]

II. BACKGROUND TO THE ANALYSIS OF THE ORGANISATIONAL STRUCTURE

Evolution of IT policies over the past decade

IT policy developments in OECD Member countries have followed the general trends summarised below.

Similar motivation

A primary motivation behind national efforts to establish IT programmes was a certain sense of "competition" felt by some Member country governments. This was manifest in the so-called "high-tech race" inaugurated by countries with competitive IT sectors, such as Japan and the United States, who were later joined by France, the United Kingdom and Germany. Once the impacts of IT were felt and its potential perceived, especially with respect to the use of microelectronics (ME) in manufacturing and end products, other countries quickly followed. Many national programmes for promoting IT sought to stimulate structural adjustment in existing industry by using IT as an instrument for innovation in both production processes and products.

The move towards applications

As policies for IT evolved during the 1980s, applications became increasingly important. At the beginning of the decade, the priority goal of IT policy was to create and develop IT-based equipment and systems in industry. From the mid-1980s, policy concerns increasingly turned towards IT users. A wide range of new user support policy initiatives were taken, from the promotion of IT take-up by small and medium-sized enterprises (SMEs) to R&D efforts for improving ease of use of IT-based systems. Examples include Japan's FRIEND 21 project and Sweden's MDA and DUP programmes.

Policy convergence

The number of ministries and agencies involved in IT has greatly increased over the past five years. In the early 1980s, usually only the ministry (or agency) responsible for science and technology was concerned with IT. As IT became more widespread, the number of ministries and agencies involved in IT-related areas increased substantially. Issues such as infrastructure and the need for common IT user rules became increasingly important policy concerns. Other examples of evolving IT policy concerns include: education and training for IT skill enhancement, data protection in electronic retrieval systems, and rules for sharing responsibilities among users of the same computerised information systems.

Today, the promotion of IT is becoming less a policy goal in its own right and more an instrument for attaining other policy goals. For example, governments in many countries today consider

microelectronics as a way to promote the growth of SMEs. The same is true for regional development; IT promotion is viewed as a means to an end, not as an end in itself. Other examples include the promotion of computerised farm management systems as a part of agricultural policy in the Netherlands, and the use of electronic networks for health information services as an aspect of social policy in Canada.

Different responses

Over the past decade, government responses to ever increasing IT applications have varied widely. Some illustrations can be found in OECD country studies of the past two years.[2] Austria initially pursued the development of social conditions for IT users and later promoted IT for industrial development. IT promotion for industrial development is also a policy concern in Canada and the Netherlands. In Sweden, where per capita IT expenditure is high and where the IT manufacturing sector is competitive, maintaining national pre-eminence in leading-edge IT has high priority in national IT R&D policy, as do the development of rules for the protection of privacy and R&D for improving the ease of use of IT. The promotion of leading-edge IT R&D is also of strategic importance in the Netherlands, although the government has pursued its IT R&D policy goals through such international R&D initiatives as EUREKA and RACE. Policies for IT in Germany were developed according to a comprehensive framework announced in 1988, which advocated interministerial co-ordination to enhance overall efficiency of the policies.

IT spending in selected countries

Introduction

The data and definition of IT spending used in this report are taken from the results of a 1990 survey undertaken by the International Data Corporation (IDC). IDC data are the only reasonably reliable data source that permits comparison of 17 OECD Member countries (Australia, Austria, Belgium, Canada, Denmark, France, Finland, Germany, Italy, Japan, the Netherlands, Norway, Spain, Sweden, Switzerland, the United Kingdom, and the United States). The definition of IT spending is provided in the Annex to this section.

Indices used are IT spending as a percentage of GDP in 1989, IT spending per capita in 1989, and the growth rate of IT spending from 1989 to 1990. These indices make it possible to compare figures in small, medium and large economies without significant distortion. GDP data were used in order to examine the correlation between the size of economies and the level of IT spending.

Major findings

Figure II-1 shows a positive correlation between IT spending per capita and IT spending as a percentage of GDP. This means that in the countries where IT spending per capita is high, IT spending in relation to GDP is also high.

In the 1989 data, the level of IT spending is not necessarily correlated with the size of national economies (Table II-1).[3] The level of IT spending differs even for countries in the same category. For example, for countries that belong to large economies ("High" in GDP in Table II-1), the level of IT spending is in the medium range for some (the United States, Japan, Germany, France and the United Kingdom), while for others (Canada and Italy), it is in the low range. The same diversity is found among medium and small economies.

Table II-1. **Correlation between GDP and IT spending in relation to GDP, 1989**

	GDP		
IT spending/GDP	High	Medium	Low
High		Sweden Netherlands	Norway Denmark
Medium	United States Japan Germany France United Kingdom	Austria Switzerland Belgium	Finland
Low	Canada Italy	Spain Austria	

Cross-analysis of IT spending as a percentage of GDP and the growth rate in IT spending between 1989 and 1990 also indicate diversity in IT spending patterns (Figure II-2). The fact that both indices are relatively high in Nordic countries (Sweden, Finland, Norway) deserves attention.

Some groupings of countries are possible at least for a short period of time (1989-90):

Countries where the growth rate was high:

-- Both IT spending as a percentage of GDP and the growth rate were high (Sweden); demand for IT was large in relation to GDP.

-- IT spending as a percentage of GDP was in the medium range, but the growth rate was high (Belgium and Finland, and, to some extent, Japan and Norway); IT spending was growing rapidly and had a relatively high market potential.

-- The level of IT spending relative to GDP was low, but the growth rate was high (Italy); the potential for growth in the IT market was large.

Figure II-1

IT spending per GDP and IT spending per capita, 1989

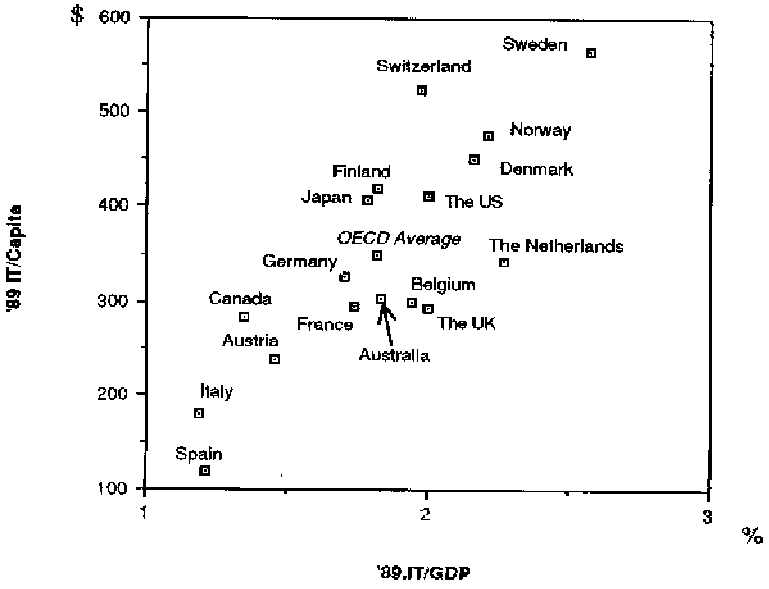
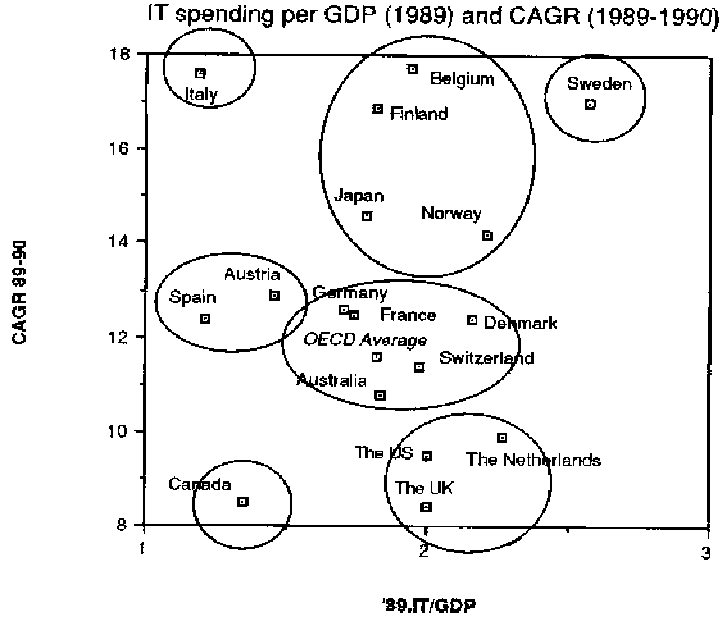


Figure II-2

IT spending per GDP (1989) and CAGR (1989-1990)



Countries where the growth rate was medium:

-- IT spending as a percentage of GDP was low, but the growth rate was medium (Austria and Spain); the growth potential of the IT market was relatively high, but its current growth was moderate.

Countries where the growth rate was low:

-- IT spending as a percentage of GDP was medium, but the growth rate was low (the Netherlands, the United Kingdom and the United States); the growth of IT spending reached saturation point in 1989, but there was a potential for further market growth.

-- Both IT spending as a percentage of GDP and the growth rate were low (Canada); there was a possibility of high market growth in IT, but a breakthrough might be needed to activate the IT market.

IT policy implications

In countries such as Austria, Canada and Spain, where IT spending relative to GDP and population as well as its growth rate are low, policy measures that raise awareness and promote the use of IT may help IT to take off.

Countries such as Sweden, Norway, Denmark and the Netherlands, where IT spending relative to GDP and population as well as its growth rate are high, are considered as having a relatively high penetration of IT use. Policies for these countries would have to focus on efficient use of IT, such as development and management of information systems that connect interrelated sectors of the economy, since in these countries stand-alone use of IT is already widely diffused.

III. REVIEW AND COMPARISON OF ORGANISATIONAL STRUCTURE OF POLICIES FOR INFORMATION TECHNOLOGY

Introduction

The comparative analysis of the organisational structure of Member country IT policies is based upon three sets of source material: Member country responses to the OECD questionnaire;[4] prior OECD reports on national IT policies;[5] and several additional studies carried out in connection with the recent survey.[6]

The OECD questionnaire focused on government policies for promoting IT use outside government. Government actions that affect IT use in industry, education and elsewhere are all regarded as IT policies. IT, in this context, was defined as meaning both hardware and software, physical components and systems (e.g. IT-based information systems). The use of IT in government administration, whether for office automation systems or information resource management (IRM), was excluded.

Ministries and government agencies involved in IT-related policies

Breadth of IT policies

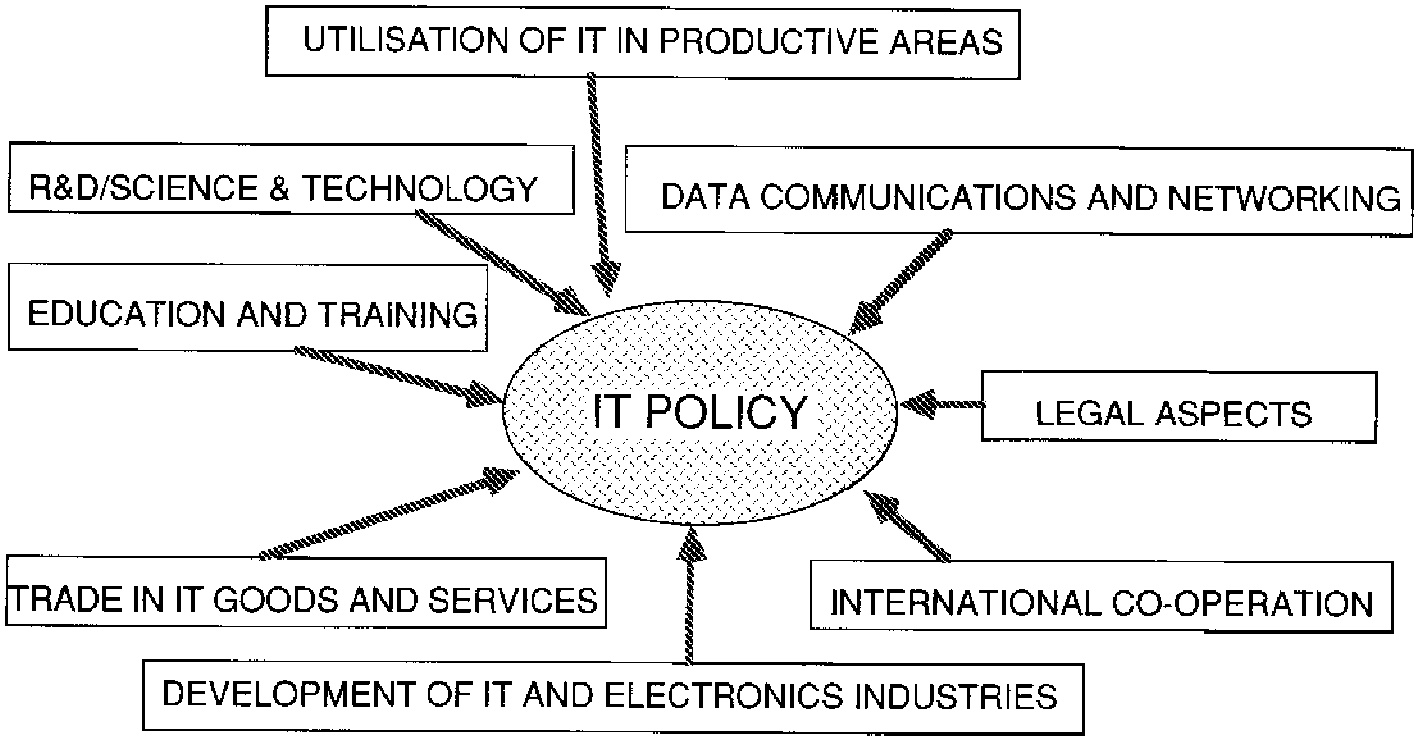
Among the various IT-related policy areas, prior OECD studies have identified nine as being especially pertinent.[7] They are: science and technology (S&T); IT use in industry; IT-producing sectors in industry; data communication and IT-based networking; education and training; labour; legal matters; trade; and international co-operation (Figure III-1). This list indicates how IT development and application (i.e. IT use) is part of the economic, industrial, social and technological fabric of Member countries.

Member country responses to the questionnaire reveal considerable variety in both the type and number of government ministries and agencies involved in IT-related policy areas. None of the Member country respondents indicated the existence of a single ministry responsible for IT policy as a whole. Rather, IT policy in Member countries is comprised of a group of policies that are relevant to IT in the nine categories listed above.

Nevertheless, some areas have more policy relevance for IT than others. Four areas -- S&T, industry (including both IT and non-IT sectors), IT-based networking and legal issues -- are of priority concern in Member countries. The country responses showed that the number of policy areas and level of their intensity tend to increase in countries that place greater importance on the role of IT in overall policy. The four policy areas referred to above are the minimum coverage of national policies for IT.

Figure III-1

COVERAGE OF INFORMATION TECHNOLOGY POLICY



Categorisation of policy-making structure

In terms of concentration of IT-related policy issues, Member country policy-making structures may be categorised in two ways: *i)* those where only one or two ministries are heavily involved in IT-related issues; and *ii)* those where a much larger number of ministries is involved. The level of involvement can be estimated from the frequency with which a given ministry is mentioned, although this measure should be used carefully, owing to considerable variations in the level of detail provided in the responses to the OECD questionnaire. Nevertheless, it may be safely assumed that those ministries more involved in IT-related areas tend to assume more responsibility. For example, in Canada, the Department of Communications (DOC) and Industry, Science and Technology Canada (ISTC) are more directly involved in more IT-related policy areas than other ministries and agencies. The same is true for Germany (the Ministry for Research and Technology and the Ministry for Economics), Japan [the Ministry of International Trade and Industry (MITI) and the Ministry of Posts and Telecommunications (MPT)], the Netherlands (the Ministry of Economic Affairs), Sweden [the Ministry of Industry (MIND)], the United Kingdom [the Department of Trade and Industry (DTI)], and the United States [the Department of Commerce and the National Science Foundation (NSF)]. In several other countries, such as Denmark, Finland, Italy and Portugal, it is more difficult to identify principal ministries because IT-related issues are treated by many different ministries exercising the same or similar levels of responsibility.

Differences in a country's institutional organisation may lead to the involvement of certain ministries that are not specifically involved in industry or S&T. In Sweden, the Ministry of Foreign Affairs is involved in issues of trade in IT goods and services. In Denmark and Sweden, the Ministry of Finance has IT-policy relevance due to its responsibility for the security of information systems and for computer misuse.

Industry and S&T policies in the context of IT policy

Policy related to IT is often closely linked to industry and S&T policies. Most Member countries consider IT very relevant to these two major policy areas. It is very important to innovation and to the development of applications, and this fact is reflected in the organisation of policy-making. While it is true that IT R&D, when undertaken as a part of publicly sponsored S&T programmes, should in principle be limited to pre-competitive subjects, it is also true that IT R&D and applications are, in practice, very closely related. IT is also often regarded as a strategic technology of considerable importance to industrial and economic development. In consequence, public authorities seek to orient IT R&D programmes towards industrial applications, while avoiding direct subsidies to industry. Under such circumstances, it is natural that the ministry in charge of industry, rather than of S&T, is responsible for policy. In fact, R&D in IT and its transfer to industry are often supported co-operatively by ministries (and agencies) responsible for S&T and industry. This may be a practical solution in countries such as Germany, the Netherlands, New Zealand, Spain and the United Kingdom where responsibility for industry and for S&T resides in separated institutions.

At the European level, R&D programmes initiated by the Commission of European Communities (CEC), such as ESPRIT and RACE, are intended to enhance R&D capability through international co-operation by firms in member States. These programmes are instrumental in improving the competitiveness of the European IT sector. They support the implementation of EC industrial policy, which is aimed at promoting Community-wide free market competition, regardless of the nationality of individual industrial firms.

Public policy responses concerning multinational enterprises (MNEs) in the IT sector occur most frequently in the context of industry and S&T policies. Many IT MNEs are developing global approaches to R&D, manufacturing production, marketing and sales. Some countries, such as Canada, Germany, Ireland and the United Kingdom, have adopted positive attitudes towards these MNEs. They consider the foreign-based firms a resource to help develop IT R&D and industry in the host countries. They both expect and accept the transfer of capital and technology capability from the MNEs. Foreign firms in these countries are allowed to participate in publicly-supported R&D programmes, as long as certain conditions are met, such as the establishment of R&D functions in the host country and a degree of employment of the local work force.

Roles for telecommunication policy in policies for IT

In the formulation of policies for IT, the policy role of the telecommunication sector, both for production of equipment and for provision of services, requires some attention. In some countries, the ministry originally in charge of telecommunications is very involved in IT policies.

With respect to telecommunication services, telecommunication policy has increased its influence by helping to shape an environment favourable to users of IT-based information network systems. In Japan and the United States, for example, policies to promote competition in telecommunications and to liberalise the use of leased circuits have resulted in a great variety of telecommunication services connected with computing systems (i.e. the so-called value added network services or VAN).

With respect to telecommunication equipment, IT, in industrial and S&T terms, is of increasing relevance to the telecommunication sector, due to the merging of IT and communication technologies. IT development is crucial to the telecommunication equipment sector. Standardisation also provides a substantial bridge between IT and telecommunications. The number of possible and real areas of co-operation between IT and telecommunication standards-making bodies is increasing, as co-operation between the International Standards Organisation (ISO) and International Telephone and Telegraph Consultative Committee (CCITT) shows.

One distinctive feature of Canadian IT policies is their close interrelationship with policies in both service and manufacturing in the telecommunication sector. Telecommunications have historically played a substantial role in bringing together communities across Canada, and the country has developed telecommunication network systems over a vast geographical area. This development has been supported by the telecommunication equipment manufacturing sector and its high level of R&D capabilities. The strength of Canada's telecommunication sector was one of the major reasons why the Department of Communications (DOC) became involved in policies for IT-related sectors (IT service industry). DOC places considerable emphasis on information (not necessarily technology *per se*) as a resource for economic development and for improving public welfare. In this sense, communication policy in Canada includes a substantial element of IT policy, on a par with those of ISTC that seek to promote the development of the nation's IT industry, IT R&D and technology transfer.

Japan also regards IT-based communication systems as instrumental in economic development, but in a different context. Public interest in information network systems (which make heavy use of computing and telecommunication technologies) is high in Japan. Extensive use of information systems, such as banking and order-entry systems, is considered critical to improving the competitive edge of firms.

For this reason, policies for IT use, IT industry and IT-based information systems are considered inseparable elements of IT policies.

The telecommunication sector is a driving force behind IT R&D in countries such as Spain and Sweden. To some extent, the same applies to the IT R&D at the level of state governments in the United States. Where the computer sector is not highly competitive, IT R&D activities tend to address questions of applications in telecommunication systems. This comes from the nature of IT, i.e. information processing systems, which provides a common basis for computing and communication systems.

IT legal issues

Some countries place relatively greater emphasis on IT legal issues than on issues related to IT industry and S&T. This is the case in Austria, Denmark, and Sweden. As noted in Sweden's response to the OECD questionnaire, "privacy and security are related to public confidence and trust in a technologically-oriented society" and are issues that receive priority over other IT-related policy concerns.

Policy convergence

IT has many social and economic goals and is felt across all sectors of the economy. This necessitates the involvement of many ministries in IT-related policy areas. The breadth of IT issues has also resulted in the gradual convergence of formerly separate policy areas. IT R&D is relevant to the policies of the ministries for industry and S&T, and ministries for telecommunications are also often concerned. This calls for a new categorisation of IT policy areas.

