**Universität Trier**

Fachbereich III: Politikwissenschaft
Lehrstuhl Professor Hanns W. Maull

Promotionsarbeit/Dissertation

# The Vision of a Future Information and Communication Society

## Computer-Mediated Communication and Technology Policy in the United States, the European Union, and Japan

**Daniel H. Huedig**

Dr. Daniel H. Hüdig
Am Heideborn 20
D-65527 Niedernhausen
Germany
+ 49-6127-703743
e-mail: huedig@t-online.de

Internet Publication
University of Trier, 2000

*In memory of*

*Heinz-Ulf Hüdig*

*1938-1978*

## Preface

The vision of a future information and communication society has prompted leading politicians in the United States, the European Union and Japan to influence or even lead the economic and social transition in the context of an active technology policy. The technological development of society, however, is a product of a complex interplay of technological, economic and socio-political constraints. These constraints limit the political decision-making and implementation abilities. Moreover, facts and information are continuously changing during a paradigmatic technological, economic and social shift, which limits political decision-making abilities.

This study compares political decision-making to promote computer-mediated communications in the Triad since the beginning of the 1980s, on four levels: the development of a political vision, the long-term aims and strategies, technology policy (e.g. the promotion of technological development and competition policy) and regulatory policy (e.g. universal access, protection of privacy and intellectual property). While technology policy tends to be uncontroversial, during a paradigmatic shift regulatory policy is difficult and lengthy. Nevertheless, the inclusion of interest groups, which rise during this paradigmatic shift and which are close to the technologies and their societal consequences, help to aid decision-making processes. In this context, politics in the United States has been more successful that in the European Union and especially Japan.

This study was written between August 1995 and May 1997, with a few updates during 1998. Accordingly, it cannot account for developments following these dates. Nevertheless, many of the themes outlined in this study remain on the political agendas of decision-makers throughout the world, on national, supranational and especially international levels. For example, for encryption and secure payments, which are necessary for eCommerce, no international standards do yet exist. The issue of taxation has hardly been opened for discussions. In sum, this study does not only offer a historical overview of the development of the Internet, but it also discusses issues of continuing present concern.

The study was written without monetary but with extensive moral support. I want to especially thank Professor Dr. Hanns W. Maull of the University of Trier for supervising this dissertation and Professor Dr. Wienand Gellner of the University of Passau for volunteering as second reader. I also want to thank Ann Rupp for her valuable proof-reading. Last but not least, I want to thank for the incredible patience and moral support of my wife Doris, my son Kenneth and my daughter Zoé.

Niedernhausen, July 2000

# Table of Contents:

Introduction ... 1

Chapter 1: The Technological Development of Society and Technology Policy ... 13

Chapter 2: Computer-Mediated Communication: Technological and Societal Issues ... 81

Chapter 3: Computer-Mediated Communication and Technology Policy in the United States: The ”Information Superhighway” ... 123

Chapter 4: Computer-Mediated Communication and Technology Policy in the European Union: The ”Information Society” ... 215

Chapter 5: Computer-Mediated Communication and Technology Policy in Japan: The ”Intellectually-Creative Society” ... 297

Conclusion ... 369

Bibliography ... 393

# Table of Contents: Long Version

*Preface* …………………………………………………………………………………………………… ....*iii*
*Table of Contents* .......... *v*
*Table of Contents: Long Version* .......... *ix*
*List of Figures* .......... *xiii*
*List of Tables* .......... *xv*
*List of Boxes* .......... *xv*
Introduction .......... 1
Chapter 1: The Technological Development of Society and Technology Policy .......... 13
*I) The Technological Development of Society: A Theoretical Exploration* .......... *15*
A. Technological Development as an Autonomous Process .......... 16
1) Unilinear Science-Centered Approaches to the Technological Development of Society .......... 17
2) Technological Development and Constraints .......... 18
B. Economic Models of Technological Development .......... 24
1) Unilinear Economic Approaches to the Technological Development of Society .......... 24
2) The Economics and Politics of Compatibilities and Standards .......... 26
C. Socio-Political Models of Technological Development .......... 30
1) Unilinear Socio-Political Approaches to Technological Development .......... 31
2) Interaction, Systems and Networks .......... 31
D. Conclusion .......... 40
*II) Visions and Computer-Mediated Communication* .......... *42*
*III) Technology Policy and the Changing Nature of Political Action* .......... *47*
A. Traditional Technology Policy: Technology Policy as a Component of Industrial Policy .......... 47
1) Introduction and Definitions .......... 47
2) Instruments of Industrial and Technology Policy .......... 50
3) Industrial and Technology Policy: Regional Implications and the Appropriate Level of Policy-Making .......... 51
4) Technology Policy in Large and Small Countries .......... 58
5) Technology Policy and Multinational Corporations .......... 61
6) A Critique of Industrial and Technology Policy .......... 65
7) Institutional Competition: A Viable Alternative? .......... 68
8) Conclusion .......... 71
B. Societal Technology Policy .......... 72
*III) Conclusion* .......... *76*
Chapter 2: Computer-Mediated Communication and Basic Political Issues and Choices .......... 81
*I) A Brief History of Computer-Mediated Communication* .......... *83*
*II) The Information and Communication Society: Principles for Political Consideration* .......... *96*
A. The Rise of the Information and Communication Society? .......... 97
B. Computer-Mediated Communication: Political Choices, Technology, and Society .......... 101
1) Considerations for Technology Policy: Future Infrastructures and Choices .......... 101
2) Considerations for Regulatory Policy .......... 109

a. Universal Service, Universal Access, Open Platforms, and Interconnection ... 109
b. Privacy, Free Expression and Democracy ... 112
c. Intellectual Property, Copyright and the Fair Use of Information ... 118
d. Work and Workers' Rights ... 120
*III) Preparation for the Next Chapters ... 121*
Chapter 3: Computer-Mediated Communication and Technology Policy in the United States: The "Information Superhighway" ... 123
*I) The Reagan and Bush Administrations ... 125*
A. The Reagan Administration and the National Security Imperative ... 125
B. The Bush Administration, Networks, and Scientific Research ... 130
*II) The Clinton Administration: The Vision of the "Information Superhighway" ... 137*
A. The Vision ... 137
B. The Long-Term Aims and Strategy ... 141
C. Policy ... 148
1) Technology Policy ... 149
a. The Peace Dividend: The Shift from Military to Civilian Research and Development ... 150
b. The Integration of Science and Technology Policy ... 155
c. The Infrastructure of the Information Superhighway ... 161
d. The Business Environment and Technology Policy Instruments ... 167
2) Regulatory Policy ... 176
a. Access to the "Information Superhighway": Universal Service ... 176
b. Policy Strategy on Providers: Competition, Regulation, and Interconnection ... 178
c. Information Infrastructures and Network Security ... 182
d. Privacy ... 186
i) Privacy and Cryptography ... 186
ii) Cryptography Policy and Exports: Business v. National Security ... 194
iii) Privacy, Data Security, and Confidentiality ... 200
iv) Privacy, Free Speech, and Indecency ... 203
e. Intellectual Property Rights and Copyright ... 206
*Conclusion ... 209*
Chapter 4: Computer-Mediated Communication and Technology Policy in the European Union: The "Information Society" ... 215
*I) Introduction ... 217*
*II) The Politics of the European Union and the Creation of an "Information Society" ... 219*
A. The Vision ... 219
B. The Long-Term Aim and Strategy ... 224
C. Policy ... 226
1) Supranational Policies in their Historical Context ... 227
2) Technology Policy ... 232
a. Instruments ... 232
b. From Traditional to Societal Technology Policy? ... 237
c. The Infrastructure for the Information Society: Networks and Content ... 250
i) Information Transmission Networks: The Hardware ... 250

ii) Applications and Content: The Software ........ 256
c. Small-and Medium-Sized Enterprises ........ 262
d. Supplementary Technology Policy ........ 264
2) Regulatory Policy ........ 266
a. Competition Policy and Interconnection ........ 267
b. Universal Service ........ 274
c. Privacy ........ 278
i) Privacy and Personal Autonomy ........ 278
ii) Free Expression and Indecency ........ 279
d. Intellectual Property Rights and Copyrights ........ 283
e. The Workplace and Workers' Protection ........ 288
*Conclusion* ........ *289*
Chapter 5: Computer-Mediated Communication and Technology Policy in Japan: The ”Intellectually-Creative Society” ........ 297
*I) Introduction* ........ *299*
*II) Japanese Politics and the Creation of an ”Intellectually Creative Soviety”* ........ *303*
A. The Vision ........ 303
B. Long-Term Aim and Strategy ........ 308
C. Policy ........ 311
1) Technology Policy ........ 311
a. Technology Policy of the 1980s: A Six-Prong Strategy ........ 319
b. Technology Policy and Computer-Mediated Communication in the 1990s ........ 327
i) MPT and the Four-Level Approach ........ 327
ii) MITI and the Intellectually-Creative Society ........ 330
c. Computer-Mediated Communication Technologies and the Public Sector ........ 334
i) Education ........ 334
ii) Research and Research Networks ........ 336
iii) Medical and Welfare Services ........ 337
iv) Administrative Systems and Libraries ........ 338
2) Regulatory Policy ........ 340
a. The ”Second Info-Communications Reform”: Providers and Competition ........ 341
i) Deregulation ........ 344
ii) Interconnection ........ 348
iii) NTT Restructuring ........ 353
b. Universal Service ........ 357
b. Systems Review ........ 360
c. Intellectual Property Rights ........ 361
*Conclusion* ........ *362*
Conclusion ........ 369
Bibliography ........ 393

# List of Figures

Figure 1.1: Global and Local Networks ... 37
Figure 1.2: Attachment and Mobilization in Networks ... 39
Figure 1.3: Welfare Losses as a Result of Centralized Policy-Making ... 56
Figure 1.4: Distribution of Welfare Losses with Extreme Initial Regional Divergence ... 57
Figure 1.7: Models of Interaction between Public Institutions and Private Enterprises ... 74
Figure 2.1: Internet Hosts (in mill.) ... 86
Figure 2.2: Development of Sites in the World Wide Web ... 89
Figure 2.3: World Wide Web Usage by Location 1995 (in %) ... 92
Figure 2.4: Global Information-Related Markets 1993 (total value DM 3.281 bill.) ... 95
Figure 2.5: Use of Microelectronics in Electronic Appliances, and Products, International Shares, 1994 (total value $102 bill., shares in %) ... 97
Figure 2.6: World Market Software Production 1993 (total value $50 bill., shares in %) ... 98
Figure 2.7: World Market Software Purchases 1993 (total value $50 bill., shares in %) ... 99
Figure 2.8: Expected Developments in the Offline Multimedia Market until 2000 (in bill. DM) ... 99
Figure 2.9: Expected Developments in the Online Multimedia Market until 2000 (in bill. DM) ... 100
Figure 3.1: Comparative Non-Defense R&D Spending 1991 in the United States, Germany, and Japan (as % of GDP), as outlined in the Clinton campaign ... 142
Figure 3.2: Comparative Investment Rates in Plants and Equipment 1991 in the United States, Germany, and Japan (as % of GDP), as outlined in the Clinton campaign ... 144
Figure 3.3: United States R&D Expenditures, Source of Funds (current $, in mill.) ... 146
Figure 3.4: Distribution of Government R&D Expenditures by Sector 1994 (in %) ... 151
Figure 3.5: United States Obligations for R&D, by agency (current $, in mill.) ... 154
Figure 3.6: United States Non-defense R&D Expenditures (% of GDP) ... 155
Figure 3.7: United States National Expenditures for Basic Research (current $, in mill.) ... 158
Figure 3.8: United States National Expenditures for Applied Research (current $, in mill.) ... 159
Figure 3.9: United States National Expenditures for Experimental Development (current $, in mill.) ... 160
Figure 3.10: Information Infrastructure Task Force (IITF) Structure ... 162
Figure 3.11: ATP-Budget History (in mill. $) ... 165
Figure 3.12: United States Federal R&D Obligations for the Department of Commerce and the National Science Foundation (current $, in mill.) ... 166
Figure 3.13: Enterprise Alliances in the United States in Information Technologies ... 168
Figure 3.14: Total Federal R&D Outlays, Credits Claimed and Received by US Firms for Tax Experimentation Credit (current $, in mill.) ... 169
Figure 3.15: Federal Research and Tax Experimentation Credit in Proportion to R&D Outlays (in %) ... 170
Figure 3.16: Small Business Innovation Research (SBIR) Awards (current $, in mill.) ... 170
Figure 3.17: The Formation of High Technology Enterprises in the United States, Selected Technologies ... 171
Figure 3.18: Small Business Innovation Research Awards(current $, in mill.) ... 174
Figure 4.1: Distribution of Government R&D Budget Appropriations, United Kingdom 1994 (in %) ... 245

Figure 4.2: Distribution of Government R&D Budget Appropriations, France 1993 (in %) ............................ 245
Figure 4.3: Distribution of Government R&D Budget Appropriations, Germany 1993 (in %) ........................ 246
Figure 4.4: Distribution of Government R&D Budget Appropriations, Italy 1993 (in %)................................ 246
Figure 4.5: Digitization of Telephone Networks in the European Union, 1994 (in %).................................... 251
Figure 4.6: ESPRIT-Projects, Applications (Call 1-6) ...................................................................................... 254
Figure 4.7: ESPRIT-Projects, Funding Requested and Awarded, Call 1-6 (in mill. ECU) ............................... 255
Figure 4.9: ESPRIT Participation and Funding in the European Union, until March 1996 (in %) ................... 263
Figure 4.8: Intra- and Extraregional Alliances in Information Technologies.................................................... 269
Figure 5.1: Selected Computer-Mediated Communication-Related Statistics, Comparison Japan and United States (in mill.)............................................................................................................................................. 306
Figure 5.2: Selected Computer-Mediated Communication-Related Markets; Comparison Japan and United States, Revenues (in bill. Yen)............................................................................................................... 307
Figure 5.3: Source of R&D Funds, 1993 (in %).................................................................................................. 315
Figure 5.4: Spenders of R&D Funds in Japan, 1993 (in %) ............................................................................... 315
Figure 5.5: MPT Structure.................................................................................................................................... 317
Figure 5.6: Interregional Alliances in Information Technologies...................................................................... 325
Figure 5.7: NTT-Restructuring Scheme .............................................................................................................. 355

# List of Tables

Table 1.1: Examples of Substantive Visions on Computer-Mediated Communication within the Technological, Economic, and Political Domains ..... 43
Table 1.2: Substantive Vision Compromises and Associated Meanings ..... 45
Table 1.3: Traditional and Modern Technology Policy ..... 75
Table 1.4: Scientific-technological Models and Technology Policy Implications ..... 78
Table 1.5: Economic Models and Technology Policy Implications ..... 79
Table 1.6: Socio-political Models and Technology Policy Implications ..... 80
Table 2.1: Online Language Populations ..... 91
Table 2.2: Top 20 Countries on the Internet, July 1996 ..... 94
Table 3.1: United States Trade Balance in Selected High-Electronics (in mill. $) ..... 141
Table 4.1: Research expenditures in the European Union, the United States, and Japan ..... 244
Table 4.2: Number of Scientists and Engineers, Comparison ..... 244
Table 4.3: Financing Proposal for Information-Related Investment Projects, 1994-1999 ..... 252
Table 4.4: INFO2000 Summary Budget Distribution Table 1996-1999 ..... 261
Table 5.1: Proposed Interconnection Regulatory Agencies and Tasks ..... 351
Table C.1: Intensity of Substantive Visions in the United States, the European Union, and Japan ..... 390

# List of Boxes

Box 3.1: The Vision of the Information Superhighway and Societal Effects ..... 138
Box 3.2: The Long-Term Strategy of the Clinton Administration ..... 147
Box 3.3: Department of Defense's Guiding Principles for Science and Technology Management ..... 153
Box 5.1: MPT's Four Level Info-Communications Structure ..... 328
Box 5.2: Telecommunication Deregulation Plans in Japan ..... 345
Box 5.3: Expected Effects of NTT-Restructuring ..... 354

# Introduction

> In many respects, information superhighways are a widening of the 'lanes' of this existing information highway, increasing the speed of information access, and with it, the ways in which communication can take place. Their construction will support and facilitate more effective and more natural communication and collaboration between individuals and groups over networks. They will permit access to, and exchange of, information in real time, in multimedia formats most appropriate to users' needs, and assisted by intelligent agents able to roam networks to find, carry and organize what is required to from the mass of information, and stop that what is not wanted. Information superhighways, and the applications they support, will almost inevitably change the way in which individuals, groups, and organizations communicate and work. Their development will be *evolutionary*, but their impact *revolutionary*.
>
> *Stephen J. Emmott (1995, 7)*

In the final years of the Twentieth Century, few doubt the significance of computer-mediated communication. Expressions such as ”Information Superhighway” or ”Data Highway” have become most popular in the 1990s. Their definition, however, is subject to great variation: some imply the telecommunications infrastructure, others the integration of communication and information systems in the economic sector, and again others the *Internet*. These definitions involve various intensities of societal permeation; therefore, each entails different technological, economic, and political strategies for their achievement. Decision-makers recognize the potential pervasiveness of computer-mediated communication; however, the uncertainty over its definition points to a lack of understanding of the future impact of these technologies and how decision-makers should react.

Underlying this study is a pervasive definition of computer-mediated communication. Computer-mediated communication implies the integration of communication and transaction methods within and between the economic, political, social, and private spheres. Computer-mediated communication *permeates* society, even if it is not always visible; it is not just the computerization of isolated spheres or geographical regions. Elements of computer-mediated communication are communication infrastructures, interactive or digital television, business and home applications, multimedia applications and content, traditional and new services in digital format or mediated by digital technologies, online services and networks, intelligent home applications, and more importantly, the convergence and integration of these technologies. Since many call the emerging communication networks ”highways” or

”Autobahnen”, we will use these allegories to exemplify what the social permeation of computer-mediated communication implies. The permeation of computer-mediated communication is not only the creation of a road structure, as seems to be implied by a ”highway”, but the creation of a complete societal infrastructure. Computer-mediated communication is not a product, but it increasingly becomes an input for daily transactions. For people to fulfill their societal functions and, which is important but often neglected in traditional technology policy, to pursue their personal aims, happiness, freedom, and democracy, they do not only need roads, but also schools, universities, hospitals, houses, transportation, maps, roadsigns, central and local governments, maintenance, peers, advisors and consultants, a legal framework, police, and so on. People must be able to gain knowledge, know how to get around, participate in democracy, get help when something breaks down, know what is the right or wrong conduct, and be protected from an invasion of privacy. In sum, the metaphor ”Information Superhighway” means relatively little; this has been in existence for over one hundred years as the telegraph and telephone systems connect people throughout the world. What is important is the grasp of societal implications of computer-mediated communication when it is fully implemented, with both its potentials and its pitfalls.

Shumpei Kumon, former professor at the University of Tokyo and founder of the Institute for Global Communications (GLOCOM), argues that the history of human civilization has been dominated by three stages, which he calls ”games”: the Prestige Game, in which military force was the dominant source of power, succeeded by the Wealth Game, in which national economic and social forces undermined the importance of military power, and the Wisdom Game [Kumon, undated]: ”The current trigger for a transition to a new stage, in Kumon's theory, is the world communications network, and the next game will involve information, knowledge, and folklore-sharing cooperatives around the world that will challenge the primacy of traditional wealth the way industrial wealth challenged the primacy of military and national power and prestige. Today's virtual communities, Kumon came to understand firsthand, offer a small-scale model of a society in which people communicate in a way that creates collective wealth” [Rheingold, 1993, 210]. In sum, the permeation of computer-mediated communication in society is much more than an upgrade of one country's location within the world economy by means of communications technologies, as Machlup had hypothesized when he coined the term ”knowledge economy” [1962]. Rather, it implies a fundamental reordering of power and wealth, with many winners and losers.

The ultimate success of a technological paradigm depends on its particular embedding process in society. The technological development of society is not just a matter of the development of technologies. Rather, technologies must also be compatible to the society as a whole: they can only be successful when they permeate society, at least in the case of civilian technologies. Permeation implies acceptance; technologies can only be accepted when they are easily usable and when they do not undermine societal interactions in one way or another. However, it is not politics that creates technologies, as technological development is a complicated process that involves technology-inherent, economic, social, and political aspects. Nevertheless, politics can influence the embedding of technologies in society. It can promote or forbid technologies, create fertile soils for technological development, and open the society to exogenous influences. The embedding of technologies and their proliferation in society is thus highly political.

The empirical subject of this study covers the question of how decision-makers in the United States, the European Union, and Japan react to and promote the rise of computer-mediated communication. Politics is here viewed in the context of the decision-making process, or ”the authoritative allocation of values in society”, as defined by David Easton [1953, 129]. Disagreements exist over the question of whether decision-making processes in the political sphere are similar to those in the private sphere, or whether specific ”rules of the game” exist in the particular configuration of political institutions and organizations [Dougherty and Pfaltzgraff, 1990, 474; this section is based on their elaboration]. Classic decision-making theory utilizes the rational actor model. In the consideration of alternatives, decision-makers attempt to achieve an optimal course of action which is compatible with their own preferences and which they conceive as a viable option that can be adopted [see, for example, Dimock, 1958, 140; Singer, 1963, 424; Russett, 1963, 97-109]. In the decision-making process, the preferences of decision-makers derive from the rules of the organizational system, shared organizational experiences, the available information in the organization, and individual biographies [see, for example, Snyder, et al., 1963, 176].

Limits, however, exist to rational decision-making. The ability to make decisions depends on the problem-solving capacities, on the available information generally, on the cost of analysis, and on the inseparability of fact and value [Baybrooke and Lindblom, 1963, Chapter 4]. Especially the question of available information is an especially crucial one; in an elaboration of the concept of ”bounded rationality”, Herbert A. Simon argues that decision-makers sequentially examine information as it comes in and make decisions based on the information that fits best (”satisficing”) [1955, 1957, 1958]. Baybrooke and Lindblom call this process ”disjointed incrementalism”. Other theorists introduce social and quasi-mechanical processes that impact the decision-making process. For example, in the case of social processes, interest groups have an important impact on the decision-making process [see, for example, Bentley, 1908; Truman, 1951], especially when these interest groups have a longstanding relationship with the decision-makers and thereby raise the access barriers for other interests. Others stress the importance of coalitions in the decision-making process [see, for example, Riker, 1962]. Quasi-mechanical processes may result from the collection of individual activities that subsequently force decision-makers to act. For example, if many businesses were to leave a particular country because of complaints about the general business environment, this would force decision-makers to improve the economic attractiveness of the country, otherwise the government might lose a substantial portion of its tax revenues, as well as votes from the newly-unemployed and other dissatisfied citizens.

Graham T. Allison has supplemented the rational actor-based decision-making theory with two other ”frames of reference” [1971, 5]: the organizational process model and the bureaucratic politics model. In the organizational process model, the political outcome is not necessarily the consequence of rational choice and deliberate actions by a collection of specific decision-makers, but the codetermined output of several organizations in which standard operating procedures prevail. The bureaucratic politics model is an extension of the organizational process model: not only inter-organizational struggles obscure the decision-making process, but also intra-organizational, bureaucratic ones. In both cases, the decision-making process is subject to short-term considerations, and often focused on the maintenance of relative power. Such considerations can obstruct the identification and execution of a consistent and overarching master plan.

The subsequent study explores the decision-making process regarding computer-mediated communication.[1] It argues that especially during leaps in the technological development of society, the rational actor version of the decision-making model is undermined. First, the available information on short-, medium-, and long-term development paths is limited. Second, inter-organizational struggles are likely to intensify as particular development paths alter competencies and jurisdictions; the overlap of tasks increases and is therefore the source of inter-organizational conflict. The same reasoning applies to intra-organizational processes. Third, innovations and their successes promote the entry of new and increasingly powerful actors into the decision-making process. This is especially important in the context of social and quasi-mechanical processes. Fourth, and last, decentralizing trends, often subsumed under the catchword "globalization", reorder the political capabilities to steer the technological development of society. The empirical portions of the study pose three fundamental questions:

1. How do decision-makers in the Triad define computer-mediated communication? More specifically, what intensity of social permeation do the political actors attribute to the emerging communication technologies? What are the motives for the political promotion of computer-mediated communication?
2. How successful has political action been in the three regions *vis-à-vis* computer-mediated communication in the past ten to fifteen years? What specific actions have decision-makers undertaken in this period? In a comparative perspective, is it possible to decipher what is politically preferable: limited aims and their full achievement, or broad and cumulative aims with eventually limited success? Does each of the three regions exhibit a particular strategy to achieve its aims, or is decision-making largely circumstantial and short-term-oriented? What technological, economic, political, and social factors intervene in the decision-making process?
3. As was hypothesized above, the permeation of computer-mediated communication in society implies a redistribution of power and wealth. How do decision-makers incorporate the social implications that arise from this redistribution in their

---

[1] In the context of this study, decision-makers are governmental actors that are responsible for the elaboration, implementation, and administration of policies. Unless not otherwise cited, decision-makers

decision-making? What kind of public discussion on the potentials and dangers does computer-mediated communication policy parallel? How do decision-makers reduce the fears about the technology-inherent possibility of the invasion of privacy, of network crimes, of surveillance by the state or by the neighbor?

In the comparative political analysis, we will concentrate on the national political levels in the United States and Japan, and on the supranational political level of the European Union. To make this study manageable, we will ignore regional and local politics, and national politics in the case of the European Union. The exemption of the national political levels in the latter case is likely to yield unsatisfactory results and prompts the question whether the supranational level is the preferable level of analysis, however, the additional elaboration of fifteen individual national policies is not feasible in the context of this study. In the same manner, we will also ignore politics on the level of international diplomacy, first because the complexities would not be manageable, and second, the activities on the international level are yet limited to specific issue areas, for example, the negotiations in the World Trade Organization (WTO) over the definition of intellectual property rights.

The analysis of political activities is strictly issue-oriented; we will only consider policy relevant to the societal permeation of computer-mediated communication. More general aspects, such as the debate over the Maastricht Treaty or foreign policy issues in the United States, are not under examination unless they are directly relevant (for example, Art. 130 of the Maastricht Treaty which outlines industrial policy in the European Union, or American restrictions on the export of technologies). Furthermore, other societal actors than political actors, such as unions or employer organizations, are only considered with regard to computer-mediated communication-relevant topics: for instance, the mechanics of the traditional relationships such as trilateral talks between unions, employer organizations, and governmental members are not considered; however, the positions of these actors are considered when they concern computer-mediated communication. Relevant issues could be the implications of increased teleworking, the working at home via online networks, for retirement systems, or workers' rights. The research strategy is thus strictly issue-oriented: first, the identification of the issues that are relevant for the

---

are not meant to be those who make decisions in enterprises or other private institutions.

study, second, the identification of governmental strategies and aims, and third, the individual actions of the governments and the public reaction, if any, to these actions. This limited scope may not be satisfactory to all readers, however, much has been written on general aspects of political action and technology policy, but very little on the specifics of computer-mediated communication technologies, their role in the technological development of society, and their political implications. Political analysis of organizational and institutional processes is often based on a stable societal framework, or it compares processes that predominate in different systems within countries or between nations, but it is difficult to apply concise theoretical models of decision-making when the underlying society is changing in an unknown manner, for example, during an ongoing technological leap the end of which has not been reached. For this reason, this study is more descriptive than theoretical.

Technology policy attempts to steer the technological development of society. With the conduct of technology policy, governments attempt to steer the flow of resources, economic and human, into directions they would have not otherwise taken in a free market. Regulatory policy attempts to flank the implications of the permeation of technologies in society. New technologies often imply new ways of societal interaction, with winners and losers. This process creates cleavages that may undermine the societal bonds that are the basis for a political system, especially in a situation of few winners and many losers. In sum, the technological development of society is a highly fragile process which requires a political reaction. Whether that political reaction entails *more* or *less* regulation, however, is not predetermined.

What are the policy demands of the emerging computer-mediated communication technologies? Is it sufficient to build a high-capacity broadband network that enables everyone to express themselves freely and pursue their individual desires? The counter question is what benefit would a country have of an eight-lane highway when only a few can use it and all others remain on dirt roads? Since computer-mediated communication is argued to have a fundamental impact on power and wealth, to what extent does government policy orient its activities towards preventing the development of a few privileged islands on which only a few smart and witty people reside? Who should be the principle benefactors of government policy: a few large enterprises that create the enabling infrastructure, frequently with public funding, and that later control it and its content? Or do governmental activities yield truly public goods? Who later controls the computer-mediated communication infrastructure, the access to it, its pricing, its rules, and its policing? To put it more pungently, should government subsidize the research lab of a large multinational corporation to develop the highest-tech artifact so that the particular enterprise or industry is able to compete internationally, or computers in school so that everybody has the chance to learn how to use and benefit from computer-mediated communication? In sum, computer-mediated communication technologies promise a new society. What priorities and actions do decision-makers define and undertake to enter a new communication age? Also, importantly, based on which information do they make their decisions, and who do they consult to raise this information?