IT policy co-ordination

Most Member countries have one or more bodies responsible for co-ordinating IT-related policies. The responses indicated a wide variation in the status, tasks and budget influence of these bodies.

Often co-ordination of IT-related policy is the responsibility of ministries principally in charge of the area concerned and is, by its nature, spontaneous or *ad hoc*. Thus, co-ordination is mainly assured in Canada by DOC and ISTC, in Denmark by the Ministry of Justice for legal issues, and in the Netherlands and Sweden by several ministries.

Co-ordination tasks vary widely, and many co-ordinating bodies have more than one task, e.g. the formulation of policy guidelines and the monitoring of policy implementation. Eight out of 14 countries responding to this question indicated the existence of a body that co-ordinates the development and purchase of information systems within government. In many countries, co-ordination includes the formulation of guidelines and programmes for the management, procurement, and utilisation of electronic information processing and telecommunication equipment and systems.

Most co-ordination bodies do not have a direct say in budget appropriations. For co-ordination related to specific public actions, such as the provision of financial assistance for IT development in industry, the lead ministry has control over the budget in countries such as the Netherlands and Sweden.

Finland and Germany have a general co-ordinator for IT policies, as did the Netherlands at one time [the Informatics Stimulating Scheme (INSP) of 1984-88]. From 1975 to 1991 in Finland, the Delegation for Information Technology (TINK) co-ordinated the major political, economic and social issues generated by the development and diffusion of IT. It formulated policy guidelines and made specific proposals based on its own research. In Germany, the Federal government established three co-ordinating bodies in connection with its framework policy for IT.[8] These are the Inter-Ministerial Working Group on IT-Policy, the Federal Government-Länder-Ministerial Working Group for IT-Policy, and the IT-Round Table Ministries and IT-Industry. Each group is established within the competent ministry. In the Netherlands, the Ministry of Economic Affairs took on the role of formal co-ordinator with the co-promoters of INSP, the Ministry of Education and Science, and the Ministry of Agriculture and Fisheries. Under the scheme, the government promoted policies for economic development, science and technology, and the development of the human resources needed for the use and diffusion of IT.[9]

The role and effectiveness of these policy co-ordinating bodies deserve some attention. When the INSP ended, the government of the Netherlands ceased formal co-ordination of IT. By that time, IT promotion had become less important to the ministries involved, and the government considered that IT use should be instrumental in ongoing public actions and that IT and IT-based systems should be used by each ministry in the implementation of its own goals. In Finland, TINK no longer has a general co-ordinating function. Only Germany has established a framework for comprehensive IT policies and co-ordinating bodies that cuts across different ministries, Länders and the private sectors. The different experience of these countries can help other countries judge the necessity and role of inter-ministerial IT policy co-ordination.

National IT programmes

All the respondent countries except Denmark reported one or more national IT programmes. These programmes reflect the industrial and technological background of each country (major programmes are presented in Table III-1). It is not possible to categorise these programmes exhaustively. Different countries have different problems and require different strategies. Some countries place higher priority on the promotion of the development of leading-edge IT (e.g. Finland, Japan, Sweden and the United States), while others emphasise the promotion of IT use in industry in general through its integration in production processes and products (e.g. Austria, Greece and Spain). In fact, Member countries tend to assign a mixed set of goals to their national IT programmes. Some, such as Germany and the United Kingdom, have a large-scale programme with different tasks assigned to different targets. Table III-1 is a tentative attempt to categorise some of the wide variety of national IT programmes.

Table III-1. **Major national IT programmes**

Category		Country and programmes (Programme period)
A.	Leading-edge IT	**Finland**: Machine Vision (92-96). **Japan**: Fifth Generation Computing System (82-92), The Real World Computing System (92 onward). **Sweden**: IT4 (87-92). **The United States**: High Performance Computing & Communications (HPCC) Programme (FY 92/93 onward).
B.	IT integration in industry	**Austria**: Austrian Industrial Research Promotion Fund (FFF) (67 onward), Innovation and Technology Fund (ITF) (88 onward). **The Netherlands**: Programmatic Business Oriented Technology Stimulation (PBTS-IT) (88 onward). **Norway**: IT-Plan for the Industrial Sector (92-95).
C.	Promotion of microelectronics (ME)	**Canada**: ME and System Development Programme (MSDP) (88-93). **The Netherlands**: Grant for stimulating ME applications in products (MiToe) (91 onwards). **Switzerland**: ME Programme (92-97).
D.	Pre-competitive R&D	**Canada**: Strategic Technology Programme (88 onward). **Finland**: Machine Vision (92-96). **Germany**: Promotion Concept IT 93-96). **Italy**: Informatica.
E.	Applied R&D	**Canada**: Industrial Research Assistance Programme (IRAP) (92-96). **Finland**: Graphic Arts (92-95).
F.	Science and technology in general	**Austria**: FFF (67 onward). **Ireland**: R&D Support (ongoing).
G.	Promotion of research, industrial, and academic co-operation	**Canada**: Networks of Centres of Excellence (88-93). **New Zealand**: National Research, Education and Information Network. **Norway**: National Infrastructure for IT (90-92).
H.	IT-based networks	**Greece**: ATHINA. **Ireland**: Information Systems for Education. **Japan**: Inter-Industry EDI Pilot Model Development Project. **The United States**: High Performance Computing & Communications Programme.
I.	Telematics	**Finland**: TELMO (88-92). **Greece**: HELLESTEL (92-93), HELLASCOM (92-93). **Japan**: The Frontier Research in Telecommunications (88 onward). **The Netherlands**: Programme for Projects in the Field of Telematics (TGP) (91 onward). **New Zealand**: World Communications Laboratory
J.	Comprehensive IT programme	**Germany**: Future Concept for IT (89-93). **Greece**: Mediterranean Integrated Programme - IT (86-92). **Portugal**: Integrated Programme of IT and Electronics (PITIE) (89-92). **The United Kingdom**: Joint Framework for IT (JFIT) (88 onward).
K.	Software sector	**Ireland**: National software Directorate (91-95).
L.	Human resource development	**Canada**: Canada Scholarships Programme (88 onward). **Ireland**: Learning Certificate Vocational Programme (LCVP) (89 onward). **Switzerland**: CIM Programme (90-95).

Source: Country responses to the OECD questionnaire.

In some countries, where the population of IT users is still small, the public sector plays an important role as the largest user of IT-based systems. Many programmes involve universities and research institutions, for example, and national governments support these programmes for two reasons: to stimulate the use of IT-based systems; and to promote the development of educational and R&D infrastructure. The High Performance Computing and Communications (HPCC) project in the United States and the National Research Education and Information Network in New Zealand are examples. In Norway, the government network systems were originally developed for internal administration but are now being extended to link the government sector with the private sector.

Higher education institutions sometimes play a similar role in promoting IT use by local governments where the latter are responsible for education policy, as in many US state governments.[10] The development of IT-based information networks is increasingly coming to be considered as an important means of access to information for higher education institutions in the United States. Examples include the New York State Education and Research Network (NYSERNet) in New York and the Texas Education Network (TENET) in Texas. In Tennessee, a university is used both as a network testing ground and the centre of expertise. The State Department of Economic and Community Development started the Telecommunications Applications Partnership (TAP) programme, involving Bell South, the University of Tennessee and state businesses.

Goals of IT policies

Current major policy goals

A degree of overlap is inevitable when describing IT policy goals. This is largely due to IT's role as an instrument for achieving various policy goals and to the fact that IT policies go beyond the development of IT industry or the technology itself. In all the country responses to the survey, more than two policy goals were indicated (Table III-2). This indicates that policies for IT are often directed toward several goals, and the responses therefore should be interpreted as approximations of policy goals, which have a variety of meanings in the diverse national policy contexts.

Table III-2. **The current major policy goals**
(multiple answers)

	Goals	Responses
a.	To support national economic development by enhancing the competitiveness of national industry	11
b.	To support the improvement of national welfare through the use of information networks enabled by IT	7
c.	To encourage better use of IT in economy and society	13
d.	To support the sound development of the national science and technology basis	9
e.	To support the international development of IT	4
f.	Other	5

Source: Country responses to the OECD questionnaire.

Norway and Sweden responded that IT policies are considered as a means for achieving existing policy goals, and that there were no specific policy goals for IT itself. In contrast, Germany selected all the options. Nonetheless, in spite of the differences, IT appears to play a substantial role in the implementation of existing policies in all these countries.

The choice of goals

Member countries generally saw IT as necessary for improving industrial competitiveness (Table III-3). Fourteen out of the 17 countries responding to the survey included this option in their responses.

Table III-3. **Reasons for the selection of the goals**
(multiple answers)

	Reasons	Responses
a.	Information is becoming a resource for the development of the national economy	11
b.	It is recognised that IT use is inevitable for the enhancement of competitiveness of the national industry	14
c.	There is a national consensus that the support of the development of science is a role of the government	6
d.	Other	5

Source: Country responses to the OECD questionnaire.

Various reasons were given for selecting policy goals. Industrial implications were central, and the reason most often given was the importance of information as an economic resource and IT as a way to enhance industrial competitiveness. This was the case for Canada, Denmark, Greece, Ireland, the Netherlands, Portugal, the United Kingdom and the United States. Norway and Switzerland may also be included in this group, although the former's response only gave industrial implications and the latter included S&T policy support.

In prioritising policy goals, Sweden placed equal importance on industrial, scientific and social aspects of IT. The development of legal measures, such as privacy and security protection, was given high priority and was considered helpful to ensuring public confidence and trust in the use of advanced technologies.

Japan's rationale for selecting policy goals was broader. It recognised IT as a resource for enhancing national welfare in general terms.

Austria, Germany and Italy selected all the options, thereby indicating the importance of IT for economic development in general, as well as for industrial and S&T development. The diversity of the reasons in Austria and Italy seems to stem from the relatively weak focus of IT policies. In Germany, instead, the coherent IT policy framework embraces all the IT-related policy areas. One reason provided

by Germany deserves special attention: "Information plays a decisive role in international co-operation and understanding."

IT policy debates

High popularity

IT policy is a popular topic of discussion in OECD Member countries. Fourteen out of 17 countries had been involved in discussions on IT policies in the previous three years in a variety of venues: Parliament, relevant ministries, the media, industrial associations (in Canada, Japan and New Zealand), seminars (in Portugal), and many others. In some countries, sub-national government, e.g. at the level of the provinces in Canada, has a substantial role in the IT policy debate.

Major subjects of discussion

IT policy debate is often linked to industrial policy (Table III-4), and IT R&D and IT skills obtained relatively high response rates in the survey. This may be because these subjects are discussed in connection with IT use in industry. Six countries expressed concern over the organisation of IT policies, reflecting the inherent difficulty of developing efficient policies for such a pervasive phenomenon.

Table III-4. **Major subjects of discussion on IT**
(multiple answers)

	Subjects	Responses
a.	Organisation of policies for IT	6
b.	IT R&D	8
c.	Enhancement of competitiveness in national industry	14
d.	Formulation of legal rules for the use of IT-based systems	4
e.	The development of IT skills in human resources	7
f.	Other	3

Source: Country responses to the OECD questionnaire.

Detailed study of country responses on this issue reveals certain characteristics of the respondent countries. In Germany, the social impact of increasing IT use is discussed, particularly its potential impacts on communication patterns and behaviour and the labour market.

Japan indicated that major topics of IT policy debate include the development and implications of open systems. This reflects the fact that, in Japan, IT is seen in the context of IT-based information network systems, including tools for manufacturing systems such as Computer Aided Designing and

Manufacturing Systems, and computing systems, *via* telecommunication infrastructure, rather than ME components and stand-alone equipment.

In some countries, IT policy debate focuses on a specific sector, such as the development of the software sector in Ireland and New Zealand. Such countries seem to have a policy of concentrating resources on one sector rather than spreading them over many.

IT policy definition

Table III-5 indicates the number of countries that chose each option. The preceding responses reveal that there are two definitions of IT policy, one that places IT in a broad policy framework and another with a more narrow industrial focus. Eight countries responded that IT issues are considered in a broad framework that embraces industry and economic development (Denmark, Germany, Greece, Ireland, Japan, the Netherlands, the United Kingdom, and the United States). The other group (Canada, Italy, New Zealand, Norway, Sweden and Switzerland) is more concerned with industrial policy; those countries that responded to options a. (IT industry) and b. (industry in general) are included in this group.

Table III-5. **General definition of IT policy**
(single answer, N=15)

	Definition	Responses
a.	Policies for the development of IT manufacturing and service sectors	2
b.	Policies for the development of national industry in general by using IT	5
c.	Part of policies for the development of science and technology	1
d.	IT policy indicates a broad policy framework that includes all IT-related policy areas	8

Note: A multiple answer from one country is included.
Source: Country responses to the OECD questionnaire.

International co-operation

Co-operation partners

Existing regional organisations provide a forum for international IT co-operation in Europe, where there is a tradition of exchange of S&T personnel and knowledge among neighbouring countries. The most well-known IT R&D programmes are the European Strategic Programme of Research in Information Technology (ESPRIT) and the Research and Development in Advanced Communications Technologies for Europe (RACE), initiated by the Commission of the European Communities (CEC). The attractiveness of these programmes extends beyond the Community. Non-EC member States, such as Austria, Norway, Sweden and Switzerland, also participate on a project-by-project basis. EUREKA, another European R&D initiative, is also a major framework for international IT co-operation.

The Nordic and Pacific countries also undertake co-operative IT R&D at the regional level; examples are the Nordic University Network and Nordic IT Programme (1986-90), and the development of automatic translation systems initiated by Japan with Asian countries, such as Thailand and Malaysia.

R&D for leading-edge IT necessitates broad international co-ordination. The EC, Japan and the United States jointly undertake R&D projects on advanced manufacturing systems. Japan invites international participants to take part in the Real World Computing Systems and, with the EC, is carrying out an ISDN interconnection experiment.

Purposes

International co-operation allows countries to achieve goals or solve problems which surpass the capabilities of a single country. International co-operation augments human and financial resources and is an efficient way of dealing with tasks that concern many countries, such as standardisation and IT policy issues.

Pre-competitive R&D is the most widespread area of international co-operation. The development of the technology base is considered a major responsibility of government in many OECD Member countries. In addition, the costs of leading-edge IT R&D are great, and the work involves high-level expertise. It is natural, as a result, to seek economies of scale in R&D. Developing human resources by taking advantage of mutual strengths is also a goal of R&D co-operation, as in the European IT R&D programmes already mentioned.

Promoting technology transfer to extend the advanced use of IT in industry is another reason behind international co-operation. This is the case for Canada, for example, where the integration of IT in production processes and products has high priority in the broader policy of the promotion of the knowledge-based economy.

IT standards are a major and necessary area of international co-operation. National standardisation systems are well-established both in countries with a competitive IT sector and in those that mainly use, rather than produce, IT. These national systems work closely with international standards organisations, such as CCITT and ISO.

International organisations provide another useful forum for countries to discuss IT issues other than those related to technology itself. The Council of Europe and the OECD, for example, serve an important function in policy deliberations on international rules covering legal issues, such as protection of privacy and IT network security. The OECD is also active in other policy issues related to IT.

IT policy making by regional/sub-regional authorities

The role of regional/sub-national authorities differs from country to country, depending on the structure of policy-making institutions. It is difficult to make generalisations about their roles across OECD Member countries (Table III-6).

The regional/sub-national governments or authorities in Canada and the United States formulate and implement IT policies with a high degree of independence. Canadian provincial governments are influential in the development of regional economies, and they promote IT use in industry.

US state governments play different roles in IT-related areas.[11] Forty-four states have central IT policy bodies, according to a recent national survey of state information resource management. At the state government level, however, IT more often means information than technology. IT policies mainly concern information systems management for government administration: policies, standards and guidelines for managing IT resources; plans for the acquisition, management and use of IT resources; monitoring implementation of information management plans; and review of IT budget requests and priorities.

State governments have various policy-making systems for IT; among the states surveyed by the OECD, three have independent agencies, one is cabinet-level, and the others are attached to the departments of Administration, Finance, Treasury or Budget Control. Their major functions vary from one state to another. Some have advisory, some have regulatory, and others have consultative functions. Eight out of ten bodies surveyed have an influence on budget.

Table III-6. **The roles of regional/sub-regional authorities**
(single answer, N=15)

	Roles	Responses
a.	The regional/sub-national authorities have independent roles in the planning and implementation of IT policy on local level	7
b.	The regional/sub-national authorities are more involved in the implementation than the planning of IT policy on the national level	7
c.	Other	1

Source: Country responses to the OECD questionnaire.

There has been a growing trend to separate IT policy functions from the operation of information resources. Public actions directed towards recipients outside state government, such as IT diffusion and R&D, are becoming increasingly important. Some programmes are undertaken in co-operation with those funded and initiated by the Federal government or government agencies. In some states, regional telecommunication companies (such as the Regional Bell Operating Companies or RBOCs) play a substantial role in the state government's promotion of the IT sector.

The regional/sub-national authorities with a high level of autonomy in policy-making thus have roles similar to those of national authorities. Government IT policies should take this into consideration.

Private sector involvement

Fifteen out of the 17 countries surveyed consider assessment of private sector needs essential to policy formulation. Areas assessed differ, reflecting the difference in the economic and industrial

background of each country. For example, in Canada, the Netherlands and Japan, IT policy-makers listen to users of IT-based information network systems and to the views of the IT components sector. IT R&D is a major subject of dialogue in Finland, Germany, Norway, Sweden and the United Kingdom. In Germany, Portugal and Sweden, legal issues are also a main concern.

Institutional systems for such assessment vary widely. Most often, the government obtains private sector inputs to policy-making by organising a forum. Structures include the Canadian Advanced Technology Association (CATA); several informal discussion groups on specific subjects in Germany; government councils in Japan; the Information Technology Advisory Board (ITAB) in the United Kingdom, which includes academics; seventeen committees in the United States, such as the Industry Sector Policy Advisory Committees for Trade Policy Matters.

Some countries, such as Austria and Sweden, traditionally have a well-established system for incorporating the opinions of representatives from the society (social partners) in the policy-making process. Corporate managers, workers and academics are all involved. The governments use such systems for the assessment of private sector needs on IT-related issues.

NOTES

1. For detailed analysis of policies for IT in Canada and Sweden, see OECD (1992*a*).

2. OECD (1991) and OECD (1992*a*).

3. As for GDP, countries are classified into three groups, i.e. major, medium-sized and small economies, according to the OECD classification.

4. Member countries responding as of 15 July 1992 included: Austria, Canada, Denmark, Finland, Germany, Greece, Ireland, Italy, Japan, the Netherlands, New Zealand, Norway, Portugal, Sweden, Switzerland, the United Kingdom and the United States (17 countries).

5. In-depth analysis can be found in OECD (1991), OECD (1992*a*), and OECD (1992*b*).

6. For a description of the organisational structures of IT policies in five selected countries, i.e. France, Italy, Japan, Spain and the United Kingdom, the CEC, and ten state governments in the United States, see Part 2 of the present volume.

7. OECD (1991) and OECD (1992*a*).

8. The report, "Future Concept of IT, Framework Conditions for the 1990s", is discussed in OECD (1991).

9. For further discussion, see OECD (1992*a*).

10. For details, see the study on the United States in Part 2 of the present volume.

11. For details, see the study on the United States in Part 2 of the present volume.

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Annex

DEFINITIONS

IT spending is a country's total expenditure on the following items:

-- **Hardware** systems, which include CPUs (central processing units) and basic peripherals. The value of systems include add-on processors, memory, and peripherals, as well as revenue for new systems added to the installed base.

-- **Software**, which includes both packaged software and professional services, i.e. customised software.

-- **Data communications**

***Local area network (LAN) hardware*:**

Restricted to the cards required to implement a local area network. Value was normally assigned on a per-node basis, and includes both new networks and nodes shipped into existing LANs. Includes both PC LANs and system LANs.

Other data communications equipment, limited to hardware:

-- *Modems*

Restricted to analogue and short-haul modems, segmented into dial-up and leased line segments and by speed (14.4, 16.8-19.2, 1 200, 4 800 and 9 600 bps). No fibre optic, satellite, packet or broadband modems or data-over-voice (DOV) products are included.

-- *Multiplexors*

This includes time-division multiplexors, point-to-point TDMs, networking T-1 TDMs, and four types of statistical TDMs; coaxial, frequency-division, or DS-3 multiplexors, or digital access cross-connect systems are not addressed.

-- *X.25 Packet-Switching Equipment*

Includes all packet-switch nodes to route data packets *via* the most efficient available path and packet assemblers/dis-assemblers (PADs) to convert asynchronous and/or synchronous data to the X.25 protocol format.

-- *Digital Switching Equipment*

Matrix switches and data PBXs used to connect terminals to computer ports.

-- *Communication Processors*

Front-end systems designed and sold exclusively for this purpose.

-- *Channel extenders*

Devices to extend the distance over which an I/O channel on a single IBM mainframe can communicate with an IBM-compatible peripheral or another IBM mainframe.

-- Services

The repair or replacement of components of computer systems' hardware and other hardware services, namely, disaster recovery, site planning, installation, and relocation. Maintenance revenue may be generated by on-site maintenance, time and materials, parts for self-maintenance, and/or depot services, in each case on a service contract or non-contract basis. It specifically excludes all software support.

Part 2

COUNTRY STUDIES

FRANCE

Government IT policies

Policy framework and objectives

France's industrial policy is founded on the traditional notion of a procedure that begins with basic research and follows on to mass production. For this reason, policy statements on information technologies rarely use the term "information technologies", preferring sector-oriented terminology such as electronics or electronics and informatics (*électronique et informatique*). Thus, information technologies appear to be mainly viewed in the context of a production process (as final products or as intermediate goods), rather than in terms of end uses (by individual consumers or by other firms).

The IT sector as a whole is seen as strategic because of its size and relative growth and also because:

-- it is a major source of employment;

-- it contributes significantly to the commercial balance; it induces innovation and growth in the whole economy; it is the main factor for progress in production, R&D and education;

-- it is a dominant component of military systems;

-- as a vehicle for news and for ideas, it is instrumental in shaping civilisation and defining its contents; it is therefore the key to effective control of France's (and Europe's) cultural identity.

French officials generally feel that all important aspects of the IT sector are strategic. As all fields in the sector are strongly interrelated (mainly through the "components" sub-sector), a weakness in any of them makes firms in other fields dependent on foreign competitors.

Moreover, IT is an emerging industry and one for which the rules of the market economy cannot be applied blindly, all the more because competitors are suspected of not playing according to those rules.

The European context

The way of thinking just described initially reflected the views of the French IT industry. When it became clear that France could not carry out projects of the necessary magnitude alone, emphasis switched from the national to the European level. Recognising the lack of a national critical mass as compared to non-European competitors, French industrial policy has turned to European firms, to Europe

as a natural market for IT-related activities, and to the need for a joint European (pre-competitive or project-oriented) R&D effort. The European dimension has become essential to the French concept: an integrated industry whose main elements must all attain critical mass is dependent on a European effort.

As the goals of French industrial policy are now being set with reference to Europe, French officials naturally expect European institutions to take upon themselves at least part of the responsibilities, including technological leadership, regulation, and trade negotiations. Steps taken by departments of French ministries are intended, from the onset, to be formalised and implemented through the European Community. While the Ministry of Industry is, in most cases, the leader in the decision-making process, no single department of French government can be seen as the co-ordinator of an overall IT industrial policy.

Other aspects

Still, it would be misleading to restrict French IT policy to European industrial considerations. There has always been a clear understanding, within the administration and at the decision-making level, of the importance of other aspects of IT, such as basic research, education, and use by firms and individuals alike. Two recent changes have given those concerns even more weight.

The first is a direct result of the shift from a national industrial policy towards a European one. French government ministries have effectively surrendered the ability to set up national projects of their own. They consider themselves responsible for designing high-level policy and for having it endorsed by the European Community, but they accept the fact that implementation of that policy is mostly outside their realm. Thus, by comparison with the time when the French government put all its energy into attempts to design and implement an industrial policy of its own, more time and attention are now available for market-oriented policies.

While major decisions on industrial and trade policies are dependent on co-operation between France and its European partners, action within France is devoted to creating a favourable environment for IT. Government's role is to help emerging needs find new solutions by helping units that are receptive to both the technologies and the market. One instance is the use of public tenders for industrial firms or research laboratories by both the Ministry of Research and the Ministry of Industry.

The second major change results from the decentralisation process of the last decade. Local authorities have been given broader powers, as well as the ability to raise more funds to finance their activities. Public-interest groups and private corporations have been involved in local development projects, particularly high-tech projects. For IT, the effects are already visible in education, in R&D, and in the creation and operation of science parks. As these developments are largely the result of local initiatives, national ministries need not be involved, although some local experiments participate in wider schemes managed by the Ministry of Industry. At present, due to the novelty of the phenomenon, there is no overall view of decentralisation, and it will take some time to gather enough information to make a general assessment. Nevertheless, decentralisation is likely to foster more innovative uses of IT, paving the way, in some instances, for nation-wide action. Data networks, for instance, were built in technology-minded regions and were only later integrated into a national network.

Organisational framework

Ministries act in their own fields, with occasional co-operation on specific matters. General principles are usually formulated by two ministries: the Ministry of Industry and Foreign Trade, acting through its *Service des industries de communication et de service* (SERICS), a 60-person unit within the *Direction générale des stratégies industrielles*, and the Ministry of Research and Space, acting through its *Département des mathémathiques et technologies de l'information*. The Ministry of Posts and Telecommunications is involved in matters pertaining to its own field, including procurement for its activities. The same can be said of the Ministry of Defence. The Ministry of Education and Culture deals with training for IT and the use of IT as training tools, with copyright regulation on software products, and also with IT in the context of mass culture. Last, but perhaps not least, the *Commissariat général du Plan* is the place where representatives from all concerned ministries meet with representatives of universities, research centres, and public and private firms; while its role is to issue recommendations and while it takes no part in enacting government policies, the *Commissariat* often expresses prevailing opinion on major issues.

The promotion of IT in education and training

Education for IT and IT in education

Since the 1970s, the Ministry of Education has been active in promoting the use of computers at school, both as a teaching tool and in order to introduce young pupils to IT concepts. In the early 1980s, *Informatique pour tous* followed a national plan whereby schools all over the country were equipped with computers. However, the experiment encountered many difficulties, due to lack of adequate software and a sufficient number of trained teachers. Since then, investments have been made in software and in training teachers in the use of multimedia tools. Today's approach is far more decentralised, in terms of the kind of tools used (distance interactive systems based on the Minitel network, local cable networks, individual computers, VCRs); the context in which they are used (primary or secondary schools, vocational courses, university teaching); and the geographical framework (national, regional, or local, depending on the degree of local initiative and funding).

With regard to the teaching of IT at the high school level, there seem to be two conflicting views. One position is that already fully packed teaching programmes should not be burdened with additional IT courses: pupils should receive good training in mathematics and physics, so that those who have the capacity and the motivation to pursue the subject can do so at a later stage; on the other hand, the argument continues, all pupils should be given an opportunity to become familiar with the use of computers and with software tools like word-processing or spreadsheet applications. The alternative stand, expressed by teachers, is that simple familiarisation is useless, since the tools available at school will soon be obsolete; instead, it is necessary to provide all pupils with an understanding of IT, including algorithms and the basics of programming, so that they can later relate to the subject itself in an educated way.

Every year, the French educational system produces about 14 500 university level specialists, of which 6 500 engineers; the number is generally considered too low. There is a lack of qualified specialists, mainly in such fields as software engineering and the design of circuits and machines. Accordingly, attention has been devoted to attempts to attract some of the most gifted students to IT. For example, it has been announced that a new high-level engineering school, the *École des Mines* to be established at Nantes, will be entirely devoted to IT. Another way of improving the present situation is to

train workers and technicians employed at IT firms; recently, both firms and the state have invested heavily in either on-the-job training or extensive training schemes leading to degrees. It is also felt that marked progress could be made if more women were attracted to IT-related fields.

IT as a training tool

IT is an important tool in training schemes for people who cannot attend regular courses, such as employees at SMEs undergoing on-the-job training, people who live far from the main cities or who work on an incompatible fixed schedule. In such cases, distance education (including interactive techniques) offers a very effective solution. The *Délégation de la formation professionnelle*, which is part of the Ministry of Labour, has earmarked budgets for multimedia training. At the Ministry of Education, the *Mission des équipements pédagogiques et des nouvelles technologies d'enseignement* acts mainly as a co-ordinator for local initiatives in that field. The main problem, at the present time, seems to be a lack of teaching materials adapted to the new technologies.

In 1990, the *Délégation de l'aménagement du territoire et de l'action régionale* (DATAR) began to support the development of distance education and training through IT. In November 1990, the Council of Ministers stressed the importance of this effort. About 30 local initiatives benefited from help by DATAR, in projects such as linking schools to cable networks, transmitting courses by satellite between two universities, and building communication networks for vocational training. However, commercial or legal factors lessened their effectiveness; university courses transmitted by satellite could not receive credit in a regular curriculum, and the high communication costs for distance education caused difficulties.

IT in industrial policy

An assessment of Europe's problems

Any statement on France's IT industrial policy begins with a recognition of the profound crisis in Europe's electronics industry. Its commercial balance is negative and getting worse by the year; moreover, a significant part of IT production inside Europe comes from firms owned by non-European capital.

In computers and electronic components, France's -- and Europe's -- prospects have long been recognised as weak. But in sectors considered as its strongholds, such as telecommunications, professional electronics, software and related services, the situation seems to be worsening. The so-called domino effect might well put the electronics industry at risk.

European firms are dependent on foreign suppliers for micro-electronic components and for peripheral equipment. According to French analysts, this dependency hurts Europe's IT producers in two ways:

-- For commodity products: Europeans mostly buy from potential competitors in other products (e.g. advanced DRAM memories, where Japan is by far the main supplier). Such dependency is potentially dangerous, because there is no guarantee of future supplies. The possibility that foreign suppliers/competitors may indulge in unfair practices -- such as intentionally supplying parts of inferior quality, with backward technologies, at high prices and not on time -- is

mentioned, in the report of the working group on IT at the *Commissariat Général du Plan*, as a reason why European firms should have capacity in such fields.

-- For specific products (peripheral equipment and especially components): French analysts stress the need for the proprietary know-how of the system's builder, whence the impossibility of relying on foreign suppliers. European firms must have the ability to produce these products on their own, but the ability to produce is useless if the firms cannot use advanced production techniques while remaining reasonably cost-effective -- and that, in turn, is possible only if those firms can enter mass-production of commodity products. This is one extreme example of the "domino effect".

The problem of Europe's electronics industry is seen not as a lack of innovative or technological ability, but rather as the inability to bring a new product to industrial large-scale production and then to mass commercialisation. Because they are so dispersed, European firms cannot afford to invest appropriately in R&D and equipment (or they must amortise on small production series, which makes them either uncompetitive in pricing or unprofitable); their investments are often redundant; research workers cannot change jobs as freely as desirable; and decisions on how to buy or sell are not made under optimal conditions. Moreover, since firms are not usually vertically integrated, they cannot switch risks and cash-flows from components to systems and back.

Principles for a European policy

Generally speaking, French officials do not object to a market-oriented approach to information technologies. But their view is that the IT sector suffers from a "structural" market distortion. It is therefore necessary to correct the inherent deficiencies of the sector, in order to pave the way for a true IT market in the long term. A major policy aim is to build a large industrial base that will give industrial users free and equal access to the needed technologies. Considering the size of the market and of firms, such a programme makes sense only at the European level. Thus, French views are to be transformed into European policy-making, which in turn will be transformed, at a later stage, into French practice. That policy should have three main aspects: fostering active European co-operation on all related matters, creating a favourable environment for the production and use of information technologies, and getting fair and reciprocal treatment from Europe's trading partners. International co-operation is considered mainly, if not solely, in the European context. A permanent concern is the need for European industries to attain the so-called "critical mass", that will enable them to compete against American and Japanese industries. In order to attain that goal, European firms should not be merged into wider entities but should co-operate in such a way as to benefit from economies of scale in R&D, equipment, production and marketing.

Even more than the restructuring of the industry, what is needed is a broad market for its products. Without such a market, firms will never attain the size needed to finance R&D and investments and to amortise them afterwards. Neither will they be able to mass-produce at competitive prices. Hence, the importance attached to the unification of the European market.

It is important to ensure that the development of a European market benefits European firms and not solely those foreign firms that stand ready to invade it as soon as it is wide open. At the same time, other industrial countries (meaning, mainly, North America and the Far East) should give European firms, in their home markets, the same rights as those granted to their own firms in Europe. A call for

commercial reciprocity goes along with a call for retaliation, should Europe's partners not be responsive enough.

Sectoral considerations

Electronics have long had high priority in French industrial policy. In that sector, computers are the weakest link. Starting with the ill-fated *Plan Calcul*, successive French governments have tried to build a competitive industry. Lessons have been learned about the dangers of protecting producers from the market and about the wish for national autonomy. But the government still has to find a way to give the French computer industry a fair chance in a future European IT industry. In the most recent attempt, at the end of 1991, new commercial and technical agreements between state-controlled Bull and the main foreign computer producers were announced. At the time of this review, no public evaluation of those efforts was available.

French policy-makers stress the fact that electronic components have an increasingly "normative power" in systems: software, which used to give systems their specificity, is today part of system components. Therefore, a European industry deprived of the ability to produce such components would lose, in the long run, the ability to develop systems; even the existence of its software and service industries would be endangered.

The logical conclusion would be to engage simultaneously in the production of all IT components. However, the need for a more strategic approach is recognised. An undeclared policy on electronic components, but one apparently shared by many French officials and by major industrial partners, concerns three main areas. The specific components that are seen as strategic, and for which Europe's industries have a reasonable chance of competing, should be actively helped through R&D promotion and through major projects. Those commodity-like, mass-produced components for which Europe has little chance to compete, should be left to private initiative. As for the intermediate category, it should be given indirect help, mainly by providing it with effective markets within Europe.

According to French spokesmen, European IT firms should be incited to co-operate more closely than they presently do. This means horizontal co-operation, since none of the three leading firms in semi-conductors (Philips, Siemens and SGS-Thomson) controls a significant part of world production, and since a critical mass in R&D and production is a condition for survival. It also means vertical co-operation, since end-products and systems are increasingly linked to their electronics components, making verticalisation another condition for survival.

In both cases, the accent is not on mergers but on co-operation between independent industrial firms. That co-operation is to be as direct as possible; national governments and European authorities are expected to create an adequate environment and, perhaps, to give an initial push in the right direction. Structural and long-term co-operation, say French officials, may be attained through a permanent consultation framework for component makers, and for components makers and systems builders; the European Community would be instrumental here, by supplying background technical and commercial information. Other suggested modes of co-operation include partnerships in capital, joint research centres between both kinds of firms, and common quality standards.

IT and government action

IT and administration

The French public administration is currently being modernised, with widespread use of information technologies. But procurement of IT-related items is only used to modernise the administration; those in charge do not use it as leverage to help local suppliers, or to strengthen certain directions in the development or production of equipment.

At present, the French government's main direct leverage on local IT industry -- apart from the above-mentioned actions pertaining to general regulation or industrial policy -- is through state-controlled industrial actors, such as Thomson-CSF and Bull, or through public entities like France Télécom. Still, even in those cases, the government seems to be less involved in decision-making than public statements suggest.

Similarly, defence-related IT is not defined as critical to R&D or industrial strategies, although Thomson-CSF is a major defense contractor. There are no reports of significant spin-offs, nor are defence considerations said to be critical in the choice of civilian IT objectives.

IT and telecommunications

The Ministry of Posts and Telecommunications intervenes in two ways. Among its purely ministerial attributions (through its *Direction de la réglementation générale*) are the regulation of the telecommunication market (including VAN), research assignments given to the *Centre national d'études des télécommunications* (CNET), and initiatives regarding the industry as a whole. On the other hand, the Ministry has (through its *Direction du service public*) oversight responsibilities for the national telephone operator France Télécom which, although it is no longer a part of the Ministry, remains in the public sector. France Télécom has a rich tradition of innovation, exemplified by the national home interactive network Minitel; it also carries decisive weight through its policies in standards-setting and purchasing of IT equipment, all of which remain subject to government approval.

All main research and higher education institutions in France have had, for some time, their own data networks; so have regions with a high-tech orientation. But these networks were not systematically interconnected, a situation described as a major drawback, particularly by comparison with other countries. So in February 1991, the Ministries of Education, of Posts and Telecommunications, and of Research, decided to launch the network RENATER (*Réseau national de télécommunications pour l'enseignement et la recherche*). The new network, presently defined at a capacity of 2 megabits, will be operated by France Télécom and connected to European countries and to other nations.

Standards

Standards are seen as a major tool for forming a unified European market; this is, as already noted, a major aim of France's IT policies. French experts therefore participate actively in the preparation and implementation of European standards, and French spokesmen stress the need to grant due priority to the standards-making process. Firms should be active in that process through international joint committees. One important goal is to make information systems fully compatible throughout Europe. Conformity testing

procedures should also be expanded, including the development of testing tools and mutual recognition of testing reports. This should lead to strict observance of European (as opposed to non-European) standards in public procurement, mainly for computing equipment. French spokesmen also stress the need to put a stop to discriminatory practices concerning standards, such as those that allegedly exist in main competitor countries.

Some IT standards are set by the *Association française de normalisation* (AFNOR), which is the organisation in charge of standards under the authority of the Ministry of Industry. Others are set by users or, increasingly, by producers. Much work is being done on the issue of legal proof in IT-processed documents, particularly in the area of hierarchies of digital signatures and gradual cryptologic treatment of the document as a whole. It is directed jointly by the *Observatoire juridique des technologies de l'information* (OJTI), which belongs to the Prime Minister's Office, and Edifrance, a non-governmental organisation linked to AFNOR which includes representatives of government and industry.

IT in science and technology policy

R&D projects

Project-oriented R&D takes place largely at the European level. Programmes include EUREKA and particularly JESSI (Joint European Submicron Silicon Initiative), ESPRIT, and the EC's general R&D framework. Pre-competitive research, which has been given high priority in European projects, is still considered important, but France welcomes the recent trend towards more product-oriented projects. France would like to see more work done on industrial projects and on such activities as data network between European research centres, or the new generation of high-performance computers. According to French spokesmen, there is a need for a joint European project on computers and software beyond the IT research done within ESPRIT II and Eureka EAST (Eureka Advanced Software Technology) and ESF (Eureka Software Factory).

The programme on High-Definition Television (HDTV) is seen as a major issue:

-- because the choice of compatible or non-compatible technology will be decisive as to the worldwide market for TV sets, an area of importance to French industry;

-- because control of that technology has bearings on such matters as mass communication, culture and education, and even political influence;

-- because of its other effects on IT-related subjects, e.g. visualisation techniques (flat screens, colour tubes, etc.), integrated circuits (receiving, treatment and control of signals) and software (transmission modes).

France played a major role in having the MAC standards accepted by the EC in 1989 and in promoting research on HDTV within the ESPRIT and RACE programmes. Its aim is to enable European firms to control, in due time, all the technologies, components and equipment needed for HDTV, and to ensure world recognition of European standards.

National R&D

At the national level, the main co-ordinator of R&D is the Ministry of Research and Space, together with research organisations such as CNRS, INRIA and CEA-LETI. The *Centre national de la recherche scientifique* (CNRS), a national multidisciplinary organisation under the supervision of the Ministry of Research, pursues basic and "basic-applied" research in IT in its own laboratories or in associate laboratories, mainly university research centres supported jointly by CNRS and universities. The *Institut national de recherche en informatique et en automatique* (INRIA), a research centre supervised jointly by the Ministry of Research and the Ministry of Industry, employs 600 people and plays a role in the exchange of information at both the national and at international levels. Both CNRS and INRIA set their own goals, according to their appreciation of the major research issues in the field. The Ministry of Research oversees their work according to general science policy in IT, but it does not interfere on specific matters, nor does it try to define "directions". The ministry prefers not to publicise basic research projects; it feels that untimely announcements on such issues as fifth-generation computers or supra-conductivity did more harm than good.

Closer to industry are two other research centres: CEA-LETI and CNET. LETI, a research centre of the *Commissariat de l'énergie atomique* (the public administration, under the authority of the Prime Minister, in charge of France's military and civilian nuclear programmes), is located in Grenoble. It has four departments, specialised in microelectronics, optronics, systems, and electronics and nuclear instrumentation. The *Centre national d'études des télécommunications* (CNET) formerly belonged to the Ministry of Posts and Telecommunications. Under the 1990 law, which defined the new status of France Télécom as a public operator distinct from the ministry, CNET remained with France Télécom, with the provision that it should pursue, apart from its technical assistance to the telecommunication network, wider basic research under direct guidance from the ministry. The CNET's *Centre Norbert Segard* at Grenoble is a major research centre in microelectronics. Together with SGS-Thompson, it set up in 1990 a common research centre in Grenoble dedicated to the development of submicron technology.

In 1984, the Ministry of Research created a scheme for IT research, the *Programmes de recherches co-ordonnées* (PRC). A PRC is a framework for co-ordinated research by public organisations on related subjects. PRCs deal with specific issues linked to fields such as artificial intelligence, man-machine interface, databases or machine architecture; four at first, there were eight in 1992. The person in charge of a PRC is a researcher assisted by a committee composed of representatives of government, of the private sector and of end users. Under each PRC, selected research teams (working at organisations such as CNRS, INRIA, CNET and institutions of higher education) are given professional guidance and co-ordination, together with some financial backing from the ministry or the CNRS. The approach is a long-term one: all four PRCs launched in 1984 are still active. According to the Ministry, the procedure has been highly effective. It has succeeded in strengthening French IT research teams, in guiding them towards appropriate fields, and in getting them more involved in co-operative activities and in European programmes.

Moreover, the involvement of the industry's representatives in PRC committees has improved their links to basic research; this is seen, in retrospect, as a major result which should take on even more weight in the future.

Another scheme for IT research is the *Actions concertées*. This is a framework for specific research projects, led by private as well as public organisations. It is overseen by the Ministry of Research and the Ministry of Industry. Every year, research teams are called on to submit proposals according to

a pre-defined list of subjects (such as software for parallel machines or multi-captor systems). Priority is given to joint industry-university projects. Proposals are typically for a two-year programme; according to its content, a proposal is transferred to one of the two ministries where, if selected, it is granted funding. Although the amounts involved are limited, it is a way of enabling motivated teams to shift their work schedule to meet perceived opportunities.