In uncertain periods of technological development, governments often look to each other for advice on how to react to the rising political challenges. If, however, the thesis is correct that the technological development of society depends on the combination of technological, economic, and socio-political factors that exist in each society or political entity, then, in a comparative perspective, to what extent does political action converge or diverge between different societies?

Chapter 1 introduces the theoretical underpinnings of how technologies impact societal development, and how societal factors (economics, politics, social and cultural elements) impact the development of technologies. It cautions against overly simplistic and deterministic applications of existing economic, political, and social theories to the technological development of society, and argues for the development of concepts that are useful for the evaluation of decision-making on the technological development of society. These concepts, for example, sufficiently-large installed user bases, or the argument that technological development of society requires a consistent elaboration of an integrative strategy, form the first type of evaluation variables. Relevant here is also the concept of a ”substantive vision” that may serve as a guiding principle for governmental conduct. This discussion will identify individual substantive visions that exist in the world of computer-mediated communication: technological, economic, and socio-political ones.

Chapter 1 continues with a brief introduction to the theory of technology policy. It outlines ”traditional” and ”societal” technology policy conduct. Traditional technology is principally an extension of industrial policy. It is primarily linked to the different stages of the research and development process. Failure to achieve competitiveness in particular product markets is often interpreted to be a consequence of deficiencies or failures within the research process of enterprises which in turn are related to the production of public goods in society. These failures may be a consequence of market failure; in this case, the government intervenes (subsidizes) to overcome the consequences of market failure. Or, failures may be a consequence of excessive interference in the market; in that case, the government reduces its involvement by altering the regulatory structure for the conduct of research. In any case, the evaluation variables are predominantly economic: variables such as the proportion of high technologies in relation to total exports, high technology export surpluses or deficits, or the proportion of technologies in relation to total output. These popularly used variables have the advantage that they can be quantitatively measured. However, as the state moves from a material orientation of technology policy to a relational, societal one, it must increasingly incorporate variables that are not quantitatively measurable, for example, the effect of a technology on the relative power of societal or economic actors. Societal technology policy describes the attempts to identify, define, and consider ”soft” variables for future decision-making. Chapter 1 concludes with several tables that outline variables which are relevant for the technological development of society and with which we can qualitatively measure the degree of policy integration in terms of the technological, economic, and socio-political spheres.

Chapter 2 opens with a brief introduction to the history of computer-mediated communication, with a special focus on the Internet. The second part of Chapter 2 explores the political demands that computer-mediated communication technologies pose. First, what aspects of computer-mediated communication technologies are important for the conduct of technology policy? For example, can governments create complex technological systems that contain all the necessary components? Second, what aspects of computer-mediated communication technologies are important for the conduct of regulatory policy? What are the potential implications of these technologies for privacy, security, access, the equality of personal opportunities, work and workers's rights, and other societal issues?

Chapters 3-5 outline the decision-making on computer-mediated communication in the United States, the European Union, and Japan in the past ten to fifteen years. This study will be undertaken on two levels. The first level explores general programmatic governmental outlines, the substantive visions. The highest political levels in the European Union, the United States and Japan have all presented strategy papers on information and communication technologies. These strategy papers outline a vision of the future and the means of achieving such a vision. The second level of analysis examines the policy action in particular issue areas. In the technology policy domain, we examine issues such as research and development subsidization, competition policy, policy on small- and medium-sized enterprises, and relevant education, health, and trade policies. In the regulatory policy domain, we explore issues such as universal access to computer-mediated communication networks, privacy protection, intellectual property rights, and copyrights.

The Conclusion evaluates the decision-making capabilities during important changes in the technological development of society. Do a higher degree of complexity and greater general decentralization reduce decision-making capabilities? As leaps in the technological development of society cause informational problems, does the inclusion of a greater variety of actors reduce or increase decision-making capabilities? Is the move away from a traditional technology policy towards a greater concentration on wider societal factors such as education or competition policy a reaction to rising uncertainties?

# Chapter 1

# The Technological Development of Society and Technology Policy

## I) The Technological Development of Society: A Theoretical Exploration

What are the causes and effects of technological progress? To answer that question, a wide array of theoretical approaches have developed across a number of disciplines. These approaches explore the theoretical underpinnings of technological development of society and the complexities of scientific-technological, economic and socio-political factors. Three basic types exist:

- Models of technological development as an autonomous process: scientists and engineers, driven by curiosity, combine, recombine and apply techno-scientific knowledge to create a technology that can be seen and held.
- Economic models of technological development: entrepreneurs, driven by the profit motive, interpret technologies as the means to financial utility. The outcome is not necessarily a technically superior technology, but a technology that can be sold with a profit.
- Socio-political models of technological development: politicians or policy-makers, driven by altruism, or more likely, by the quest for power, view technology as a means to change society, to improve its economy or the standard of living. To define ”technology” itself is difficult; however, the underlying motives that enter into the creation of a technology can tell us a lot about the design and function of a technology within society.

The models on the technological development of society vary in their inherent complexity. Some models simplify this process. They identify one dominant independent variable that determines the outcome of the dependent variable of the technological development of society. This dominant independent variable may be the technology itself, the incentive of the entrepreneur or policy-maker, or the overall social or political ”realities”. Other, more complex models treat all factors that vary in their degree of influence as dependent variables. Unilinear, ahistoric and sometimes openly deterministic approaches have the advantage that they can serve as a simple guidelines for decision-makers: since the technological development of society is a foreseeable process, policy-makers can interfere in this process with foreseeable results. More complex models caution against such a simplistic application of theory. The technological development of society is extremely complex; any action, or lack thereof, is likely to have unforeseeable implications, for the technology itself, the economy, politics and the society as a whole. Political action becomes a game of lottery, or at least, a trial-and-error process.

## A. Technological Development as an Autonomous Process

Scientific inventions and subsequent technological artifacts are often perceived as being the principle motor of the technological development of society. Advocates of this view argue that technologies are autonomous and objective, in other words, technologies are an unavoidable extension of existing natural-scientific knowledge, the ”'mirror-image twin' to the scientific community” [Constant, 1987, 223; for an early example see Layton, 1972]. A newly discovered scientific fact proliferates throughout the world with similar effects in every region.

Below, we will introduce some approaches with different levels of intensity on this hypothesized autonomy. Some argue that technology is completely autonomous, i. e., that it is unilinear in its development path, and that it is the predominant cause of societal change. The plow changed agriculture, the steam machine industry, and the computer the nature of information. Others assume that technologies are subject to certain basic choices. Science can produce several types of technologies within one scientific domain, but once the choices are made, the development path is relatively autonomous from exogenous influences. For instance, despite the fact that cars need energy, and preferably ”clean” energy, improvements in solar energy technologies have not (yet) impacted the way cars operate. And again others argue that economic, social and political factors influence the path of technological development within a ”technological paradigm”, however, only major scientific breakthroughs cause radical or quantum technological leaps. For example, the sources for radical improvements in the speed of computer central processing units (CPUs) are known; technologies are not implemented because they are (still) too expensive until a new scientific breakthrough reduces the production costs.

### 1) Unilinear Science-Centered Approaches to the Technological Development of Society

Some authors argue that the technological development of society is unilinear and largely ahistoric. Technology is an independent, autonomous, and primary cause of societal changes, or in other words, ”an artifact reorganizes social structures” [Schwartz Cowan, 1987, 261]. Either scientists invent technologies independent of society's influences or technologies are imported from other countries:

> In the most common version of technological determinism, these technologists are seen as 'applying science', as working out the practical implications of new scientific discoveries, and those scientific discoveries are seen simply as new, more accurate insights into natural reality. Scientists discover, technologists follow the logic of those discoveries in turning them into new techniques and new devices, and these techniques and devices are then introduced into society and have (often unpredicted) 'effects' – that is the most widespread account of how technology comes to be an independent factor [MacKenzie and Wajcman, 1985, 4].

Sample studies based on this argument examine the social effects of the radio [Ogburn and Nimkoff, 1964, 571-575] or the microchip [Large, 1980]. Common to the stronger versions of technological determinism is that with time technologies force a convergence of different societies over time. Some historic technological developments support this argument: one can witness the considerable influence of the personal computer in today's world and its impact on production and leisure processes. Another, more classic example is the telephone: all over the world, people use the telephone to converse with family and friends or to conduct business.

Problematic, however, is the *undifferentiated* view of technologies and societal development. Societal differences persist throughout the world despite the strong proliferation of technologies. People in one nation may spend less time, or other times of the day, on the telephone than people in other nations, depending on the fee structures. Even within societies, differences exist between urban and rural regions, or between social classes. In short, economic, social and political factors impact the *use* of technologies in various and sometimes unpredictable ways. Furthermore, unilinear and ahistoric explanations fail to answer a number of questions. What societal factors impact the *invention* and *development* of technologies? Why do some technologies succeed while others do not? These questions are better answered by approaches that explore technological development within the context of technological constraints.

2) Technological Development and Constraints

Advocates of the ”technical shaping of technology” approach acknowledge that those involved in the invention process certainly are members of society and therefore influenced by it [see, for example, Vincenti, 1995]. Nevertheless, these scientists are *primarily* lead by natural-scientific and technical constraints. Thus, technological development is not autonomous of societal factors but still relatively unilinear as scientific constraints limit technological choices. Walter Vincenti [1995] suggests that regardless of Edison's organizational and managerial capabilities [Hughes, 1983], his developments had to follow the constraints and choices inherent in Joule's and Ohm's Laws on the flow of electric current. Furthermore, implemented technological systems steer subsequent technological development. For example, even if a computer is more energy-efficient when it is gas-operated, which would be a benefit to society because it requires less total energy, nobody would consider building such a computer. Computers plug into the wall (directly, or indirectly with accumulators), and that is final *until new natural-scientific facts and their technological application are established.* Natural-scientific facts provide choices (for example, the choice between high or low currents), however, once one adopts a certain path, they limit the basic choices. The process is highly autonomous except for rather unimportant design choices. A hierarchy of constraints exists: the strongest constraints come from natural-scientific laws, with the least room for maneuver, and less strong constraints come in form of design questions, with more room to maneuver but of lessor consequence for the technology and its impact on society. Vincenti summarizes:

> Although they may be hard both to discern and assess, real-world technical constraints inevitably appear in some form at some level of design, limiting the engineer's room to maneuver. … Until scientific understanding affords demonstrably better concepts and relations, they have no choice. Similar constraints, combined often with constraints of cost, have consequences for design in all branches of engineering. Much engineering labor is devoted to unraveling and implementing such techno-logical (or perhaps econotechno-legal) shaping, both to solve specific problems and to advance the related state of the art. To dismiss such activity as 'of course' … runs the risk of misreading this essential learning process [1995, 564-565].

Basic to the discussion of ”real-world technical constraints” and their changes is the distinction between incremental and radical innovations. Incremental innovations emphasize ”the continuous and often anonymous stream of discoveries, inventions and improvement” [Freeman, 1991, 305; based on Gilfillan, 1934]. Extensions of this view include Kenneth Arrow's ”learning-by-doing” [1962] and E. von Hippel's ”learning-by-using” [1976], both of which emphasize the incremental process of technological change. Empirical evidence suggests that incremental changes, both in the technical and organizational senses, can lead to productivity gains [Hollander, 1965; Townsend, 1976], even when the process of knowledge accumulation within enterprises is long-term [Pavitt, 1984].

If incrementalism is a sufficient and satisfactory mode of technological development, why do radically different technologies develop? ”Learning-by-doing” and ”learning-by-using” are not sufficient explanations for technological leaps. Christopher Freeman argues that incrementalism has technical limits [1991, 306]. Experience, learning, organization or technical improvements cannot overcome these limits. Moreover, incremental change reaches an economic efficiency limit: at some point the cost of improving a technology exceeds the value of the improvement (Wolf's Law). Furthermore, limits to scale and limits to distribution and transportation exist. Thus, an enterprise cannot infinitely build larger plants, use infinitely-larger transport ships, or design infinitely smaller computer chips.

Some associate radical innovations with radical productivity gains, cost reductions and organizational changes:

> Radical innovations involve structural change in the economy and lead ultimately to entirely new branches of industry. They are indeed, as Schumpeter insisted, the main source of dynamic development, distinguishing capitalism from earlier production systems. Today they involve different types of research and development, different relationships with basic science, different types of marketing and financing, different types of input and a different pattern of productivity gain. By definition they need quite new skills and management organization and different types of production equipment [ibid., 307].

Let us now explore two paradigm-centered approaches, the Nelson-Winter-Dosi and the Freeman-Perez models. Although they are in essence economic models, they still consider autonomous innovation as the central cause of change. Before introducing these models, we need to briefly introduce the organization approach that considers complex technologies to be the primary source of organizational change. Both the Nelson-Winter-Dosi and the Freeman-Perez models implement elements of the organization approach.

The organization approach theorizes what role technologies have in the structural development of organizations. Alfred Chandler argues that vertical integration of organizations appears when managerial efficiency is higher than that of the market or of inter-organizational coordination [1977]. The greater the complexity of the technological product, the greater is also the necessity of managerial coordination. Kenneth Galbraith reasons that specialized knowledge is only effective when the organizational structure of an enterprise embeds it:

> The real accomplishment of modern science and technology consists in taking ordinary men, informing them narrowly and deeply, and then, through appropriate organization, arranging to have their knowledge combined with that of other specialized but equally ordinary men. This dispenses with the need for genius. … No individual genius arranged the flights to the moon. It was the work of organization – bureaucracy. … Finally, following from the need for this variety of specialized talent, is the need for its coordination. Talent must be brought to bear on the common purpose [1971, 61].

In sum, organization *organizes* technologies, however, it does not *create* them but only *alters* them within the organizational setting. Therefore, this approach stays within the knowledge-equals-technology argumentation.

The organization approach introduces the concepts of ”heuristics” or ”routines” in organizational and institutional contexts. Organizations rely on extensive sets of behavioral characteristics, for example, management and researchers interact on the basis of routine processes [for example, see March and Simon, 1958; Constant, 1987]. Giovanni Dosi implements heuristic organizational patterns in his definition of technology, which is:

> a set of pieces of knowledge, both directly ”practical” (related to concrete problems and devices) and ”theoretical” (but practically applicable although not necessarily already applied), know-how, methods, procedures, experience of successes and failures and also, of course, physical devices and equipment. Existing physical devices embody – so to speak – the achievements in the development of a technology in a defined problem-solving activity. At the same time, a ”disembodied” part of the technology consists of particular experience, experience of past attempts and past technological solutions, together with the knowledge and the achievements of the ”state of the art”. Technology, in this view, includes the ”perception” of a limited set of technological alternatives and of notional future developments [1982, 151-52].

Enterprises employ loosely-structured routines whose ”outcome is judged by the market, or, more generally, when government policy and all kinds of institutional arrangements are included in the *selection environment*, which thereby determines indirectly which routines are viable enough to acquire widespread use in the population of firms” [van den Belt and Rip, 1987, 137]. Within this framework of routines, innovation is the outcome of predefined search patterns. The mutated outcome (innovation) may influence existing routines, or may even lead to the introduction of new ones. This notion of routines and its application to innovation is consistent with the concept of incremental innovation.

However, not only organizational routines pattern innovative behavior but also ”technological regimes” or ”technological paradigms” [Nelson and Winter, 1977; Dosi 1982]. A technological regime derives from ”technicians' beliefs about what is feasible or at least worth attempting” [Nelson and Winter, 1982, 258-259]. Dosi, Pavitt and Soete extend this definition: a ”technological paradigm defines contextually the needs that are meant to be fulfilled, the scientific principles utilized for the task, the material technology to be used. In other words, a technological paradigm can be defined as a 'pattern' of solution of *selected* problems based on highly selected principles derived from prior knowledge and experience. … [It] also defines the boundaries of the inducement effects that changing market conditions and relative prices can exert upon the directions of technical progress” [1990, 84].

Within such a regime or paradigm, ”technological trajectories” exist [Nelson and Winter, 1977]. Technological trajectories are defined as ”the activity of technological process along the economic and technological trade-offs defined by the paradigm” [Dosi and Orsenigo, 1988, 16]. The direction of the technological trajectory depends upon a number of ”selection” variables which serve as socioeconomic filters: economic (feasibility, marketability, profitability), institutional (the economic interests of the organizations involved in R&D, their technological history and the fields of expertise, and institutional variables), and the cost reduction capability of the new trajectory [Dosi, 1982, 155]. The ”crucial hypothesis”, Dosi, Pavitt and Soete argue, ”is that innovative activities are strongly *selective*, *finalized* in quite precise directions, and often *cumulative*” [1990, 84, ital. orig.]. The concepts of the Nelson-Winter-Dosi approach are consistent with Vincenti's ”technical shaping of technologies”: within a technological regime, researchers adopt certain search routines, influenced by economic, social and political factors. Dosi argues that this model explains continuities and discontinuities in technological change, and incremental versus radical changes (of which the latter leads to a paradigm change). Furthermore, the model concentrates on procedures that may succeed or fail; technological progress is not a random process. Moreover, the model accounts for the cumulativeness and the uncertainty of technological progress.

That the Nelson-Winter-Dosi model fails to provide a theory of regime *change* is perhaps the most relevant critique for our discussion.[2] Nelson and Winter only mention a ”confluence of a number of R&D strands” as the source for a regime change [1982]. Dosi argues that a regime change is based on new scientific knowledge, bottlenecks associated with the ”old” technology, and changing economic conditions [1982, 157]. However, his model still fails to account for radical technological change. The variables that influence the trajectories and that possibly lead to a paradigm change are, as Dosi states himself, ”selection” variables and not more: they select a certain choice out of a pool of existing choices, and these choices themselves are relatively independent of societal variables [Heimer, 1993, 58-59]. Societal factors only ”filter out” certain choices but do not create choices themselves. In sum, the Nelson and Winter propositions, and Dosi's extensions, incorporate technological, economic, social, and political variables. However, they cannot escape a mild technological determinism in which the relatively autonomous transformation of scientific knowledge into technologies is an important source of societal change. In other words, once new scientific facts are created, they are likely to become part of organizational routines and thereby permeate society.

In the study of long-waves and technological development, Christopher Freeman and Carlotta Perez attempt to circumvent this type of mild technological determinism; the success of technologies is possible *only in connection with simultaneous institutional, organizational, and societal changes* [see Freeman, Clark and Soete, 1982; Perez, 1983; Freeman, 1988a, 1988b, 1990, 1991; Freeman and Perez, 1988]. Although technology creation is somewhat autonomous, its *success* depends on supplementary societal changes *before* the technology can fully exploit its economic and social potentials. With the concepts of ”technological style” and ”techno-economic

---

[2] This is admittedly an unfair critique as this was not intended by the authors.

paradigm", Freeman and Perez "go beyond engineering trajectories for specific product or process technologies" and argue the existence of a "technical common sense" [Freeman and Perez, 1988, 47; Perez, 1983, 361].

Freeman and Perez identify a paradigm change on the basis of perceivable and significant productivity increases. By means of this result-orientation they circumvent the mild determinism of the Nelson-Winter-Dosi model. They explicitly incorporate societal variables such as supplementary institutional changes or market factors that extend beyond the heuristics and routines of research laboratories. Perez relates the "quantum jump in productivity" directly to the general cost structure of particular inputs, which she calls "key factors" [1983, 361]: clearly perceived low – and descending – relative cost, unlimited supply for all practical purposes, potential all-pervasiveness, and a capacity to reduce the costs of capital, labor, and products, as well as to change them qualitatively.

Perez identifies "a strong feedback interaction between the economic, social and institutional spheres which generates a dynamic complementarity centered around a technological style" [1983, 360]. The emergence of a new technological style appears within the framework of existing economic, social and institutional settings. It causes a considerable crisis as it increasingly disrupts older types of interaction. This increasing disruption by new technologies and processes finally leads to a crisis of the whole system, often in the form of the decline of traditional economic sectors and the continuous increase of base unemployment:

> The structural crisis thus brought about is [..] not only a process of 'creative destruction' or 'abnormal liquidation' in the economic sphere, but also in the socio-institutional. In fact, the crisis forces the restructuring of the socio-institutional framework with innovations along the lines that are complementary to the newly attained technological style or best-practice frontier [Perez, 1983, 360].

The seeds for the structural crisis already appear in the downswing phase of the so-called Kondratiev long wave [Kondratiev, 1935]. The new and the old technological styles overlap, with the newer one gaining force. The speed of transition depends on the forces that support either the old or new style:

> The final form the structure will take, from the wide range of the possible, and the timespan in which the transformation is effected to permit a new expansionary phase will, however, ultimately depend on the interest, actions, lucidity and relative strength of the social forces at play [ibid.].

In sum, the Perez-Freeman model emphasizes that technological progress does not itself lead to the technological development of society. Rather, socio-institutional factors leave room for different speeds and paths of development. The question that the model leaves unanswered, however, is, what particular social and institutional changes are necessary to achieve a particular outcome, a question that most often can only be answered retrospectively.

## B. Economic Models of Technological Development

Entrepreneurs transform scientific knowledge into profit. Some argue that economic incentives are the predominant cause of the development of technologies and the subsequent technological development of society. Others integrate elements of crisis and discontinuity, and consider multiple technological outcomes and the ”lock-in” of inferior technologies. We will now explore some propositions from the economist's perspective on the technological development of society.

### 1) Unilinear Economic Approaches to the Technological Development of Society

Business cycles are the periodic up- and downswings of an economy along a trend path. The trend path has a positive slope; the economy grows over time because more resources become available due to population growth, accumulation of capital in enterprises, greater use of land, increasing stock of knowledge, and new methods of production. However, the economy does not remain stable along this trend path, but it fluctuates above when the employment of factors increases (expansion) or below when the employment of factors decreases (recession). Without reviewing the wealth of business cycle literature, let us now examine how business cycle theory can be applied to innovation and the technological development of society with the aid of Joseph Schumpeter's and Jacob Schmookler's classic innovation theories.

Proponents of the ”technology-push” model argue that the technological development of society derives from the transformation of exogenous natural-scientific knowledge into a marketable product by profit-seeking entrepreneurs.[3] For Schumpeter

[3] I will here only introduce a ”strong” version of the model. There are numerous derivatives that qualify some of the criticisms offered here.

[1942], the motive for innovation depends upon the entrepreneur's (perceived) prospect of achieving a monopoly during the expanding phase of the business cycle. Schumpeter emphasized a radical process of technology replacement as opposed to a process of incrementalism. The search for ever new monopolies results in a ”perennial gale of creative destruction”. Due to market power, a monopolist has the resources to invest in innovative activities to protect the lucrative monopoly position. The outcome is the perennial quest for radically new and difficult-to-copy products and processes.

This simplified version of the technology-push model is not a sufficient basis to explain the technological development of society. The technology-push model reduces societal development to the profit motive of entrepreneurs and is therefore excessively unilinear and deterministic. Entrepreneurs operate within a ”spider web” of societal conditions and regulations that are constantly in a fluid state. For example, Schumpeter said little about employment and wage effects (i. e. demand factors) that could impact businesses and markets.

Advocates of the alternative demand-pull approach argue that either growing demand or exogenous shocks (such as cost reductions due to, for example, a natural-scientific breakthrough) are the motors for technological change [see for example Schmookler, 1962, 1966]. The ”causal prime mover […] is some supposed 'recognition of needs' by the productive units in the market, to which follows their attempts to fulfill those needs through technological efforts” [Dosi, 1982, 149]. Underlying this argument is the differentiation between production and consumption goods. The demand for innovation in production goods results either from the desire for cost reductions and productivity increases or from the perceived (future) demand for capacity expansions. The incentive for innovation in consumption goods originates in shifts within the goods basket of consumers. Income or income elasticity shifts may cause an expansion of demand, which in turn leads to the incentive to invest in the production process. End customers, therefore, also indirectly determine the demand for innovation in production goods as well. All related sectors innovate, including improvements in the production of raw materials. First, demand increases or costs decrease, then innovative activities increase. The model implies that ”there *generally exists* a *possibility* of *knowing a priori* (before the invention process takes place) the *direction* in which the market is 'pulling' the inventive activity of producers and furthermore that an important part of the 'signaling process' operates through movements in relative prices and quantities” [Dosi, 1982, 149]. The decline of innovative activities does not necessarily signify a decrease of technological opportunities but the reduction of demand. In sum, the customers and their demand ”pull” the innovativeness of the producers. Winners in the technological game are those who recognize the rising demand and who can react accordingly.

Similar to the technology-push model, this simplified version of the demand-pull model reduces the technological development of society to primarily economic incentives and thereby ignores the enormous complexity of the technological development of society and the interplay between various technological, economic, political, social and cultural aspects. More recent economic approaches to the technological development of society attempt to overcome this unilinearity and emphasize certain socio-economic processes that feed back into the strategic considerations of enterprises and thereby influence the innovation process. Not only do economic incentives spur the innovation process, but the interactive process of technology and society affects the innovation process itself. We will now examine several approaches that focus on this interactive process.

### 2) The Economics and Politics of Compatibilities and Standards

Compatibility describes the *ex post* connection between different products, either by the development of one-way adapters (for example, adapters to connect different plugs) or of two-way gateways that transform the signals in electronic devices (for example, a modulator-demodulator, or modem). Standards are an agreement between certain actors to establish an *ex ante* integration of their products, mostly in form of the pre-definition of connectivity and protocols. Industrial norms, such as the precise definition of screw sizes, are an example of this. In sum, *ex post* compatibility requires the development of adapters and gateways without cooperation between different actors, while *ex ante* standards yield the development of compatible products but assume an initial agreement.

What distinguishes approaches that focus on compatibilities and standards from business cycle theories is that the achievement of compatibilities and standards does not only entail the economic incentives of individuals or enterprises, but depends, to a large degree, on facets of social and economic *inter*action between participating actors, and between these actors and the surrounding environment. Economic factors, such as price effects and cost considerations, learning-by-doing, network externalities, technological interrelatedness, informational externalities, production problems, or competitive advantages, and social factors, such as different user groups or power, together determine the success and failure of economic strategies and the subsequent technological development of society [Heimer, 1993, 125-126; David and Bunn, 1988, 175-197; Hughes, 1983]. Additionally, political motives often interfere in market developments. For example, greater compatibility of product markets between different nations may create or sustain positive international economic relations (conversely, many historical ”incompatibilities” or different standards are really trade barriers and not of a technical nature).

If so many incentives and potential benefits exist, why do enterprises not always agree on standards? Foremost, the strategic considerations of enterprises dominate their incentive for participating in standardization activities. Enterprises prefer those standards that are most compatible with their own systems, system components or production processes. Furthermore, enterprises also consider the reactions of rivals; thus a positive-sum game is not always sufficient to promote cooperative enterprise behavior when some competitors may win more than others.

Let us consider an example in which a strategic environment influences the innovation process. Joseph Farrell and Garth Saloner [1986] argue that the existence and size of an ”installed user base” influence the strategic actions of enterprises. The greater the user base, the greater are the positive externalities. In other words, the more people who have access to a technology, the more is the value they derive from it. Network externalities derive from the interchangeability of complementary products, the ease of communication and costs savings by economies of scale. For example, if only a few people have access to a telephone network, the value of this access is lower to them than when they could reach everybody. Telephones fall in price because with a large user base, they can be mass produced, they use the same analog transmission method and are easy to use. A recent example is the Internet: standardization of protocols and application platforms have greatly expanded the possibilities of this medium.

When a new but incompatible product enters the market, certain dynamics develop. When a user switches to a new product that is incompatible with the existing product, s/he loses the benefits of this product ”unless other current users also switch and new users also adopt the new technology” [ibid., 940]. The awareness of the user to the potentiality of losing these benefits creates an "excess inertia" that obstructs the large-scale move to this new product [ibid.]. This excess inertia is a direct result of user expectations and may become a self-fulfilling prophecy: since everyone expects that no-one will switch to the new technology, no-one does switch.

Not only the economic self-interest may cause excess inertia, but also non-economic factors such as social, health, environmental, or ethical concerns. For example, while in the late 1980s and early 1990s large groups of early users purchased the newest computer technologies, the combination of rising environmental concerns and new information about the ecological problems that the production and discharge of computer components causes [Grote, 1996, 1995, 1994; Soldera, 1995; Ebeling, 1996] may reduce the size of the early adopter group in the future.[4] Similarly, concerns about child pornography on the Internet have discredited this global medium and alarmed many potential users. Therefore, non-economic social factors may, therefore, obstruct the proliferation of a technology in its important initial phase.