Promoting the use of IT in industry and services

Even closer to industry, the ANVAR (*Agence nationale pour la valorisation de la recherche*), a public agency under the Ministry of Industry, defines its vocation as "innovation engineering". It provides advice and financial help to companies in all sectors who are involved in development and transfers of technology. About 20 per cent of projects assisted by ANVAR are IT-related.

It is the government's policy to promote the integration of R&D efforts in regional development, particularly for the linkage between IT and local SMEs. Regional delegations of the Ministry of Industry and of the Ministry of Research are active in this field. They include ANVAR's 24 regional offices and the 150 *Centres régionaux d'innovation et de transfert de technologie* (CRI77). The recently reinforced trend towards a greater decentralisation of the *Centre national de la recherche scientifique* (CNRS) should also result in more synergies between new technologies and local initiative. IT, which lends itself to such synergies, is also a vehicle for them, as can be seen in *Provence-Alpes-Côte d'Azur* (PACA), where research centres and high-tech firms (many of them in IT-related activities) are linked by a regional data network.

European co-operation and trade policies

Principles

A memorandum on European policy in electronics and computers, which was submitted by French representatives to the European Commission at Brussels, states that international trade in IT should be based primarily on fair competition, i.e. it should exclude intra-governmental arrangements on exclusive access to markets, ensure full transparency of internal regulations, suppress *de facto* production cartels, and give consumers as well as producers truly free access to the marketplace. According to the memorandum, action should be initiated primarily by the European Community within the framework of the GATT, or on a bilateral basis, or by OECD work on relevant international anti-trust regulations.

Access to foreign markets

The position of the French government, as expressed in the aforementioned memorandum, may be summarised as follows. New regulations enforced by the European Community have given foreign firms broad access to the European market, without reciprocity from Europe's main commercial partners. European firms do not have access to most external markets, while competing firms enjoy free access to the European market. This, according to French officials, puts Europe at a disadvantage relative to their competitors, who can amortise infrastructure and development costs on their protected domestic markets.

Reciprocity and a preference for Europe

According to French spokesmen, European negotiators must insist on reciprocity agreements with trading partners, in order to increase the prospective market for European firms. If full reciprocity is not granted, Europe is entitled to extend to local industries the same preferential treatment received by those of other countries.

Although the French government is committed to the lowering of tariff barriers in accordance with the principles of GATT, it is felt that some IT-related items (such as cathode tubes, television sets and VCRs, and integrated circuits linked to the JESSI programme) should have special treatment. The reason is their perceived strategic importance for the emerging IT industries and the lack of reciprocity from Europe's trading partners. A similar reasoning applies to action taken against dumping practices, suspected to be widespread among foreign competitors, which deprive European industries of a much sought-after home base and penalise them on the world market.

Legal issues

Protection of privacy

A law on the protection of privacy in information storage and retrieval was enacted in 1978. That law created a permanent supervisory body, the *Commission nationale de l'informatique et des libertés* (CNIL). According to the law, any automated filing system that includes information on named individuals must be declared to CNIL; subsequent changes in such files must also be declared. CNIL should therefore have full knowledge of the existence and the structure, but not the contents, of all such existing files. In principle, it is illegal for any individual, or for any organisation, private or public, to have files, whether in electronic or manual filing systems, that contain information about a person's race, religion, philosophical or political beliefs, etc. A waiver can only be given by the CNIL. Any individual is entitled to full access to information contained in his or her files, and to demand rectification or suppression of information.

Security in IT

Problems of IT security are centralised, at the state level, by the DISSI (*Délégation interministérielle pour la sécurité des systèmes d'information*). DISSI was created in 1986 as a department of the *Secrétariat général de la Défense nationale*, which is the Prime Minister's administrative authority in charge of defence. DISSI deals with cryptology, protection against radiation, and logical security of software. Its main missions are to develop and maintain technical and industrial abilities in those fields in France, and to answer any related need, public or private. A small body largely devoted to decision-making, initiative and co-ordination, DISSI relies upon the *Service central de la sécurité des systèmes d'information*, a technical department; the *Commission interministérielle de la sécurité des systèmes d'information*, a co-ordinating body, and the *Centre d'études supérieures de la sécurité des systèmes d'information*, a research and training institution.

Property rights

The main body involved in legal protection is the *Institut national de la propriété industrielle* (INPI), which is under the responsibility of the Ministry of Industry. INPI negotiates directly with foreign partners on such issues, including work on European regulations and international agreements (with formal interministerial co-ordination through the Prime Minister's Office). However, officials at INPI, mindful of past failures in international IT treaties, give priority to pragmatic solutions and to harmonisation at the European-level -- including the adaptation to the French legal system of binding documents issued at Brussels.

For French legislation, INPI can draft the relevant documents, subject to approval by the Ministry of Industry, and co-ordinate further steps with other ministries and industrial partners, until a proposal is sent to the Prime Minister's Office for formal interministerial discussion and approval. (Legislation related to intellectual property for software is under the responsibility of the Ministry of Culture.) INPI acts also as the government's patent office; drawings for integrated circuits can be registered with INPI. The drawings are not patentable as such, and registration only serves as proof in case of litigation. INPI does not register software, since that is protected only as intellectual property; registration is made by non-governmental associations.

Conclusion

French IT policy has two sides or is even two policies: one, oriented upstream towards structures and producers, is increasingly active at the European level; the other, oriented downstream towards markets and users, is based first and foremost on private initiative, with some incentives at the national level and sporadic intervention by local (or regional) authorities. The first policy is conspicuous and, at times, widely publicised by government spokesmen. The second, by its very nature, is more difficult to perceive; moreover, it is seldom heralded as such. Therefore, a report based on official statements or public action might over-estimate the first policy and under-estimate the second. The two policies are not necessarily contradictory. Yet it is difficult to describe them simultaneously, and their effective co-ordination must also pose a serious challenge to any national policy-maker.

JAPAN

Government policies for IT

Since the mid-1980s, a distinctive feature of public policies for IT in Japan has been the strong notion of the "Information Society". The idea of the "Information Society" was first used in a governmental document in 1969. The meaning of "Information Society" is broad. It is generally understood as a society in which everyone obtains benefits from information systems (such as computer-based systems). IT is of central importance for the transition towards such a society. The idea of the "Information Society" has been well accepted by the public in Japan. In fact, there is almost a national consensus that it should be a goal of policies that involve IT and IT-based systems.

The current policies for IT are built upon the further development of the idea of the "Information Society": the "Advanced Information Society". The "Advanced Information Society" reflects the evolution of IT use, ranging from stand-alone systems to networks, and from a limited number of users (e.g. large firms) to the wider public, including personal users. The two basic features of the policy goal remain the same; i.e. priority is placed on IT applications, and information is regarded as an economic resource. Policies for IT in Japan, such as those for technology development, the information industry and telecommunications, should be seen in this context.

The Ministries of International Trade and Industry (MITI) and Posts and Telecommunications (MPT) are the two major ministries involved in the development of policies for IT. MITI is involved with IT-related issues in support of the development of IT industries and applications. MPT is concerned with information systems connected with the telecommunication infrastructure, such as Videotex and Personal Computer communication systems. Some other Ministries are involved with policies for IT. In these cases, however, it is because IT is instrumental in the achievement of existing policy goals (such as assisting farm management by developing information systems for cattle raising), or the improvement of the administration in the Ministry (such as drivers licence registration systems).

The fierce competition in the domestic IT market and the high level of liberalisation in the telecommunication sector are the two major factors that have shaped policies for IT in Japan. This is true for both the IT-providing and IT-using sectors.

In the IT manufacturing sector, several vendors of main-frame computers, both domestic and foreign-based, are competing with each other. An even greater number of vendors are competing in the mid- to small-range computer markets. All obtain profits from both international and domestic markets.

Liberalisation of the telecommunication market in 1985 was of critical importance in the development of IT-based networks. The removal of restrictions on the usage of leased circuits and interconnection with the public switch led to the rapid development of providers of value added network (VAN) services. At the beginning of 1992, there were more than 1 000 telecommunication carriers that provide services *via* circuits leased from telecommunication network operators.[1]

The economic sector's interest in IT use continues to be high. Although the current economic recession resulted in a decrease in IT spending in the private sector, it is expected to increase again once the recession is over. It is reported that corporate managers plan to increase investment in IT (hardware, software and human resources) (Figures 1 and 2 in Annex). In summary, government policies for IT in Japan are developed against an industrial background in which both IT suppliers and users have a vanguard nature.

The non-existence of an official policy co-ordination system does not seem to harm the promotion of IT use at the government level. In the private sector, users under fierce competition in the domestic market are quick to introduce IT-based systems. The competition between IT users then motivates IT producers (both hardware and systems) to meet clients' needs. This leads to product and service improvements, since the producers themselves are competing with each other. This environment has oriented government policy towards the development of framework conditions, such as standards, human resources, and pre-competitive R&D, rather than the direct promotion of IT use in industry.

Policy goals of the major ministries

The policy goals and the implementation measures of policies related to IT by MITI and MPT characterise the latest orientation of the environment in Japan. There are some similarities in the recipients of policies by these two Ministries, in spite of the difference in the sectors of their original concern. Both IT suppliers and end-users are included in the recipients of policy programmes. Both Ministries emphasise international co-operation and the improvement of quality of life. The information industry is included in policies by both Ministries. As the industry develops on the basis of IT-based systems interconnected with telecommunications networks, the possibilities of overlap may increase.

MITI

The policies related to IT in MITI are called "informatisation" policies. This means that they encourage the use of information systems enabled by IT to their fullest extent.

The promotion of the use of information systems is considered to be one of the critical factors in the achievement of the overall policy goals of the Ministry. These goals include:

-- to contribute to international society;
-- to build the basis for sustainable economic development; and
-- to contribute to the improvement of the quality of life.

The policy focus is placed on the development of infrastructure for IT applications, especially computer-based information systems. Infrastructure for both users and suppliers of IT-based systems is included in the policies. Examples of such infrastructure are the programmes for the promotion of standards (e.g. Open System Interconnection, or OSI), information network security, database development, pre-competitive IT R&D and human resources. Major implementation measures in 1992 are listed in Table 1 below. These measures are not much different from those in other Member countries. What characterises MITI's policy is the fact that policies for IT hardware, software, user training and laws are organised in such a way that the public will be able to make use of information as a resource for economic development.

Table 1. **Major implementation measures of "informatisation policies" by MITI in 1992**

a.	The promotion of open systems;
b.	The promotion of pre-competitive IT R&D on an international basis (e.g. The Fifth Generation Computers and the Real World Computing Programme);
c.	Enhancement of information processing functions in less developed regions;
d.	The promotion of video information systems;
e.	The development of information systems for personal use, especially for senior citizens ("Mellow Society Project");
f.	The development of infrastructure for the "Information Society" (e.g. the promotion of computer network security, the development of human resources, etc.);
g.	The international co-operation in IT development;
h.	The promotion of the formulation of rules for the protection of intellectual property rights.

Source: MITI (1992).

MPT

In an IT policy context, MPT places much importance on data communication systems. MPT originally increased its involvement in IT as a telecommunication policy-maker in the early 1980s. The Ministry is now increasing its policy orientation to network systems users in economic activities. In April 1988, MPT announced the basis of its communication policies and major tasks for the 1990s. The Ministry stated that it considered information and communication systems to be an integral part of social and economic activities, and that communication policy should be the major policy that serves economic development in the 1990s. IT is, in MPT's policies, the technology that enables users to make use of information systems as economic resources.

MPT regards information as an economic resource and its major tasks for the 1990s are:

-- promotion of an international flow of information over global network systems;

-- promotion of telecommunication standards, e.g. OSI, telematic terminals and data communications, network security;

-- creation of new information service industries based on telecommunication networks including video communication systems;

-- creation of new information services over the country; and

-- improvement of the quality of life.

Policy goals in each year during the 1990s are to conform to the achievement of the major tasks mentioned above. The goals and measures for 1992 are summarised in Table 2 below.

Table 2. **Goals and major implementation measures of "info-communication" policies by MPT in 1992**

I.	**Goals**
	a. the improvement in the quality of life;
	b. the response to the increase in international interface in society; and
	c. the development of information and communication technologies.
II.	**Implementation measures**
	a. the improvement of the use of frequency;
	b. the improvement of quality of life equally all over the country (the promotion of regional development);
	c. the promotion of the advanced use of IT-based telecommunication services and systems in economic activities;
	d. the promotion of international co-operation;
	e. the promotion of R&D in communication technologies.

Source: *The Principles of Info-communications Policies for the Fiscal Year 1992*, MPT, August 1991, Tokyo.

Human resources policy (IT skills)

Human resource development programmes are undertaken as a part of the development of the infrastructure that supports the "Advanced Information Society". MITI identifies two major tasks: one for IT-system producers and another for end-users. The focus of the former task is placed on the software supply. A large software supply shortage is foreseen by the government in the year 2000 ("Software Crisis"). In the software market in Japan, the ratio of spending in packaged software to the total spending in software is significantly low (about 20 per cent in 1989[2]). MITI promotes the development of both software engineers (SE) and instructors. This is done with the intention of establishing a high quality supply system for software.

MITI promotes IT education to the public, i.e. all potential IT users. Various opportunities for education are included in government programmes, from schools to vocational education and in-house training by firms. MITI and the Ministry of Science and Education (MSE) co-ordinate the programmes for the promotion of computer use in school education.

MPT promotes the enhancement of skills of telecommunication engineers. The Ministry identifies two major roles in support of better management of telecommunication systems, one for telecommunication networks and the other for interconnection of terminals to the networks. The Ministry promotes the

qualification system of the engineers in these two fields, i.e. for the former, "the chief telecommunication engineer", and for the latter, "the installation technician".

Promotion of IT use

Much emphasis is placed on user-support for computerised information systems and networking of systems. This reflects an increase in user requests to mix IT equipment provided by more than two vendors in the same system. Such demand increased as the application areas became wider. MITI provides various programmes that are intended to initiate the development of an environment that will meet the demand.

The promotion of Open Systems in IT-based systems is one of the main measures for the support of IT users. The Open Systems provide more options to users in the development of IT-based information systems, and thus enable them to take advantage of information systems.

Three major programmes comprise the promotion: the promotion of Open System Interconnection (OSI), Electronic Data Interchange (EDI) and the enhancement of software productivity. The targets of the OSI promotion include system development and the purchase of information systems based on OSI. In this way MITI intends to increase the possibility of physical interconnection of computer systems. EDI, in contrast, is intended to develop the standardisation of a business format in the transfer of information between firms. Based on a recognition of EDI's critical importance, MITI has provided a series of guidelines for each industrial sector (such as the iron and steel production, electronics and furniture production sectors). Low interest loans are available for users to encourage the purchase of EDI systems. Improvement of software productivity has continued to be given high priority since the mid-1980s. The results of the Sigma project are applied to enhance the productivity.

The development of databases and assistance with IT investment are other measures that support the creation of basic conditions facilitating IT use. For database development, the government provides low interest loans to the private sector. Financial assistance is also provided for the development of software for database operations. For IT investment, low interest loans are made available to firms to enable them to better equip their IT-based systems with hardware and software. These loans cover the purchase of computers and development of information systems between firms.

The "Advanced Information Society" is the key word in regional development programmes initiated by MITI. A variety of programmes are provided, such as "the New Media Community", "the Informatised City of the Future", "the Information Centres in the Commercial District", and "the High-vision (HDTV) Community". Enhancement of software productivity is also integrated in the regional development programmes, because the software sector is expected to be a prosperous industry for the future. This idea has materialised as "The Project for the Development of Software Production Centres in Regions", started in 1989.

In telecommunication policy, MPT focuses on the development of IT-based communication systems that bring benefits to the public. The promotion of competition and investment in the renewal of network infrastructure are instrumental in the achievement of the tasks. A decrease in the price of telecommunications service and an increase in the service options are the expected results of competition. To promote investment in the enhancement of telecommunication infrastructure, the MPT enacted a special law in June 1991. It is the first law, although its period of validation is limited, that is intended to

stimulate the telecommunications carriers (both Types I and II) to invest in the improvement of network infrastructure.[3] It is expected that the carriers' investment will lead to the development of "the New-generation Telecommunication Network" that is composed of a broad-band integrated services digital network (B-ISDN) and an intelligent network (IN), and thus enable high-speed, intelligent and multimedia networks.

The promotion of the vanguard use of advanced telecommunication systems is linked with the regional development programmes. The "Teletopia" project is an ongoing and country-wide project. Among the 87 cities and regions nominated as "model cities" by MPT, 198 systems in 77 cities and regions are currently in operation. The systems are used for a variety of purposes, reflecting regional requirements for their development. Some examples include: the weather condition information systems for road transport systems in Sapporo (a city in the northern region) and information systems for new technologies and management for small and medium-sized enterprises (SMEs) specialised in the traditional industry in the region (e.g. fabric and tableware) in Kurume. MPT also promotes other projects, such as "Telecom Research Parks", "Telecom Plazas" and "Telecom Towns". These are intended to be telecommunication infrastructures that support regional economic development.

The MPT promotes interconnectivity of IT-based systems to facilitate IT use. OSI, ISDN and electronic data interchange (EDI) based on message handling system (MHS) are examples of these systems. To achieve that purpose, the Ministry established the Promotion Conference of Harmonisation of Advanced Telecommunications Systems (HATS), in co-operation with telecommunication operators and equipment manufacturers. The HATS conference's recommendation has lead to the formulation of several Test Implementation Liaison Committees (TILCs) that undertake, on a voluntary basis, interconnection testing of IT-based products used as on-line systems. The Ministry also supports the activities of the Japanese Electronic Mail Association, that has been established to promote electronic mailing systems based on MHS.

IT in science and technology policy

Overview

The role of the government in IT in the context of science and technology policy is relatively limited in Japan. The major sources of finance for IT research and development (R&D) are business enterprises. The ratio of government financed R&D to total R&D expenditure in Japan is low compared with that of many OECD Member countries (see Figure 3 in the Annex). Most government efforts are centred on pre-competitive and leading-edge projects.

Increasing involvement in international co-operation is another distinctive feature observed in the basic orientation of overall science and technology policy. In IT, this especially applies to R&D projects by MITI and MPT. This indicates that the government of Japan is increasing its involvement in international co-operation in IT R&D in pre-competitive areas.

Pre-competitive IT R&D

MITI undertakes several R&D projects, mostly in computing technologies and related areas. The budget for IT R&D was Y 13 539 million in 1991 but decreased to Y 8 943 million in 1992. The

development phase of its large-scale project for Fifth Generation Computing Systems (FGCS) was almost finished in fiscal year 1992. This project is now at the phase in which evaluation and a search for possible applications of the research results are being undertaken. Examples of major products from the FGCS project are an innovative computer system based on "logical inference using a knowledge base" and new "fifth-generation computer technologies" that combine knowledge processing software and large-scale parallel processing technologies. The Ministry currently intends to develop the technologies to port the FGCS software to open platforms.

The "Real World Computing Programme" is becoming the major IT R&D project undertaken by MITI. The development of a processing system of imperfect information in reality is the purpose of this project. The Programme is thus intended to develop innovative IT that enables flexible information processing based on functions similar to those of human beings, such as learning and various recognition functions. The project will be undertaken on the basis of international co-operation. The development of a human-machine interface of IT-based systems (the "FRIEND 21" project) is continuing in response to the ever-increasing opportunities for personal uses of IT. R&D on materials and software systems that facilitate the processing of large volumes of information also receives government R&D. Specifically, this research relates to super conductivity materials and new structures of software.

Another aspect of IT R&D, i.e. communication technologies, is undertaken by MPT. Examples of the research subjects include R&D on technologies for ultra high-speed communications, human and biological communications and high performance networking. These are undertaken by a programme of "Frontier Research in Telecommunications" (with a budget of Y 577 million in FY 1992), on the basis of co-operation between industrial, academic and government research institutes that include both domestic and international institutions. Other examples include R&D activities centred on Advanced Telecommunications Research Institute (ATR), a consortium of six research institutes established by MPT. R&D on communication systems, interpretation technology, audio and visual perception, optical and radio communications, and human communication mechanisms is undertaken by ATR.

MPT provides financial incentives for the promotion of R&D undertaken in the private sector. Tax reduction and low interest loans are provided.

IT R&D in support of other purposes

MITI undertakes some IT R&D projects in connection with purposes other than IT R&D itself. To identify possible policy implications of media convergence, a study on processing systems for high definition picture data was undertaken in 1992. To assist in the development of basic conditions in which the public can take advantage of information systems in neighbouring Asian countries, several systems are being developed. These are: an automatic translation system among east Asian languages (Chinese, Malay, Thai and Japanese) and, in co-operation with Singapore, intelligent CAI systems for software engineering.

Some other Ministries have also undertaken IT R&D programmes. The Ministry of Science and Education (MSE), for example, is currently promoting information network systems as infrastructure for universities and academic institutions. The Ministry, in 1991, allocated Y 2 400 million for the National Centre for Science Information Systems (NACSIS), and Y 629 million for the development of Local Area Networks (LAN) in national universities. The Ministry of Construction (MC) is developing various IT-based systems, such as a Natural Hazard Information Systems, an Automatic Recognition System for Map Information (an AI based system for the promotion of the development of geographical information systems) and an Automatic geological map-making system. These programmes are not aimed at technology development *per se* but rather at facilitating the achievement of the current tasks of the host Ministries.

International co-operation

Japan's partners in international co-operation are geographically widespread when compared with those of other OECD Member countries. Asian, North American and European countries are included. This is natural given the combination of Japan's geographical location and its interest in IT development. The level of closeness in co-ordination, however, is not as high as in the project initiated by the Commission of the European Communities.

Both MITI and MPT initiate international co-operation mainly in IT R&D. MITI's programmes are stated in the section above. MPT established the Asian ISDN Council in 1988 for the purpose of assisting the Asian countries in developing multimedia communication systems through technology co-operation. Japan-EC ISDN interconnection experiments started in 1992. It is intended to confirm interconnectivity between the two and thus promote ISDN on a co-operative basis.

Other points

Policy assessment

An assessment of policy needs for the promotion of IT applications is part of the policies for the promotion of the "Information Society". The assessment has both the nature of technology-push and demand-pull. An example of a project with technology-push is the policy assessment for multimedia development initiated by MITI in 1992. Possible applications and supporting technologies will be assessed. Another example of policy assessment undertaken by MPT is the promotion of video communication systems. The Ministry recognises policy needs in the future that correspond to the increasing demand for new services provided *via* the systems enabled by digital transmission systems with large capacity. The Digital Video Committee was organised under the Telecommunication Technology Council in order to assess the way in which various standards for video coding technologies are integrated.

In response to ageing in Japanese society, i.e. demand-pull, MITI continues to undertake the "Mellow Society" project. IT applications for senior citizens, such as human-machine interface and health information filing systems, are examples of major projects.

Jurisdictional issues

The development of jurisdictional rules is an important issue in policies for IT. A number of Ministries and Agencies are involved in these issues: MITI, MPT, the Ministries of Cabinet Affairs and Finance and Home Affairs and the National Police Agency.

The involvement of Ministries that are not directly in charge of jurisdictional matters other than IT-related issues is worth noting in Japan. This fact indicates that knowledge of IT systems and applications is a requirement for the development of new rules. MITI, for example, considers the issues to be part of the development of framework conditions for IT industry. This reflects the fact that IT industry, such as the production of semiconductors, has a high level of importance in Japanese industry. The support of studies on the legal protection of computer programmes and databases, and Japan's participation in the rule-making processes in international arenas, such as GATT and WIPO (World Intellectual Property Organisation), are major activities for the protection of intellectual property.

Network security, i.e. alleviation of the possible negative consequences of IT use, is promoted in support of IT-based networks. MITI regularly updates guidelines for the security of computing systems, such as "Computer Systems Security Standards", "Computer Virus Prevention Standards" and "System Auditing Standards". MPT has established "Safety and Reliability Standards for Information Communication Networks" as guidelines for the safety and reliability of information networks. The government provides low interest loans for investment in computer and communication system security to implement network security.

Conclusion

The relationship between policies for IT and telecommunications should be seen in the policy context in Japan. *Information* is the key word connecting these traditionally different policy areas. Information, rather than IT as technology, is expected to be the basis of Japan's wealth towards the year 2000. The word "Advanced *Information* Society" indicates this point. The policy goal is to develop the basic conditions for the public to use information to create new products and services, and the ways in which these products and services are provided. Consequently, the development of vanguard applications of IT-based information systems is seen as a means to support the transition of society. Fierce competition between IT producing sectors in the domestic market has been the driving force that stimulated IT firms to develop applications systems. The two Ministries that were originally in charge of IT-based industry and telecommunications are, consequently, involved most in public policies for IT.

The importance of international co-operation in IT development will continue to increase in Japanese IT policies. The penetration of international spheres in IT, such as standards-making activities, international IT R&D projects and technology transfer, may have some impact on IT policies in Japan in the 1990s.

NOTES

1. There are two types of telecommunication carriers in terms of the ownership of the network and switching facilities. Those that own the facilities are called "Type I carriers", and those that do not, "Type II carriers".

2. Source: OECD (1992), *IT Outlook 1992*, Paris.

3. The major examples of the infrastructure include optical fibre cable, SDH transmission modules, network control points, ATM switches and information media conversion equipments. The government provides various kinds of financial assistance, such as tax incentives, low or no interest loan and credit, to those carriers that invest in such equipments.

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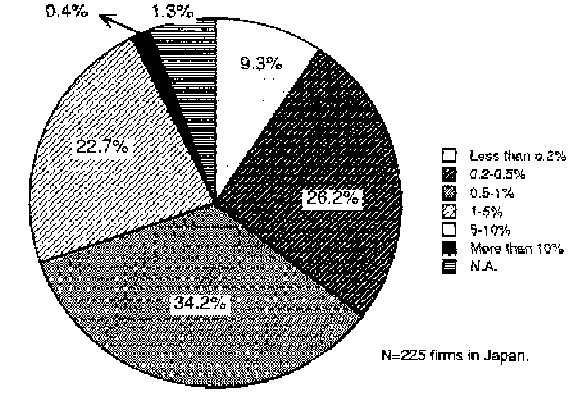
Annex

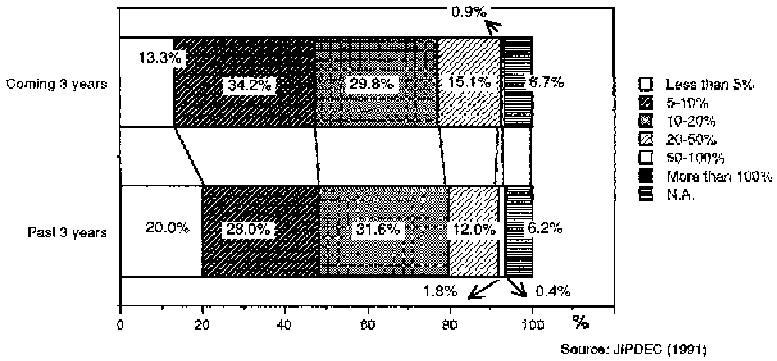
Figure 1
Ratio of IT expenditure to sales performance, 1989



N=225 firms in Japan.

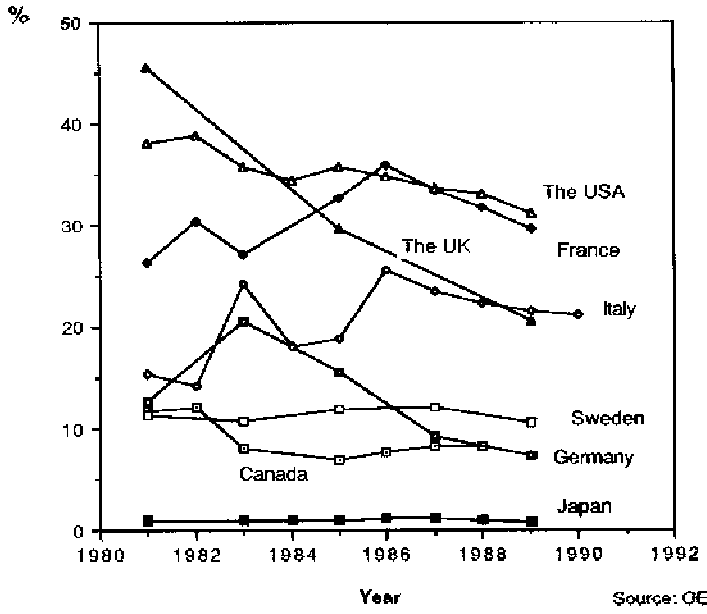
Source: Japan Information Processing Development Center (JIPDEC) (1991)

Figure 2
Estimated growth rate of IT expenditure
(As of 1990)



Source: JIPDEC (1991)

Figure 3
Ratio of R&D Funds provided by the Government
Electrical and Electronics Industry



Source: OECD Database.

UNITED KINGDOM

Government IT policies

Policy framework and objectives

Public policies for information technology (IT) in the United Kingdom are based on the idea that the government should support the free market economy and only provide support to overcome genuine market failures. Government's responsibility is to create the right climate so that markets can work better and vital corporate activities take place.

Specific objectives for IT are set in line with this general policy framework:

-- To promote the widespread, efficient and effective use of IT in the economy.

-- To stimulate the increase of opportunities for IT education and training so that human resources with sufficient IT skills will be provided to IT users and suppliers.

-- To improve the efficient functioning of the IT market and its development. The liberalisation of the telecommunication market, support of the development of international standards, and the promotion of internationally open markets are measures to achieve this objective.

-- To support basic research in higher education institutes and to promote the transfer of the results to UK firms to enforce their technological capacity.

-- To maximise the cost-benefits of IT use in the government to improve the efficiency and effectiveness of public administration.

Organisational framework

The Department of Trade and Industry (DTI) has a broad role in the development of basic conditions that favour IT users and that ensure the functioning of the free market mechanism. A number of other departments and government agencies have specific responsibilities within the overall framework set by DTI. Major examples of these departments and agencies are as follows:

-- the Department for Education (DFE) -- education policy;

-- the Office of Science and Technology (OST) -- science policy;

-- the Employment Department (ED) and the Training Agency -- training issues;

-- the Science and Engineering Research Council (SERC) -- funding of research and provision of postgraduate fellowships;

-- the Central Computer and Telecommunications Agency (CCTA) -- aid to best practice of IT in government departments.

There are several other bodies that provide independent advice to DTI regarding many aspects of IT-related policies. The Information Technology Advisory Board (ITAB), established in 1988 by DTI and SERC, provides advice to both organisations concerning their support for IT in connection with the Joint Framework in Information Technology (JFIT). These bodies are discussed below.

The government does not have a single department in charge of all the policies related to IT. The idea of such a department is believed to be neither feasible nor desirable. Although DTI has broad coverage of IT policies stemming from its responsibility for the good functioning of the IT market, the government does not assign DTI executive responsibility that supersedes IT-related policies of other departments. Such an assignment of roles is believed to be confusing rather than useful.

The promotion of efficient IT use

The DTI undertakes various activities to promote efficient IT use. The major goal of DTI activities in IT at the beginning of the 1980s was the raising of general awareness and the promotion of knowledge of possible IT applications in business activities. Examples of programmes for these purposes are those that stimulate awareness and use of value added and data services (VANGUARD) and promote knowledge and use of interactive video technology.

The Enterprise Initiative was launched in 1988, following increases in awareness of the economic benefits of IT use. The government intended this initiative to compensate for the inefficiency of market mechanisms and to support the sustainable development of an economy benefiting from the advantages of IT use. Several sub-initiatives, such as the Financial and Information Systems Consultancy Initiative and the Manufacturing Systems Consultancy Initiative, were intended to compensate for inefficiency of managerial skills and information in small and medium-sized enterprises (SMEs).

Some of the programmes undertaken in connection with the Enterprise Initiative focus on IT-based networks and serve to stimulate potential and current IT users in the private sector to take the best advantage of information systems enabled by the networks. These are the Advanced IT Technology Transfer Programme, intended to promote potential benefits from the use of advanced tools and methods of software engineering, expert systems and other major results of computer engineering, and the Open Systems Technology Transfer Programme.

DTI undertakes evaluation of major IT programmes in order to further improve policy measures. The results of the evaluations are sometimes made available to non-participating but potential beneficiaries of the programmes. Collection and improvement of data on IT use also fall under the domain of promotion of IT use by DTI.

Human resource policy (IT skills)

Government policies for reinforcing the IT skills of human resources are developed with the recognition that a programme to increase awareness of IT, to enhance IT-related disciplines and to increase a work force with high quality IT skills needs to be integrated in the whole range of education services. This inevitably involves several Ministries and government agencies in providing a wide variety of programmes on a collaborative basis.

IT hardware and software are already provided in all schools through programmes funded by DTI and DES. The current goal of IT education initiated by DES is to increase the extent and effectiveness of IT use in schools for teaching and learning for pupils of all ages and abilities. DES also provides training programmes for advisory teachers in IT and in-service training for classroom teachers. DTI's contribution to human resource development is the provision of funds in support of the introduction of new technology in schools.

The government, its agencies and local education authorities provide various programmes to stimulate IT education at all levels in all educational institutions, in addition to schools. These public bodies promote studies of IT-related subjects and IT use in training schools to prepare school graduates for work, as well as in colleges and universities.

The government intends to orient the education service towards greater responsiveness to the needs of firms that employ school graduates. Encouraging dialogue between educational institutions and enterprises throughout the country is a major means of doing so. Dialogue is promoted on the local level since this is believed to be most efficient.

The Training Agency provides opportunities that meet all levels of training needs. The High Technology National Training Initiative provides training opportunities to meet the demand for professional IT skills on a high level. Computing and IT are compulsory in the Youth Training Scheme (YTS) programmes. DTI, in co-operation with the Training Agency, established the Information Technology Centres to provide specialised IT training for YTS trainees.

Improvement of the IT market

The UK government undertakes various measures to assist the development of an IT market in which efficient competition takes place. The underlying general policy goal is to secure an open and competitive economy both at home and abroad.

Infrastructure for IT-based networks

The government promotes liberalisation and competition in communications infrastructure and services. This policy is one of the main measures that favours the development of IT-based networks. Terminal interconnection, provision of services over the network infrastructure (e.g. value added network services) and the provision of infrastructure for both terrestrial and mobile communications have, in principle, all been liberalised.

It is government policy to leave the introduction of new technologies and services to the corporate decision of network operators. The government prefers to let market demand motivate investment in new technologies and services by operators, rather than to intervene in their market introduction.

Telecommunication users in the private sector have been supporting increased liberalisation. They are represented by several interest groups, such as the Telecommunications Managers Association and the Computing Service Association. While liberalisation of telecommunications was well accepted by industrial users, further relaxation of telecommunication infrastructure continues to be advocated, especially by the users of distributed computing systems.

Standards

The government recognises the importance of IT standards, especially those for the interconnection of different information processing systems, and it supports international efforts, centred on the International Standards Organisation (ISO), to develop the framework of open systems interconnection (OSI). This is because open standards will be fundamental to the development of vital IT markets. There is the possibility of significant benefits from open standards, such as the allowance of easy market entry, increased opportunities for software providers, and wider options for users who are not constrained by a particular producer.

The promotion of standards-making activities, the raising of user awareness and public procurement are the major aspects of UK standards policy. A substantial budget is allocated to the first two measures. For example, £12 million were funded for the Open Systems Technology Transfer Programme which aimed to stimulate use of open systems and which was launched as a part of the Enterprise Initiative.

The FOCUS Committee on IT standards was in charge of advising on open systems standards from 1981 to 1991. Now a new consultative committee to DTI, the IT Standards, Security and Quality Committee, is being established to take the place of the FOCUS Committee. The new Committee will form part of the ITAB Committee structure. The Secretary of State has also set up a group to advise on the impact of the single European market and on issues of particular relevance to the information and communication sectors.

International trade

The underlying doctrine in trade policy is that Europe should become the home base from which UK firms compete in markets outside of Europe. The same applies to IT hardware, software and services. To develop national IT sectors and IT users, the government regards it as more useful to expose UK IT firms in international markets than to protect them from competition. Open and competitive markets help make UK IT firms more competitive.

The government supports public procurement open to firms of any nationality and open systems standards. The former is a direct measure that it adopts as a purchaser of IT equipment and systems, and the latter an indirect one that is intended to eliminate discriminatory barriers to market entry in the United Kingdom.

Inward investment of multinational IT firms

The underlying principle of UK policy for multinational IT firms is practical, in the sense that the government intends to take advantage of their inward investment rather than discriminate against them to protect domestic firms. R&D grants from public funds are allocated to firms that undertake R&D in the country and exploit the results within the European Community, regardless of their nationality. This means that UK firms that do not meet these requirements are not eligible for the grants, whereas foreign firms that meet them are. In this way, the government intends to maintain national capability in IT R&D and product development, rather than see domestic firms withdraw from international markets.

IT in science and technology policy

Policy orientation

The emphasis on IT issues in science and technology policy is primarily placed on pre-competitive collaborative R&D. An orientation in the major national IT programmes towards industrial application has, however, increased since the beginning of the 1990s, when compared with the Alvey project.[1] Participation in European programmes, such as ESPRIT (European Strategic Programme for Research and Development in Information Technology) and EUREKA, has strategic importance in maintaining this emphasis.

Public system for the management of IT R&D

DTI and SERC are in charge of IT R&D in the domestic sphere. The Information Engineering Directorate was created in 1989 in DTI, and renamed the Information Technology Directorate in 1990, when the Information and Manufacturing Technologies (IMT) Division was reorganised to bring together all IT R&D activities undertaken by the Department. The Directorate is composed of industrialists and university researchers, as well as civil servants. The management of collaborative IT R&D between the private, academic and public sectors is expected to improve.

Co-operation between the IMT Division and SERC's Information Technology Directorate was improved by the formation of the Joint Framework in Information Technology (JFIT) in 1988. SERC was originally responsible for the funding of research in academic institutions and graduate programmes. From the organisational viewpoint, JFIT is intended to make government support of IT more coherent, by bringing together two major government institutions with responsibilities for IT (DTI and SERC). As well as R&D, JFIT is responsible for several other activities, including technology transfer, education and training, standards, security and quality.

This change was made thanks to a lesson learned through the Alvey Programme, the predecessor of the JFIT. One of the criticisms of the programme was that its research was successful but that its results were insufficiently exploited. Also, more benefits were reaped by large firms than by SMEs. The JFIT, when it inherited the research of the Alvey Programme, was to involve more medium-sized enterprises and bring in more of the industrial interests closer to the markets.

The Information Technology Advisory Board (ITAB), established by DTI and SERC, serves both organisations as an outside committee. ITAB has broad responsibilities in the provision of advice, ranging

from basic research, technology transfer, and education, to priorities in R&D. The Board is composed of eight committees, of which six are responsible for particular areas. The other two are responsible for Education and Training and for Standards, Security, and Quality. ITAB's members come from both industry and universities. Representatives from the Ministry of Defence (MoD) and the Central Computer and Telecommunications Agency (CCTA) also participate in ITAB as observers. The government makes efforts to enable UK firms to take advantage of national and European R&D efforts. Participation in European programmes is promoted so that UK firms may efficiently integrate R&D activities in the programmes while avoiding duplication of research subjects.

Funding priorities

Pre-competitive research for IT obtains higher priority in allocation of government funds. Firms are expected to finance industry-oriented research in IT by themselves. For industry, government sources of IT R&D should be peripheral.

Priorities for public support by DTI and SERC of IT R&D and allocations are determined through detailed consultation processes, partly in ITAB and its committees, partly through other public consultation procedures. In considering research priorities, the government also assesses the future orientation of IT R&D, taking into account government R&D activities in other countries.

Military IT R&D

The role of military IT R&D in relation to policies for civil IT R&D is not substantial. These two areas are sometimes involved together in national IT R&D programmes, but they are completely separate in policy-making processes. The industrial sector that produced IT-based equipment for military purposes is now increasing its commercial orientation to civil markets, due to the decrease in the tension of the "cold war".

International co-operation

IT R&D within the framework of European programmes, promotion of international IT standards and free trade are major subjects of international co-operation in IT-related policies. These are essential aspects in the development of the UK IT sector and market.

International co-operation in IT R&D has two different aspects. In some programmes in which the United Kingdom has relative strength, UK firms provide substantial impetus for achieving goals. The EUREKA Road Transport Group of Projects (ERTPs) and health informatics projects are examples. In others, the UK government uses projects as an opportunity for UK firms to enhance their capability. The government promotes the participation of SMEs in ESPRIT so that these firms improve their international competitiveness through joint work with other European firms. Access to leading-edge IT that is not always available in the United Kingdom is considered to be a significant benefit of participation in the Joint European Semiconductor Silicon Initiative (JESSI).

In any case, participation in EC initiatives in IT R&D is an integral part of UK R&D. Both government and non-government experts consider that co-operation with experts in other countries is very

useful for the UK IT sector and its research communities. In this sense, the intention of the Commission of the European Communities (CEC) is well received in the United Kingdom.

Jurisdictional issues

Both DTI and the Home Office[2] are involved in jurisdictional affairs related to IT and its use. The Data Protection Act and the Computer Misuse Act are the two major laws in this area. The Data Protection Act regulates the use of electronic databases related to individuals and the provision of services in respect to such information. The Computer Misuse Act introduced three offences related to unauthorised access to and modification of computer material. DTI has recently carried out a campaign to raise awareness among UK business of the importance of IT network security. The Department has also assumed responsibility for monitoring the effectiveness of the Computer Misuse Act.

Conclusion

The underlying doctrine of UK public policies to date has been that those operating in the IT market-place are best able to determine the direction and pace of IT development. Government action is justified, under such circumstances, only where there is evidence of market failure, for example in education and basic R&D.

It is worth noting, however, that there is increasing recognition that promotion of IT R&D and its industrial application are inseparable. This is one of the lessons of the Alvey Programme, and one which has been integrated in the JFIT. Government support towards industrial involvement in collaborative R&D might be seen as a means of ensuring exploitation of the results of IT R&D.

Regional co-operation with European countries is an integral part of UK IT policies. This is especially true for the promotion of IT R&D. Many government officials involved in national R&D programmes are simultaneously involved in major EC programmes such as ESPRIT. Integration of UK human resources in policy-making on IT R&D in the Commission of the European Communities is an effective way to help enhance UK interests in harmony with those at the overall EC level.

NOTES

1. The Alvey Programme was launched in 1983-84 as the prime UK R&D programme in IT. £350 million were allocated, including a government fund of £200 million with industry supplying the balance, during the programme period of 1984-90. Pre-competitive research, rather than "near-market research", was the focus of the programme, although the objective was an increase in the competitiveness of the national IT industry. The major research areas include Intelligent Knowledge-Based Systems, Software Engineering, and Very Large-Scale Integrated Circuits.