In the other case, when users switch or when new users enter the market, this increasing installed user base may cause a reduction in the size of the old installed base. For example, more teleworking, i. e., working at home with the computer, reduces the attractiveness of Local Area Networks (LANs), which are closed enterprise networks, and promotes the development of "Intranet" applications that permit the integration of the traditional LANs with the communicative abilities of the Internet. The new product becomes increasingly attractive the more teleworkers exist.

Farell and Saloner argue that enterprises are aware of these economic and non-economic processes. Accordingly, they act strategically on the perceived installed user bases. The identification of network externalities and strategic sunk costs becomes important and enterprises implement them in the market or standardization strategy. Effectively, a large installed user base is a barrier to entry that a new technology cannot break through, despite the fact that the latter is sometimes superior to the older technology. Correspondingly, enterprises carefully watch the state of the current user base and prevent anything that could promote the development of new user bases. For

---

[4] Although the linkage between ecological concerns and the use of novel technologies may only be wishful thinking; consider, for example, the careless conduct with the waste products of modern technologies in most countries, nuclear waste being only being one of the more visible ones. Waste disposal in the open seen and so-called Third World countries will certainly increase when the first generations of computer equipment will be outdated.

example, some enterprises release certain technological information only when developers guarantee that their products remain compatible only with the original technology.

Enterprises that are behind in a particular technological race have an incentive to obstruct a competitor's creation and maintenance of such a barrier. They can either make ”premature announcements” or ”predatory preannouncements” on the future availability of their product. Thereby, they attempt to ”discourage existing customers from switching to another supplier and to encourage those intending to buy soon to wait, and thus not become part of the 'installed base'” [Farrell and Saloner, 1986, 942]. Such a strategy may include a pre-release (in the software industry called ”beta-versions”) or the free distribution of a product. The effect of a preannouncement is twofold: first, those that prefer to wait for the preannounced product potentially become the new installed base when the finished products enters the market. Second, this reduces the potential size of the alternative user base.

Such strategic conduct often approaches the frontiers of legality. The problem from a social-welfare perspective is that ”when there are significant network externalities, the timing of the announcement of a new incompatible product can critically determine whether the new product supersedes the existing technology. In that case, because of the externalities arising from the installed base, a preannouncement can sometimes secure the success of a new technology that is socially not worth adopting, and that would not have been adopted absent the preannouncement” [ibid.]. Similarly, some enterprises conduct predatory strategies that consist of free releases or temporary price reductions to defeat competitors. In the case of Internet-technologies, some already speak of a ”war over the Internet” [Fey, 1996a, 1996b]. Authorities in the United States and elsewhere are currently critically reviewing such activities in order to establish whether the ”warriors” are not violating existing competition and anti-cartel laws.

W. Brian Arthur expands on the interplay between producers and users by introducing the concept of ”increasing returns to adoption”: ”the more [complex technologies] are adopted, the more experience is gained with them, and the more they are improved” [1989, 116; see also Arthur, 1983]. Distinct from a ”learning-by-using” argument, Arthur explicitly incorporates societal factors in the product *development* path of technologies and points out that ”historical chance events” can have a decisive impact on this path:

> When two or more increasing-return technologies 'compete' [..] for a market of potential adopters, insignificant events may by chance give one of them an initial advantage in adoptions. This technology may then improve more than the others, so it may appeal to a wider proportion of potential adopters. It may therefore become further adopted and further improved. Thus, a technology that by chance gains an early lead in adoption may eventually 'corner the market' of potential adopters, with the other technologies becoming locked out [ibid.].

Historical chance events are unrelated to the innovation process. Currency fluctuations that improve the cost-benefit ratio of foreign technologies, strikes, the assassination of a governmental leader or even natural catastrophes and their consequences could qualify as chance events as they may delay particular innovation processes. The innovation process is thus continuously unstable and subject to crisis and discontinuity. Accordingly, governmental technology policy may be ineffective, and the lock-in of competing or even inferior technologies is always possible. Individual economic considerations may obstruct the achievement of governmental aims.

In sum, strategic considerations of enterprises may directly affect their conduct; either in terms of product release strategies, or *indirectly*, derived from these strategies, the product development path. Furthermore, enterprises increasingly incorporate the possibility of random events into their strategic considerations. The exploding market for enterprise consultants who develop contingency plans for potential future developments signifies this.

## C. Socio-Political Models of Technological Development

Socio-political models consider the technological development of society as an outcome of, predominantly, the societal context. Unilinear and deterministic versions assign an exclusivity to socio-political factors. Proponents of interaction, systems, and network models incorporate technological and economic constraints but argue that primarily societal or political factors steer the development of technologies.

1) Unilinear Socio-Political Approaches to Technological Development

Unilinear socio-political approaches to the technological development of society assume that technology is not in the slightest sense autonomous from societal or political influences [for an exhaustive review, see Teusch, 1993, 215ff]. For example, David Noble argues that technology is not an autonomous and exogenous force in its influence on people. Rather, technology is the *product* of social *processes* [1986, 98f]. Thus, the social context of the innovation process determines the development path of a technology [see, for example, Pinch and Bijker, 1984; Hughes, 1983].

The principle problem of such an approach is analytical and methodological. The emphasis on the social *context* ”merely substituted one set of high-level abstractions for another and left too much room for misunderstanding the social, political, economic, et cetera. Further, if the relationship between context and content was not specified, then the reader was left asking if context constructs content, if content shapes context, or if there is an interaction” [Hughes, 1988, 10]. Furthermore, as the discussion above showed, technological and economic constraints always exist outside of specific social contexts.

The notion that technology is an outcome of social dynamics tempts the argument that political action can *determine* it. Traditional technology policy, to which we will return to in a section below, bases on such reasoning. It can be argued that political action unilinearly leads to a desired outcome, whether the motive is the national economic welfare and prosperity or international competitiveness. The argument states, that if the political will exists, political constraints and incentives to promote inventions can direct the scientific and economic spheres.

2) Interaction, Systems and Networks

Non-linear interaction, system and network approaches focus on the complex interaction between societal domains and actors as well as their mutual interdependencies and mutual shaping. The interactive model emphasizes the interaction of actors, institutions and technological artifacts in the technological development of society. Trevor Pinch and Wiebe Bijker propose that the ”developmental process of a technological artifact is described as an alternation between variation and selection” [1984, 410ff]. Whether a technological artifact stabilizes (selection) or an alternative artifact succeeds (variation), depends on a complex number of social demands that are external to the technology itself. In their interaction, society and science shape each other – inventors, engineers, managers, financiers and politicians interact in what Thomas Hughes calls a ”seamless web” [1988, 12]. In a seamless web, the arbitrary differentiation between the social, political and economic is not necessary. However, as the systems and network approaches show, the study of the mere *interaction* does not suffice.

In the context of the systems approach, Hughes prefers to examine physical artifacts, organizations and organization methods not only in terms of their interaction but of their *integration*. He defines a technological systems and their components as follows:

> Technological systems contain messy, complex, problem-solving components. They are both socially constructed and society shaping. Among the components in technological systems are physical artifacts, such as turbogenerators, transformers, and transmission lines in electric light and power systems. Technological systems also include organizations, such as manufacturing firms, utility companies, and investment banks, and they incorporate components usually labeled scientific, such as books, articles, and university teaching and research programs. Legislative artifacts can also be part of technological systems. Because they are socially constructed and adapted in order to function in systems, natural resources, such as coal mines, also qualify as system artifacts [1987, 51].

The systemic character of a technology derives from the definition of an artifact: ”An artifact – either physical or nonphysical – functioning as a component in a system interacts with other artifacts, all of which contribute directly or through other components to the common system goal. *If a component is removed from a system or if its characteristics change, the other artifacts in the system will alter characteristics accordingly*” [ibid., emph. added]. Thus, the alteration of artifacts within the system potentially leads to choice, conflict, and perhaps crisis and discontinuity.

The systems approach emphasizes ”critical actors” who are ”broadly experienced and gifted system builders [that] invent hardware as well as organizations, but usually different persons can take these responsibilities as a system evolves” [ibid.].

> One of the primary characteristics of a system builder is the ability to construct or to force unity from diversity, centralization in the face of pluralism, and coherence from chaos. This construction often involves the destruction of alternative systems. … Modern system builders … have tended to bureaucratize, deskill, and routinize in order to minimize the

> voluntary role of workers and administrative personnel in a system. … A crucial function of people in technological systems, besides their obvious role in inventing, designing, and developing systems, is to complete the feedback loop between system performance and system goal and in so doing to correct errors in system performance [ibid.].

Thus, as opposed to the Freeman-Perez model, institutional changes are not only a necessary *complement* to the technological development of society, but institutional change *drives* this development. Structures and strategies complement each other to promote technological development.

The source of a systemic change is invention. Radical inventions tend to inaugurate a new technological system, while conservative inventions tend to ”improve or expand existing systems” and occur during the competition and system growth phases [ibid., 57]. This is consistent with paradigmatic approaches. However, the differentiation between radical and conservative inventions yields important insights about the role of systemic change because it develops *external to the organizational context*:

> Because radical inventions do not contribute to the growth of existing technological systems, which are presided over by, systematically linked to, and financially supported by larger entities, organizations rarely nurture a radical invention. … Radical inventions often deskill workers, engineers, wipe out financial investments, and generally stimulate anxiety in large organizations. Large organizations sometimes reject the inventive proposals of the radicals as technically crude and economically risky, but in doing so they are simply acknowledging the character of the new and the radical [ibid., 57-58; 59].

Since enterprises often do not pursue radical inventions, the role of independent inventors, for example, of academic and industry-independent researchers, becomes important. These researchers, however, depend on enterprise-external resources. Since non-economic organizations, foremost the state, distribute these resources, they also attach non-economic demands to these resources, for example, that a technology promotes some public good without financial benefits. By distributing these resources, decision-makers hope to influence the technological development of society.

During subsequent development ”the social construction of technology becomes clear. During the transformation of the invention into an innovation, inventor-entrepreneurs and their associates embody in their invention economic, political, and social characteristics that it needs for survival in the use world” [ibid., 62]. Problems are common during this phase. Scientists represent a societal microcosm; they do not only test the technological characteristics but the societal compatibility (or at least the compatibility to the desires of the individual patron or customer).[5] The technological characteristics must be adjusted to the demands of the individual system components *as they relate to each other*. Hughes states that this process often yields a number of follow-up inventions or patents.

The process of invention and development yields an innovation. An innovation ”clearly reveals technologically complex systems. The inventor-entrepreneur, along with the associated engineers, industrial scientists, and other inventors who help to bring the product into use, often combines the invented and developed physical components into a complex system consisting of manufacturing, sales, and service facilities” [ibid., 64]. The technology is now marketable. The technological development of society, however, requires not only the sale of a technology but also technology transfer and adaptation. This may imply the sale of patents, the licensing of the technology or the adaptation to specific circumstances, such as the adaptation to foreign markets. Particular geographic, market, social and legislative conditions are crucial in technology transfer as the developers have a ”creative latitude” [ibid., 68]. Due to this creative latitude, each environment can yield its own technological style. Important related factors are whether the organizational components be transferred as well and what effects these adaptations have on the technological system as the adaptations may feed back into the shape of the original technology. These factors may initiate a new wave of inventive activity and thereby again alter the technological styles.

One of the causes for reentering a technology into the invention and development phases may be the existence of ”reverse salients”: these ”are the components in the system that have fallen behind or are out of phase with the others” [ibid., 73] Reverse salients are not identical to technological bottlenecks. They can also be of an organizational nature, for example, the management style or a law in a particular country or region. A reverse salient must not appear suddenly and surprisingly, it can also be expected. In this context, Edward Constant proposes the concept of a ”presumptive anomaly” [1980, 15]. A presumptive anomaly is the

---

[5] Some may criticize this idealistic characterization of scientists and their motives. Many inventions have been far from benign, for example, modern weapons. However, some societies value certain

prediction that a system will fail in the future. Such an expectation accordingly creates the need to find a solution preemptively. Following this process that involves technological, economic, and societal feedback, the technology consolidates and gains momentum. The components of the technology stabilize in relation to each other until new scientific breakthroughs, the end of the product life cycle, or obstructive regulatory or societal actions impact their development.

Hughes' description of the technological development process focuses on components of a system as they are defined by the system. The complexity of this model is great as the components influence each other in ways that are difficult to foresee. In other words, Hughes' systems approach is useful for an historical account of the development of a technology and its impact on society. The systems approach, however, does not yield an *ex ante* strategy that decision-makers could pursue.

The network approach attempts to circumvent this all-inclusiveness by making a fundamental distinction between the level on which aims are defined and the level on which these aims are achieved.[6] The analysis of the relative power of actors is a central component of this approach. John Law and Michel Callon differentiate between a ”global” and a ”local” network. A global network ”is a set of relations between an actor and its neighbors on the one hand, and between those neighbors on the other. It is a network that is built-up, deliberately or otherwise, and that generates a space, a period of time, and a set of resources in which innovation may take place”. A local network, which should not be misunderstood to imply a geographical space, is ”the development of an array of the heterogeneous sets of bits and pieces that is necessary to the successful production of any working device” [1992, 21-22]. The differentiation between a global and a local network provides a basis for the mutual shaping of the actors. Actors on the different levels have different sets of underlying motives and work processes. Furthermore, the differentiation between the different levels enables the incorporation of technological, economic, political and social constraints that the various actors are subject to. In sum, the network approach attempts to overcome the inherent complexity of the systems approach by reintroducing *sets of actors* and their complex relationships to other system components.

---

malignant technologies, for example, for national security reasons; therefore, these technologies are socially ”compatible” even if they do not necessarily improve the standard of living.

The global network actors may be human and non-human, individuals, organizations, but also systemic constraints such as the market or regulatory framework. These actors predefine the aims. A local network consists of technology-relevant enterprises, local authorities, but also technology-specific market and technological constraints. The participating actors each have different underlying motives. Law and Callon call this ”interpretative flexibility” or ”variable geometry” [1992, 24]. These motives may complicate or ease the execution of a project. They may complicate the process when each actor expects a certain outcome that does not actually appear as the different underlying interests cause a redirection or dilution of original aims. They may also ease the execution of a project when the project's components and the consequential input of individual actors are highly specialized. For example, some actors may fund a project, others specialize on coordination, and again others execute the minute technological elements. Law and Callon argue that ”[t]his process of reciprocal simplification has several consequences. One is that from the standpoint of both its neighbors and an outside observer, the project can be treated as a series of transactions” [ibid.]. Transactions are economic, political, and technical.

Transactions, also called ”intermediaries”, are a fundamental requirement in the undertaking of complex processes between various actors. They do not, however, only shape the project itself but also the interests of the individual actors. Initially competing organizations or enterprises may eventually recognize the benefits of cooperation. The identification of these ”process[es] of mutual shaping” is important because ”it breaks down an abstract distinction common in social analysis between (determined) actor and (determining) structure, or between content and context. Neighbors do indeed shape new actors as they enter into transactions with them, but they are in turn reshaped by their new circumstances” [ibid., 25, 26]. For that reason, Law and Callon emphasize the importance of a ”negotiation space” within a project that insulates the actors from negative external influences: ”it offers a degree of privacy for project builders to make their mistakes in private, and without interference” [ibid., 46].

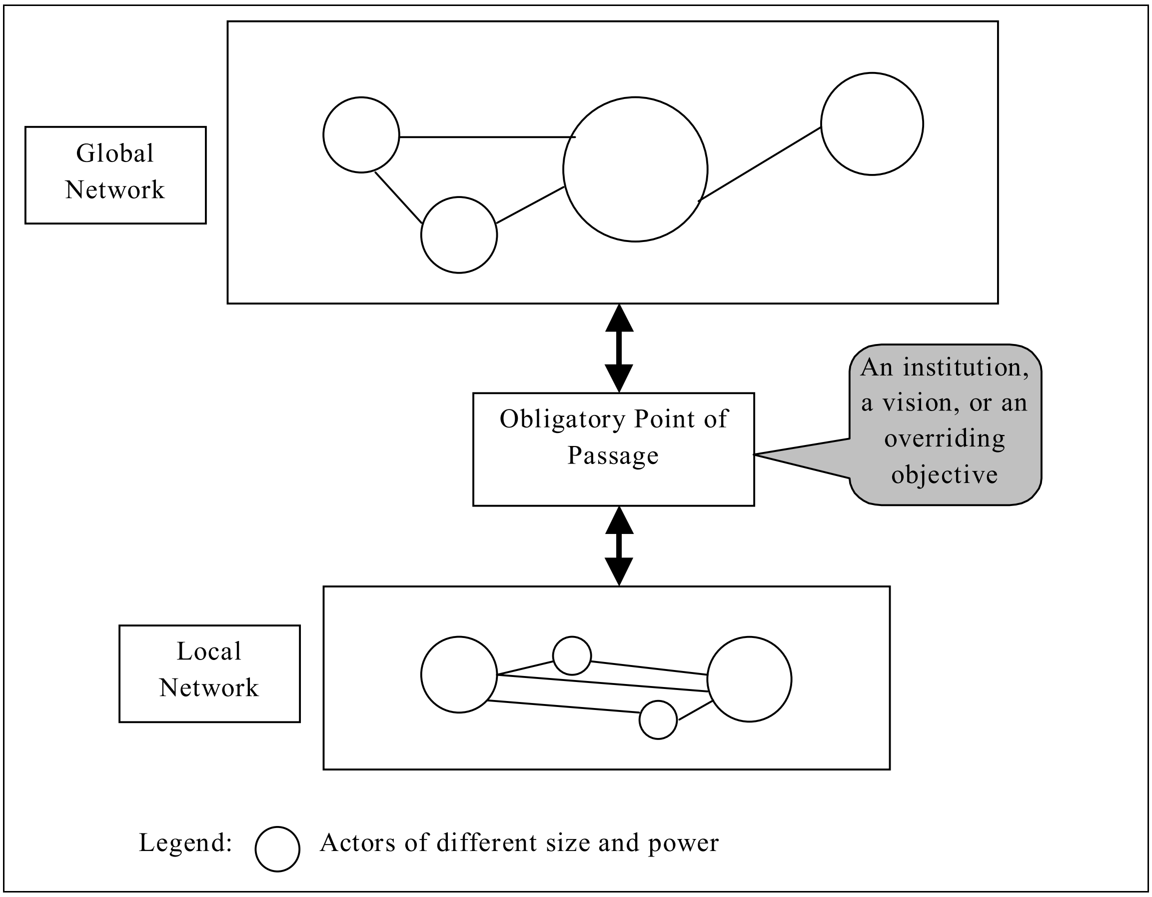
In contrast to the other socio-political models introduced above, Law and Callon's model can be relevant for the conduct of technology policy. First, decision-makers could identify relevant global network actors, such as departments or ministries

---

[6] No network approach exists as such. For a review of the network literature and related works see Harnischfeger, Hüdig, and Zoche, 1996, 1-36.

responsible for technology, finance, education, or other relevant aspects. These global network actors form a pre-consensus on the aims. Second, the actors could agree on a preliminary method to fulfill the project by identifying the possible local network actors, which might be specific enterprises, local authorities, or grass-root organizations. The important difference from a traditional technology policy approach is that the degree of initial actor inclusion is higher: as will be addressed in the section on technology policy, traditional approaches have predominantly pursued a supply-side strategy without implementing user concerns. The issue of technological feasibility has dominated traditional technology policy. More modern technology policy, which we will call societal technology policy, is increasingly opening these initial stages to the public. For example, political institutions have recently moved to conduct or sponsor open hearings in relatively early stages of the innovation or regulatory process.

Figure 1.1: Global and Local Networks



Following the identification of local network actors, the actors must consult on technological *and* societal feasibility.[7] The latter may include financial feasibility or public acceptance. The participating actors have to address design features and schedules. They have to agree on coordination processes and the division of labor, within the local network and between the local and the global networks. If the production of the initial intermediaries is successful, and the actors of the global network are satisfied, they can ”stabilize” the local network. In other words, the global network actors can award contracts and the necessary financial means. Stabilization finalizes the creation of the network and the process of innovation can begin.

For the successful operation of the network, Law and Callon argue the necessity of an ”obligatory point of passage”: ”a single locus should shape and mobilize the local network *and* [..] this locus should have control over all transactions between the local and global networks” [ibid., 31, ital. orig.]. Competencies and responsibilities between the global network actors must have been agreed upon. An obligatory point of passage is important because the participating actors do not only have a variable geometry coming into the network, but the technological development of society may, over time, also alter the underlying interests. Figure 1.1 summarizes the network structure.

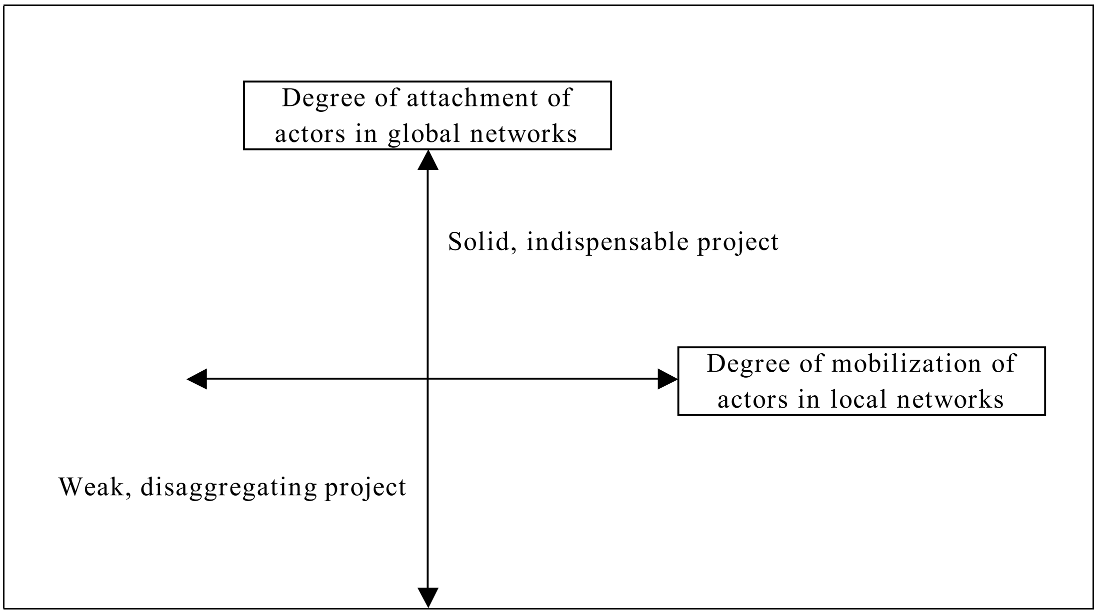
Without a predesignated and institutionalized obligatory point of passage, vertical transactions between the local and global networks could develop. These may be harmful; they can evolve from competency struggles within the local network or between the local and global networks. Take the case of the European Union in which multiple governments are members of the global network: individual enterprises of the local network may lobby their respective national government in the global network and thereby undermine the agreed-upon intermediaries. For example, when Philips and Siemens are members of the local network that has the predefined task to design and develop microchips, and they disagree on the appropriate strategy, they may each lobby the Dutch or German governments to intervene on their behalf. This is even perceivable when their specific tasks have been clearly separated, for example, the production of different types of chips for different purposes. The relative success of a competitor may

---

[7] Although Law and Callon describe a process to create military aircraft, i. e., technologies without a civilian application, societal feasibility must still exist. In their case, the societal part concerned financing. However, in other projects, popular acceptance must exist to be able to predict actual costs and benefits. For example, the conduct of a network approach in line with Law and Callon's propositions may have caused a different outcome with respect to the civilian application of nuclear energy.

undermine the general competitive standing of the other, for example, the more successful company may gain more future R&D resources. Law and Callon call this process of vertical transactions ”seepage” [ibid., 33]. Seepage may effectively undermine the whole project.

Figure 1.2: Attachment and Mobilization in Networks




Source: Law and Callon, 1992, 49.

Destabilization of a project may not necessarily imply its end; the global network may reshape. It could take the conflicts that were previously protected by the negotiation space into a wider arena, for example, by politicizing the issue. It may also redefine its purpose and aims, and draw in new actors. In both cases, the global network takes on a new shape in which all the actors have again redefined their interests. To continue the new ”game” with old instruments, however, does not seem adequate. The reshaping of a project could require a new project leader, strategy and coordination or mediation mechanisms.

In summary, Law and Callon propose that the ”shape and fate of technological projects is a function of three interrelated factors”:

4. the capacity of the project to build and maintain a global network that will for a time provide resources of various kinds in the expectation of an ultimate return;

5. the ability of the project to build a local network using the resources provided by the global network to ultimately offer a material, economic, cultural, or symbolic return to actors lodged in the global network;
6. the capacity to impose itself as an obligatory point of passage between the two networks [ibid., 46].

Those projects that are likely to succeed are those that are characterized by a high degree of global network stability and local network mobilization. Conversely, projects that are likely to fail, are those where both global and local networks are unstable and insufficiently integrated (Figure 1.2 summarizes these propositions).

Such complex models are of course difficult to apply in practice. Especially the question of the relative power of the involved actors makes their consistent application difficult. Nevertheless, the proposed concepts of socio-political models are important and helpful as they emphasize that the technological development of society is a complex and interactive process, a process of constant fluidity.

## D. Conclusion

The technological development of society is not a unilinear process. Neither technological, economic, or socio-political constraints unilaterally determine the technological development path, nor can technologists, economists, or politicians force a particular outcome. The principle conclusion of this section is that disciplinary boundaries are not useful to describe and predict particular development paths. Rather, the notions of choice, crisis and discontinuity enable us not only to explain the successes, but also the failures.

The technological development of society involves a combination of scientific, economic, social, and political processes that are unpredictable because the interaction and mutual shaping of the actors alters each actor's initial condition and interests. However, to focus on interaction and mutual shaping does not necessarily benefit the analysis as we are unable to decipher which actor or event carries more weight. The proliferation of possible actors and constraints lead to a failure to explain the whole, not because the whole is necessarily more than the collection of its components, but because of the methodological impossibility of identifying all possible actors and their mutual interaction. One has to define all relevant actors, human and non-human, and all possible relationships and mutual shaping within and between systems or networks. This is especially difficult because every system or network and their creators are part of another system or network. Therefore, they are themselves subject to constraints from above and below.

Variables that focus on crisis and discontinuity are more successful than variables that attempt to explain the interaction and mutual shaping. For example, the concepts of reverse salients and presumptive anomalies are valuable because they emphasize that technological problems are not only of a technological nature. The notion that inferior technologies can ”lock-in” has a greater explanatory power than the reduction of the technological development of society to predominantly economic incentives of individuals and enterprises and to the claim that the technological and market outcome is always socially optimal in the allocation of resources and subsequent social effects. Feedback processes affect the innovative process. The interaction between economic incentives and social factors may be harmonious or conflictual. For example, the success of a technology requires supplemental societal changes before and while the technology diffuses and permeates society. Political factors may drive the process as well: for instance, public procurement and official governmental sponsoring of standardization processes often play an important role for the size of user bases and the subsequent technological development. Politics may alter the incentive structures of entrepreneurs; for example, the imposition of strong restrictions on the exercise of monopolies or the creation of trade or non-tariff barriers. By feeding back into the economic incentive structures, environmental or ethical concerns as well as historical chance events may indirectly impact the process of innovation. Crisis-oriented concepts point out that the solution to a technological problem lies in the ability to overcome these problems in an overarching manner, including scientists, entrepreneurs, politicians, and social groups. Paradigm-oriented approaches and approaches that emphasize feedback processes support such claims.

In sum, the technological development of society is multilinear and embedded in particular social and historical developments. Models that consider crisis and discontinuity, development choices and failure have greater explanatory power than models with unilinear or overly complex theoretical propositions. Nevertheless, the complexity involved in technological development is likely to be enormous. To overcome this problem, analysts have proposed to bundle the relevant variables into the context of overarching visions.

## II) Visions and Computer-Mediated Communication

During periods of technological uncertainty and a lack of knowledge about the social, economic and political implications of new technologies, visions on the future proliferate. How do we, however, differentiate speculative science fiction from serious and responsible forecasting and planning?