2. A government institution equivalent to the "Ministry of Justice" in other countries.

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SELECTED STATES IN THE UNITED STATES

Introduction

Public policies for information technology (IT) at the state level are a reflection of the fundamental realignment of government's roles and responsibilities, which have been under way in the United States for well over a decade. Not since the Great Depression and the New Deal (1933-41), when the federal government sought to confront economic crisis by assuming many tasks previously performed by the states, have more far-reaching changes occurred in government administration. Today, the role of state government has greatly expanded. The re-emergence of the states as major players in service delivery, regulation enforcement, and policy formulation can be attributed to a number of factors.

As the federal government has sought to improve bureaucratic efficiency and market effectiveness by emphasising deregulation, the impetus for greater state involvement in regulatory reform and enforcement has also increased. At the same time, many state governments have come to realise that social and economic crises demand more proactive, even entrepreneurial approaches to problem-solving; hence, a more activist stance on the part of state government with respect to strategic, statewide planning.

State governments are, therefore, under considerable fiscal as well as political pressure to improve performance. In this context, states see information resource management and IT infrastructure as powerful tools for providing governmental services on an efficient and cost effective basis.

State government policies for IT

State strategies for IT are largely inner-directed; that is, they are directed towards improving state government information resource management (IRM) and IT infrastructure in ways that will provide the greatest future benefits. States recognise that information is a basic resource of government.

States are particularly preoccupied with devising strategies aimed at: establishing standards and guidelines to ensure connectivity between agency facilities and statewide telecommunication networks; completing statewide networks; improving the state's ability to recruit and retain qualified personnel; improving IT education and training for state workers; increasing application development productivity through the use of new IT tools; and establishing plans for ensuring the continuous availability of the state's essential information processing capabilities.

Just as there is no single, comprehensive and cohesive national policy for information technology at the federal government level in the United States, states have yet to embrace more holistic, outer-directed approaches to IT policy formulation. To the degree that state policy-makers perceive the critical linkages between science, education, technological innovation and state economic development and industrial productivity, IT is still generally considered but one of a number of potentially important areas for state

policy development. IT, in this context, still remains an untapped resource at the state government level in the United States today.

The inexorable pressures on state IT policy-makers to improve government agency performance, to respond to growing public demands for more efficient service delivery and better accountability, to plan and complete the development of IT networks, and to provide more effective management control over escalating IT infrastructure costs are not inconsiderable. These are today's priority concerns. Nevertheless, as discussed below, several significant trends and developments point to important new directions for IT policy-making at the state government level.

The focus of this study is on state government policies to promote IT use outside its own departments and agencies. By selecting a representative sample of ten (out of 50) states, this study seeks to present a general overview of state government structures for IT policy-making, to provide illustrative examples of state IT programme initiatives in selected areas, and to indicate new and emerging trends affecting state IT policies. The study presents neither a comprehensive review of all states nor of all state programme activities for information technology.

The ten states selected for coverage in this survey were chosen on the basis of: size of population, geographical location, centralised or decentralised-policy making, strong or weak executive powers, IT legislative history, and IT industrial base. They are: California, Kentucky, Massachusetts, Minnesota, New Jersey, New York, South Carolina, Tennessee, Texas and Virginia.

Policy frameworks

Policies for IT vary widely among states, since governments have sought to adopt approaches that best respond to their political directives, executive branch management philosophies, and available resources. Nonetheless, there is an important common trend: a concerted effort to better manage information resources to support the improvement of state welfare.

State policy-makers contacted for this survey also agreed that the term "IT policies" indicated a broad policy framework including all policy areas related to IT. That is, they consider that IT policies should provide a means to guide the development of the social, economic, industrial, scientific and human resource potential of the state.

That states differ in their IT policies should come as no surprise, given the diversity of the states themselves. For example, no other state can compare with California, which has more than 5 000 state IT professionals and annual IT expenditures of more than $ 800 million. California is one of the largest government users of information technology in the world. The state has three major data centres with a combined annual budget well in excess of $ 165 million, its Law Enforcement Telecommunications System handles approximately one million messages per day, while its EDP Acquisition Unit within the Department of General Services spends more than $ 300 million a year on acquiring goods and services for state agencies.

The combined IT expenditures for Kentucky, South Carolina and Tennessee do not even begin to approach those of California. Nor is it likely that these states would ever pose a serious threat to California's microcomputer industry which accounts for nearly one-third of the nation's private producers and suppliers. Yet, each of these states sees in advanced communication and information technologies new opportunities for transforming their rural communities and enhancing economic prospects. Their policies today for IT are, therefore, clearly focused on promoting state economic development.

Specific political and historical traditions also have a bearing on state IT policies. For instance, Minnesota has a populist tradition of open, effective government responsive to direct citizen involvement and the protection of the rights of the individual. More than any other state, Minnesota has directly included local government in its IT policy-making. This involvement is clearly reflected in the State Information Architecture, a framework for achieving the state's vision for information: within the law, equal access to information regardless of location.

Other states, such as Massachusetts, New York, New Jersey, and Texas, each with a strong science, technology and IT industrial base, have fashioned information technology policies to promote the development of state research capabilities in higher education, enhance technology transfer from universities to business, and encourage the start-up of new enterprises in science and technology fields.

Organisational frameworks

One recent national survey of state information resource management found that 44 states have central IT policy agencies, two-thirds of which were created after 1981, including 24 since 1984.[1] This is a reflection of the considerable change in state government organisation, planning and information resources goals over the last several years. The impetus for change has largely come from the executive branch.

For example, in Minnesota in 1984, the Governor's Blue Ribbon Committee on Information Policies advised the establishment of a cohesive state information strategy and programmes to manage information. It recommended instituting a new policy and planning function, assigning responsibility for reviewing and approving state information policy to a strengthened user group.

In 1985, this User Advisory Council was renamed the Information Policy Council. Two years later, in 1987, the Council became part of a new Information Policy Office (IPO), within the Department of Administration, with responsibility for developing and establishing policy and standards for state agencies to follow for the development, purchase and training for IT systems.

Similarly, in New Jersey, the executive Office of Management and Budget initiated in 1983 an information processing organisation project to assess the structure and range of IT in state government and recommend strategies for information processing on a statewide basis. As a result, the Office of Telecommunications and Information Systems (OTIS) was created within the Department of the Treasury to consolidate and co-ordinate the telecommunication and information processing functions of state government.

However, not all central policy organisation changes stemmed from executive branch initiative. The Kentucky General Assembly provided an important early impetus in 1977, requesting its Legislative Research Commission to study the feasibility of a statewide information system that would provide the Legislature with access to data on state programmes, finances, and personnel. As a result, the General Assembly eventually created, in 1984, an independent Kentucky Information Systems Commission (KISC) with broad responsibilities for co-ordinating the planning of computer system development across all three branches and elective offices of state government. In subsequent years, the legislature has expanded KISC's authority to develop a long-range statewide strategic plan, promulgate administrative regulations, and develop legislation and procedures on key information issues.

In Virginia, following a series of studies initiated in the early 1980s by the executive branch to assess public service efficiency and effectiveness, the General Assembly created in September 1984 the Department of Information Technology (DIT) in an effort to better co-ordinate the previously fragmented state IT services. Six months later, the Department of Telecommunications was merged with DIT. Then, ten months after that, in response to growing concerns over escalating service costs and other IT issues, the General Assembly authorised its Joint Legislative Audit and Review Commission to undertake a staff review of state IT management.

Following its 18-month review, the Commission recommended the creation of an independent Council on Information Management (CIM). This Council was granted broad authority for ensuring the effective development and efficient use of IT resources serving the needs of state agencies and institutions of higher education. In addition, CIM is responsible for IT budget recommendations, advice to the governor on IT resources, and support to the General Assembly's study mandates.

As indicated above, state central policy structures have undergone considerable and rapid changes in recent years. In the states surveyed, three have established central policy organisations as independent agencies (Kentucky, Texas and Virginia), two are located within Departments of Administration (Minnesota and Tennessee), and three are located within finance, treasury or budget control departments (California, New Jersey and South Carolina). In Massachusetts, the Governor's Advisory Committee on IT is a cabinet-level body. New York does not have a central policy body.

The roles and functions of these policy bodies have also undergone rapid change. In fact, much turmoil surrounds the issue of appropriate state central policy and operational agency roles for information management strategies. In some instances, long-standing political and public administrative traditions and practices have had a determining influence.

California and New York are exceptional in this respect. Information management authority in both states is so highly decentralised that there is no separate central operating agency responsible for information systems statewide. Information is considered an agency resource which demands the same management attention as budgets, personnel, and facilities.

Accordingly, in California, IT projects are managed by individual agencies, with support and technical expertise provided by the fee-for-service agencies that operate centralised data processing and telecommunication facilities. California's Office of Information Technology (OIT), located within the Department of Finance, makes policy recommendations and identifies barriers to IT use and information management techniques.

New York also enjoys a long-standing tradition of executive agency hegemony; information management responsibilities are also highly decentralised. In the absence of any single, central policy organisation, the New York State Forum for Information Resource Management serves as the primary network of public officials and state government organisations concerned with information management, policy and technology. Created in 1987 and located at the Rockefeller Institute of Government, the Forum's role is to promote the development and use of IT across state and local government, maintain liaisons with organisations with IT expertise, and examine and recommend policies.

In the other eight states covered in this survey, the central policy organisations of Kentucky and Massachusetts serve as advisory agencies only, whereas the policy bodies in Minnesota, Tennessee, Texas

and Virginia function as regulatory agencies. In the remaining two states, New Jersey and South Carolina, these policy bodies work in both regulatory and advisory roles.

There has been a growing trend at the state level to separate IT policy functions from information resource operations. More often than not, the main reason has been to clarify control processes by trying to eliminate possible conflicts of interest; to avoid having the same state office both sell and approve information processing services. Five of the states surveyed have separated these functions, while four continue to combine policy functions with operations (see Table 1).

Table 1. **History, status, role and functions of state IT policy organisations**

	Year Est'd	Cabinet level	Inde-pendent	Other[2]	Functions	Tasks[3]	Influence on budget	Combined with Operations	Source[4]
California	1983			b	Advisory	23	No	No	ABC
Kentucky	1984		x		Advisory	1234	Yes	No	AB
Massachusetts	1982	x			Advisory	123	Yes	No	C
Minnesota	1987			a	Advisory	1234	Yes	Yes	A
New Jersey	1984			c	Reg./Advisory	1234	Yes	Yes	C
New York[1]	1987	--	--	--	Consultative	--	No	--	--
South Carolina	1987			d	Reg./Advisory	1234	Yes	No	A
Tennessee	1972			a/b	Regulatory	1234	Yes	Yes	C
Texas	1989		x		Regulatory	1234	Yes	Yes	A
Virginia	1988		x		Regulatory	1234	Yes	No	A

1. New York does not have a central organisation responsible for IT policy.
2. Other: Departments of a) Administration, b) Finance, c) Treasury, d) Budget and Control Board
3. Tasks: 1) formulates policy guidelines, 2) monitors implementation of IT-related policies in departments/agencies, 3) evaluates state IT-related programmes, 4) other (see Appendix 1)
4. Source: Established by A) Statute, B) Administrative Code, and/or C) Executive Order

The functions and tasks performed by these state central policy organisations are primarily concerned with internal government IT management. The statutory tasks of the Virginia Council on Information Management (CIM), described above, provide an illustrative example.[2] They are to:

-- develop policies, standards, and guidelines for managing IT resources;

-- develop a comprehensive, statewide four-year planning process for the acquisition, management and use of IT resources;

-- monitor implementation of information management plans;

-- review IT budget requests (including those for IT procurement) and recommend priorities;

-- maintain an inventory of all state IT resources.

Similar sets of tasks have been assigned to state IT policy bodies in Kentucky, Minnesota, New Jersey, South Carolina, Tennessee and Texas. However, certain tasks, such as IT procurement, are handled differently in some states. For example, California's Department of General Services is responsible for all state IT procurement, while South Carolina's specially designated State IT Procurement Office works closely with the Office of Information Technology Policy and Management (ITPM) in the review and approval of state IT acquisitions.

As a result of the tendency in recent years to consolidate information systems planning and policy responsibilities in central state IT offices, these bodies have also been assigned greater authority. In Kentucky, the 1990 General Assembly extended the planning authority of the Kentucky Information Systems Commission (KISC) to higher education, a responsibility that is also shared by Virginia's Council on Information Management (CIM). In most other states, policy responsibility for higher education remains under the authority of separate boards, commissions and departments.

However, policy-making responsibly for telecommunications is increasingly coming under the purview of state central IT policy organisations. In eight of the ten states surveyed, telecommunication policy and planning functions have now been assigned to these bodies (Kentucky, Massachusetts, Minnesota, New Jersey, South Carolina, Tennessee, Texas and Virginia). Regulatory authority for telecommunications is vested in state public utilities commissions comprised of appointed or elected officials.

As these state policy bodies have consolidated their authority for information technology management, they have begun to address the need for statewide strategic plans and priorities. Six of the ten states surveyed -- including Kentucky, Minnesota, South Carolina, Texas and Virginia -- have completed IT strategic plans that are far-reaching in scope.

One of the major outcomes of this strategic planning process is that it provides a more structured way to define state information needs across functions and organisations. Equally important, such statewide, cross-cutting and horizontal planning efforts can help to reveal major gaps or inconsistencies in overall state policy planning. This is not to suggest that the simple availability of statewide strategic plans ensures their effective implementation. In fact, given the vertical orientation, political autonomy, mission-mindedness, and traditional sense of territoriality of many state agencies, overcoming the force of inertia to implement statewide IT plans is no small challenge. For what is inherent to IT strategic planning is the fact that it is forcing state agencies, as never before, to redefine their roles and missions.

Policy objectives

Strategic planning is at the very heart of public policies for IT at the state level. States have adopted concepts or principles, sometimes referred to as "strategic directions", to provide a guiding "vision" to their IT resource management plans. For example, the 1991 Texas IT Strategic Plan sets forth the following set of seven "guiding principles" for state information resource management:

-- provide state-level support for the effective long-term use of information technology by agencies;

-- prepare the statewide telecommunication network to support strategic uses of information technology;

-- take advantage of shared resources: data integration, common software, and geographic information systems;

-- adopt standards and guidelines to ensure necessary connectivity among state information technology facilities;

-- enable cost-effective acquisition of information technology for maximum benefit to state service delivery;

-- improve the state's ability to recruit and retain qualified information technology personnel;

-- provide for the continuous availability of state information processing capabilities.[3]

Strategic plans prepared by other states covered in this survey, most notably in Kentucky, Minnesota, South Carolina and Virginia, manifest a quite similar set of priority policy concerns. What is not reflected in these plans are other state government IT-related goals and objectives concerned specifically with issues such as economic development, private industry, education, and R&D and science and technology policies -- issues of critical relevance to the articulation and development of fully coherent and comprehensive state IT policy.

These areas still tend to be the province of other state agencies and policy-makers. For example, states have tended, historically, to direct all their economic development activities and initiatives towards their Department of Commerce and/or Department of Community and Economic Development. State Commissions on Higher Education play an equally important role with respect to IT policies and universities.

Newer actors on the IT public policy scene include state commissions and councils on science and technology. They play an increasingly important role in many states, fostering academic/industrial research collaboration with emphasis on the application of advanced science and technology (including IT) to industrial issues. Programme initiatives in some of these areas are described in more detail below.

What this reveals, nevertheless, are some of the current limitations of public IT policy-making at the state level. Central state IT policy bodies remain heavily preoccupied with improving internal information resource management, telecommunication infrastructure development, records management, library services and training. Yet the real challenge facing state government is to forge new, meaningful and lasting linkages between these inner-directed IT policy concerns and broader, more far-reaching state policies for economic and social development. The very effectiveness of these economic and social policy initiatives will depend upon their linkages to IT policies.

Promotion of efficient IT use

Advances in communication and information technologies coincide with a shift towards a more service-oriented economy. Recognising the inherent implications of this relationship, many states are coming to view IT generally, and telecommunications in particular, as essential economic development tools. For well over a decade, states have been actively involved in fashioning policies and programmes to promote IT use outside government in order to encourage technological innovation, stimulate the growth of new small and medium-sized enterprises (SMEs), and attract new businesses and foreign investment.

Many of these initiatives have been undertaken under the aegis of state departments responsible for commerce, trade, or economic and community development. Others are managed by state science and technology commissions, councils or foundations. Programmes include: technology and business assistance services, business incubators, research parks, seed capital financing, and specialised on-line data services. Most programmes provide services across a broad range of technologies and businesses; some are more directly focused on IT.

For example, the New Jersey Commission on Science and Technology has established a Technology Extension Centre in Information Sciences to aid New Jersey businesses in the areas of computers and telecommunications. It provides training, reference resources, demonstration and testing facilities. Its full-time professional staff and subject matter specialists are drawn primarily from the faculties of the New Jersey Institute of Technology and the Stevens Institute, as well as from other New Jersey colleges and universities.

Similar "technology extension" programmes are found in Texas and New York and in other states not covered by this survey.[4] However, their focus is more general. The New York State Science and Technology Foundation operates an Industrial Technology Extension Service (ITES), which seeks to strengthen the state's manufacturing sector and improve the competitiveness of its smaller manufacturing companies by providing direct technical assistance to manufacturing firms of 500 employees or less. Operating in all ten state economic development regions, the ITES promotes technology transfer with universities and helps companies obtain project-oriented financial assistance grants through the state's Department of Economic Development's Industrial Effectiveness Program.

A Texas Technology Extension Network (TTEN) has been created by the state Department of Commerce's Office of Advanced Technology, with federal support from the National Institute of Standards and Technology (NIST). The purpose of the TTEN is to co-ordinate state technology assistance resources in six technology development areas: manufacturing technology assistance, technology development financing, small business technology commercialisation, work force training for technology business, technology information and communications, and technology transfer from Texas universities and federal laboratories.

Another approach to business assistance involves a recently established Tennessee Telecommunications Applications Partnership (TAP) programme, located at the Institute of Public Service at the University of Tennessee. This TAP programme, a partnership between the university, the public utility Bell South, and the state Department of Economic and Community Development, acts as a "facilitator" and catalyst, promoting collaboration between state businesses and university faculty and researchers in the development of new telecommunication applications for business.

Business incubators -- facilities providing office and laboratory space for start-up companies at below market rates -- were an innovation of the early 1980s in a few states. A recent study identified more than 300 such incubator facilities across the United States today.[5] Three major technologies targeted by incubators are: IT, manufacturing technologies, and biotechnology and life sciences. The Austin (Texas) Technology Incubator, one of the largest and fastest growing business incubators in the nation with 55 000 square feet and 18 tenants, is targeted primarily at IT-related start-up companies. Affiliated with the Graduate School of Business at the University of Texas at Austin, this incubator programme is jointly funded by the City of Austin, the Austin Chamber of Commerce, private sources, and the university.

Research parks are also most often affiliated with universities and, like incubators, have proven to be a popular mechanism for stimulating the growth of technology-based businesses. It is estimated that there are now approximately 130 such research parks nationwide.[6] States have worked closely with universities to develop research parks, most of which have a general technology orientation. However, state/private partnership arrangements have evolved in recent years for the development of telecommunication research parks in Kentucky and Tennessee. These new developments are discussed below.

Several other state initiatives to encourage the growth and development of technology-oriented enterprises, including start-up IT companies, are associated with early-stage business financing. All of the states surveyed have special programmes to encourage small business participation in the federal Small Business Innovation Research (SBIR) programme. In addition, some states, such as California, Massachusetts, Minnesota, New Jersey and New York, have special "seed capital" programmes to assist in the start-up of new businesses.

Texas has also recently introduced a new state-subsidised on-line technological data service to small businesses, called the Technology Access Program (TAP). Operated under the aegis of the state Department of Commerce's Office of Advanced Technology, this TAP programme provides information on state and federal technology opportunities. Through this initiative, businesses have direct access to the Texas Innovation Network (TINS), a state-authorised clearinghouse for technical and business assistance information.

Human resource policy (IT skills)

Government policies to promote enhancement of IT skills through training and education are receiving growing support. Centralised training programmes have been established in all states for the improvement of the IT skills of state government employees. However, IT training for workers outside government appears to be less of a priority concern, in that states generally consider this primarily a responsibility of the private sector. However, the use of IT-based systems as instruments for education in general continues to receive considerable attention across all states and at all levels.

State policy-making responsibilities for education in most states are usually shared by several different departments and agencies. Two exceptions are Virginia and Kentucky, where the Virginia Council on Information Management (CIM) and the Kentucky Information Systems Commission (KISC) both have state policy planning authority over schooling through high school and higher education.

The importance of education to the future of Kentucky has become a dominant theme across the state over the last several years. The State Supreme Court recently declared the state's public secondary school system unconstitutional. Kentucky also ranks among the bottom third among the states in federal funds for higher education. The resulting ground swell of support among the state's citizenry for an aggressive and innovative strategy for improving the state education system contributed to the passage in 1990 of the Kentucky Education Reform Act (KERA). The legislature subsequently passed a significant new tax increase -- $1.3 billion over two years -- in order to entirely revamp the public schools.

New impetus has also been given to state "distance-learning" initiatives, including Kentucky Education Television's (KET) plans to deliver science and foreign language programmes via satellite to secondary schools and tele-education programmes for community colleges fed from university courses. At

the same time, the state is developing a new electronic communication network, the Kentucky Networking System (KENS), to link all levels of the state's 178 public school districts to the state Department of Education.