One systematic method is the establishment and outline of a *Leitbild*, as follows called a ”substantive vision”.[8] A substantive vision is a vision of a future whose specifics are not yet observable and that cannot be quantified: substantive visions ”are no concrete aims, but *generalized*, *simplified formulas*, *etiquettes* or *metaphors*. They set norms and are instruments of organizational and societal influence and control. They permit to design and enforce programs found to be rational and legitimate” [Strümpel and Langolius, 1991, 75, emph. orig.]. Meinolf Dierkes states that substantive visions ”aggregate *basic perceptions*, *values* and *behavioral conceptions*; [they] therefore serve as a central *orientation framework* for decisions with still unknown consequences. Conceptions of the *desirable and the principally achievable technological possibilities* manifest themselves in [them]” [1988, 54, emph. orig.]. Dierkes et al. add that a substantive vision consists of three components [1992, 40ff].: first, a ”collective projection” in which dreams, desires, and anticipation combine with experience of what is possible; second, ”synchronous preadaptation” that causes various actors with different evaluation mechanisms to come together; and third, ”functional equivalent” which is the substitute for rules and decision-making principles that do not yet exist. In sum, a substantive vision has the function to stimulate, mobilize, and motivate individually and collectively.[9]

Bockholt et al. point out that since the relevant actors have varying conceptions on the *precise* nature of the future outcome, the actor coalitions are fragile [1993, 40].

---

[8] Leitbild is a German term that has no direct English translation; literally translated it means a leading picture, an image on whose basis one can orient one's actions, a guiding principle. We will here call it a ”substantive vision” to differentiate it from the speculative aspects of a vision. Of course, also a substantive vision contains speculation, but normally its elaboration attempts to build on serious forecasting and statistics.

[9] For a review of the mostly German literature on *Leitbilder*, see Bockholt, et al., 1993, 27-51.

The more a substantive vision approaches the stage of taking concise actions, the more likely is conflict between the relevant actors. This point is important for policy on computer-mediated communication; the underlying interest coalitions are quite diverse, cutting across various industries, political interests, and consumer and civil rights groups. Especially the inherent contradiction between equity and efficiency is likely to result in a conflict between industrial and governmental actors. Industrial actors want to maximize profit and governmental actors have the constitutional task to provide equal access. Thus, when we examine the pursuit of substantive visions, we inevitably reject the classic version of decision-making theory that bases predominantly on the rational actor model. Rather, we consider both social and quasi-mechanical processes that derive from collective efforts, as well as organizational and bureaucratic issues within government.

Table 1.1: Examples of Substantive Visions on Computer-Mediated Communication within the Technological, Economic, and Political Domains

| Technological, the technically possible | Economic, the economically rational | Political, the politically desirable |
|---|---|---|
| modernization of computer-mediated communication | national and international competitiveness | mastering of economic crisis |
| standardization of computer-mediated communication | deregulation and liberalization | informational autonomy |
| acceleration of information exchanges | acceleration of decision-making | acceleration of bureaucratic action |
| greater availability of information | more intense utilization of information | larger information exchanges |
| flexibility of technical execution | greater labor productivity | humanization of the workplace |
| rational solutions by means of digitalization | rationalization: reduction of employment | protection of employment |
| rational solutions by means of fiber optics | rationalization: reduction of space and material | protection of natural resources |
| network and infrastructure security | data security | data protection |

Source: Bockholt, et al., 1993, 158.

The failure of the rational actor model of decision-making may be the reason that governmentally-propagated visions and the subsequent reality diverge in many cases. Table 1.1 outlines general substantive visions, partitioned into the technological, the economic, and the socio-political. Each vision can display important differences in underlying motives and incentives. According to a technological substantive vision, anything technologically feasible is worth undertaking and implementing. On one hand, the technological substantive vision underlies a supply side-oriented strategy: only what exists can be demanded. On the other hand, the technological development of society is largely an evolutionary process. When society fails to pursue certain technologies, some argue, they will fall behind vis-à-vis their competitors. In the economic substantive vision, the improvement of economic performance is the foremost priority. Superior information flows result in greater efficiency, better economic performance, and competitiveness, and therefore in a greater standard of living for all and profit for enterprises. The socio-political substantive vision concerns the improvement of democracy and its underlying prerequisites. On one hand, accessible politicians and institutions and more efficient bureaucracies make politics more accountable. On the other hand, informational autonomy can only be guaranteed when the central substantive vision concentrates on the freedom of the individual, and when his or her civil rights stand at the center of attention. Important is the recognition of the corruptibility of information and the protection of the individual against abuses.

”Motive coalitions” that incorporate all three substantive visions often develop, however, frequently these are fragile, constructed efforts [Bockholt, et al., 1993, 117]. Such coalitions attempt to connect the disparate motives of the groups involved to a homogeneous whole. In a study of the creation of an ISDN infrastructure in Germany, Bockholt et al. conclude that motive coalitions appeared quite frequently, however, these coalitions were based on rhetorical but effectively meaningless elements rather than on a clear and honest presentation of motives. Bockholt et al. observed that individual members, in an effort to hide their own motives, adopted the arguments of other coalition members. They also observed a hierarchical development of the substantive visions, with the socio-political one being only of ”marginal” importance. In early stages of the process, economic interests largely captured political ones. In later stages, with the debate becoming increasingly public, this partial substantive vision coalition disentangled. While all coalition members used common terms, as outlined in

Table 1.2, i. e. communication, information, immediateness, access and accessibility, integration, and individualization, they applied different meanings. Bockholt et al. argue that to prevent a situation in which a lack of coherent aims undermines cumulative long term aims, the individual members of the process should form a "grand substantive vision coalition" early in the process that considers all motives and interests. This is similar to the socio-political approaches outlined in this chapter, especially to Law and Callon's propositions on the obligatory point of passage.

Table 1.2: Substantive Vision Compromises and Associated Meanings

| Common Substantive Vision | Technological, the technically possible | Economic, the maximization of profits | Political, the maximization of power |
|---|---|---|---|
| Communication | telecommunications | office communication and advertisement | settlement of interests |
| Information | transmission units | factor of production | instrument of political influence |
| Immediateness | acceleration | temporal savings and cost reduction | direct contacts to electorate (among others) |
| General Access and Continual Accessibility | widening of service offers | employee control and guidance | flexibilization of the employment market |
| Integration | network control | expansion of informational use | information and media supervision |
| Individualization | perfection of telecom systems | optimization of employment | individual versus group power |

Source: Bockholt, et al., 1993, 159.

Grand motive coalitions, however, are difficult to establish, especially in the early stages of the development of a new technological system. First, the identification of the relevant actors is difficult. Second, even if they can be identified, it will be difficult to achieve a common position. Third, and perhaps the greatest constraint on such a grand coalition is the variation of interests *within* each substantive vision. Within the technological substantive vision, researchers, engineers, and whole research and development departments of enterprises compete for the enforcement of their particular view. Within the economic substantive vision, enterprises compete for contracts and orders. Within the socio-political substantive vision, politicians and political parties compete with each other for the achievement and maintenance of power.

Decision-makers often use visions to raise the salience of a particular issue area. These visions prompt a reaction by individuals, institutions, and enterprises, thereby initiating a public debate. Whether such visions can guide the decision-making process is not clear, as we will see in subsequent chapters. The more extensive such a vision is, the more actors it may draw into the decision-making process. On one hand, this may complicate the process. Those that oppose certain policies in a particular issue area may promote self-fulfilling prophecies that effectively obstruct the achievement of aims. Some might argue that a certain technological development path is ”bad”, leading to a wide rejection of these technologies, and thereby obstructing efforts that could overcome precisely the drawbacks that concurrently exist. For example, some argue that the Internet is inherently unsafe for economic transactions. As, however, no-one trusts the system, no critical mass of users can develop which is the prerequisite for technological developments and institutions, for example, user-friendly cryptography and certification and trust centers. On the other hand, a substantive vision may draw in actors that otherwise would be excluded or would enter the process only later, thereby strengthening the competition between those that contribute system components.[10] These actors are potentially those that, by their early involvement, prevent negative self-fulfilling prophecies. The empirical chapters will outline the substantive visions in the Triad and analyze their effects.

[10] This, in turn, may promote the development of technological artifacts that are later superfluous, thereby causing an inefficient resource allocation; see the subsequent section on technology policy and efficiency considerations.

# III) Technology Policy and the Changing Nature of Political Action

## A. Traditional Technology Policy: Technology Policy as a Component of Industrial Policy

### 1) Introduction and Definitions

Richard Musgrave defines three aims of a state: stability (of macroeconomic variables), distribution (of welfare), and allocation (of resources in an efficient manner) [1959]. The motive for industrial policy is strategic: the improvement of the relative competitiveness of a nation, a nation's regions, an industrial sector, or individual enterprises, as well as the enhancement of welfare of a nation or a nation's region. Paul Krugman and Maurice Obstfeld define industrial policy as "an attempt by a government to shift the allocation of economic resources" [1991, 281]. Pierre Buigues and André Sapir describe industrial policy as "the set of measures applied by governments to deal with the process of structural adjustment associated with changes in comparative advantage. It includes measures aimed at declining sectors as well as policies oriented towards the future" [1993, 21]. Chalmers Johnson adds the public policy *process*: industrial policy "means the initiation and coordination of governmental activities to leverage upward the productivity and competitiveness of the whole economy and of particular industries in it. Above all, positive industrial policy means the infusion of goal-oriented, strategic thinking into public policy. ... In more abstract terms, industrial policy is the logical outgrowth of the changing concept of comparative advantage" [1984]. Victoria Curzon Price defines industrial policy as "any selective government measure, or set of measures, to prevent or promote structural change *on a specific ad hoc basis*. Thus modern industrial policy aims at more than merely setting a general framework. It descends increasingly into the microeconomic sphere of decision taking that was formerly left to the price mechanism" [1981, 18]. More specifically, industrial policy includes "accelerating the structural transformation of domestic industry in a desired direction, improving the international competitiveness of designated products, encouraging the development of new technologies, smoothing the phasing out of chronically depressed industries, assisting the rationalization and reorganization of a weakened industry that is judged to have a chance for recovery, and protecting domestic employment in a particular industry" [Audretsch, 1989, 11]. In sum, industrial policy is principally a strategic reaction to changes in the relative position of an economy or economic sector within the national and global economy. Public policy has the purpose of altering the free market price mechanism to achieve a predefined reallocation of resources. According to the allocation aim, decision-makers provide incentives for private economic actors to produce goods and services and to reduce or eliminate negative externalities. According to the distribution aim, decision-makers allocate funds to prevent or abate the decline of economic sectors or regions; thereby improving the welfare of the citizens. Below we will see that the distribution and allocation aims tend to conflict: the distribution of public funds to specific industries or regions may reduce the overall economic efficiency of the allocation of resources. The allocation aim may also conflict with the stability aim: optimal efficiency may undermine the stability of macroeconomic variables, most prominently of employment.

Traditional technology policy shares similar aims; it is therefore a sub-set to industrial policy. A popular way of describing the innovation process is to divide it into base research, applied research, and experimental development. Base research is the conduct of research to achieve new scientific insights, applied research is the continuation of base research with the definition of specific practical aims, and experimental development is the application of the results of applied research to products, materials, methods, systems and services [OECD, 1980]. To overcome perceived failures in technological development, technology *policy* intervenes in particular stages of the innovation process. Evaluatory elements to determine the competitiveness of a country in high technologies include the level of spending on R&D, the R&D potential, the registration and usage of patents, the relationship between base and applied research, the transmission speed of research results, the educational standards, and the export share of high technology products [Grewlich, 1992, 37].

In most contemporary economic theory, technological innovation is seen as the precondition for growth. Paul M. Romer [1986] and Robert E. Lucas [1988] argue that technological advances have cross-sectoral benefits that give an additional push to economic growth and welfare. The motive for political intervention derives from the recognition of positive externalities and their role in the innovation process. In early stages, the innovation process displays a public good nature:[11] as the results of the early innovation process are of a general scientific nature, most of the time not patentable, and often with unintended results, enterprises cannot internalize the benefits of innovation. The research results are far from a market application, and open for any other enterprise to exploit; consequently, no individual enterprise has an economic incentive to conduct such early research as it is expensive but without tangible benefits that justify the investments. Thus, the private industry is unwilling to provide these public goods when others benefit from the provision without paying for them. Both applied research and experimental development concern products that are already in the pre-competitive and competitive stages. The results are patentable; this implies that they yield no external and public benefits, and the enterprise profits from its investments. Hence, enterprises prefer to conduct applied research and experimental development. The problem is that in such a situation, base research, which is the prerequisite for the conduct of subsequent stages of development, is neglected. With the conduct of technology policy, the state attempts to fill this vacuum. Nevertheless, the state is confronted by a dilemma: the results of base research are public goods also in an international sense as enterprises from other countries can exploit them as well, thereby undermining the strategic motives. If, on the other hand, the state promotes domestic applied research and experimental development, or even the market introduction of end products, it undermines domestic competition (the allocation aim) and potentially regional cohesion (the distribution and stability aims). In sum, in the context of the strategic conduct of technology policy, the state attempts to achieve at least four aims: international competitiveness and the three classic aims of stability, distribution, and allocation. According to classic economic theory, the achievement of a particular number of aims requires the consistent utilization of at least as many instruments.[12]

---

[11] For the seminal work on public good theory, see Olson, 1971 (1965).

[12] Jan Tinbergen, 1952, first introduced and applied this principle in terms of the achievement of internal and external balance. For subsequent developments, see Meade, 1952, Mundell, 1968, Swan, 1955, Corden, 1960. The context is the achievement of internal and external balance in terms of trade and monetary relations, and therefore relevant for the strategic considerations of decision-makers.

### 2) Instruments of Industrial and Technology Policy

One can distinguish between general and selective, or between passive and active instruments [for example, see Audretsch, 1993; Tyson and Zysman, 1983]. General and passive instruments impact the general economic framework and are therefore not discriminatory, in other words, they are public goods. The state can provide public goods such as general and higher education, general tax and investment incentives, infrastructures, support human capital and base research, and reduce bureaucratic or licensing obstacles. Or it can concentrate on macroeconomic factors, such as the interest rate, currency stability, and trade policy. These policies are normally subsumed under the heading *economic* policy, not industrial policy.

In the conduct of industrial policy, the state selectively and actively intervenes in the market or price mechanism by supporting individual companies or sectors. Two general policy types exist: (pro)active and reactive policy. (Pro)active policy supports the development of new industries by influencing economic structures. For example, technology and education policies are proactive when they focus on aspects that are integral to new technologies (for example, the introduction of computers in schools *with the appropriate educational guidance*). Reactive policy prevents that old structures decline (or decline excessively fast), often for social and welfare reasons to avert massive localized unemployment. A similar distinction can be observed between accelerative and decelerative policy, or between offensive and defensive policy [for example, see Hummel, 1993]. Accelerative or offensive policies concentrate on the creation of new companies, industries, and technologies. Decelerative or defensive policies promote rationalization, restructuring, or revitalization of declining industries or industrial sectors. In short, industrial policy does what the price mechanism would not achieve alone: a reallocation of resources for distribution and allocation purposes.

Decision-makers often provide direct subsidies. Direct subsidies directly promote the financial health of enterprises and can be regionally, structurally, company, or project oriented. The state can subsidize or save declining companies, finance investments in innovation, modernization or rationalization, sponsor specific research and development projects, provide direct assistance to regions with a concentration of declining industries, allocate project bound research funding, loosen or tighten competition policies to benefit certain sectors by, for example, allowing oligopolies to promote economies of scale, or alter the regulatory structure on health and safety requirements. The provision of public funds are so-called performance subsidies as they directly impact the production process. These can be either ”lost” subsidies, premiums, low interest loans, guarantees and warrants, preferential public procurement, or the granting of natural monopolies., or they can be exemption subsidies, the granting of tax rebates, and fee or contribution exemptions.

In sum, decision-makers can utilize a variety of instruments in their conduct of industrial and technology policy. However, the problem is the selection of the *appropriate* instruments for intervention. As already mentioned above, the conduct of industrial and technology policy is continuously subject to the contradictory nature of the stability, distribution, and allocation aims, or in other words, between enabling general economic welfare for all and improving the efficiency of specific industrial sectors or regions. In particular, the overall economic efficiency of a nation may be undermined when industrial policy aimed at rescuing declining industries or regions for welfare reasons, steers resources away from future industries of great potential.

### 3) Industrial and Technology Policy: Regional Implications and the Appropriate Level of Policy-Making

Regional policy is a subsidiary to industrial policy: it can be used to influence economic structures and performances by means of political intervention. Musgrave’s distinction of state aims can be applied to regional policy: the equality (distribution) aim has the purpose of reducing regional inequalities. The growth (allocation) aim is intended to exploit endogenous growth potentials of regions by creating a better infrastructure, supporting the development of structurally weak regions, and assisting regions that are hit by structural decline. The stability aim has the objective of promoting a balanced settlement of economic activities in the regions so that they are more able to survive economic downturns; one-sided regions (monoeconomies) are more strongly affected by recession or specific trends in the global economy than regions with a balanced mix of industrial activity. Theories of regional policy emphasize different methods to achieve these aims.

Neo-classical economic theory applied to the issue of regional divergence, argues that these aims can be automatically fulfilled by a functioning price mechanism without political interference, assuming that the economy undergoes technological progress and growth [Solow, 1956]. The freeing of factor and goods markets [Mundell, 1961; McKinnon, 1963], price and wage flexibility [Friedman, 1953], economic diversification [Kenen, 1969], and free capital mobility [Ingram, 1969], reduce regional inequalities and contribute to economic integration with a functional currency area. Comparative advantages in wages, land, or capital are the necessary and sufficient incentives: regions that provide one of these factors more cheaply than other regions attract industries that use this particular factor intensively in production, thereby contributing to the aim of welfare convergence. Political action can be limited to the elimination of market barriers.

Not all believe in the superiority of automatic stabilizers; a contrary argument is the polarization hypothesis. Gunnar Myrdal argues that ”the play of the forces in the market normally tends to increase, rather than to decrease, the inequalities between regions” [1957, 26]. According to the ”principle of circular and cumulative causation”, the economic performance of agglomerations is superior to that of the periphery because productivity increases cause a positive interaction between investment incentives, growth, and productivity [Myrdal, 1959; see also Krieger, 1985]. The periphery is unable to create an independent basis for growth (”backwash effect”) and becomes the ”extended workbench” of the center by undertaking medial work [Perroux, 1964, 193ff]. The center concentrates the production of high-value goods, while the periphery concentrates the production of low-technology products [for the international context between developed and developing nations, see Wallerstein, 1974]. Consequently, the periphery is subject to the swings of the business cycle as its products are easily imitated by competitors and therefore exposed to greater competition than regions that produce high-value goods.

An extension of the polarization hypothesis is the theory of growth poles. J. G. Williamson argues that a phase of divergence is followed by a phase of convergence [1975, 158ff, his arguments center on the North-South context]. The process proceeds as follows [see, for example, Nijkamp, 1989]: in the first phase following the removal of market barriers as advocated by the neo-classicists, demand for goods and services increases suddenly. Those regions with greater productivity levels, reserves, and excess capacities benefit the greatest from the static benefits of the removal of barriers. Dynamic effects also develop from which the stronger enterprises in the stronger regions benefit as well: they have the organizational capacities to expand their markets and to adjust their productive capacities to satisfy specific customer preferences. In the second phase, ”spread effects” develop to the benefit of the peripheries (congestion and/or other social and economic costs in the center), and the regions converge economically. However, two conditions have to be satisfied to achieve economic convergence: the peripheries must be able (economic and political infrastructure) and willing (economic risk-taking) to react to the rising demand, and must in time grow faster than the agglomerations.

Paul M. Romer [1986] and Robert E. Lucas [1988] argue that technical progress and innovation entail positive externalities. In contrast to neo-classical growth theory, however, these externalities benefit the center regions to a greater extent than factor movements benefit the peripheries. Market pressures are the principle source: productivity increases in the center, caused by innovation, and this overcompensates the wage pressures from the periphery. Consequently, despite the fact that the transaction costs of labor movements are high, labor moves into the center, while capital does not move to the peripheries where it would exploit lower wages. As already mentioned above, the argument of positive externalities is based on the assumption that technical progress and innovation are to some extent a public good. Spillovers to other sectors are likely. In the economic centers, human capital is used to both innovate and produce, while in the periphery it is used primarily for production [Grosman and Helpman, 1991, 1990]. Given the public good nature of technology, a technology transfer from the center to the periphery *would* develop, *if* the center would permit the periphery to free-ride. Instead, the center emphasizes production, and not research; thus the periphery cannot exploit its wage advantages to attract productive capacities.

These approaches to explain regional convergence or divergence entail policy recommendations. The neo-classical approach proposes to free the movements of input factors. The polarization hypothesis presents a pessimistic picture of the development of regions that are already behind; it performs as a model for an interventionist regional policy. The two-phase model suggests that temporary adjustment difficulties will eventually be overcome without active policy interference, provided that minimal political and economic infrastructures exist; in the case that they do not exist, they must be actively created. The growth approach places an emphasis on the necessity of base research as opposed to research in pre-competitive and competitive stages.

Even critics of industrial policy acknowledge and approve of its conduct during transitional periods for political and social reasons. No consensus, however, exists on the appropriate level of governmental policy-making, in federal systems, and especially in supranational political configurations such as the European Union. The extreme cases are the following. In a complete decentralization of technology policy, each country or region would support technologies that satisfy its specific needs. This strategy has the advantages that it can account for regional particularities and that it can optimize strategies to attract particular industries.[13] Critics argue that a decentralization of decision-making is simply inefficient as centralization yields scale effects: fewer people make decisions, learning is not redundant, and the costs of administration are smaller. Furthermore, when public goods have cross-border externalities, they may promote the free-riding of bordering regions [see, for example, Breton, 1970; Cornes and Sandler, 1986; Pauly, 1970; Sandler, 1980; 1992; Sandler, Loehr, and Cauley, 1978]. Moreover, a centralization of previously decentralized policy-making interactions may break up distributive coalitions [Olson, 1982]. However, Gordon Tullock argues that costs of public administration in a federal system are in form of a ”U” [1969]: on the low and high governmental levels, costs are high, and on the mediate level, they are low. Lower governmental levels have information problems, especially, in terms of the probability of research duplication [Dasgupta and Stiglitz, 1980], and the higher governmental levels are excessively inflexible in response to market transitions. A question is whether a second best approach is achievable by the relegation of regional policy to regional institutions. If the sectors in which taxes and subsidies are introduced are small in comparison with the overall economy, and if the particular sector marginal cost and benefit calculations differ substantially from the other economic sectors, then intervention may improve economic welfare [Mishan, 1962, introduced in Sandler, 1978, 32]. In sum, technology policy in its regional context calls for hybrid methods of execution and administration as both centralized and decentralized technology policies are sub-optimal; we expand on this point in the section on societal policy below.

---

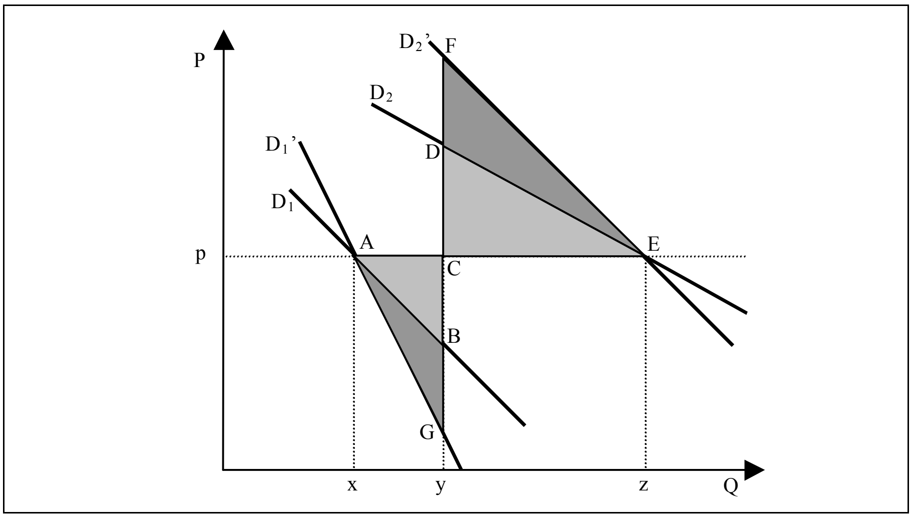
[13] However, evidence suggests that enterprises do not necessarily make locational decisions on the availability of economic assistance (for example, see Nerb, 1992, on the importance of locational factors).1

Until now, public goods have only been considered in the context of their provision, but not in the context of their public finance. Let me expand this issue by addressing what Mancur Olson has called the principle of fiscal equivalence [1969]. The principle of fiscal equivalence poses the question of which governmental level should have policy responsibilities to optimize the provision of public goods. Olson argues that an optimal provision of public goods can only be expected when those who finance them correspond in numbers to those who benefit from them. When those who benefit exceed those who pay, then the public good is likely to be under-supplied because the smaller group will refuse to provide benefits for the larger one (”free-rider effect”). Alternatively, when those who pay exceed those who benefit, then the good is also likely to be under-supplied because more persons are harmed than advanced (”forced-rider effect”). Thus, in a majority system without a social consensus, those projects are foregone that benefit less than half of the population. The implication of fiscal equivalence is that the great majority of taxpayers should benefit from governmental policies to ensure the sufficient provision of public goods.

A problem is that for each issue area, a different fiscal equivalency exists. As a ”second-best solution” [Lipsey and Lancaster, 1956], the state can attempt to approximate it. Most OECD-countries have developed means to provide public goods despite the lack of full fiscal equivalence, normally in the form of social, regional, or generational transfer contracts. When smaller groups benefit from public assistance more than the whole population, the purpose is often to trade transfer payments for social and economic stability. In federal systems, for example, in Germany and Austria, transfer payments from the more prosperous states to the less prosperous ones have the purpose of reducing regional inequalities, or, as in the United States, automatic stabilizers exist in the form of federal income taxes; those regions that are economically weaker also contribute less to the tax income of the federal government.

If one assumes the necessity of industrial policy in order to overcome transition problems, the initial economic divergence is highly important. The more a country’s regions, or as in the European Union, the member states, diverge in economic performances, the greater becomes the problem of fiscal inequivalence and resulting welfare losses. Figure 1.3 shows welfare losses as a consequence of the centralization of policies [Klodt and Stehn, et al., 1992, 10-12]. The demand for public goods between two regions is characterized by $D_1$ and $D_2$. The first region demands $x$ goods, the second *z*. The actual central provision of public goods is *y* as the central policy is likely to compromise between the preferences of both regions. Since both regions do not receive the amount of public goods that they prefer, the welfare losses are the triangles *ABC* for the first region and *CDE* for the second. Therefore, the greater the regional divergence, the greater are the welfare losses. The comparison of centralized and decentralized policy-making adds another dimension: Klodt and Stehn et al. argue that elasticity decreases the more centralized a policy is because information costs are higher than in a decentralized policy-making approach. In Figure 1.3, the demand curves $D_1$' and $D_2$' display a lower elasticity than $D_1$ and $D_2$; thus, the welfare losses increase to the area of triangle *ACG* in the first region and *CEF* in the second. In sum, when the initial regional divergence is substantial, the greater are the costs of central policy-making.

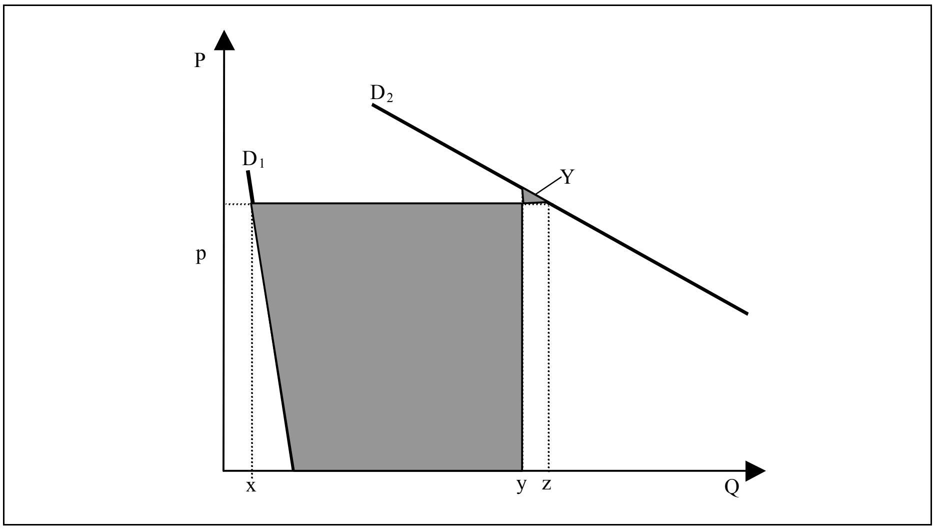
Figure 1.3: Welfare Losses as a Result of Centralized Policy-Making




Source: Klodt and Stehn, et al., 1992, 11.

The distribution of welfare losses changes when we apply the consequences of a centralized *technology* policy. If we distinguish between those regions that already concentrate economic activity and those that are more rural, it is probable that the former receive research assistance. They have functioning infrastructures (otherwise they would not have concentrated industries) and have vertical sectoral characteristics (for example, a large automobile producer is surrounded by support industries). Especially high technology industries are likely to be concentrated [Grewlich, 1992, 23]. Technological innovation requires large sums of capital for R&D that normally only the larger companies can afford. Larger enterprises have greater economies of scale, more effective distribution systems, and are closer to the principle markets. They can better survive the ever-shortening product-cycle by means of capital vaults. They combine base research and applied research, can better integrate production technologies, and are more likely to enforce technological standards.

Figure 1.4: Distribution of Welfare Losses with Extreme Initial Regional Divergence




Source: Klodt, 1989, 9; own adaptation.

For these reasons, those regions that already concentrate large high technology enterprises are those that primarily benefit from research assistance. The distribution of welfare losses is depicted in Figure 1.4. Rural regions are not eligible for research assistance because they have no companies that demand it. The demand curve is also much more inelastic: to attract one company to a rural area entails greater costs than to attract a company to developed areas, and the centralization of policies adds information costs when some regions have considerably less administrative and budgetary powers. Thus, cumulative welfare losses are greater than in regions that are relatively close in their economic development, and the less developed regions additionally suffer from the inelasticity of demand (compare the areas *X* and *Y*). Evidence backs up this hypothesis: structural funds go mostly into poorer regions; R&D funds, however, mostly into the richer regions [Franzmeyer, 1991]. Consequently, when no transfer mechanisms exist, the regions that do not concentrate economic activities carry a greater burden than those that do. Technology policy in its regional context is therefore a case of fiscal inequivalence, especially, when the initial degree of divergence is great and when state assistance focuses on direct technology policy rather than on basic infrastructure measures.

In sum, while centralized technology policy has efficiency benefits, it is likely to counteract the regional cohesion aim. In economic integration without clear political competencies, such as in the European Union, technology policy is especially problematic when central and national policies coexist. The individual members of the integrating region do not only compete on the global scale, but also with each other. When technology policies benefit those that are already strong, perhaps because national technology programs and subsidization have been historic practice, the cohesion aim is not served. In contrast, countries with a higher degree of economic convergence experience fewer disadvantages in their conduct of a centralized technology policy.

4) Technology Policy in Large and Small Countries

No consensus exists on whether small countries are advantaged or disadvantaged in the technology race.[14] Some argue that small countries have no influence on international markets, are unable to achieve sufficient economies of scale, have no or only few global enterprises or multinationals, and have insufficient domestic markets to sell their products. Others argue that small countries are more flexible to respond to external economic challenges and can therefore exploit the opportunities of markets in transition. They generally have open markets and are able to circumvent the economies of scale problem by expanding their export base.

Evidence suggests that small countries spend less on R&D, but not necessarily per capita [Walsh, 1988, 42]. Less total spending forces the adoption of two strategies: either decision-makers spread R&D assistance more thinly over all technologies, or they promote only a few selected activities. Evidence on Australia points to a paradox situation that the lower the availability of funds in smaller countries causes them to

---

[14] I assume the following differentiation between small and large countries: large countries have a large population, high total GNP, and a high per capita income. For example, according to that definition, large countries are the United States, the European Union, and Japan, but not Russia, Brazil, China, or India. Small countries have smaller populations and a lower GNP, but not necessarily a lower per capita income. For example, smaller countries are the Netherlands, Austria, and other West European countries, but also countries such as Australia, New Zealand, and Canada. France, Germany, and Great Britain are medium-sized countries. In sum, I compare between larger, medium, and smaller developed OECD-countries, not including developing countries.

spend more on base research [ibid.], despite that base research constitutes a public good that foreigners can exploit. Theoretically, smaller countries cannot internalize and exploit their base research results to the extent that larger countries can. Larger countries can benefit from base knowledge better because they can apply it to a greater variety of products and they also have greater production capacities. Nevertheless, the principle reason for the concentration on base research is that it is cheaper; it is better to conduct some research than none at all.

A disadvantage of small countries that attempt to build a high technology product base is that a small country often lacks a sufficient user base:

> The proximity of the users to the suppliers of an innovation plays an important role in the design and de-bugging of new products, especially high technology products. Indeed, many expensive, high technology innovations involve collaborative development work between supplier and user. For this process to be successful, or even possible, the supplier needs ready access to a reasonably large constituency of potential users with the complete range of skills necessary to apply the innovation successfully or the expertise necessary to formulate problems for the innovator to solve. In a small country this may not exist, or the necessary users might be in other countries [Walsh, 1988, 40; see also Lundvall, 1983; 1985; 1986].

Another disadvantage of small countries is that the small research base limits the opportunities for scientists who, as a consequence, often move to countries with greater opportunities. This is especially the case when the country hosts few research institutes or when the research institutes have a relatively narrow research focus. Larger countries that have a wider selection of research facilities are more attractive; these facilities may be able to coordinate the different facets of similar problems or applications, and able to coordinate base and applied research. Thus, if a small country invests heavily in general education, it may benefit little from this investment. Furthermore, when researchers do not emigrate, they nevertheless maintain an external orientation. Vivien Walsh summarizes:

> The absence of national research groups of a workable size has left the isolated researchers to orient their efforts towards the international scientific community, and to be involved in pushing back the scientific frontiers on an international scale. Thus turning towards the international community takes place at the expense of developing an ability to develop, orient, apply and diffuse science and technology towards the solution of problems and meeting of needs within their countries. In addition, the 'international science' is most likely to be concentrated on the most abstract and theoretical ideas, while innovation-oriented R&D is more likely to be the

> private property of business enterprises. Researchers are often keener to publish theoretical papers abroad than apply their knowledge at home [1988, 44; see also OECD, 1984].

Whether the combination of these factors indeed leads to disadvantages in small countries and causes the larger countries to dominate high technology trends, is questionable in practice. An advantage of small countries is that they can develop flanking strategies to promote the usability of high technology and exploit their potentials more quickly than a large country. Small countries also have open markets that force them to build an infrastructure to facilitate their own position in the global economy. The smaller markets force domestic producers to respond to international developments at an earlier stage than producers in larger countries because in smaller countries the higher import penetration forces competitive pressures. For example, those smaller countries with large telecommunications enterprises and multinational corporations (MNCs) tend to have a high export orientation and can lead technological innovation (the Netherlands, Sweden, and Finland have proven to be innovative leaders in this sector).

To upgrade its competitiveness in high technologies, a small country could emphasize the following research and development strategies, even in the context of relatively large R&D programs:

- areas where it is important for the small country to pursue an indigenous R&D effort to meet its social and economic needs;
- areas where current R&D makes it natural to establish ‘axes of penetration’;
- areas in keeping with the small country’s R&D capability regarding cost, manpower, type of activity, and field of science and technology;
- areas useful to a strategy for strengthening the small country’s position relative to the international division of labor [Kristensen and Levinsen, 1978, 53].

K. Green has suggested a strategy that emphasize an ”industrial and community consensus” [1985]. The government should assist technologies that are:

- fundamental to the next generation of technological developments;
- applicable across a range of industrial and economic sectors;
- particularly important for small domestic markets;
- able to reinforce and extend areas of comparative advantage;

- able to contribute to the development of high value added products, processes, and services for export markets; and
- offering prospects of establishing new job generating industries based on new products, processes, and services.

A third strategy is to concentrate on market niches and to create special products for endogenous applications: specialized applications of basic technologies that have low market entry costs and low economies of scale [Walsh, 1988, 53-54]. Either the small country or the enterprise within can purchase the base technology or license it. Rob van Tulder and Gerd Junne argue that some applications are produced decentrally because some markets base on particular domestic conditions [1988]. And finally, Granstrand and Sigurdson have identified four strategies for successful government procurement in small countries [1985, 10, cited in Tulder and Junne, 1988, 172]: first, the procurement object corresponds to a considerable societal need; second, an institution has to exist with the authority to lay down the specifications of the product (service) and to procure centrally for the needs of the society; third, the central body has financial resources not only for ordinary procurement but also for ordering technical development; and fourth, the central body has a sufficiently high technical competence in order to make design specifications and collaborate closely in the development, for example, by testing the equipment produced.

In the context of this study, the small-large country problematic is less relevant for the United States and Japan. It is, however, highly relevant for the European Union as it combines countries of different sizes and economic performances. These factors complicate decision-making, as regional, structural, and technology policy entail contradictory implications in terms of the classic distribution, allocation, and stability aims of the state.

### 5) Technology Policy and Multinational Corporations

The reasons for international research cooperation between multinational corporations (MNCs) are multiple [Tulder and Junne, 1988, 217-221]. First, companies cooperate to share risks. Risk sharing is advantageous because enterprises often cannot predict whether products are technologically feasible or profitable, whether they can recover R&D costs when the market share turns out to be insufficient, or whether the markets accept the products at all as other standards may excel. Cooperation splits the risk of patent litigation, the risk that pending patent litigation restricts market access, or the risk that a product fails to pass a certain regulatory framework. Second, cooperation can circumvent protectionism (for example, in the case of the European Union, cooperation between European and American or Japanese corporations). Third, to exploit potential multiple applications of a technology, a company requires a partner that already has competencies in this field (to internalize what would otherwise be an externality that benefits all). Partners may share complementary technologies, for examples, opto-electronics and telecommunications applications. Cooperation may enable the incorporation of individual applications to form a system as systems often sell better the more complex the components are because they guarantee compatibility. Fourth, the agreement on common standards in the early development phase prevents a waste of research resources. In sum, a number of reasons speak for a cooperation between enterprises.

In the conduct of industrial and technology policy, decision-makers have historically favored large enterprises:

> the bulk of public R&D support has gone mainly to assist development activities in large companies. Most of these funds have been concentrated on large, prestigious projects in a few sectors of industry (aerospace, computers, defense, nuclear energy); of the remainder, a significant proportion has gone in support of marginal, relatively low market potential projects of the sort that the large companies would not themselves fund wholly out of their own resources.... In the case of private sector industrial support, in most countries loans and equity participation has also been concentrated in large companies. Thus, finance for the technological development activities of small firms generally has been scarce during most of the post war era [Rothwell and Zegveld, 1985; cited in Tulder and Junne, 1988, 183].

The emphasis on large enterprises derives from the strong lobby powers of large enterprises and MNCs, from historical links between governments and these enterprises, and often on the basis of the argument that this emphasis limits bureaucracy and raises the overall efficiency of administrative efforts. Governmental advisory boards often consist of representatives of large enterprises, especially when the projects are large.

Critics argue that the preferential treatment of large enterprises is collusion, leading to excessive market concentration, to a reduction of competition, and to a pursuit of projects that are only second or third best in the context of international competition. Foremost, the emphasis on subsidizing larger enterprises harms smaller competitors, as van Tulder and Junne argue: ”The intricate interrelationship between the public administration and the larger companies makes it difficult to realize a shift of subsidies in favor of smaller companies. New political priorities are not enough. The whole institutional apparatus would have to be geared explicitly towards such a goal. The promise of large support for the creative potential of small and medium sized enterprises otherwise will remain purely theoretical” [1988, 185]. This preferential treatment is especially problematic as smaller enterprises often prove to be more innovative and more responsive to market developments. Furthermore, MNCs, by definition, are multinational; should decision-makers support these enterprises when part of the research funds leave the country, thereby causing fiscal inequivalence?

The historic preferential treatment of larger enterprises does not necessarily imply that no private provision of these public goods exists. Large corporations, in particular, often finance base research either by conducting it within the enterprise or by initiating research foundations with preferential tax treatment. A corporation may have the following motives [Vetterlein, 1991, 128]: base research may benefit own ”strategic” research, even if only indirectly, by stimulating researchers’ interest or by additionally training young scientists. Results from base research may also be at least partially patentable, and if not, time and experience advantages may justify the costs of base research. Base research may be tax deductible. The latter point, in particular, raises the question about the justification of the financial assistance for large corporations.

MNCs can also assist in overcoming some of the disadvantages that small countries experience. For example, in the Netherlands, Philips’ ”position as the third largest producer in the world of micro circuits gives the Netherlands the possibility of developing a national strategy based on a fairly significant contribution on the supply side of industry, although in fact Dutch IT policy seems to be oriented towards cooperative ventures” [Walsh, 1988, 54]. Not only own MNCs are important, however, but also foreign MNCs that conduct research operations in the country. For example, in the Netherlands three-quarters of all industrial R&D funding was undertaken by five MNCs [Freeman, 1988, 80]: ”this meant that in particular industries, firms in the small countries were able to attain the high threshold levels of R&D necessary for effective international competition in product and process development”. However, the pure location of an MNC is not a guarantee to overcome the small country disadvantage.

Often, MNCs restrict the conduct of research and development to their home bases. This creates no external effects for the host country. Even when the home base lies in the small country, it is no guarantee that the MNC conducts important R&D at home. It may still conduct R&D in a larger country to exploit the greater opportunities in such a country, both in terms of research capacities and in financial (subsidies) and market access (government procurement) opportunities. Thus, ”if large firms in a small country place their laboratories elsewhere (as has often been threatened) this would have considerable impact on the small state’s power base: it might instantly be stripped of 10-20 per cent of ‘its’ research capacity” [Tulder and Junne, 1988, 157]. Walsh argues:

> The danger of cooperation agreements in cases where large and small, or in particular more and less developed countries are the partners, is that some partners may use the cooperation as a substitute for independent development effort, with the possibility of firms in one country developing into little more than ‘screwdriver factories’ for the firms in other countries, with no increase of technical capacity in the first country, but in fact a reduction in the long term [1988, 58].

For example, only state subsidies prevented Philips from relocating its R&D activities. In sum, state assistance for MNC may backfire and consume more costs than accrue benefits. This is especially the case in small countries as they have considerably less bargaining power as opposed to a larger state.[15]

In the era when telecommunications research was a matter of public procurement (an era which ended in many OECD-countries in the late 1980s and early 1990s), it was important to consider whether governmental agencies have their own R&D and manufacturing capabilities. When governmental institutions have such capabilities, they retain a stronger position *vis-à-vis* their suppliers, for example, they have greater bargaining power *vis-à-vis* MNCs that pursue R&D in the context of their *international* strategy. They can create standards that integrate non-economic concerns. They can compare prices, and do not have to submit to the demands of particular MNCs. In contrast, Edgar Grande and Jürgen Häusler argue that when the government directly conducts research, it loses the capability to influence R&D in enterprises [1994, 500-501]. Furthermore, assuming a functional technology transfer from the state research institution to the enterprises, the latter may not be capable of exploiting the

---

[15] To circumvent such a possibility, some propose that small countries should form alliances with each other to offset the small country disadvantage. See, for example, Dalum and Fagerberg, 1985.

research results as they could not gather fundamental process know-how that research conduct yields. This is indeed an important critique, especially as technology transfer has been gaining attention in recent years. Governmental institutions, however, most often conduct base research; the question arises whether enterprises would conduct such research at all, especially if we consider the discussion above of public goods and the difficulty for enterprises to internalize their benefits.

The role of MNCs in relation to technology remains a highly complicated issue, especially with a higher degree of economic globalization. They retain strong bargaining power in their relations with individual governments as they can threaten to close their subsidiaries in the country in question or to open new ones in other countries. Nevertheless, as we will see below, recent technology policy is less responsive to the demands of MNCs.

6) A Critique of Industrial and Technology Policy

Critics of industrial policy argue that the provision of direct subsidies violates the allocation and efficiency aims. They question whether the benefits are indeed larger than the direct and indirect costs of subsidization. State intervention distorts the functioning of markets and price mechanisms, causing an inefficient allocation of resources. Decision-makers encounter an information collection problem: they do not have more and better information than thousands of market participants and millions of customers [Hayek, 1975]. For industrial policy to be effective, decision-makers would have to know what the future key industries or market conditions are going to be. They would have to predict future demand and subsequent enterprise or industry performance. The consequence of this informational problem is that the decision-makers inevitably make errors on who and what to support, leading to the movement of capital, and human and natural resources to protected sectors. This harms other sectors as they have to increasingly compete for these resources, causing input prices to rise. Furthermore, interest rates rise because of the ‘crowding-out effect’ of governmental debts to which subsidies contribute. Henning Klodt puts forward three primary reasons for the lack of success of traditional technology policies: an excessive focus on technological aspects instead of product revenues, the likelihood that erroneous decisions are not corrected; and ”adverse selection”, which is the subsidization of research that enterprises evaluate as too risky to conduct themselves [1992, 311].

Technology policy is also problematic in its international context. On one hand, to delegate research assistance to lower levels of government may cause a national subsidization race between regions as the central government is increasingly unable to control subsidization activities by its lower levels. On the other hand, assuming central control, research assistance may become part of strategic trade policy to gain a comparative competitive advantage *vis-à-vis* other countries or regions [Spencer and Brander, 1983; Krugman (Ed.), 1986]. Technology policy raises the possibility of international subsidization races and retaliation, both contributing to a decline of general welfare. Klodt summarizes the situation in the late 1980s:

> It is a matter of fact that the industrial countries are in a subsidy race in the area of technology policies. Public research assistance concentrates worldwide on a few and identical areas – microelectronics, atomic energy, and aviation and space. Much more money is invested in research than is beneficial in welfare terms. Technology politicians are obviously in a situation in which they can gain little, but in which nobody wants to take the first step in the reduction of subsidies [1989, 11].

In enterprises, subsidization may lead to a rent-seeking mentality and the specialization on how to receive subsidies. Consequently, companies waste resources that they otherwise would invest in production or research. For example, a study in the Netherlands showed that of 27 large enterprises at least 20 of them had ”subsidiologists”, employees or departments who specialize in contacts with governmental officials and institutions [*De Volkskrant*, April 1, 1986, cited in Tulder and Junne, 1988, 184]. The active coordination of research efforts, another popular form of state assistance, may eventually lead to mutual dependencies and a reduction of competition. Similarly, the subsidization of certain companies and sectors entails no realistic assessments of personal risk; when the subsidized company fails, the taxpayer carries the burden. Furthermore, especially larger companies undertake the same projects regardless of whether assistance is granted. When they do receive assistance, they reap benefits without an economic basis or necessity.

Political motives for state assistance, such as the reelection motive of politicians, often cause the provision of subsidies that have short-term benefits but uncertain long-term consequences. Similar to the lack of risk assessment in enterprises, if an assistance program fails because of bureaucratic inability to predict market conditions, the taxpayer has to pay for the conditions that decision-makers have caused.

Those who emphasize the geopolitical and geoeconomic nature of international relations (improved economic competitiveness or a wider power base of the nation) frequently argue that the lack of homegrown high technologies causes a dependence on foreign suppliers and is therefore a national security problem that has to be countered by an active technology policy. One fear is that foreign monopolists can overcharge enterprises in other countries for high technology inputs for end products. For instance, some fear that if a country does not have a domestic production of semiconductors, it may not be competitive in those end products that integrate this technology. This may threaten the competitiveness of the nation's enterprises and may cause domestic unemployment and a decline of the standard of living.

Economic theory accounts for the existence of temporary monopolies; however, even monopolies based on patents are not likely to last indefinitely [Klodt, 1992]. Patents expire, or other enterprises circumvent them with similar products that have alternative designs or features. Furthermore, those who cite the dependency argument on foreign technologies fail to consider the operational mode of the contemporary global economy [Junne, 1992]. First, they underestimate the economic development dialectic: it is highly questionable, for reasons mentioned above, that one country is able to maintain a permanent comparative advantage in high technology products. That monopolies automatically enable enterprises to implement secondary monopolies in consumer products assumes that these companies also have a comparative advantage in those industries, a situation that is unlikely to persist in the long run. Another cause for the persistence of monopolies, an inability to implement the public good of base knowledge because of a lack of qualified personnel, is not found in OECD-countries. Furthermore, technological knowledge increasingly becomes a highly mobile factor that cannot be simply contained for political or economic reasons. Second, some overemphasize the importance of highest technologies and underestimate customization and differentiation of less-than-highest technologies. Christopher Freeman argues that ”it is *not* necessary to have a technological and production capability in *all* the major new products associated with a new techno-economic paradigm in order to catch up or maintain competitiveness. What is necessary is to have the capability to *use* the new technologies in some industries and to produce a part of the wide range of new products and services appropriate to local conditions, resources and comparative advantages” [1988, 78]. Third, strategic analysis fails to consider the high risks of closed markets to producers: it is not in their interest that their product be abused for strategic political or economic purposes because this may threaten their own revenues. Fourth, the alleged dependence on high technology products is often alleviated by existing production capabilities for these products in the country in question, even if the producers are foreign-owned. Fifth, those who argue for an aggressive approach to high technology assistance underestimate the effects of global interdependence. Large enterprises that are subsidized often are multinationals, or at least they conduct a strategic alliance with other large companies from other markets. Thus, technology policy does not yield the desired effects because part of the research results are externalized. Sixth, the importance of vertical integration is often overestimated. Some argue that the success of Japanese enterprises results from the intra-company application of high technologies. However, not only Japanese, but American and European companies are vertically integrated. IBM uses its complete chip production for its own products, Microsoft is currently acquiring enterprises on a massive scale, and Siemens is perhaps the most vertically integrated company in the industry. Seventh, it is not always the technological advances that ensure success, but other factors such as work organization or the marketing capabilities of an enterprise. In sum, the thesis of technical dependence is unconvincing, at least in the context of the relations between developed countries.

### 7) Institutional Competition: A Viable Alternative?

The proposition of institutional competition is a neo-classical alternative to active industrial and technology policies that has regained considerable attention in the integration context of the European Union [for example, see Siebert, 1989; Siebert and Koop, 1990; 1993. For theoretical groundwork, see Buchanan, 1950; Tiebout, 1956; Rothenberg, 1970; Oates, 1972]. Institutional competition describes a situation in which different local or national governments compete to attract economic activity. Each region concentrates on its comparative advantages, depending on its labor, land, and capital endowments, as well as on its political endowments. Political endowments include laws, market regulations, economic policies, political stability, and more specifically, the level of capital income taxation, corporate taxation, infrastructure, education, and others. The economic reasoning behind institutional competition is that it creates arbitrage incentives for households and enterprises. Enterprises move to where they enjoy lower levels of regulations or taxes, or households prefer to buy in the country or region with the cheaper products. In the international context, locational arbitrage causes a competition between national regulatory systems as ”immobile factors of production compete for those factors that are internationally mobile by providing favorable conditions for production” [Siebert and Koop, 1993, 2]:

> Locational arbitrage results from the interplay of mobile and immobile factors of production and endowment. Immobile factors, including the institutional setting, determine the price of the mobile factors before arbitrage takes place and thus influence the attractiveness of a region (nation). After arbitrage, prices for mobile factors should be equal. The arbitrage of consumers and firms will show which national regulatory system is best in the eyes of the consumer or the producer: national regulation has to pass a litmus test of private agents voting with their purses and with their feet. Apparently, there will be pressure on national regulations to adjust over time [Siebert, 1990, 56].

Enterprises that specialize in products with a high labor input move to regions where labor is cheap and where labor-related costs are low (for example, a low social security payment employers’ share). Conversely, if an enterprise specializes in high technology products, it may prefer a framework that promotes higher education and a modern telecommunications infrastructure. The point is that in such an approach, the comparative advantages of enterprises coincide with the regions' comparative advantages. In short, institutional competition constitutes a market for institutional arrangements where governments compete.

The advantages of institutional competition are the following [Siebert and Koop, 1990, 2-10]: first, it reduces the influence of tight lobby groups that base their influence on the diffusion of their opponents. According to Mancur Olson's theory of collective action, tight special interests have an advantage in lobbying. In comparison, large and diffused groups are less able to organize; the costs of elaborating a common position exceed the benefits of lobbying [1965; see also 1982; 1987]. Second, institutional competition implies less bureaucracy in the center, promotes experimental and innovative activities of public authorities, and thereby contributes to an improvement of the services offered [Oates, 1972, 12; Brennan and Buchanan, 1980]. Third, the necessity for difficult bargaining declines as no overarching or supraregional agreements are necessary. Fourth, institutional competition adds an additional check on governmental officials as the market punishes misuse or abuse of power, prestige, and income maximizing individuals. In short, the advantage of institutional competition is, its proponents claim, that it approximates fiscal equivalence.

Critics of the principle of institutional competition argue that it either leads to strategic behavior of governments to maximize the welfare of its particular constituency, or to zero regulation. (Regional) governments are involved in a competitive game of ever-increasing subsidization of economic activity that leads to subsidization levels where the costs exceed the benefits for all involved [Klodt and Stehn, et al., 1992, 30-31], both in the national and international contexts. This argument is one conclusion of the ”new paradigm” of modern theory of international trade that describes the rise of strategic trade policies [Helpman and Krugman, 1985; Krugman, 1987]. Governments ”create” a comparative advantage by supporting education, investment, R&D, and infrastructure, thereby attracting highly dynamic industries. This is not bad in itself as it adds to overall welfare. For example, Michael Porter argues that economic clusters are a necessary precondition for growth [1990]. Such strategic conduct, however, adds to political difficulties within and between countries because some regions are not as competitive as others. The consequence is that some regions concentrate dynamic economic activity, while others are left with low value economic production; regional disparities may rise even further. This situation arises also in the context of bordering regions, for example, on one or the other side of the Rhine between France and Germany; locational arbitrage *within* a country also has *external* consequences.

In institutional competition, (regional) governments can also compete to eliminate obstacles to economic activities, for example, pollution controls. The fear is competitive deregulation, ultimately causing harmful zero regulation. Some regions could become poor and polluted shanty regions. The advocates of institutional competition reply that the acceptance of certain negative externalities entails opportunity costs [Siebert, 1990, 62-68]: for example, higher pollution reduces the quality of life in this area. Either the region’s policy-makers will increasingly tax pollution, and thereby contribute to the convergence with other regions' regulations, or they accept the opportunity cost. Furthermore, a region with lower tax income can only offer fewer public goods or it may have to incur a higher public debt. Some regions may be uncompetitive with any setup. A preliminary agreement that decides on basic rules on economic behavior, outlines a transfer modus, and sets caps or floors on certain governmental activities, could overcome this problem; however, this is a complicated task in federal and especially supranational contexts and it opposes the logic of institutional competition.

8) Conclusion

What emerges from this discussion is a critical, but inconclusive picture of industrial and technology policies. Several number of reasons speak against active industrial and technology policies that utilize direct and selective instruments. Even if such policies have short-term benefits, the long-term costs are likely to outweigh the benefits. Any governmental policy entails certain tradeoffs and risks. First and foremost, the information problem on future markets and demand is especially prominent in high technologies. Governmental decision-makers are likely to connect economic aims with political motives, thereby undermining the economic cost-benefit relationship. Assisted enterprises, especially the larger ones, may undertake the same projects even without assistance. The coordination of research efforts creates alliances and reduces the competitive interaction between companies. Smaller companies often do not qualify for assistance because they lack productive capacities. In sum, any technology policy entails the risk that it causes a misallocation of resources. Especially regarding technology policy, this factor is important: technological innovation requires massive investment; the question is to what extent the benefits outweigh the costs, if at all. Another question is, assuming that a country decides to pursue an active policy, which governmental level should do so?

For decision-makers, the principal conclusion is that the effectiveness of policy is highly situational, especially for technology policy, as the instruments may have differential effects in different contexts: decision-makers need to consider the initial domestic regional divergence, the presence of larger and smaller enterprises, the underlying size and structural setup of the country, and the country's position in the global economy. The creation and support of internal competition, however, has not been the priority of technology policy as a component of industrial policy. As we will see in the next section, decision-makers place an increasing emphasis on competition within the country; internal competition raises international competitiveness, not the success of a few privileged enterprises.

## B. Societal Technology Policy

Societal technology policy diverges from the aims, methods, and instruments of industrial policy and its subsidiary of traditional technology policy. Several factors have contributed to the declining effectiveness of traditional technology policy. Multinational enterprise networking, mergers and acquisitions, joint ventures, and strategic alliances have limited the effectiveness of traditional, nationally-oriented technology policy. Shorter product cycles, greater expenditures on research and development, increasing technological complexity, and turbulent global markets have led to a restructuring of enterprises and production processes [Grande and Häusler, 1994, 508]. Greater technological complexity has promoted an inclusion of an ever-increasing number of governmental institutions and other actors, horizontally and vertically, causing considerable coordination problems. In short, the framework for technology policy as a component of industrial policy has changed significantly. These factors have not only altered the decision-making capabilities of governmental actors but also the role of the state in the technological development of society.