Networking issues are, in fact, a pervasive concern on college and university campuses nationwide. Networking provides the access to information considered to be the most important strategic need in higher education today. As one recent Virginia report on planning for IT resources notes: "Networks are viewed as supporting a general change in the process of education by distributing access to information and educational resources, both within and beyond the physical campus ... a location-free study and workplace".[7]

The New York State Education and Research Network (NYSERNet), which went on-line in 1984, provides the state's academic and industrial community with high-speed computing and data communications. Through a newly offered dial-up connection, users can access NYSERNet and the worldwide computer network, Internet, by simple computer modem connection, as an alternative to more costly leased lines. Among the network's newest user groups are elementary and secondary schools, libraries, museums, small developing businesses, and non-profit organisations. Coupled with the state's Technology Network Ties (TNT) programme, which links together the various school system administrative Boards of Co-operative Education Services (BOCES) from all regions around the state, New York has one of the most sophisticated education networks in the nation.

Texas has developed a statewide Electronic Information Transfer System, also known as the Texas Education Network (TENET), patterned after the New York TNT programme described above, to exchange electronic mail within and among school districts, regional education service centres, and the Texas Education Agency. The system is used by over 800 state school districts across the state.

Distance learning is also a priority policy concern within the state, which is currently deploying an Integrated Telecommunications System linking, primarily via satellite, the Agency, school districts, and regional education service centres. The goal is to put satellite dishes into every single school district over the next several years, thereby providing access to courses for credit for high school students and for in-service and technical assistance for staff.

A third Texas IT-related education initiative involves the recent creation of the Texas Centre for Educational Technology (TCET), an R&D consortium of hardware, software and other companies, as well as schools, institutions of higher education, and the state education agency. Its mission is to promote and test innovative applications of existing and emerging IT in the public school system.

IT education and skill development are a priority concern in all of the states surveyed for this study, especially in California, Massachusetts, and South Carolina where the state school system's "pathways" programme and higher education distance-learning initiatives receive strong support. In all states, the future trend is clear: to extend distance learning beyond institutions of higher education to the home.

Improvement of the IT market

State government has generally taken a position in support of free market competition in communication infrastructure and services. For example, the telephone system in the United States is

largely owned and operated by independent, privately-owned companies. The divestiture of the nationwide Bell System (AT&T) and the shift towards deregulated services has resulted in the emergence of large private networks. Coupled with this shift is the unbundling of the communication infrastructure and the development of new network architectures and technological applications.

Over the last several years, a number of states, including California, Minnesota, New Jersey, New York and Tennessee, have commissioned major studies and task forces to delineate the potential of telecommunication applications for economic development. In the more highly industrialised states, such as California, Massachusetts, New Jersey and New York, central IT policy-making organisations have begun to work more closely with state public utilities commissions in planning the design and regulatory frameworks for advanced telecommunication networks. Institutions of higher education are also beginning to play an increasingly important policy advisory role, both because they are such large users themselves of communication services -- often ranking second only to state government -- and because they are knowledgeable in the use of communication technologies.

In other states with more rural economies, such as Kentucky, Minnesota, South Carolina and Tennessee, government has come to consider advanced telecommunication networks as providing important new opportunities for promoting economic growth and development.[8]

Minnesota, like many states, has suffered economically from the recent down-sizing which has affected its well-established computer industry. It considers advanced network infrastructure essential not only to retain and attract high-technology firms to the Twin Cities urban area of Minneapolis/St. Paul, but also to ensure that the state's rural communities not be left behind due to lack of access to these networks. Increasing emphasis is being placed on upgrading the state's telecommunication network infrastructure. However, achieving the desired network upgrades to fibre optics will be no easy, short-term task. It will require considerable policy co-ordination efforts at the state and local level. This is due in part to the fact that Minnesota, like several other states, has literally hundreds of private, independently-owned telephone companies.

Tennessee boasts the nation's most complete fibre optic cable system; it connects all 95 counties and has ISDN capabilities approaching 60 per cent (by 1995) for all telephones. The challenge now is how to maximise return on its investment in telecommunication infrastructure for economic growth. The state Department of Economic and Community Development, in partnership with South Central Bell, has commissioned several studies focusing on the growth potential of the state's manufacturing industry.[9] Although analysis of these study results is still underway, two likely target areas for future state economic development initiatives are: computer-integrated manufacturing and warehouse/distribution and back-office administration service functions.

Kentucky has also undertaken a number of programme initiatives targeted to specific economic development goals. One of these relates to plans for a series of new "information age office parks" to be located in so-called "micropolitan" (i.e. non-metropolitan) areas. This concept was first pioneered by GTE in the mid-1980s. To date, GTE has completed 34 "smart parks" throughout the south-eastern United States, eight of which are situated in micropolitan areas. Kentucky's plans have been developed jointly between the state Office of Business and Technology, the Kentucky Science and Technology Council, and GTE and South Central Bell.

These rural telecommuting centres are envisioned as mixed-use facilities providing an array of advanced telecommunication and related services to client firms and organisations. They are essentially

information-intensive business parks, designed to assist interested communities to create and attract new jobs, economic growth and development. By utilising fibre optic and digital switching network infrastructure, these parks are supposed to function as gateways to the fibre optic "highways" being deployed nationally.

Kentucky has also recently established a Telecommunications Research Centre (TRC) at the University of Louisville to study the effects of telecommunications on the workplace and develop technology applications for business. Funded jointly by the state, South Central Bell, and the university, the TRC serves as a demonstration facility both for educating visitors on the most up-to-date telecommunication technologies and for supporting the efforts of state and local economic development agencies to help existing Kentucky business expand and to attract IT-intensive companies to the state.

These experiences also demonstrate a growing awareness on the part of state governments of how the use of advanced telecommunication systems can play a role in promoting IT-use in general. This is especially true for rural communities and states such as Kentucky, South Carolina and Tennessee with fewer opportunities to learn about telecommunication and computers than metropolitan areas and more industrialised states. In the latter, there is a seemingly limitless availability of classes, seminars and other educational programmes on information technologies available through high schools, community colleges, local universities and professional associations. To the degree that programmes such as Kentucky's TRC can meet their educational mission, they can help to promote broader use of IT.

IT in science and technology policy

During the last decade, state government has assumed a significant role in developing science and technology policies in the United States. Supported by a growing public consensus on the importance of science, technology and innovation to economic growth, productivity, industrial competitiveness and social well-being, states have taken a leading role in promoting technological innovation.

Increasingly, states today are the agents of development and change. State government has assumed a new "entrepreneurial" role in encouraging economic development and building public/private co-operative partnerships in science, education and industrial applications in colleges and universities. They are well connected to state government, since many are governed by state boards and funded by state legislatures. They are also increasingly linked to businesses seeking access to knowledge, research and training.

State efforts to promote academic/industrial research collaboration take many forms. With respect to IT R&D, research grants to universities and support for advanced technology research centres are the most important.

The Texas Higher Education Co-ordinating Board annually distributes over $60 million in research grants to state universities under its Advanced Research Program and Advanced Technology Program. Approximately 3 000 research proposals are submitted annually, of which about 11 per cent receive funding. In 1991, Advanced Research Program proposals in computer and information sciences received just over $1.3 million. Under the state's Advanced Technology Program, grants totalling $7.3 million were awarded for information sciences ($2.5 million), microelectronics ($3 million), and telecommunications ($954 000).

Although there are no formal requirements for private matching funds, over half of the proposals funded under the Advanced Technology Program (ATP) involve some industrial financial commitment. Additional criteria used for evaluating these ATP proposals include prospects for commercialisation and technology transfer and evidence of the proposal's relationship to or expansion of an existing base of technology or science.

The New York State Science and Technology Foundation's R&D Grants Program, which was initiated in 1983, seeks to link the institutional resources of state universities with industrial companies to develop innovative technological products and processes. About one-third of these research proposals are in IT-related fields. However, due to state budget constraints in 1991, only 16 proposals (the fewest in six years) received funding of $600 000. Private matching funds totalled $934 000.

A similar matching programme of research grants is the Innovation Partnership (IP) in Telematics administered by the New Jersey Commission on Science and Technology. Under this programme, grants are awarded on a competitive, peer-review basis, on the condition that the researcher receives an equal amount in matching funds from a company with New Jersey operations. This IP research programme in telematics, which focuses on IT research at the interface between computer science and telecommunication technologies, received state funds of $600 000 and matching funds totalling $676 000 in 1991.

Other research grant programmes of this kind exist in a number of other states, including California, Minnesota and Virginia. The same is true for advanced technology research centres.

New York's programme of centres for advanced technology (CAT) is one of the oldest and most extensive efforts of its kind nationally. Established in 1982, the programme seeks to encourage greater collaboration between private industry and universities in the development and application of new technologies. The mission of the CAT programme is to foster R&D which leads to more productive and competitive companies and commercialised products and processes which add to the economic growth of New York state.

Two IT-related programmes include the new Northeast Parallel Architectures Centre (NPAC) at Syracuse University, and the Cornell Theory Centre at Cornell University, both of which are funded in part by the New York State Science and Technology Foundation. The NPAC receives about $800 000 annually from the Foundation and the Cornell Theory Centre an equal amount. The Theory Centre also receives additional matching funds of $12.6 million from the federal government's National Science Foundation (NSF) and $15.6 million from IBM and other corporate sponsors. Since its designation more than eight years ago, the Theory Centre has received nearly $56 million from the NSF and $14.8 million in state government support. Other state CAT programmes include the Centre for Advanced Technology in Telecommunications at Polytechnic University and the Centre for Advanced Technology in Computers and Information Systems at Columbia University.

The New Jersey Advanced Technology Centre for Computer Aids for Industrial Productivity (CAIP) at Rutgers University was established in 1985 and is jointly supported by the New Jersey Commission on Science and Technology, the university and industrial sponsors. It conducts forefront computer applications research in parallel computing machine vision, computer-aided design, and software engineering. Funded by the state through the Commission at an annual rate of about $1 million, it has successfully leveraged $1.4 million in funds from the NSF, the US Air Force, NASA and industrial sponsors.

In addition, there is the recently established Centre for Manufacturing Systems at the New Jersey Institute of Technology, which conducts research on manufacturing processes, robotics, systems integration and product design. This Advanced Technology Centre receives $450 000 annually from the Commission, as well as over $1 million in matching funds from industry.

The significance of these initiatives resides in the concerted efforts states have made to promote the development of state research capabilities in certain targeted IT-related industries as well as in other fields of science and technology. New Jersey, for example, has selected the following four high-priority fields to receive special state financial support: information technologies, biotechnology, advanced materials, and environmental protection technology. Within the area of IT, as illustrated above, it has chosen to promote CAD-CAM industries in both its CAIP and CMS Advanced Technology Centres.

New York has identified telecommunications and computer and information systems as technological areas very likely to help promote the growth or greater productivity of state industries. Massachusetts has identified microelectronics and materials sciences as priority fields in two of its Centres of Excellence programme.

In California, microelectronics technology industries have been targeted for special focus under the state MICRO programme, established in 1981 to promote joint industry/university research collaboration. In addition, a Council on Science and Technology was recently established to examine science and technology public policy issues of importance to the state, including science and technology aspects of economic, educational, social and technical issues. Comprised of 24 distinguished scientists, engineers, scholars and industrialists, the Council has recently launched a major new initiative, Project California, a 14-month study to determine state transportation system needs for the 21st century, including the future role of IT in the state economy.

State and local government co-operation

The importance of local government involvement in state IT policy-making and strategic planning is increasingly recognised today. Although some state central IT policy bodies include representatives of local and community government among their members and on their advisory boards (Kentucky, Minnesota and Virginia), most states have yet to devise formal frameworks and procedures for local government participation in state IT policy-making. However, recent efforts to promote state/local co-operation in such IT-related policy areas as communication infrastructure design, standards formulation, and statewide economic development planning indicate a desire to achieve more harmonised approaches to state policy-making.

The development of statewide geographical information systems (GIS) provides a most relevant example of some of the benefits to be derived from effective state/local co-operation. GIS is considered important not just as a means for promoting statewide data exchange, common applications, and systems integration, but also as a major benefit to local government agencies, such as area development districts, county governments and planning commissions.

GIS has received considerable attention in all the states covered in this survey. In fact, according to one estimate, more than $9.9 billion was spent nationwide on GIS hardware, software, consulting and maintenance during 1991 alone. The development of statewide geographical information systems is a prime example of the role and importance of shared resources. GIS technology is emerging today as a major tool

for productivity, one which could greatly improve the delivery of services at all levels of state, county and local government in such major areas as: resource development in the human services, criminal justice and education systems; environmental and public health management; and economic development and tax policy formulation.

States also recognise the importance of adopting GIS data standards in order to support the productive sharing of information across state, county and local government agencies and across programmes within agencies. At the same time, GIS development calls for the formulation and implementation of statewide information access policies to address the issues of confidentiality, security, and privacy in the context of shared resources.

Policy-making for information access is generally a responsibility of state central IT policy organisations. In California, Minnesota and Texas efforts are underway to develop statewide access policies as well as concomitant legislation concerning privacy, data security and computer crime. New privacy legislation (Senate Bill 1447) has recently been introduced before the California Legislature, and in Texas a draft legislative proposal to combat computer crime has been presented to the Texas Legislative Council for consideration.

Minnesota's Data Practices Act, which dates from 1974, seeks to reconcile the need for freedom of information with the need to preserve individual privacy. Implementation of this legislation is closely monitored by the Data Practices Division of the state Information Policy Office (IPO), which helps state and local government to understand and apply the Act and related laws.

In all these areas -- GIS development, harmonisation of standards, and the formulation of information access policies -- the need for closer state and local co-operation is increasingly evident. The same is true for interagency co-operation at the state level; effective systems integration will increasingly depend upon whether strategic state goals take precedence over the pursuit of agency-specific imperatives.

Conclusion

Public policies for IT at the state level have developed and evolved rapidly over the last decade as government has sought to respond to growing demands for improved performance, to new levels of accountability, and to the revolutionary changes underway in information management and technology. Government has sought more effective co-ordination of state IT policies by centralising policy-making functions and responsibilities in separate, often independent, high-level bodies. These central state IT policy bodies are playing an increasingly crucial role in the development of statewide strategic planning for information technology.

Although IT policies differ across states, they share a common point of departure: more effective management of information resources for improved state welfare. State IT policy makers in the United States are generally preoccupied with issues such as the more effective use of information technologies, improved co-ordination of information resources management (IRM) among and between agencies, and improved planning and budgeting relationships and inter-system communication. In general, IT policies at the state level today are largely directed towards improved, more effective and more efficient state government administration.

Nevertheless, one witnesses at the same time steady growth and expansion of new state initiatives to promote IT use outside state government. These include programmes designed to stimulate the growth of IT-intensive businesses, expand educational services and opportunities through IT-based systems, promote economic and community development in association with improved telecommunication networks and applications, strengthen state R&D capabilities in information technology, and encourage the transfer of technology from universities to private industry.

To a large extent, these new programme initiatives have evolved independently, outside the framework of the central state IT policy-making bodies. They reflect the piecemeal efforts of numerous, individual mission-oriented agencies, departments and commissions. Their significance resides in their attempts to foster closer public/private partnerships.

Such collaborative partnerships are perforce essential to the more effective promotion of IT use outside government. State government efforts to build closer linkages between the public and private sector are more highly developed with respect to university-based IT R&D and the promotion of technology transfer from universities to private industry. The same is true of state policies for technological innovation and small business development. However, efforts to develop closer public/private partnerships in the area of state IT policies for economic development *per se* are more tentative.

Many state policy-makers, in fact, seem to be increasingly aware of some of the inherent limitations of excessive reliance on IT use and applications for economic development. They recognise that while IT generally, and communication technologies in particular, can improve a state's economic prospects, they are no panacea.

They are mindful, for example, of how industrial park strategies of the 1970s failed to attract new businesses because they failed to provide for an educated work force and access to community services, health care, and social and cultural amenities for new potential employees. Similarly, they are increasingly aware that the success of state economic development strategies will depend on the ability of government to shape comprehensive, holistic approaches to improving not just telecommunication networks, but economic and community infrastructures as well.

These experiences also reveal the need for more effective collaborative partnerships both between public and private interests, and within the public sector between state, local and community authorities. At the same time, there is an opportunity to develop more direct, effective linkages between state IT policies (as presently conceived) and state policies for economic growth and industrial productivity, for education and human resource development, for scientific and technological innovation.

NOTES

1. For an analysis of state IT resource management see: Caudle, Sharon L. and Donald A. Marchand (1989), *Managing Information Resources: New Directions in State Government*, Syracuse University School of Information Studies, Syracuse, New York. See also: *1990-91 NASIRE Report: State Information Resource Management, Structure and Activities* (1991), National Association of State Information Resource Executives, Lexington, Kentucky.

2. *Virginia Council on Information Management, Virginia Report on Planning for Information Technology Resources: 1991* (1991), Council on Information Management, Richmond, Virginia, p. iii.

3. *Department of Information Resources, State Strategic Plan for Information Resources Management* (1991), Department of Information Resources, Austin, Texas, p. 3.

4. For a review of technology extension programmes, see Clarke, Marianne and Eric Dobson (1989), *Promoting Technological Excellence: The Role of State and Federal Extension Activities*, National Governors' Association, Washington, DC.

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6. Goldstein, Harvey A. and Michael I. Luger (1989), "Research Parks: Do They Stimulate Regional Economic Development?", *Economic Development Commentary*, Spring, pp. 3-8.

7. Virginia Council on Information Management, p. 20.

8. US Congress, Office of Technology Assessment, (1991), *Rural America at the Crossroads: Networking for the Future*, OTA-TCT-471 US Government Printing Office, Washington, DC.)

9. Studies prepared for the Tennessee Department of Economic and Community Development by JRH Associates, Inc. included "Computer Integrated Manufacturing", "A Research Report on Tennessee's Manufacturing Industry", "The Emerging Role of Telecommunications in Job Creation" and "Micropolitan Information Parks".

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LIST OF CENTRAL STATE IT POLICY-MAKING ORGANISATIONS

CALIFORNIA

NAME:	Office of Information Technology (OIT)
CHIEF OFFICER:	Steve Kolodney, Director Office of Information Technology Department of Finance 915 L Street, 6th Floor Sacramento, CA 95814 TEL 916/445-1777 FAX 916/327-0213
DATE ESTABLISHED:	1983
HOW FORMED:	Statute
STATUS:	Department of Finance
MEMBERSHIP:	State government management
DUTIES/FUNCTIONS:	Advisory: Guides and advises Director of OIT; identifies barriers to IT use and IRM techniques; recommends policies.
BUDGETARY IMPACT:	Yes

KENTUCKY

NAME:	Kentucky Information Systems Commission (KISC)
CHIEF OFFICER:	Stephen N. Dooley, Commissioner Department of Information Systems 101 Cold Harbor Drive, Frankfort, KY 40601 TEL 502/564-6856 FAX 502/564-6856
DATE FORMED:	1984
HOW FORMED:	Statute KRS 61.945
STATUS:	Independent
MEMBERSHIP:	Representatives from state government, local government, legal community, financial community, libraries and information services, media, and citizens
FUNCTIONS:	Advisory: KISC formulates, co-ordinates and reviews agency long-range strategic plans and policies, including those for higher education; reviews and approves agency information resource plans; promulgates administrative regulations, standards, guidelines and principles.
BUDGETARY IMPACT:	Yes

MASSACHUSETTS

NAME:	Governor's Advisory Committee on Information Technology
CHIEF OFFICER:	James Corum, Director Office of Management Information Systems Office for Administration and Finance One Ashburton Place, Room 801 Boston, MA 02108 TEL 617/973-0896
DATE ESTABLISHED:	1976
HOW FORMED:	Executive Order
STATUS:	Independent
MEMBERSHIP:	State Government management and private sector
DUTIES/FUNCTIONS:	Advisory: Advises Governor on IT use in state government; reviews state information processing planning; assists in developing long-range IT and telecommunications strategies and plans; recommends IT priorities.
BUDGETARY IMPACT:	Yes

MINNESOTA

NAME:	Information Policy Office (IPO)
CHIEF OFFICER:	Steve Gammon, Assistant Commissioner Information Policy Office Department of Administration 320 Centennial Building 658 Cedar Street St. Paul, MN 55155 TEL 612/296-5320 FAX 612/296-5800
DATE ESTABLISHED:	1987
HOW FORMED:	Statute 16B.41-
STATUS:	Department of Administration
MEMBERSHIP:	State Government management
DUTIES/FUNCTIONS:	Regulatory: Formulates state-wide standards, policies and guidelines governing the management of information resources, reviews all major information system requests, and sets priorities.
BUDGETARY IMPACT:	Yes

NEW JERSEY

NAME:	Office of Telecommunications and Information Systems (OTIS)
CHIEF OFFICER:	Nidia Stone, Deputy Administrator OTIS, Department of the Treasury 840 Bear Tavern Road, CN-215, West Trenton, NJ 08625 TEL 609/633-9060 FAX 609/633-9100
DATE ESTABLISHED:	1984
HOW FORMED:	Executive Order No. 84
STATUS:	Department of the Treasury

MEMBERSHIP: State Government management
DUTIES/FUNCTIONS: Regulatory/Advisory: Responsible for information systems development, planning, design, development, implementation and production support services for all executive branch agencies
BUDGETARY IMPACT: Yes