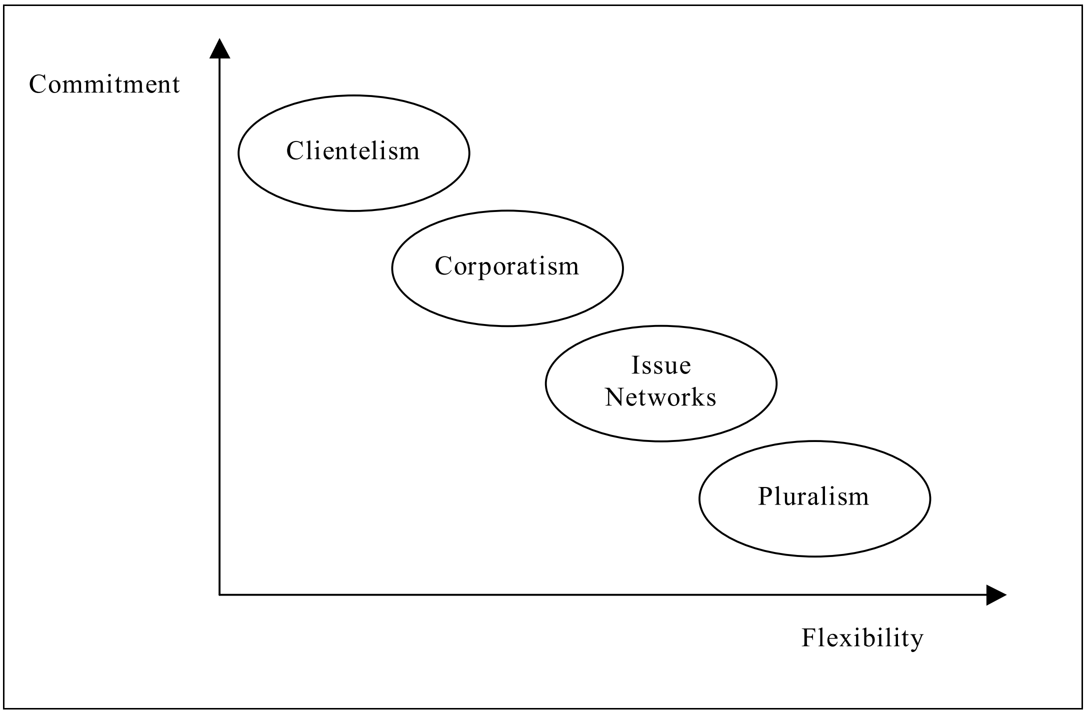
What distinguishes today's processes of building complex infrastructures is that the state has in the past either controlled this process directly or indirectly by means of government procurement and price and fee controls. With this supervisory role, the state was able to promote economic efficiency *and* social equity. Today's efforts to build a new communications infrastructure proceed in the context of deregulated markets with globally-active corporations. Governmental decision-makers have less direct power and influence. Simultaneously, they have the constitutional or democratic mandate to guarantee the equality of opportunities. In sum, the rising complexity of technologies and the declining controllability of them places special demands on technology policy.

Societal technology policy does not only depend on material technology (the product itself), but also on ”relational technology” [Rammert, 1989]: ”Technological progress is [..] a process of combined techno-organizational and socio-cultural innovation” [Schienstock, 1994, 6]. Not only does technological innovation require parallel societal change [Perez, 1987], but technologies must also be socially-compatible in a wider sense. Richard Badham argues that this ”is indicated by the numerous calls for an increase in funding of diffusion and technology transfer, the adoption of a more ‘systemic’ approach to science and technology policy, the establishment of radically new links between the education and industrial systems, the promotion of new ‘organizational technologies’, the integration of energy-saving concerns with economic-oriented technology promotion, and the establishment of more ‘proactive’ forms of technology assessment” [1994, 26]. Gerd Schienstock adds that the state has to redefine its role in the development of technologies, away from predominantly strategic military or economic concerns towards a greater social accountability of technologies:

> It would certainly be asking too much to assign to the state the role of central societal control – including the definition of basic technological developmental lines, the establishment and administration of comprehensive research and development programmes, and the control of knowledge application at the level of society. One factor would be the immense coordination problems involved in such a process. In addition …, it is these very technical qualification barriers involved that presently speak against such state dominance in the technological innovation process. Thus, a reorientation of public [research and technology] policy must in the first place be accompanied by a redefinition of the state’s role in the technological innovation process. This should primarily be based on coordination, integration and information. There is more or less unanimous agreement in professional literature that public [research and technology] policy can by no means be restricted to either supporting technological knowledge or to controlling its application. It seems to be the state’s central task to create a consensus on socially-desired and undesired lines of technological development – not least because of the far-reaching social consequences primarily due to the systemic character of new technologies. At the same time, this means that new decision-making structures should not only aim at integrating external expertise but also more at incorporating democratic elements [1994, 18].

The consequence is that a principle future role of the state is to raise the acceptance of modern technologies by altering its activities from direct and active assistance to regulating the technological and economic environment [Braun, 1994, 123; see also Anderson and Lundvall, 1988]. This implies that decision-makers reduce their commitment to individual enterprises (”clientelism” and ”corporatism”) and increase their flexibility by forming issue networks and pursuing a pluralist approach [Grande and Häusler, 1994, 514; see Figure 1.7].

Figure 1.7: Models of Interaction between Public Institutions and Private Enterprises




Source: Grande and Häusler, 1994, 514.

The advocates of societal technology policy argue that governmental activities should be restricted to general and passive policies which concentrate on the stability of macroeconomic variables and on a basic legal and economic framework achieved by regulatory policy. Frequently cited elements include the elimination of market flaws (unclear property rights, monopolies, cartels, unwarranted distribution of funding), the focus on passive industry assistance (infrastructure improvements, general R&D subsidies, investment tax allowances), the improvement of human capital (education, retraining), and the promotion of informational exchanges. Research and technology foundations, conventions, the dissemination of foreign trade information, founder and technology parks, risk capital, technical transfers from research centers or universities to individual enterprises, have all been popular instruments among policy-makers. These activities have the principle purpose to open the dialogue between producers and potential users, for example, in the form of institutionalized technological assessment processes.[16] Furthermore, instead of investing in the development of particular products, technology policy could concentrate on the *application* of certain innovations instead of only promoting their production. For example, the promotion of computer-based communication systems may promote a fundamental social change. Such an approach would have fundamental secondary effects in form of a new era of information exchanges. After all, what is the benefit when a country has the most advanced technologies if they are too complex and too expensive for the mass of the citizens?

Table 1.3: Traditional and Modern Technology Policy

| | **Traditional Technology Policy** | **Modern Technology Policy** |
|---|---|---|
| Object | Material aspects (material technology) | In addition, organizational, institutional, and cultural aspects (technological practices) |
| Objective | Economic growth | In addition, social and ecological compatibility |
| Stage of technological innovation process | Stages of little bearing on the market (primarily fundamental research) | Also stages closer to the market (technology transfer) |
| Policy integration | Part of economic policy (largely implicit R&T [research and technology] policy) | Independent policy-field closely interlinked with other policy areas (increasingly explicit technology policy) |
| Role of the state | Central actor of technological innovation process | Facilitator and coordinator of the self-regulation of the innovation process |
| Instrument | Support, regulation | Provision of infrastructure |
| Policy type | Direct control | Context control |

Source: Schienstock, 1994, 21.

In sum, the societal definition of the purpose of technologies is slowly changing from a primarily strategic orientation to one that emphasizes societal factors such as

[16] One example is ”Constructive Technology Assessment”, supervised by the Netherlands Organization for Technology Assessment (NOTA). See van Boxsel, in Aichholzer and Schienstock, 1994. For another

education, infrastructures, information transparency, access to governmental information, and the leveling of the playing field for all enterprises regardless of their size. Societal technology policies may ”be conceived as policies designed to solve technological bottlenecks which may deter social innovations. The selection criteria for investing scarce governmental resources in technology policy programmes could be existing competitive strength in discernible clusters of industries and/or commitment to participate in spurring the creation of new ones” [Dalum, 1994, 316]. Technology policy cannot only entail the promotion of individual enterprises or products. When the government conducts an active technology policy with the aims, methods, and instruments of industrial policy, it tends to neglect the wider implications of complex technologies in a societal context. Schienstock summarizes the new technology policy tasks and differentiates them from those of traditional technology policy in Table 1.3.

## III) Conclusion

As we see from the discussion above, immense theoretical complexities and difficulties surround the innovation process and the subsequent technological development of society: technology can only be as good as its underlying science, it can only be sold when people demand it, and it can only lead to its demanded welfare effects when the societal and political framework incorporates various societal actors. These complexities pose some critical problems for both the analyst and the decision-maker. Both have to acknowledge the danger of making deterministic technological, economic, or socio-political propositions. Both have to acknowledge that the world of technology is subject to a great diversity of actors, institutions, and various constraints.

What does this recognition imply for the conduct of technology policy in detail? Tables 1.4 - 1.6 differentiate between traditional technology policy as an extension to industrial policy and technology policy as societal policy. This differentiation follows the layout of the discussion of technological development of society: traditional technology is here linked with unilinear approaches, technology policy as societal policy is linked to the notions of choice, crisis, continuity, and failure.

What do these propositions imply for a cross-national comparative study? The non-linearity of technological development implies that choices along the development

---

example, pursued in the German state of Nordrhein-Westfalen, see Latniak and Simonis, 1991.

path influence the technological outcome. In a comparative perspective, this implies that different countries are likely to pursue different strategies, depending on the surrounding choice structure. Some countries may place a heavier emphasis on hardware, perhaps due to their industrial traditions. Other countries may place a heavier emphasis on employer-employee relations and the pursuit of a cooperative rather than a competitive technological or economic strategy. Again other countries may prefer a political strategy in which the technological outcome is secondary to social equity. Institutional changes may have the purpose not to maximize the benefits of one particular technology but to maximize the benefits of all technological development, even if that is not the highest feasible technology. This also implies that some choices are more compatible with the existing societal structure than others. An important question is, which societal variables are more important than others. For example, many European countries are proud of their social-democratic tradition. In the United States, people emphasize a passive central state and the maximization of personal autonomy. The Japanese value cooperation over competition and conflict. What effects do these traditions have on the technological development of society? And conversely, how do new technologies alter traditional structures, and to what extent does the state deem it necessary to defend tradition? The empirical portions of this study explore the extent to which the content of technology policy is changing in the European Union, the United States, and Japan to reflect these concerns.

Table 1.4: Scientific-technological Models and Technology Policy Implications

| | Technology Policy as Industrial Policy | Policy Implications | Technology Policy as Societal Policy | Policy Implications |
|---|---|---|---|---|
| Scientific-technological models | unilinear development path | emphasize and promote all technologies | no inevitable technological unilinearity; one can invent individual technologies, but not create technologies with a systemic character | integrate societal preferences in technology policy decision; select only technologies that are compatible with societal preferences and the democratic mandate |
| | the abandonment of the production of strategic technologies may lead to economic disadvantages vis-à-vis other countries | promote all strategic technologies that other countries develop | scientific, economic, and socio-political filters influence the development path of technologies | identify sources in the economic, social or political domains that obstruct or enable technological development |
| | technology shapes society | regulatory actions are subject to basic limits as technologies have an overwhelming influence on society | radical innovations require parallel radical societal changes | link technology policy to considerations of what institutional changes supplement the technological development, and evaluate whether these changes are desirable |
| | | | radical innovations cause societal crisis | link technology policy to parallel offsetting social measures |

Table 1.5: Economic Models and Technology Policy Implications

| | Technology Policy as Industrial Policy | Policy Implications | Technology Policy as Societal Policy | Policy Implications |
|---|---|---|---|---|
| Economic models | economic incentives are the predominant cause of technological development | alter the economic framework and regulatory structure to maximize economic incentives; technology policy as an extension to industrial policy | emphasis of feedback processes that influence the development process | not only the incentives of the entrepreneurs are important, but also those of the users; incorporate the users' demands in policy initiatives |
| | market failure obstructs the research process | subsidize enterprise research, or implement government procurement; both to overcome the logic of collective action; technology policy as an extension to industrial policy | market failure may be an unintended consequence of other policy initiatives or certain societal constraints | evaluate whether other policy initiatives justify market failure; evaluate wider societal constraints |
| | | | installed user base | closely evaluate present and likely future user bases; evaluate whether support of user bases is desirable and necessary |
| | | | historical chance events | flexible reaction to these events; rejection of dogmatic approaches |
| | | | possibility of market lock-in of inferior technologies | use government procurement when a specific user base is too small; reduce subsidization or financially punish those that pursue predatory market strategies |

Table 1.6: Socio-political Models and Technology Policy Implications

| | Technology Policy as Industrial Policy | Policy Implications | Technology Policy as Societal Policy | Policy Implications |
|---|---|---|---|---|
| Socio-political models | social context shapes the technological development path | political action can steer the development process; use of traditional industrial policy instruments can promote technological development | political action has limits; success is indeterminate and only long-term | preemptively evaluate the likely consequences of political or policy failure; minimize high short-term expectations |
| | social context determines the technological development path | technology policy can be an instrument to achieve societal welfare aims | interaction, integration, and mutual shaping of involved actors leads to an uncertain development process | carefully identify those actors that are relevant; high degree of inclusion in early stages |
| | | | exit of certain actors may lead to fundamental problems at later stages | prevent the premature exit of involved actors; flexibly adjust policy approach |
| | | | inclusion of power and interests | identify power and underlying interests; closely evaluate rhetoric and actions; consider changing power relations; sanction cartels and dominant alliances |

# Chapter 2

# Computer-Mediated Communication and Basic Political Issues and Choices

## I) A Brief History of Computer-Mediated Communication

> The essential elements of what became the Net were created by people who believed in, wanted, and therefore invented ways of using computers to amplify human thinking and communication. And many of them wanted to provide it to as many people as possible, at the lowest possible cost. Driven by the excitement of creating their own special subculture below the crust of the mass-media mainstream, they worked with what was at hand. Again and again, the most important parts of the Net piggybacked on technologies that were created for very different purposes.
>
> *Howard Rheingold, Journalist (1993, 66-67)*

The early history of computer-mediated communication is an American story. On one hand, it is deeply rooted in the quest for individualism, personal autonomy and freedom that characterizes American society and history, and on the other hand, in the post-World War II hegemonial role in international relations. The combination of military concerns during the Cold War and individualist streams rising from the subculture of early computer programmers have dominated the evolution of computer-mediated communication.

The early Internet, the largest and fastest-growing computer and communication network to date and the closest thing to a truly global communication network, is partially the consequence of three events: an MIT professor working for the Pentagon laid the groundwork for computer networks in the 1960s, a couple of students in North Carolina created the free communication forum of the Usenet, and a couple of hobbyists in Chicago triggered the world-wide Bulletin Board System that eventually enabled access to global communications for everyone. While the latter two were rather spontaneous developments in the computer subculture, the first was officially sponsored by the United States Department of Defense's Advanced Research Projects Agency (ARPA).

The spark for the creation of ARPA was the Soviet launch of Sputnik in 1957 and the associated American perception of a developing technology gap. ARPA had ”a specific mandate to leapfrog over existing technology [and the] license to look for visionaries and wild ideas and sift them for viable schemes” [Rheingold, 1993, 71]. Significantly, ARPA funded young computer hackers because ”the computer industry giants and the mainstream of computer science weren't interested in reinventing computing” [ibid., 72]. These young hackers developed word processors, conferencing systems, hypertext systems, and mouse pointing devices, and they integrated video and computer communication with considerable technical success. They were also their products' early users; thus, they concentrated on technical developments that were compatible with their own preferences and not with those of some faceless industrial or military customer. The individual user remained at the center of attention, especially the user's autonomy within the system. The perhaps most important development of the 1960s was the development of the computer display. It took computing away from abstract input codes towards greater user-friendliness. The governmental promotion of 'outsiders', and not of established industry leaders, is a highly curious but significant event for the future of computer-mediated communication.

Two elements served to overcome concurrent bottlenecks of the 1960s: time-sharing and packet-switching. Computers were rare in the 1960s, mostly giant supercomputers of room-filling size. The principle of time-sharing enabled multiple users to access a computer in a coordinated manner. Packet-switching, which is the parcelling of digital information into small packets, overcame the technical limits posed by the telephone system, especially, its lacking ability of fast and reliable digital communication.[17] Rheingold argues a twofold significance of packet-switching technology: ”First, this invention creates the building block for a communication system with no central control because you don't need a central controller when each packet and the entire network of routers all know how to get information around. Second, as the world's information becomes digitized, those packets can carry everything that humans can perceive and machines can process – voice, high-fidelity sound, text, high-resolution color graphics, computer programs, data, full-motion video. You can even send packets over the airwaves” [ibid., 75].

A significant but non-technological development was the growth of virtual communities. Subcultures, consisting of the increasing mass of hackers and early users,

[17] Significantly, the RAND corporation developed packet-switching for a different purpose than computer-mediated communication. It designed packet-switching to ensure continual operation of the communication system in the event of a nuclear war. Packet-switching ensures that a message could reach its aim; when one node is ”wiped out”, the packet would try another path. Underlying the promotion of fiber optics in the 1980s and 1990s was the same reasoning: an atomic explosion would disrupt networks based on copper wire, but not those based on fiber optics. The main problem is only that fiber optic networks rely on electricity, which would also be disrupted in the envisioned case.

employed the technical capabilities for private purposes and provided the additional tools, for example, electronic mail. A number of government-sponsored computer-mediated communication systems unintentionally proliferated. For example, Murray Turoff's Emergency Management Information System and Reference Index (EMISARI), which was initiated following Nixon's wage-price freeze in 1971 to collect price indexes from all over the country, and the subsequent Resource Interruption Monitoring System (RIMS) both came to be the first message boards in which participants could exchange messages. In 1976, Turoff noted: ”I think the ultimate possibility of computerized conferencing is to provide a way for human groups to exercise a 'collective intelligence' capability. The computer as a device to allow a human group to exhibit collective intelligence is a rather new concept. In principle, a group, if successful, would exhibit an intelligence higher than any members. Over the next decades, attempts to design a computerized conferencing structure that allows a group to treat a particular complex problem with a single collective brain may well promise more benefit for mankind than all the artificial intelligence work to date” [quoted in Rheingold, 1993, 113-114].

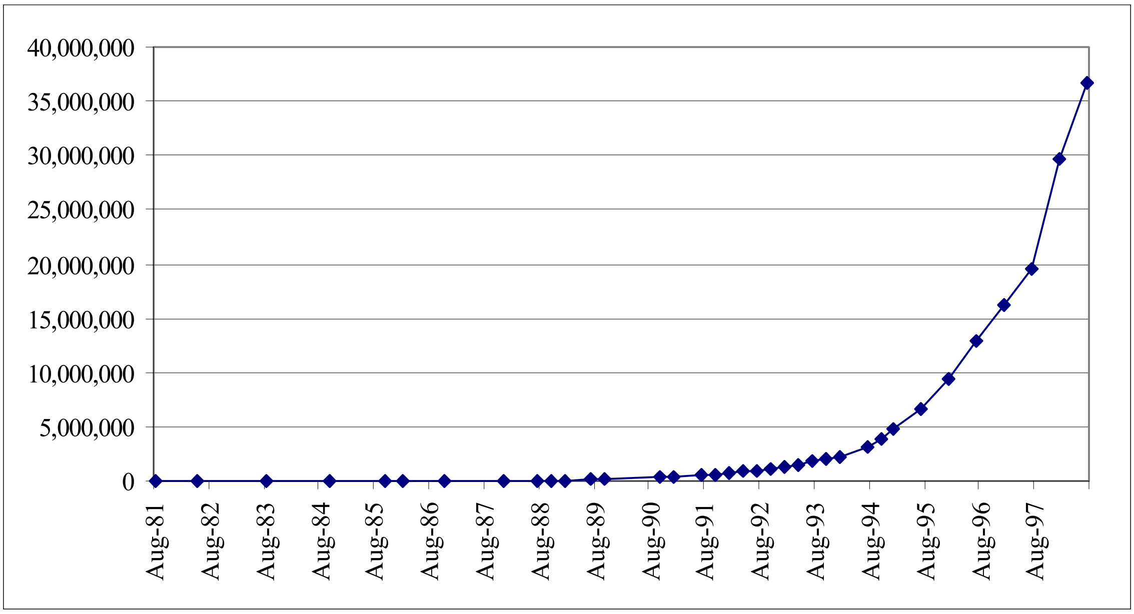
During the Vietnam War, the contradiction between private use and military application of the developing network tempted some to create alternative systems. Most prominent is the Palo Alto Research Center (PARC), initiated and funded by Xerox. Rheingold describes PARC as an ”all-star team” of computer specialists, most of whom came out of ARPA. Its fundamental aim was to make Xerox ”the architect of information for the future”, especially by promoting the development of the personal computer (PC), and ”to liberat[e] computer power for nonprogrammers to use to help them think and communicate”. Early outcomes were the ”Alto”, the first PC, Ethernet, local area networks (LANs) and the creation of gateways to link up to the ARPANET and other networks. The development of networking was a revolutionary event in the history of computer-mediated communication as it increasingly gained a non-military, societal dimension:

> Throughout the 1970s and the 1980s, the technology of Internetworking itself evolved at a rapid rate. The speed with which information can be transmitted through a medium is one fundamental determinant of what kind of information can be transmitted, the value of the information, and who can afford to send or receive it. This is one place where technological leaps in capability transform into economic leaps. When your bits-per-second rate is low and expensive, you can send messages laboriously via telegraph. When

> your bits-per-second rate is high and inexpensive, you can send books, encyclopedias, entire libraries, in less than a minute. The economics of speed in [computer-mediated communication] technology are central to the notion of citizen-accessible computing. If a citizen today can have the telecomputing power only the Pentagon could afford twenty years ago, what will citizens be able to afford in telecommunications power five or ten years into the future [ibid., 78-79]?

Initially, the US government, or more specifically, the Department of Defense, outlined an ”acceptable use policy” that regulated access to the networks. After all, the system was predominantly military-oriented and thereby subject to security restrictions. Accordingly, in the early days, only ARPA-members could (officially) access the network. Over the years, the government increasingly opened the system to government-funded scientific researchers, then to the general scientific and scholastic community, then to the business community, and last to general education community and all citizens (1993: World Wide Web). The split of the computer programmer community into military and civilian sectors described above, and the policy of limited access, spurred the development of alternative communication systems that were not subject to official regulations.

Figure 2.1: Internet Hosts (in mill.)




Source: Network Wizards, www.nw.com/zone/host-count-history.

While the government or corporate funded activities were highly important, they were not the exclusive elements that make up the present global communications network. In the late 1970s and early 1980s, the computer subculture became a critical group in this development:

> The Net is not only Internet. You could shut down all the hosts on Internet today and millions of people would still find ways to exchange e-mail and newsgroups. The Net is also partially a highly redundant citizen-to-citizen network that grew on its own, using the spinoffs from ARPA research to create something more akin to a fan culture than a military-industrial elite. The parts of the Net that grew out of ARPANET are the mainstream, and definitely the technological leaders, but not the only important tributary that contributed to today's Net. The other two confluent streams are the grassroots movement known as computerized bulletin-board systems (BBSs) that took off in the 1980s, and the history of group conversation systems over the past several decades, culminating in Usenet, the biggest, freest, noisiest one so far [ibid., 109].

The Usenet (Unix Users Network) was initially a forum for discussions about the Unix operating system, which was the most widely used operating system at the time. Corporations like AT&T and DEC aided this development by paying the telecom bills between backbone sites (a recognition of the importance of computer subcultures?). Usenet's inventors quickly realized that people were excited about an online forum that connected an increasing number of universities around the world. The Usenet consists of multiple public conversation forums on a large range of topics. The predominant feature is that no central control exists. One could describe it as a fully public e-mail system. Conversation subjects quickly proliferated and today the system can be described as an ”anarchic, unkillable, censorship-resistant, aggressively noncommercial, voraciously growing conversation among millions of people in dozens of countries” [ibid., 117-118]:

> Usenet is a place for conversation or publication, like a giant coffeehouse with a thousand rooms; it is also a worldwide digital version of the Speaker's Corner in London's Hyde Park, an unedited collection of letters to the editor, a floating flea market, a huge vanity publisher, and a coalition of every odd special-interest groups in the world. It is a mass medium because any piece of information put onto the Net has a potential worldwide reach of millions. But it differs from conventional mass media in several respects. Every individual who has the ability to read a Usenet posting has the ability to reply or to create a new posting. In television, newspapers, magazines, films, and radio, a small number of people have the power to determine which information should be made available to the mass audience. In Usenet, every member of the audience is also potentially a publisher. Students at universities in Taiwan who had Usenet access and telephone links to relatives in China became a network of correspondents during the

> 1989 Tiananmen Square incident. … Think of what the impact will be when anybody, anywhere with access to a cheap digital videocamera of the future will be able to upload eyewitness reports to the multimedia Citizen's Reporting Network of the future [ibid., 130].

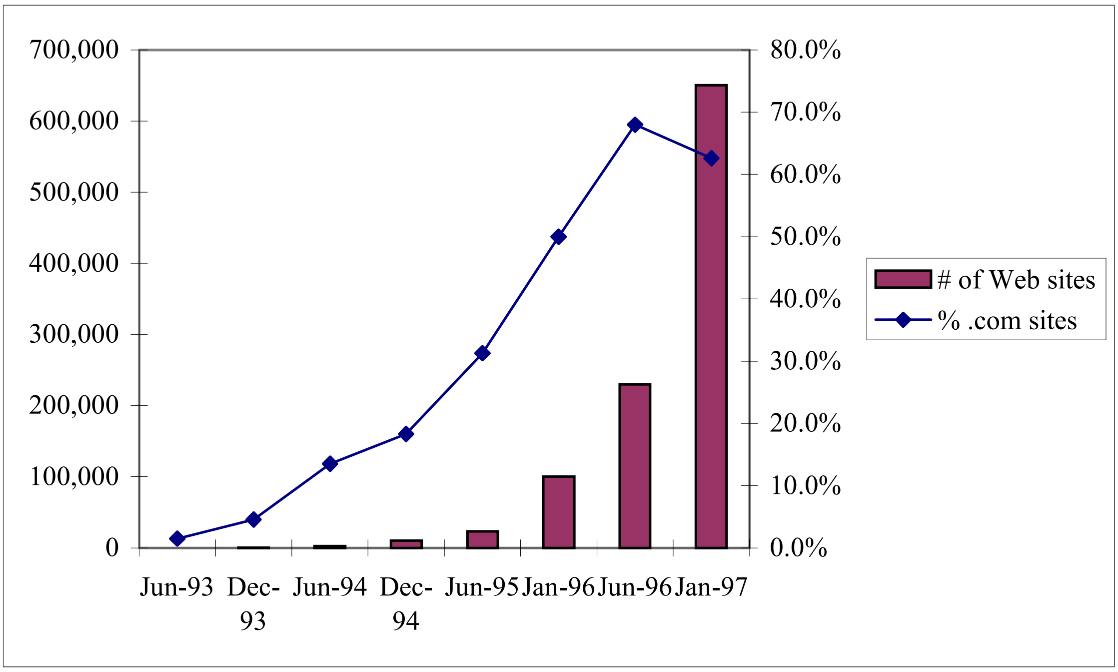
The widely spread, private bulletin board systems (BBSs) displayed similar dynamics. A BBS is a privately-operated server (most often a personal computer) to which individuals can dial up to by means of a modem. BBSs have a dual-function: on one hand, users can up- and download software (freeware, shareware), on the other, they can engage in online discussions or even participate in multi-user dungeons (MUDs; see below). BBS software is freely available, and with the rise of the PC in combination with free communications software, a personally-operated network has become relatively cheap. According to an estimate, 60,000 BBSs existed by 1993 alone in the United States, with an unknown number worldwide. In December 1983, FIDO, the first network of BBSs, was established. By 1991, according to conservative estimates, over ten thousand nodes and 100,000 users existed (the actual numbers are likely to be much higher) [ibid.]. One has to keep in mind that the BBS proliferation was a spontaneous development without any governmental support. This grassroots system has potentially a great importance for the future global network precisely because it is private and not controllable:

> If a BBS … isn't a democratizing technology, there is no such thing. For less than the cost of a shotgun, a BBS turns an ordinary person anywhere in the world into a publisher, an advocate, an organizer, a student or teacher, and potential participant in a worldwide citizen-to-citizen conversation. The technology of personal telecommunications and the rich, diverse BBS culture that is growing on every continent today were created by citizens, not doomsday weapon designers or corporate researchers [ibid., 131].

Although the commercialized Internet of today, especially the World Wide Web, has reduced the importance of the Usenet and BBSs, the latter two have been important elements of computer-mediated communication. First, they have contributed to the development of a computer culture and thereby to the installment of a large and loyal user base. And second, they have significantly contributed to technical innovation by providing incentives and information exchanges.

While the United States dominated the early history of computer-mediated communication, subsequent developments throughout the world have significantly influenced the nature of the global network as we know it today. Let us briefly consider some exemplary developments in three countries, France, Great Britain, and Japan [based on ibid., Chapter 7 and 8].

Figure 2.2: Development of Sites in the World Wide Web




Source: Matthew Gray, http://www.mit.edu/people/mkgray/net/web-growth-summary.html (June 1996 and January 1997 are estimated).

In the 1970s, the French government discovered that it was falling behind its major competitors in communication technologies. Only 60% of French households had telephones, a situation that governmental decision-makers thought to be unsustainable. The French government feared the expansion of IBM's power in Europe and the British experiments with videotext (the distribution of information per TV and telephone touchpads, which eventually turned out to be a failure). In traditional French *dirigism*, the state upgraded the communication system. One particular aspect included the initiation of the Minitel system, a proprietary, French-language online service, with six million users the largest system of its kind. The strategy included the free distribution of Minitel terminals to the public and their installment at public places to ensure universal accessibility. The Directorate Générale de Télécommunication received considerable funds for this task.

Especially the Nora-Minc Report of 1978 underlined the necessity for action in the telecommunication sphere [Nora and Minc, 1978]. The Report forecast that information would become the primary source of power in the future and that the wide mastering of skills was essential. The mere promotion of a potential user base alone, however, could not achieve wide usage of the system. Curiously, the system became successful following the manipulation by some computer programmers to exploit a flaw in the system: they enabled a chat feature that was not foreseen by the system's developers. Following initial resistance to this feature and criminal prosecutions, the system operators eventually decided to officially incorporate the feature into the system, following which Minitel became extremely popular. By 1987, millions of terminals had been distributed and, due to overload, the system broke down at least once. Especially sex chat services, in no way intended by the original developers, came to be the 'killer app' of French computer-mediated communication. These developments show one important aspect of computer-mediated communication: people preferred networks for the purpose of communication and not information dissemination as practiced in some European videotext systems.

The French Minitel strategy of free and almost universal access to computer-mediated communication must also be viewed in a wider context. The protection of French culture against foreign intrusion has traditionally been an important aspect of French politics. For example, in the early 1990s, the French government imposed minimum-French-content rules on broadcasting. While the Minitel system provides access to a large range of information and message services, its system design is largely proprietary and therefore compatible with the quest to protect the French language and culture. The nature of the terminals, specifically the lack of a modem, ensured that Minitel remained a strictly national system with an emphasis on French language.[18] The reasoning is clear: when one cannot access other systems, but receives a free user interface, the customers would remain loyal to this particular technology. This isolated the French system from American competition and from the distrusted English language-dominated Internet.

One of the major problems of the Minitel system of today is that the user interface is no longer up-to-date and unable to handle multimedia applications that now proliferate in the Internet. These two factors raise some important questions: will France remain outside the global network as much as it can, or will it promote the

[18] This was the case until the early 1990s, after which one could cross-access other national systems in Europe.

diffusion of technologically-advanced systems that have the side-effect that the global network becomes influential in France? The latter implies that the ability to protect French culture will be completely undermined; and as a latecomer, French influence on the Internet will be negligible.

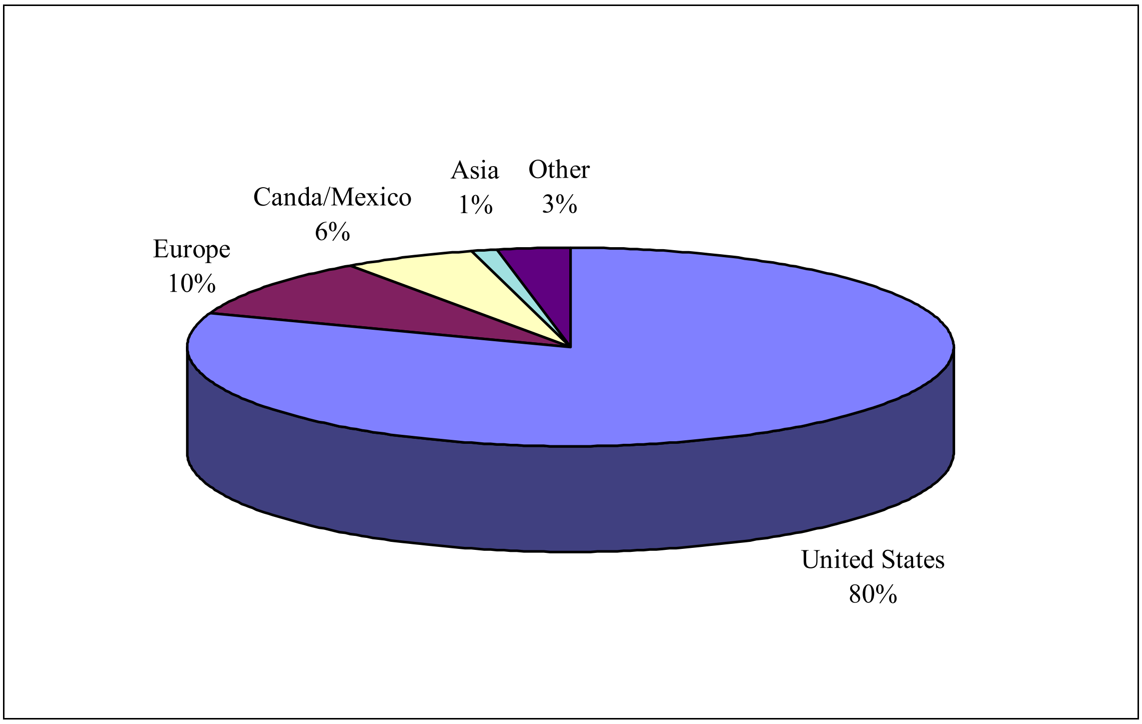
Table 2.1: Online Language Populations

| | Internet access (in mill.) | % of entire world online population |
|---|---|---|
| **English** | **82.3** | **61.8%** |
| **Non-English** | **59.0** | **44.4%** |
| **European Languages (non-English)** | | |
| Czech | 0.2 | |
| Dutch | 1.7 | |
| Finnish | 1.4 | |
| French | 5.8 | |
| German | 7.4 | |
| Greek | 0.2 | |
| Hungarian | 0.2 | |
| Italian | 2.1 | |
| Polish | 0.9 | |
| Portuguese | 2.1 | |
| Russian | 1.0 | |
| Danish | 0.6 | |
| Norwegian | 0.6 | |
| Swedish | 2.7 | |
| Scandinavian languages (total) | 4.2 | |
| Spanish | 13.8 | |
| **TOTAL EUROPEAN LANGUAGES (excl. English)** | **40.6** | **30.8%** |
| **ASIAN LANGUAGES** | | |
| Chinese (Mandarin) | 4.1 | |
| Indonesian | 0.1 | |
| Japanese | 12.3 | |
| Korean | 1.7 | |
| Malaysian | 0.3 | |
| Thai | 0.1 | |
| **TOTAL ASIAN LANGUAGES (excl. English)** | **18.4** | **13.6%** |
| Others | 0.7 | |
| **TOTAL WORLD** | **133** | |

Source: http://www.euromktg.com/globstats/, selected sources.

The greatest British contributions to the early Internet were the development of multi-user dungeons (MUDs) and offline readers. MUDs are multi-user online games in which sometimes many thousand people participate. By 1992, over 170 MUDs existed in the Internet, using 19 languages. Initially created in an English university, MUDs hosted adventure games, first on the basis of text and lately with advanced graphic design. In their proliferation since 1980, these games have expanded both in function and purpose. Complex planetary colonies now exist that integrate different virtual communities. Some MUDs remain primarily game-oriented, others have taken on an educative function by simulating real-life events. Rheingold underlines the importance of these MUDs for the future development of communications technologies: ”MUDs are living laboratories for studying the first-level impacts of virtual communities – the impacts on our psyches, on our thoughts and feelings as individuals. And our attempts to analyze the second-level impacts of phenomena like MUDs on our real-life relationships and communities lead to fundamental questions about social values in an age when so many of our human relationships are mediated by communications technology” [ibid., 146]. What was initially only a game (and often criticized for its addictive tendencies) has turned into such complex online worlds that merit its study in terms of the implications of computer-mediated communication for individual users and the development of virtual *societies*.

Figure 2.3: World Wide Web Usage by Location 1995 (in %)




Source: http://www.ariaport.com/stats.html.

Another, though less fascinating English contribution to the existing global network was the development of offline readers. Structural constraints posed by limited transmission bandwidth and speed as well as the British telecommunications pricing structure led to the development of specialized software that enabled the offline access to otherwise online information and communication. With the aid of offline readers, people could download the latest Usenet discussions, read them, and reply without incurring great telecommunications costs. Today, such software is widely applied in different contexts with a great number of advanced features. For example, it enables the automatic collection of selected World Wide Web sites for offline exploration.

While Japan is a relative latecomer to the global online network, it has already made an important impact. Traditionally, the development of an online culture in Japan had been heavily constrained by restrictive laws and technological bottlenecks. For example, the use of modems only became legal in 1985. Furthermore, students have had difficulty getting an Internet account. The Internet links to the outside world have been slow. Cultural factors have also contributed to the initial neglect of the online world: the lack of a tradition of discursive and confrontational public political discussion, the emphasis on the consensus approach, and a high level of social etiquette. One reason for the initial neglect of the early text-based Internet was perhaps that the "nonverbal context is particularly important in Japan, where gesture, posture, and tone of voice convey overtones and references that are clearly understood within a formal and well-understood set of contextual references. … This invisible and perhaps partially ineffable component of Japanese spoken communication is sometimes called *kansei*, which can be only loosely translated as an intuitive, partially aesthetic, sense of rightness about the contextual elements in a conversation" [ibid., 195-96].

The Internet, however, has been increasingly adopting non-verbal and graphical interaction, also due to the Japanese influence. One particularly interesting Japanese experiment is "Populopolis", a virtual city. Populopolis is an experiment on visually-oriented interaction. Visually-oriented interaction is compatible with the Japanese cultural tradition and not incompatible with Western culture. This visual orientation of Japanese online culture may well turn out to become an influential factor on the Internet as it may be a method to overcome cultural and lingual barriers. Despite these influences on the Internet, the Japanese will face the same problems as hinted at above in the French case. The connection to the online global community implies the opening up of the traditionally relatively closed Japanese society. Two basic choices exist: either enter the global network with an offensive strategy to participate in the shaping of the network as much as possible or risk increasing isolation.

Today's Internet differs completely from its shape in the early days. Two factors have contributed to the changes: the introduction of the World Wide Web (WWW) in 1993 and the parallel commercialization. The WWW is a graphical user interface that enables easy ”surfing” in the Internet. The WWW is based on the Hypertext Markup Language (HTML) and the Hyper Text Transfer Protocol (HTTP). The language and transfer protocol enable the non-sequential retrieval of information. By pointing and clicking on specially-marked words, the Websurfer can jump around within a text or website, or also between websites. This easy-to-use graphical implementation has increased the popularity of the Internet.

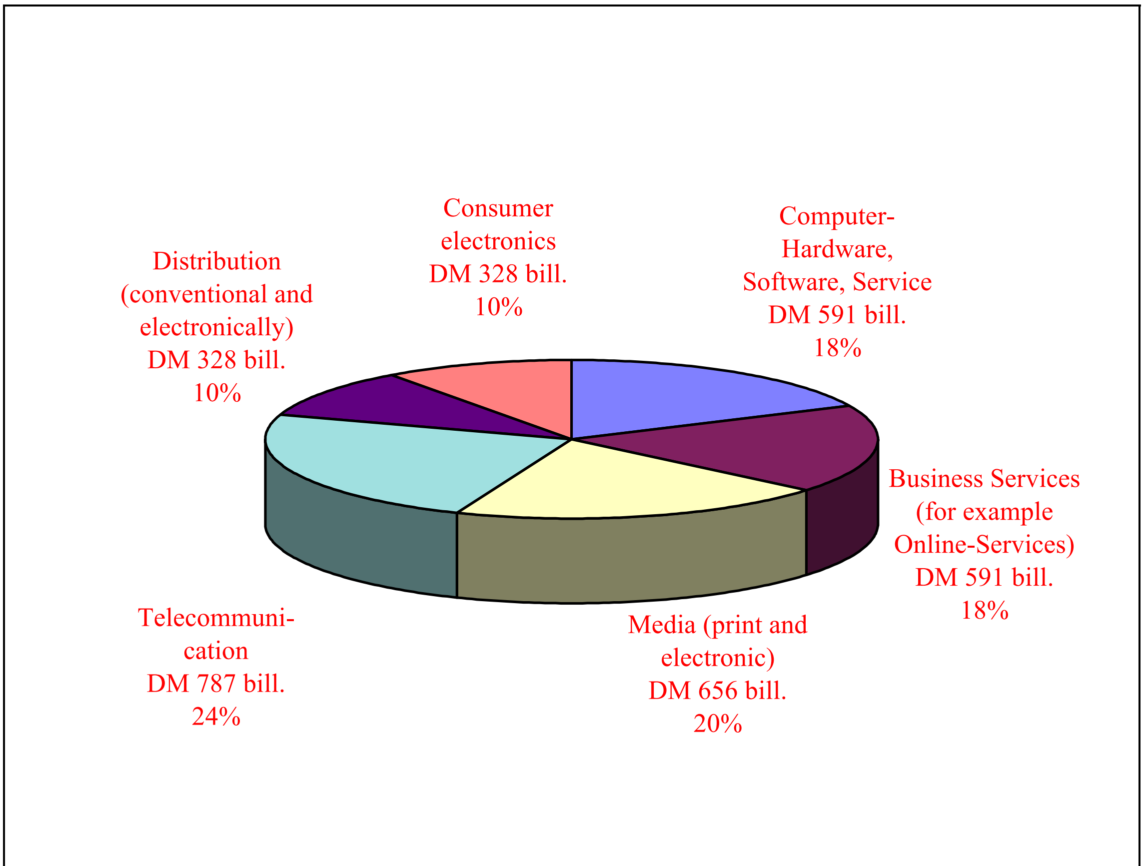
Table 2.2: Top 20 Countries on the Internet, July 1996 (by domain names, January 1996 position in parentheses)

1. United States (1)
2. United Kingdom (3)
3. Germany (2)
4. Japan (6)
5. Canada (4)
6. Australia (5)
7. Finland (7)
8. Netherlands (8)
9. France (10)
10. Sweden (9)
11. Norway (11)
12. Italy (13)
13. Switzerland (12)
14. South Africa (18)
15. New Zealand (15)
16. Denmark (17)
17. Austria (16)
18. Spain (14)
19. Republic of Korea (21)
20. Brazil (25)

Source: http://www.dns.net/andras/stats.html.

The commercialization added an economic incentive to the further development of the Internet. Today, any conceivable service is offered on the Internet. Nevertheless, the technological and regulatory reverse salient remains safe payment and currency transactions. The lack of security has to date obstructed fully-developed commerce over the Internet. We will return to this and other factors in subsequent sections and chapters. Figures 2.1 - 2.3 and Tables 2.1 - 2.2 offer selected statistics on the rising popularity of the Internet and the composition of its users according to location and languages.

Figure 2.4: Global Information-Related Markets 1993 (total value DM 3.281 bill.)




Source: VDE (1995), in BMWi, 1995, 60.

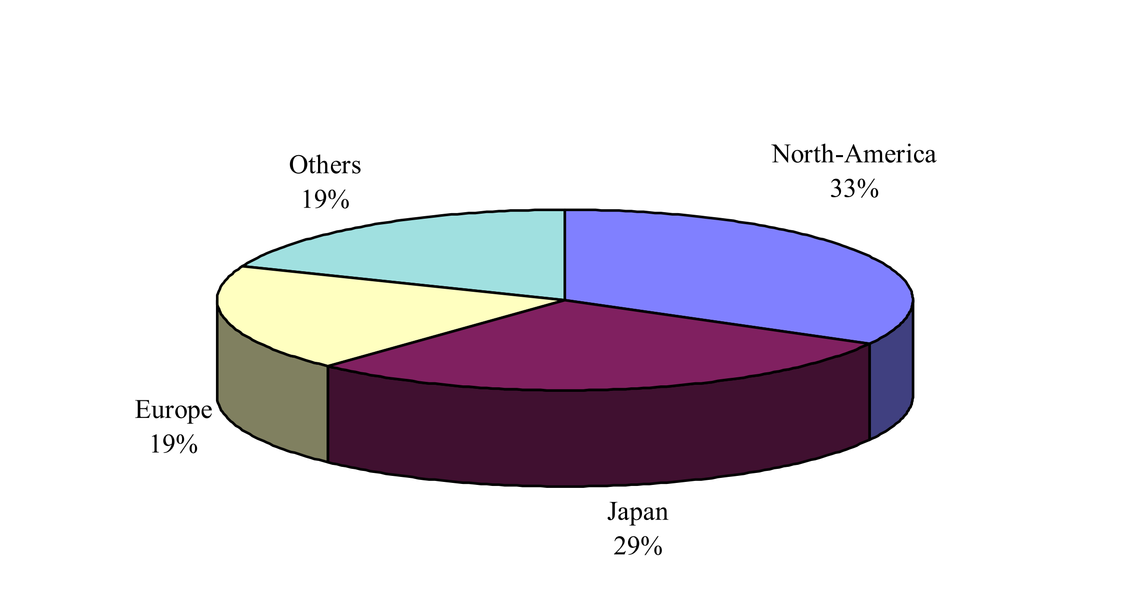
The history of the early Internet shows two important dynamics: the importance of vertical developments in the form of subcultures and of horizontal developments due to an intermeshing of technologies that originated within particular societal contexts. What is the consequence of these fundamental developments in computer-mediated communication? Are we approaching a new era, a global information and communication society, or do new technologies simply supplement traditional ways of interaction?

## II) The Information and Communication Society: Principles for Political Consideration

Information and communication have become all-important economic currencies in the 1990s. Information and communication are the life blood of Western economies, carriers of economic progress, prosperity, and international competitiveness. While in the 1950s, the manufacturing sector employed about 40% of the workforce, and agriculture 20%, the share of the information sector is expected to rise to over 50% by the year 2000 (with manufacturing declining to 20% and agriculture to 3 or 4%) [Institut für Arbeitsmarktentwicklung und Berufsforschung, in BMWi, 1995, 61]. OECD-countries now compete in the provision of the necessary global infrastructure and high-bandwidth networks. They are privatizing the telecommunications industry, and are promoting the research and development of future communication, microelectronics, and software technologies. Figure 2.4 describes the global market for information-related products. In 1993, this market amounted to over DM3 trillion (exceeding $2 trillion). Figure 2.5 shows the principal users of microelectronic components; the Triad uses over 80% of global production. Software is another giant global market. Figures 2.6 and 2.7 exhibit the production and purchase of software by region. The United States and Canada export about twice the share that they themselves consume; Europe and Japan have been clearly losing the competitive battle in this domain. The global demand for online and offline multimedia products until the year 2000 is expected to rise significantly, as Figures 2.8 and 2.9 exhibit. Thus, three principle competitive battles exist that involve the Triad: hardware, software and applications, and content, especially multimedia content.

A closer look at the technologies and their probable economic, political, and social implications, however, stimulates the question of whether public policy pursues a consistent and foresighted strategy, or whether policy-makers rush to perform for performance's sake and image purposes without taking a deeper look at the potential positive and negative forces of computer-mediated communication technologies. On the basis of what principles do governments orient themselves and their political action?

Figure 2.5: Use of Microelectronics in Electronic Appliances, and Products, International Shares, 1994 (total value $102 bill., shares in %)



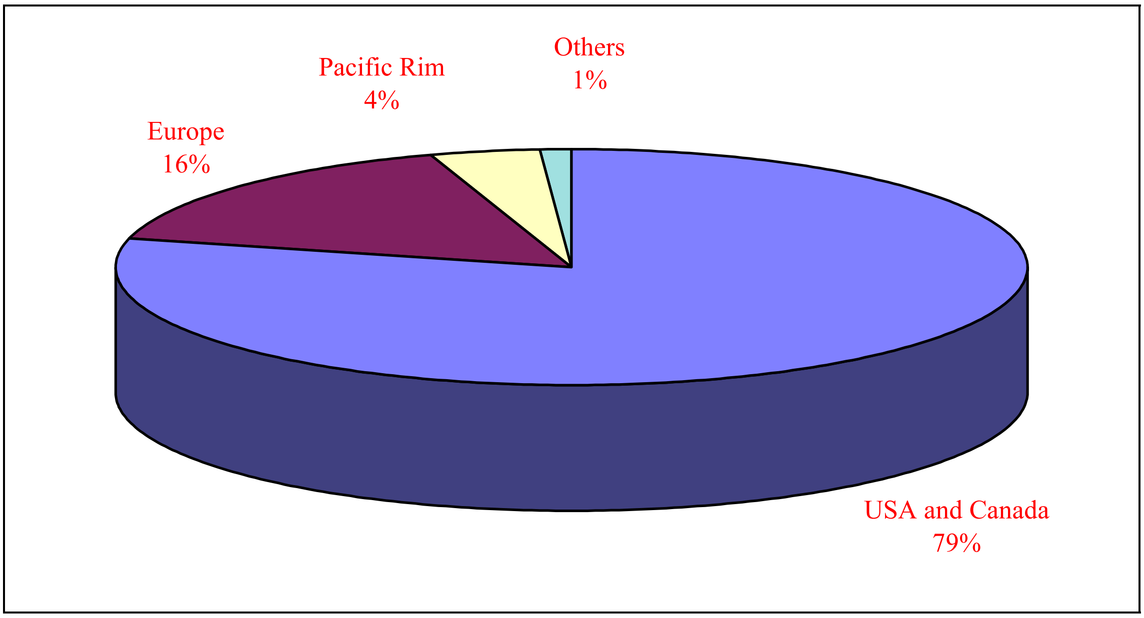

Source: VDE (1995), in BMWi, 1995, 60.

## A. The Rise of the Information and Communication Society?

The terms "information society" or "communication society" are popular expressions of the 1990s, however, no precise definition underlies these terms. Do these terms describe societies with a high portion of information-related activities in relation to GNP [Machlup, 1962] or in which knowledge and its distribution is the decisive element [Bell, 1973; Kumon, undated]. Or is it the volume of communication or the quality of interaction that is meant with these expressions?

One important distinction that aids to differentiate current developments from those of the industrial age is between the "broadcast" and the "network" paradigms [Rheingold, 1993, 244ff]. The broadcast paradigm operates on the principle of "one-to-many" communication. The media collects information, classifies it according to predefined principles, and then disseminates selected portions. This is principally one-way interaction. Similarly, in the business sector, in the 1960s enterprises began to use computers to collect information about intra- and extra-enterprise activities. This information collection had the purpose to streamline enterprise operations, for example, the automation of bookkeeping or warehouse operations. Communication was only a side product of information collection. In the late 1970s, this type of communication entered the private home: by means of videotext, individuals were able to collect information and even order products over the videotext terminal or the television at home (newspapers, radio and television were, of course, always broadcast-type media).

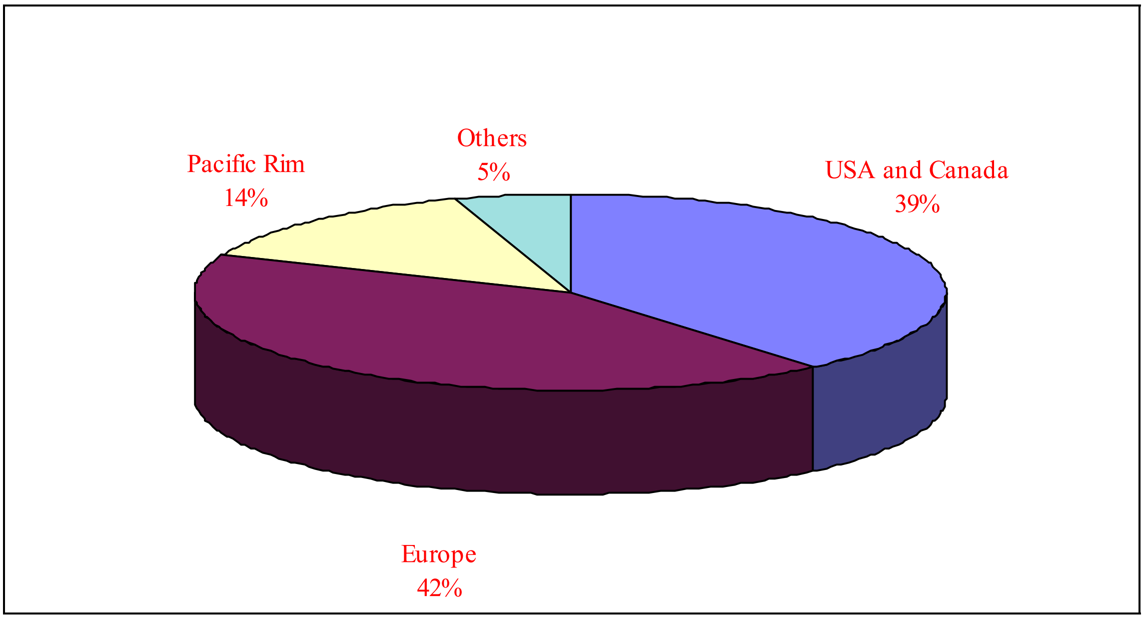
Figure 2.6: World Market Software Production 1993 (total value $50 bill., shares in %)




Source: Gartner Group (1994), in BMWi, 1995, 67.

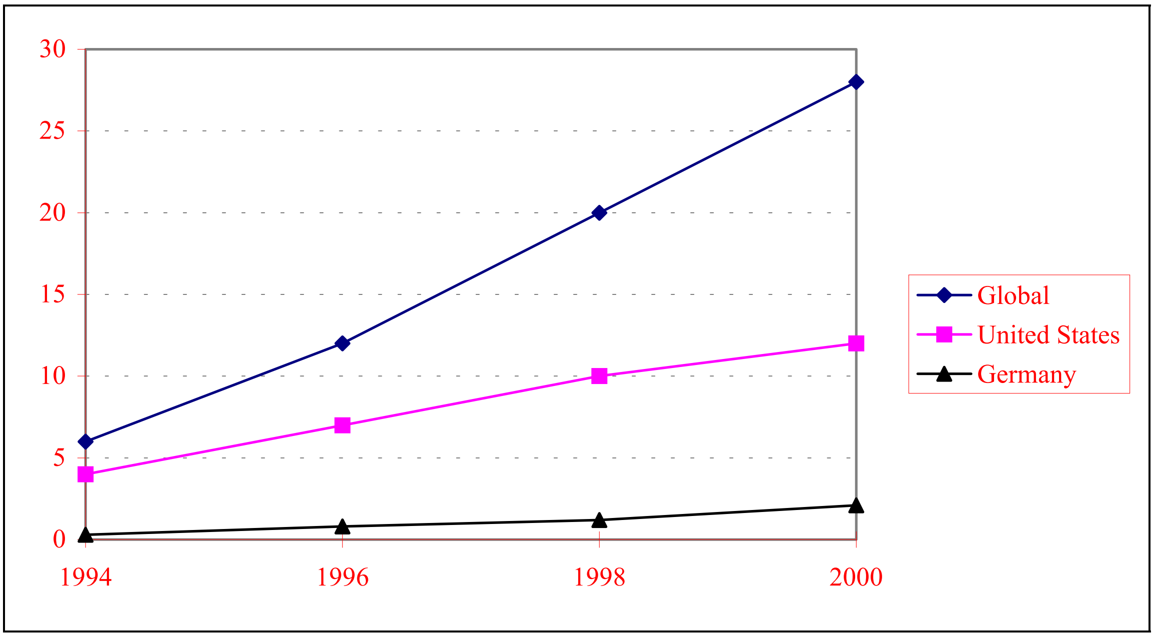
With the continuing integration of computer and communication technologies, the ”network paradigm” rose in importance. The network paradigm is characterized by ”many-to-many” communication with an emphasis on *communication* and not *information*. Within the framework of this paradigm, *many* collect information and make it publicly available, and *many* can select the specific information they desire. Thus, we are moving from an information-push to an information-pull society by means of increased interactivity and the possibility to access information without spatial or temporal limits and without mediation: ”The Internet is a model of how users are critical drivers for both the impact and the application of the convergence of computing and communications technologies. It is successful and important because it enables, as far as it can, people to access and exchange information, independently of space and time, free of corporate control” [Emmott, 1995, 6].

Figure 2.7: World Market Software Purchases 1993 (total value $50 bill., shares in %)




Source: ibid.