NEW YORK

NAME: New York State Forum for Information Resource Management
CHIEF OFFICER: Sharon S. Dawes, Executive Director
New York State Forum for Information Resource Management
411 State Street
Albany, NY 12203
TEL 518/443-5155 FAX 518/443-5788
DATE ESTABLISHED: 1987
HOW FORMED: The Forum is an independent, non-profit organisation that receives its operating funds from the NYS Budget Division.
STATUS: Independent
MEMBERSHIP: Voluntary membership comprised of state government officials from more than 65 state government organisations including virtually all executive agencies and state-wide public authorities, the court system, the state university, and both houses of the legislature, and from local government. Total membership of more than 400.
DUTIES/FUNCTIONS: Consultative: Promotes information exchange, guidelines, standards, education, training, R&D, evaluation and use of advanced IT; maintains liaisons with organisations IT expertise; examines and recommends policies; sponsors interagency information management projects.
BUDGETARY IMPACT: No

SOUTH CAROLINA

NAME: Information Technology Advisory Committee
CHIEF OFFICER: Larry Huckabee, Assistant Director
Division of Research and Statistical Services
Office of Information Technology Policy and Management Budget and Control Board
1000 Assembly Street
Columbia, SC 29201
TEL 803/734-3658 FAX 803/734-3619
DATE ESTABLISHED: 1987
HOW FORMED: Statute
STATUS: Budget and Control Board
MEMBERSHIP: State Government management
DUTIES/FUNCTIONS: Regulatory/Advisory: Develops state IT policy and strategic plan; prioritises state IT budget; approves procurement plans; provides input on interagency planning and programme co-ordination.
BUDGETARY IMPACT: Yes

TENNESSEE

NAME:	Information Systems Council
CHIEF OFFICER:	Bradley S. Dugger, Chief Information Systems Division Department of Finance and Administration Nashville City Centre, Suite 1020, 511 Union Street Nashville, TN 37243-0288 TEL 615/741-2569 FAX 615/741-6164
DATE ESTABLISHED:	1988
HOW FORMED:	Executive Order
STATUS:	Finance and Administration
MEMBERSHIP:	Executive, legislative and private sector
DUTIES/FUNCTIONS:	Regulatory: Responsible for the formulation of state information policy, reviews IT programmes, and approves state information agency long-range IT plans.
BUDGETARY IMPACT:	Yes

TEXAS

NAME:	Department of Information Resources
CHIEF OFFICER:	Ann S. Fuelberg, Executive Director Department of Information Resources 13001 Capitol Square, 300 West 15th Street, P.O. Box 13564, Austin, TX 78711-3564 TEL 512/475-4700 FAX 512/475-4759
DATE ESTABLISHED:	1990
HOW FORMED:	Legislation
STATUS:	Independent
MEMBERSHIP:	State Government management with six-member board appointed by Governor, Lt. Governor and Speaker of the House with advice and consent of Senate.
DUTIES/FUNCTIONS:	Regulatory/Advisory: Responsible for the formulation of state IT policy, development of strategic plans, co-ordination of IT programmes of all state agencies, including higher education, and the setting of standards, guidelines and principles for the use of information resources technologies.
BUDGETARY IMPACT:	Yes

VIRGINIA

NAME:	Council on Information Management (CIM)
CHIEF OFFICER:	Patricia Jackson, Director Council on Information Management 1100 Bank Street, Suite 901 Richmond, VA 93219 TEL 804/225-3622 FAX 804/371-7952
DATE ESTABLISHED:	1988
HOW FORMED:	Legislation
STATUS:	Independent
MEMBERSHIP:	Executive, legislative and private sector

DUTIES/FUNCTIONS:	Regulatory: Promotes the co-ordinated planning, acquisition, development and use of IT resources serving the needs of State agencies and institutions of higher education. Develops state-wide information systems plan and approves plans of all agencies and institutions of higher education.
BUDGETARY IMPACT:	Yes

COMMISSION OF THE EUROPEAN COMMUNITIES

Introduction

The Directorate-General for Telecommunications, Information Industries and Innovation (DG XIII) is responsible for all major IT-related policy aspects in the Commission of the European Communities (CEC). This responsibility encompasses broad areas, such as R&D on electronics and telecommunications, their diffusion, and jurisdictional matters, including the security of information systems and aspects of privacy and data protection. As of 1 January 1992, tasks have been assigned to six directorates in DG XIII.[1] The following summarises the organisational structure for public policies for IT in the CEC:

Directorate A: Information technologies, centred on the ESPRIT project;

Directorate B: Information and industry markets;

Directorate C: Exploitation and evaluation of the results of R&D and technological development, technology transfer and innovation;

Directorate D: Telecommunication policy;

Directorate E: General affairs;

Directorate F: Advanced telematic services and the RACE programme.

Distinctive features of policies for IT

IT policy context

Since the beginning of the 1990s, the CEC's science and technology (S&T) policies for IT have become increasingly instrumental in supporting improvement of the competitiveness of the European IT industry. This reflects the CEC's wish to see European IT firms compete with both European and non-European firms in the free market economy. In the Commission's view, IT firms in Europe should take advantage of the single European market to improve competitiveness through their own efforts. The R&D programmes launched by the Commission are intended to encourage Community-wide co-operation and thus reinforce the technological background of the IT sector.

IT has continued to have high priority since the beginning of the evolution of S&T policies in the CEC. Following the First Framework Programme (1985-87), the Council of Ministers in 1987 approved the Second Framework Programme for Research and Technology Development for the years 1987-91. It was the first comprehensive plan that contained programmes instrumental to achieving EC-wide goals.

Approximately 40 per cent of the total budget of ECU 5.4 billion is allocated to programmes in the areas of electronics, information and communications.

The Third Framework Programme (1990-94), adopted by the Council of Ministers in April 1990, again places the highest priority on IT. Although most of the programmes already included in the Second Framework Programme were regrouped in the Third, those related to IT and communication technologies continued to have high priority. As "enabling technologies", they accounted for 38.9 per cent of the total budget of the Framework Programme.

The Second and Third Framework Programmes were influential in orienting S&T policies, and in consequence IT R&D policies, in the member States. They helped to create research networks involving both academic and industrial sectors across States.

For industrial policy, the CEC advocates the formulation of policies for IT sectors which are coherent with Community industrial policy. The communication from the Commission released in April 1991, "The European Electronics and Information Technology Industry: State of Play, Issues at Stake and Proposals for Action", was the first manifestation of this idea.[2] In the communication, the Commission argued that the goal of policies for IT sectors should be to improve the competitiveness of the European electronics and information industry in the world market. The decreasing competitiveness of European firms in this industry, compared with that of Japan and the United States, alarmed the Commission. The Commission therefore began to take action to develop a Community-wide approach which includes a broad basis for industrial development. Stimulation of market demand, technological development, and efforts to maintain an open and multilateral international trade system are examples of the measures proposed.

The CEC has been very cautious not to intervene in national policies in relation to IT policies. The general rules for the relationship with member States' S&T policies apply to IT as well. National and EC policies for IT should be developed in harmony on the basis of the subsidiarity principle. Intervention is justified only for projects that no single member State government can undertake efficiently, due to the insufficient size of the domestic economy or a lack of appropriate resources. In general terms, the criteria for undertaking Community-level action in S&T policy are:

-- the strategic importance of the topic for the European economy and society;

-- the risk that national or bilateral efforts will be sub-optimal in size and impact (especially in small countries and in less developed regions);

-- the links to other Community level policies (single market, competition, trade, etc.);

-- the prospect that a large number of member States will benefit from the results and spin-off;

-- the catalytic impact on other activities (both public and private) throughout the Community;

-- the contribution to strengthening the European scientific community.

The same applies to IT. It is natural that IT has come to play a substantial part in the CEC's science and technology policy. Programmes initiated by the CEC are "pre-competitive" in nature. In this phase, IT R&D requires large volumes of resources, both financial and human, and thus meets the criteria that justify collective action by a supra-governmental body. The underlying assumption is that an individual

member State is too small to support certain IT R&D topics and that the market for IT-related sectors needs to be large enough to generate economies of scale if the EC member States are to be competitive in international markets. The CEC-initiated programmes are designed so that the advantages of co-operation are beneficial to the participants. The CEC thus intends to improve the collective innovative capacity of Community firms and nations.

National programmes are often formulated in parallel with the European programmes in order to exploit the potential results of the latter programmes to their full extent. This is because of the scarcity of resources available in each member State in IT R&D. For example, it is reported that ESPRIT had no severe problem of competition with national IT programmes in terms of the subjects of research, but that it did compete for scarce resources in the member States.[3] This meant that the member States allocated limited resources for IT R&D to the Framework Programmes. The programmes, consequently, were crucial to the CEC's efforts to draw together national R&D efforts that might otherwise have diverged.

Implementation of IT-related goals

A Community approach

The CEC proposed that member States take five main measures to enhance the development of the IT industry in Europe. It should be noted that the Commission emphasised that firms should take the prime responsibility for their competitiveness, and that it is up to the member States to help create a favourable environment for their efforts. This reflects the CEC's support of a free market economy.

The five measures include: stimulation of demand for IT use, technology development, training, external relations (i.e. trade rules), and the development of the business environment in general. Examples of the implementation of the measures are summarised below:

-- *Demand*: the construction of computerised telecommunication links between administrations should be promoted so that the links serve as the backbone of further development of information systems, such as distance learning and transport information systems.

-- *Technology*: formulation of a second generation of R&D is suggested so that resources are concentrated on a smaller number of better targeted and more ambitious projects with closer links to users.

-- *Training*: formulation or enhancement of multi-disciplinary training for training staff, workers and managers, in firms.

-- *External relations*: the use of trade policy to improve the competitiveness of European IT firms is encouraged. The CEC strove to obtain a satisfactory conclusion to the multilateral negotiations of the Uruguay Round.

-- *The business environment*: other initiatives that favour the development of a business environment are suggested, such as financial systems, faster standardisation of industrial products, and closer involvement of electronics and IT in the introduction of structural policies.

IT in science and technology policy

Distinctive features

The programmes initiated by the CEC have several distinctive features. First, all recipients of the programmes are industrial sectors. The academic sector participates in the programmes in order to undertake research that supports industrial growth. Much emphasis is placed on the co-operation of firms across the national boundaries of the member States. To apply for a CEC grant, at least two firms from different countries must participate in the project. Co-ordination in the promotion of international co-operation is the central function of the CEC projects.

Second, the IT programmes initiated by the CEC are intended to promote IT from inception to application. At the pre-competitive level, the goal is to enhance the competitiveness of European IT firms in world markets. At the nearer-to-market (but still pre-competitive) level, the goal is the take-up and application of the knowledge and expertise developed through the R&D projects.

Third, IT R&D programmes are designed to accommodate a wide variety of subjects. There is little intention to give priority to technology development. While this allows programme planners to take advantage of corporate decision-making in participating firms, programme evaluation may be difficult.

Fourth, telecommunication technologies are inseparable from IT R&D and constitute a substantial part of it. A major telecommunication project, Research and Development in Advanced Communications Technologies for Europe (RACE) obtained ECU 550 million, or 22 per cent of the whole budget of the Third Framework Programme. Another major telecommunication project outside of the Framework Programme, Special Telecommunications Action for Regional Development (STAR), obtained ECU 1.5 billion.[4] These budgets are very significant when compared to other major research projects undertaken by the CEC.

Major IT R&D programmes

a) ESPRIT (European Strategic Programme of Research in Information Technology)

With ESPRIT, the Commission augmented its role in the international IT policy-making arena. The first phase of ESPRIT was approved in 1984 as a five-year programme (1984-88). Its budget was ECU 570 million, matched by the same amount from industrial participants. ESPRIT seeks:

-- to provide the European IT industry with the basic technologies to meet the competitive requirements of the 1990s;
-- to promote European industrial co-operation in IT;
-- to pave the way for standards.

ESPRIT was intended to aid European firms to form co-operation networks. In the course of the programme, however, the goal has focused more on co-operation than on technology development in its own right.

In terms of the distribution of benefits of the programme between firms of different sizes, ESPRIT eventually had two facets. The programme fund was split in two, with about 75 per cent for the large-scale

projects mainly undertaken by large firms, and the rest to unique but relatively small projects mainly undertaken by small and medium-sized enterprises (SMEs). Although ESPRIT was originally intended to support technology research needed for large firms ("European Champions"), political considerations forced allocation of part of the funding to SMEs.

ESPRIT II was launched in 1988 as the second phase of ESPRIT, with a second duration of five years but on a larger scale than its predecessor. The planned budget was ECU 3.2 billion, of which the CEC finances 50 per cent. Almost 800 organisations proposed 180 projects. Major areas of research include microelectronics and peripheral technologies (e.g. application-specific integrated circuits and CAM), information processing systems (e.g. signal and knowledge processing), and application technologies (e.g. CIM and business and home systems). More emphasis is placed on IT application than it was in ESPRIT. The increased participation of SMEs is envisaged.

b) RACE (Research and Development in Advanced Communications Technologies for Europe)

RACE is intended to develop IT that supports the integrated broadband communication (IBC) systems in conformity with the development of Integrated Services Digital Network (ISDN) and its introduction in member States. Following the definition phase (1985-86), the project period was set at 1987-92. The Commission allocated ECU 550 million for RACE.

In the EC, telecommunication R&D is considered to lead the prosperous markets in electronics and IT industry. European IT R&D accords great importance to telecommunication technologies. In the past, European telecommunication manufacturers were protected by the postal and telecommunication authorities. RACE is expected to stimulate the competitiveness of the telecommunication sector in Europe (manufacturers and service providers) and in the world market.

Another expected result is a contribution to the development of international standards in the broadband network systems. Results of research activities in RACE will thus facilitate market development for participating firms that manufacture telecommunication equipment.

c) STAR (Special Telecommunications Action for Regional Development)

The STAR programme was launched in 1986, as a five-year plan (1987-91) with a budget of ECU 767.1 million (supplemented by a contribution of ECU 750 million from the European Regional Development Fund). STAR has the double task of combining regional development and promoting the use of advanced information systems in economic activities. It is intended to assist the development of specific disadvantaged regions (the less favoured regions or LFRs) in the Community by providing better access to advanced telecommunications.

STAR is mainly addressed to SMEs in the tourism sector. Such SMEs are thought to contribute to the economy of the LFRs and are expected to act as catalysts for the economic development of the regions. Advanced telecommunication systems are instrumental in stimulating the development of the tourism sector. In order to meet this objective from the telecommunication side, STAR intends to finance both investment in the infrastructure and measures to stimulate demand for advanced telecommunication services.

STAR is also instrumental in the promotion of EC telecommunication policy. Several policies are to be implemented through this programme, such as the use of standardised terminals, facilitation of introduction of pan-European mobile services and ISDN, and the promotion of the procurement procedures recommended by the CEC. In connection with the STAR programme, the providers of telecommunication services are also required to conform to the Open Network Provision (ONP) recommendations.

Other IT-related R&D programmes

The Commission promotes applications-oriented R&D on subjects of common interest to the member States, such as education, international transportation and health. Table 1 describes these programmes.

Relationship with other major Europe-based programmes

IT R&D programmes undertaken by the CEC complement other R&D programmes undertaken in European countries, including both EC member States and non-EC countries. Major examples are COST (European co-operation in the field of scientific and technological research) and EUREKA.[5] These are intergovernmental programmes set up by a declaration of intention of the European countries. COST was launched in October 1971 and EUREKA in November 1985.

Both COST and EUREKA have IT-related projects, but the basic approach to research topics, the organisation of the programmes, and the financing methods differ from those of the CEC. As far as IT is concerned, the level of "strategic" orientation, meaning the promotion of IT industry, is lowest in COST and highest in EUREKA, with ESPRIT and RACE in between. COST was set up as European co-operation for the promotion of public sector R&D for pure science and technology. Projects launched under the EUREKA scheme are, in contrast, more market-oriented and aimed at immediate industrial application, as in the Joint European Submicron Silicon Initiative (JESSI) and High Definition Television (HDTV).

Table 1. **Major applications-oriented IT R&D programmes of the CEC**

Programme Budget, Year	Purpose
AIM ECU 20 M., 1988-90 (2 years)	To develop IT for improving health care services; to contribute to the creation of an integrated health environment at the Community level.
DELTA ECU 20 M., 88-90 (2 years)	To apply IT and telecommunication technology in compulsory and continuing education programmes; to develop tools and infrastructures to support distance learning.
DRIVE ECU 60 M., 88-91 (3 years)	To develop IT to improve road transport efficiency and road safety; to reduce the environmental impact of road transport.
EUROTRA ECU 12.5 M.,89-90 (1.5 years) ECU 10 M., 90-92 (2 years)	To develop a machine translation system (prototype) of advanced design capable of dealing with all languages of the Community.
IMPACT ECU 36 M., 89-90 (2 years)	To establish a single market in the information services sector before 1992.
INSIS Annually ECU 6-7 M., 1983-92 (10 years)	To develop and promote the use of IT-based information exchange systems between the member States and institutions of the CEC.
TEDIS ECU 5.3 M., 88-89 (2 years)	To co-ordinate the development of electronic data interchange (EDI) systems for trade, industry and administration.
VALUE ECU 38 M., 89-93 (4 years)	To promote the dissemination and utilisation of the results of scientific and technical research; to give special consideration to SMEs regarding technical information and support; to promote a common infrastructure for computer communications.

Notes:
AIM: Advanced Informatics in Medicine
CADDIA: Co-operation in Automation of Data and Documentation for Imports/Exports and the Management of Financial Control of the Agricultural Market
DELTA: Development of European Learning through Technical Advance
DRIVE: Dedicated Road Infrastructure for Vehicles in Europe
EUROTRA: European Programme for Advanced Automatic Translation
IMPACT: Information Market Policy Actions
INSIS: Inter-institutional Integrated Services Information System
TEDIS: Trade Electronic Data Interchange System
VALUE: Valorisation and Utilisation for Europe

Source: CEC (1990), *EC Research Funding, A Guide for Applicants*, DG-XIII, CEC, Brussels, May.

Framework conditions for the use of IT

The security of information systems

On 31 March 1992, the Council adopted a two-year action plan for security of information systems, the European Communities Programme on Information Security (INFOSEC). The Senior Officials Group on Information Security (SOGIS) was also created by the Council. Fourteen projects are currently being undertaken. The subjects include technical matters related to the Information Technology Security Evaluation Criteria (ITSEC), laws and regulations.[6] Research items on the security of information systems are also integrated into many of the R&D initiatives, such as ESPRIT, RACE and TEDIS.

Protection of personal data and privacy

In July 1990, the CEC adopted proposals for draft directives in the field of protection of personal data and privacy. The two directives are "Proposal for a COUNCIL DIRECTIVE concerning the protection of individuals in relation to the processing of personal data" and "Proposal for a COUNCIL DIRECTIVE concerning the protection of personal data and privacy in the context of public digital telecommunication networks, in particular the integrated services digital network (ISDN) and public digital mobile networks".[7] As of September 1992, both were being amended. It is expected that the amended directives will be submitted to the Council.

Conclusion

The promotion of the single European market and the free market economy and the stimulation of the development of the IT industry in Europe shape CEC IT policies. This is because the Commission regards IT as a key technology that generates wealth for a prosperous economy. While there is a possible discrepancy between the interests of the member States, between, for example, the IT-producing and IT-using States, this would not be a major obstacle to the development of a coherent European industrial policy. The Commission recognises that European IT firms may experience difficulties as they seek to market their products in a competitive market. The CEC sees the position of the European IT sector realistically, both its advantages and disadvantages, and it strongly intends to overcome problems by incessant efforts to orient member States towards enhanced competitiveness in the IT sector.

The CEC places much emphasis on R&D co-operation between firms and research institutions from different member States. One country’s relatively strong expertise in some areas compensates for a shortage of that expertise in other countries, leading to greater competitiveness of the European IT and communication industry at the collective level. Such co-operation is also a way to increase the commitment of programme participants to improving the R&D capacity at the Community level. Greater opportunity for experts from member States to meet will help develop networks of human resources for IT and lead to the formation of an EC "community of interest". This is a long-term effort, which may last a number of years. It runs parallel to CEC efforts to develop policy-making mechanisms that overcome limitations of the nation States. So far, the development of European collaboration in IT seems to have been successful. These efforts deserve attention as attempts are made to develop international co-ordination world-wide.

There is an important difference between what the CEC intends and the experience of IT firms in the United States and Japan. Industrial competitiveness in the latter countries grew through strong

competition in the domestic market. Competitive pressure, rather than public intervention, has motivated these firms to innovate in processes and products. The CEC also advocates sharpening the competitive edge of European firms through competition in the international marketplace. The Commission's intervention in pre-competitive R&D is a means to achieve this goal. Public initiatives to promote EC-wide collaboration of IT firms and university research centres are thought to be needed until European IT firms become sufficiently competitive in world markets.

It is worth drawing attention to the fact that, in the Commission's IT policies, public intervention is a means to an end (i.e. support of competition in the IT sector) but not the end itself. The CEC ultimately intends to promote competition, recognising that competition will serve the interests of EC-wide IT users by bringing the wide options available in the free market into the European Community.

NOTES

1. Situation as of January 1992.

2. For further detail, see CEC (1991*a*).

3. Arnold, E. and K. Guy (1986).

4. Half of the funding will be provided by the European Regional Development Fund.

5. Participants are all the European OECD Member countries and the CEC, except Yugoslavia.

6. For example, definition of information security, awareness, incident reporting, inventory of security organisations, legislation/regulation, ITSEC-evaluation of the trial period, etc. See CEC (1992), "Information Security, INFOSEC '92", [DG XIII/F - GE1190/GI], Brussels.

7. CEC (1990), COM(90)314 final -- SYN 287 and 288, Brussels.

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