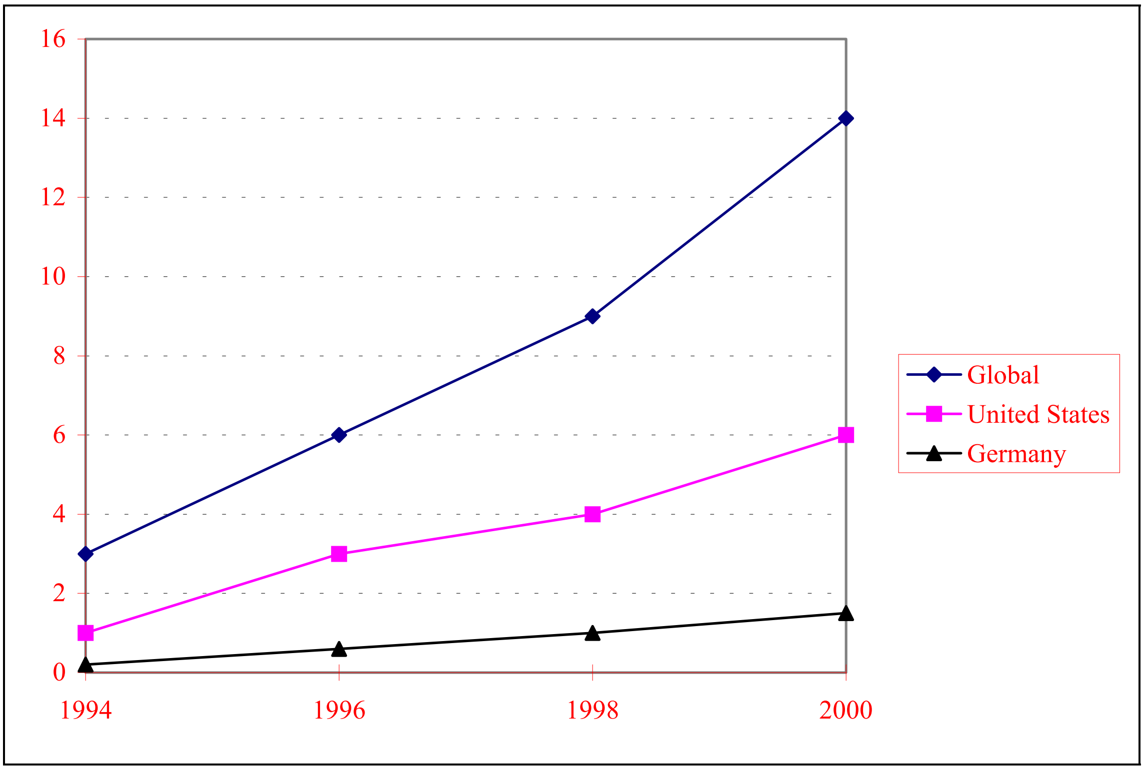
Figure 2.8: Expected Developments in the Offline Multimedia Market until 2000 (in bill. DM)




Source: Bertelsmann Stiftung (Juni 1995), in Späth, 1996.

Whether the network paradigm will actually supercede the broadcast paradigm is unclear. It requires activity by the user, but not all users will want to be active communicators and information consumers, or even their own directors in selfassembled digital movies. Mediating services are likely to become popular that select certain information or programs for the individual user, which is effectively a return to the broadcast paradigm. Nevertheless, the mere *opportunity* to benefit from the network principle may push us from an industrial to an information or communication society. The Internet opens up a world of opportunities. Anybody can open a business or exercise free expression and discussion without large investments. Small companies and individual users gain power and influence *vis-à-vis* global and seemingly almighty corporations. The Internet may give an impetus to the development of a new enterprising class that relies on knowledge and that is free of spatial and temporal limitations. Speculation on the future, however, is not the present subject. The point is that the application of the terms information or communication society is often unclear and speculative. How do decision-makers evaluate underlying information in this world of uncertainty?

Figure 2.9: Expected Developments in the Online Multimedia Market until 2000 (in bill. DM)




Source: ibid.

## B. Computer-Mediated Communication: Political Choices, Technology, and Society

The technological development of society prompts two important sets of questions. First, technology-inherent questions exist about future infrastructures and enabling technologies that necessitate political choices: what strategy on infrastructures and other so-called enabling technologies should decision-makers pursue? Should they promote the hardware, for example, the telecommunications networks and semiconductors? Or should they promote software development? Furthermore, what should a governmental strategy be with regard to top-down and bottom-up developments? Should decision-makers design an all-inclusive technology initiative or should it concentrate on indirect enablers, such as competition or education policy? Second, what is the government's position on societal questions, such as equity versus efficiency, privacy, intellectual property, copyrights, etc.? For example, should all citizens have cheap access to computer-mediated communication networks? Or should individual providers have a sufficient incentive to provide a wide set of services, with the pitfall that those who cannot pay are excluded? After all, the imperative of universal access may compromise unimpeded competition and the provision of incentives for future investments.

The first set of questions concerns the conduct of technology policy, the second implies the definition of regulatory policies. We will now explore technological and societal factors relevant to computer-mediated communication that imply certain basic political choices.

### 1) Considerations for Technology Policy: Future Infrastructures and Choices

Technology policy is the governmental promotion of the technological development. As was outlined in Chapter 1, governmental promotion can be active or passive. In the context of active technology policy, a government interferes in market processes in a direct manner, by means of subsidies, government procurement and so on. The government can also act passively. It can guard competition and it can improve human resource aspects by means of education, health and other policies. The market, however, fundamentally constrains government technology policy. Technology policy can be highly successful in one sector, nevertheless, this success may imply the long-term misallocation of resources in other sectors. Thus, in the conduct of technology policy, a government always has to find the critical balance between excessive and insufficient market interference. In the following, we will explore some technological and economic choices regarding the creation of new information infrastructures.

Computer-mediated communication is more than the convergence of the telephone and the computer. Computer-mediated communication technologies are multifold. The most basic differentiation is between hardware and software. The hardware of communication technologies consists of a network of cables (copper wire, coaxial or fiber optic cables) or airwave signals (radio, infrared, satellite) that connect two or more communicators. Reception and interpretation devices convert cable or airwave signals into text, audio and/or video formats. Each of these formats places different demands on the hardware: for example, text requires a lower bandwidth (transmission rate) than audio and video. Transmission software organizes and streamlines transmissions. Computers consist of central processing units (CPU), random access memory (RAM), storing facilities (hard disks, read-only memory, and derivatives), and graphic, sound, and video cards. A computer runs on the basis of central operating systems and graphical user interfaces and can thereby utilize various types of application software for business or personal purposes.

For the examination of computer-mediated communication and related political choices, one needs to distinguish between analog or digital methods of signal transmission is important. Analog receivers include the telephone and its analog components, such as answering machines, car phones, faxes, intra-enterprise networks or electronic impulse counters, as well as radio, television, relay stations, satellites, analog-to-digital converters and computer modems. With the emergent revolution of the personal computer and the superior stability of digital networks, the transmission of digital information has become increasingly important. Practically all analog components now have digital counterparts: ISDN (Integrated Services Digital Network Services)-based telephones and their sub-components, beepers, handys, digital radio and television, digital relay stations, digital satellites, and of course personal computers and their various derivatives. The 1990s witness a systems battle: a large installed user base of analog equipment users versus a small, but increasing installed user base of early adopters of digital equipment. This systems battle does not only affect communication and computer technologies but almost all areas of electronics, including television, radio, household appliances, cars, and so on.

Modern processing power and the immensely increasing data storage capacities place increasing demands on network capacities and infrastructures. The huge amounts of stored data and their use for online applications requires an increasing bandwidth that analog telephone networks cannot process any more:

> Today's networks are simply not up to the bandwidth challenge presented by all this increase in the power of computing and storage devices. And this increase in power is not just demanding at bandwidth. It also requires enhanced network intelligence and switched capabilities so that powerful computing and storage devices can find each other across a network for distributed computing applications or merely to exchange large files. In other words, the logic of increased computing power leads us to construct broadband networks [Gasman, 1994, 21-22].

Let us briefly examine analog versus digital transmission and bandwidth. For text transmission, a transmission rate of 9600 bps (bits per second) is sufficient. Mediate quality video conferencing requires already a transmission rate of 300-400 kbps (kilo bits per second, thousands of bps). Broadcast quality digital video requires transmission rates in the Mbps (mega bits per second, millions of bps) range, and for highest quality scientific visualization and imaging, for instance, in the medical sector, transmission rates in the Gbps (giga bits per second, billions of bps) range are required. For example, uncompressed high-definition television (HDTV) demands a bandwidth of about 1 Gbps and high-end digital video up to 9.6 Gbps. At present, analog networks permit the maximum transmission of a few Mbps. In sum, conventional systems based on analog transmission and switching and/or on copper wire have definite transmission limits. They cannot transmit data such as high-quality video or images at a reasonable quality in real time (for the moment ignoring the possibilities of software compression).

An early solution to this problem has been the development of ISDN. Besides limited bandwidth, the greatest problem of analog networks is the insufficient integration of services of telephone, telex, and data communication. ISDN has two features: "digital representation of all signals transmitted and processed, irrespective of information type – voice, text, data or images", and the integration of systems and services which is only possible on the basis of digitalization [Bocker, 1988, v]. Although ISDN allows the integration of services, it is not sufficient for the future global network. The greatest problem is the present hardware: ISDN operates on the basis of the existing stock of twisted-pair cables. However, these copper wire-based local loops have an insufficient bandwidth to transmit large data streams.

A number of solutions to bandwidth problems are already in the technological pipeline. Among them are advanced fiber optic technologies, Asynchronous Transfer Mode (ATM), Asynchronous Digital Subscriber Loops (ADSL), high bandwidth ISDN on the basis of fiber optics, and various compression methods. These technologies promise to overcome hardware constraints. Although the developers of advanced hardware and software methods continue to encounter technical problems, at the present rate of technological advances in microelectronics, bandwidth problems can be expected to be overcome in the near future. A big problem, however, is the cost factor. The construction of broadband communication networks requires an "enormous investment" [Miles, et al., 1988, 54]. One estimate for Europe expects a required investment of $400 billion between 1990 and 2005, and that includes only the creation of a fiber optic network [ibid.]. Bill Gates, one of the self-declared architects of the future system estimates costs for every household in the United States to be $1200, plus or minus a few hundred dollars [1995]. That includes the network of fiber optic cables to every part of the cities, the servers, the switching centers, and the electronics in the household. He estimates the total costs to amount to $120 billion. One obstacle for the new technologies is that a large installed base of analog equipment exists. Either, this equipment needs to be replaced by digital equipment or adapters have to be used. The problem with the latter is that non-digital equipment is not able to take advantage of all digital features. Miles et al. argue that "[u]nless there are massive governmental subsidies, we anticipate that the result will generally be a transitional period of several decades before optical fiber networks are widely available in industrial countries – some time well into the next century" [1988, 55].

Fiber optics networks are necessary for high-speed, long-distance information transmission. Whether every home will receive a fiber optic connection in the future, however, is questionable and often impractical or impossible. Microwave radio signals, coaxial cables for television transmission, and satellites are likely to supplement broadband networks in the local loop. For example, microwave radio signals and satellites enable the transmission of signals into peripheral regions, islands and moving objects, such as cars, ships, or airplanes, as well as to customers that desire short notice and short period high-capacity links, such as for televised sporting events. The advantage of coaxial cables is that they are already widely installed for the reception of cable-TV. The problem is that this network is used to transmit analog TV-signals; the installation of digital capabilities requires further investments. Despite their limitations, these supplemental technologies enable a flexible approach to future infrastructures.

Not only basic infrastructures are important for the future computer-mediated communication networks, but also the interfaces between the technologies and the users, the software. On one hand, software can help to overcome hardware limitations. For example, compression techniques, the process of reducing the size of the software stream that flows through the hardware, effectively enable the hardware to transmit larger amounts of information than otherwise possible. On the other hand, software can effectively organize and systemize information flows. For example, communication programs, such as fax, terminal or Internet software can collect information on the basis of predefined principles and enable easy re-processing. One can send a software robot into the Internet and let it automatically and periodically collect and transfer information right to the desktop at home.[19] Stephen J. Emmott underlines the importance of software applications:

> There can be little doubt that the application is one of the most critical components of information superhighways. Information infrastructures will reach and connect homes, places of work, hospitals, schools, libraries and vast information storage and exchange sites via multimedia-based interactive information products and services. Such infrastructures will be capable of delivering innovative applications which could radically transform the nature of work, finance, healthcare provision, and the education process as our access to, and use of, information undergoes a fundamental transformation in itself. The effect would be to create profound social and economic changes [1995, 5].

Commentators, however, criticize that ”today's IT industry has a multiplicity of hardware, software and interfaces, mainly designed to promote customer lock-in, and it is clear that this presents an immediate challenge. In addition, a combination of technophobia, natural or economic inability, and bad interface design has frozen out over 80% of the human race from using the technology” [Cochrane, 1995, 23]. Nevertheless, this situation is slowly changing. Object-oriented programming (OOP)

---

[19] Some call this method ”push technologies”, the transmission of information similar to processes in traditional media such as television, others call it ”automated pull”, in which the user identifies certain areas of interest and the subsequent automated transmission of information. As we will see below, the differentiation is more important than it seems on first sight.

and new programming languages such as Java allow more influence on the user side. Users do not have to depend anymore on what is offered by giant software producers, but have recourse to alternative niche products and self-designed software. These developments promise easier interfaces, automatic training and guiding ”wizards”, and more reliability. In the future, it is conceivable, that everyone can easily assemble the software they need. Software distribution methods may change towards a pay-per-use system with which users can easily conduct a cost-benefit calculation that is far more realistic than the present system of purchasing giant software packages that have functions a user will never actually use. In later stages of technological development, the user may finally move to the center stage, a factor that earlier stages do not necessarily implement:

> The key to what is going on in this information revolution is held by the *users* of information superhighways. This is a revolution that will be driven by users (consumers) rather than by media corporations. It will be users – individuals, groups and organizations – as the critical drivers for the development of multimedia and interactive applications who will determine the value and the impact of information superhighways. It will be this impact that will ultimately shape, in a profound way, the political, social and economic future of the increasingly digital world in which we live [Emmott, 1995, 3].

In sum, software is increasingly gaining in importance relative to hardware. This is especially the case as software development adjusts to bottlenecks, reverse salients and presumptive anomalies far faster than hardware development and application. Software has become so important precisely because of hardware limitations.

Network security is another critical factor. Software viruses, worms, robots – many perceive these technological developments as fundamental threats against personal and national security. Horrible news may one day proliferate in the news media as they already do in Hollywood productions: ”Hackers infiltrate the Pentagon and gain control over nuclear weapons”; or ”A computer virus causes the breakdown of world financial markets”; or ”A software robot cleaned out Your bank account”. Such potential events could very quickly destroy the dream of an Information Superhighway. If the users do not trust the system, they will avoid it. Thus, it is a predominant political imperative to design safeguards to protect the system from such attacks. The United States Office of Technology Assessment (OTA) defines information security as ”the protection against disclosure, modification, or destruction of networked information through the use of safeguards. These safeguards include hardware, software, physical controls, user procedures, administrative procedures, and management and personnel controls. The degree of security, along with the safety and reliability of a system, is reflected in the level of confidence that the system will do what it is expected to do – that is, its trustworthiness" [Office of Technology Assessment, 1994, Chapter 2]. The OTA also outlines potential problems: "The lack of any standards or too many standards, however, significantly limits the effectiveness of many safeguards. In particular, safeguards that require each user of either end of a communication to have compatible schemes – for sending messages, for example, or encrypting and decrypting telephone calls – benefit from the widest possible distribution of that product so that the users can communicate with more people. Even market-driven de facto standards, in such a case, are better than well-protected users who cannot communicate with but a few other users because of a wide variety of incompatible standards" [ibid.].

Not only the method and efficiency of information transmission but the content and its production is increasingly important. Technological creativity subsumes slowly to the creativity to produce new content and services. Users and producers adapt older content and services to the demands of new technologies and develop completely new content and services. Slowly, more professions and more people are drawn into the process of technological development.

The question that arises from this description of computer-mediated communication technologies is: what is the appropriate governmental role in the technological development of society? Developments in transmission technologies proceed at a fast pace. While technologies based on copper wire or coaxial cable may be sufficient for the end user, the cumulation of uses requires high capacity bandwidth in the long-distance networks. The principle political choice is difficult. The installation of high capacity networks may overcome transmission bottlenecks, however, these networks are also expensive and potentially outdated when they are installed. Software and hardware compression techniques are the big unknowns of the future. Compression is the reduction of redundant information in digital data. It increases the available bandwidth and thereby overcomes hardware transmission limits. Advances in compression technologies will not make communication infrastructures superfluous, however, they may radically change the cost-benefit relationship. An early engagement in the construction of expensive high bandwidth networks is risky and may cause the waste of resources. Thus, to direct technology policy solely towards the construction of infrastructures is highly risky. Software technologies promise great benefits. To what extent the state can engage to promote the development of new software, however, is questionable. This raises the question as to whether at a certain stage of the technological development of society, decision-makers should direct their technology policy to the use of passive instruments, such as competition policy, standardization to enable interoperability and interconnectiveness, consideration of the user side, training and education, and securing the infrastructures to protect them from technical failure or criminal abuse.

A trend has been the execution of social experiments in form of pilot projects. Pilot projects apply and test systems and applications, evaluate whether goals are fulfilled, and determine what side-effects may develop. However, Miles et al. criticize past approaches: ”experiments also need to be associated with more 'grass-roots' and 'hands-on' experience in order to align new technologies to real present and emerging needs. Many social experiments have been 'top-down' affairs, where the involvement of the public is largely a marketing exercise – it is designed to bring about consumer acceptance of change, and a little fine-tuning of products to emerging demands. But citizens and social groups can also be social innovators themselves – they can identify unmet needs (and problems that may be associated with technologies), participate in the design process, set priorities for R&D, propose criteria for evaluating specific technologies or the whole experiment itself, and communicate their experiences to other actors in other paces” [1988, 265]. In sum, the inclusion of unorganized interests is increasingly important to both test the value of new systems and to raise public awareness and acceptance. Miles et al. propose to especially concentrate on public services as these are ”client-intensive”. Other areas for experimentation include projects in telework, alternative transport arrangements, self-service systems, home informatics for the elderly or the disabled, demonstration projects for enterprises, community groups, public authorities, education, and “intelligent homes” that enable the central control over all electronic household components.

The process of the formation of a large installed user base and the proliferation of a technological group does not only require technology policy but also regulatory policy. We now turn to an examination of regulatory policy and computer-mediated communication.

2) Considerations for Regulatory Policy

> The technology that makes virtual communities possible has the potential to bring enormous leverage to ordinary citizens at relatively little cost – intellectual leverage, social leverage, commercial leverage, and most important, political leverage. But the technology will not itself fulfill that potential; this latent technical power must be used intelligently and deliberately by an informed population. More people must learn about that leverage and learn to use it, while we still have the freedom to do so, if it is to live up to its potential. The odds are always good that big power and big money will find a way to control access to virtual communities; big power and big money always found ways to control new communications media when they emerged in the past. The Net is still out of control in fundamental ways, but it might not stay that way for long. What we know and do now is important because it is still possible for people around the world to make sure this new sphere of vital human discourse remains open to the citizens of the planet before the political and economic big boys seize it, censor it, meter it, and sell it back to us.
>
> *Howard Rheingold, Journalist (1993, 4-5)*

Important regulatory issues regarding computer-mediated communication include universal access and universal service, open platforms and interconnection rights, privacy, and protection of intellectual property, copyright, and principles on the fair use of information.

a. Universal Service, Universal Access, Open Platforms, and Interconnection

The issue of ”universality” in computer-mediated communication networks cuts two ways, split into a demand and a supply side. First, on the demand side, the principle question is whether everyone who desires access should receive access to the networks? If the answer is yes, then the government most probably interfere in market operations because not everyone can afford the cost of access. This is called the provision of universal service.

In 1991, the Organization for Economic Co-Operation and Development (OECD) published the ”Revision of Universal Service and Fees of Information & Telecommunications Services”. It defines universal service as a telephone service which 1) is available throughout the country, 2) is economical for anyone, 3) has the quality of uniformity, and 4) functions without any discrimination. The extent to which the principle of universal service should be applied to particular telecommunication services is not clear. Services in the context of voice telephony could include the provision of the basic telephone service, subscriber directories, operator assistance, public payphones, emergency services, services to disabled users, advanced billing or calling features, and free service numbers.

Principally, universal service provision is a public good: efficiency reasons may promote the exclusion of some user groups, for example, because they live in a remote area. Or, with the rise of technical complexity and the accompanying cost increases, some user groups may be excluded because they simply cannot afford the technology. An important question is whether regulatory innovation, i. e., political action to define the regulatory framework, can compensate for the technology-inherent social pitfalls. While efficiency considerations, paralleled by concerns over the international competitiveness of computer-mediated communication-related industries, may call for the governmental support of highest technologies, equity considerations cannot be ignored. The danger of information *haves* and *have-nots* is great; and concerns over the possible appearance of a dictatorship of the few information and communication proficient are not utopian.

Deregulation and liberalization of the telecommunications sector to create a competitive environment implies newer service and cost principles than existed during the times of national monopolies. When governments ”owned” the telecommunications sector, they could directly subsidize those that could not afford either access to the system or the fees for making telephone calls. The method has been to charge more for long-distance and business services than costs deemed necessary, and to charge lower prices for the expensive ”local loop”. Competitive considerations, however, do not permit this ”cross-subsidizing” between different business sectors. The problem arises of how to minimize governmental interference in the market while promoting universal service.

A competitive environment assumes economically-calculated prices where marginal cost equals marginal benefit. However, universal service and cost calculations are a complicated matter. The cost of universal service provision can be defined as the cost of providing service to all customers at the same price, whether they live in the city or in the countryside or on a remote island. These costs should not be confused with so-called ”access-losses”, which is ”the loss associated with the shortfall of revenue from rental and connection charges with respect to the non-traffic sensitive costs allocated to the provision of exchange lines or access” [Commission, 1995b]. This is a complicated definition, it means that the access loss is not equal to the costs occurred by the provider; those people who have a telephone are also called by other paying customers, thereby increasing the income of the provider. The cost of universal service pertains to operational costs from using the network.

In the past, concerns over national security and other military issues have caused decision-makers to limit accessibility to computer-mediated communication networks. The networks operated on the principle of exclusionability: to use the networks required a certain form of authorization, normally only awarded to a small group of selected individuals. Conversely, networks that grew from below, have attempted to reach the largest number of people possible. During the 1980s, these opposing streams started, at least partially, to intermesh. An all-important question of the present and the future is the one of access to these networks. While access has above been treated as a problem because of its financing, computer-mediated communication does not entail black box technologies such as the telephone. Rather, they are complex and complicated in their use. Usability stands in a tradeoff with technical complexity: the more complex a system is, the more difficult it is to understand its components. When technical complexity is promoted, for example, for efficiency reasons, those with less education than necessary to operate the communication system are disadvantaged, and perhaps they are even excluded from the benefits of the technology. The question arises whether the issue of universal service is also one of education. If that is the case, then some universal service schemes may have positive intentions, but in reality they do not promote an equitable outcome.

Another question concerns the extent of universal service. If governments do decide to build high-capacity and high-quality networks, will all have access to all components of computer-mediated communication? For instance, some services may be based on high-quality multimedia presentations. Is access to these services by all necessary? If one negates this question, where do we draw the line between the necessary and the superfluous? In a democratic environment, this question is likely to create intense battles between the different underlying interests.

The other side of universality concerns the supply side. Universal access, open platforms or interconnection requirements concern the access of service providers to networks. Some larger enterprises are likely to pursue vertical integration of computer-mediated communication technologies and services. They provide the networks, the services, and the content. The early 1990s have already witnessed the formation of giant multinational alliances or mergers in the telecommunications, service and content industries. Small service providers without their own networks are also on the rise; already thousands present themselves on the Internet and many more are entering the online-markets daily. The question is: should vertically-integrated network providers grant access to their networks even if the other is a direct competitor? Some fear that large corporations could create monopolies by refusing access to their networks. The result is less competition and the splitting up of markets between a few giants. Thus, governments have a clear interest in protecting competition. Either they regulate the concentration on the supply-side or they set up and administrate the rules for mutual access. The specifics of mutual access, however, are not yet clear. How much can the network provider charge for access? Even if that provider grants access, how can it be prevented from obstructing the other's efforts in one way or another? These questions are high up on the regulatory agenda, as the subsequent chapters will show.

b. Privacy, Free Expression and Democracy

The issue of privacy concerns three areas: personal autonomy, which is the right over one's own information, free expression, which is the right of free speech, and the appropriate conduct in a public sphere, which involves the protection from illegal, indecent, offensive, and immoral materials. The latter issue contains an added difficulty: what are indecent, offensive and immoral materials, and for whom? What may be acceptable for adults may not be appropriate for children.

Critics from the ”Panoptic School” warn that modern information technologies expand the opportunity to observe private and commercial activities [for example, Foucoult, 1977; Robins and Webster, 1988]. The principle of a Panopticum, developed by Jeremy Bentham in the Eighteenth Century to create a perfect prison, is the following: while the one (the prisoner) is subject to constant observation, the observed cannot see the observer but knows that s/he is being observed. This leads to a type of tyranny in which nobody allows himself to do anything because s/he *could* be watched.

Computer-mediated communication entails the technology-inherent potential of surveillance and misinformation. When we use the Internet, we leave trails of our activities. For example, when we transmit sensitive or private information over the Internet, people can potentially intercept this information. Even when we are not using the Internet or online providers, we leave trails. For instance, when we use a credit card or the phone, information on these activities is saved somewhere on a digital basis and potentially accessible by intruding outsiders. These outsiders could make communication profiles, or even monitor content. The most dangerous inherent element of computer-mediated communication is that control operates in very subtle ways, without anybody noticing. Computer-mediated communication in particular is subject to that danger as it corrodes traditional social values (evidence is the frequently-observed derogatory speech in the Usenet). A big problem is that not only a state hostile to its citizens, or a hostile foreign state, can be the observer, but that everybody could spy on everyone else. Software robots, also called knowbots or spiders, can be programmed to automatically track others' activities.[20]

Thus, the security and privacy problems arise on two levels: the governmental one, where the government collects information on its citizens, for example for tax collection purposes, and the private one, where especially enterprises collect information about their (potential) customers. On the governmental level, the issue of privacy is closely linked to procedures in governmental agencies. First and foremost, to what extent should privacy be protected in the collection of information as privacy stands against legitimate activities of the state? This question breaks up into two parts: what information should be stored, and if information is stored, how confidential should it be? For example, is it appropriate to transfer the information collected in one governmental agency to another? In periods before the computerization of information collection and storage, these questions were important and because of feasibility limits easy to answer; however, with the ease of information management by powerful computers and networks, these questions are particularly pressing.

While these questions concern the issue of how people can be protected from excessive governmental information collection, how can a government assure that unauthorized people do not collect personal information on individuals, or in other

[20] Although, one must mention, the original intention of software robots was a different one, for example, the comfortable and automatic retrieval of information from the Internet.

words, how can the government protect the population from informational attacks by third persons? Take the following example: a major software producer introduces a new operating system that provides for automatic access to its own online network. During the registration procedure, the online system accesses a particular file on the user's computer. This file, which collects information on programs that are present on the computer, is then automatically transferred to the online provider. The provider can now examine the information in this file and use it for marketing purposes. For example, the existence of children's programs on the computer may prompt the provider to send information on its own online children's section. Or when many have such programs, then the software producer may perhaps decide to develop a certain type of program to satisfy this demand. The ”observed” often does not know that s/he gave that information to the online provider. This case indeed happened; it was relatively benign and the software producer (supposedly) discontinued this activity shortly after it was uncovered.

Nevertheless, this type of information collection for marketing purposes is one-off happening. So-called ”cookies” have become popular in recent years. Their purpose is to collect information about the users' activities in the World Wide Web. When the user opens certain graphical and interactive files in the World Wide Web, s/he often leaves a trail. Certain programs collect that information and distribute it to interested parties, such as marketing firms or databases. While these cookies are also relatively benign and have the purpose to ease the interaction between a service provider and a customer, less benign software in form of specially-programmed robots could easily collect sensitive information, such as passwords, online banking data, communications with one's lawyer, or the latest scientific results. These practices compromise both privacy and confidentiality, and they thereby undermine the trust in the system as a whole. In sum, informational surveillance and attacks on one's privacy are technically possible and more widespread than many suspect; this calls for a governmental response.

The issue of privacy in computer-mediated communication networks is closely linked to the use of cryptography. The Office of Technology Assessment defines cryptography as ”a fundamental technology for protecting the confidentiality of information, as well as for checking its integrity and authenticating its origin” [Office of Technology Assessment, 1994, Chapter 1, 6; see also ibid., 1987; 1992; 1993a;

1993b]. First, cryptography is a means to protect privacy, both in the national and the international realms. Second, cryptography can secure electronic commerce. For example, it can be a means for authentication of the source of a transaction. It can assure that a message content is unaltered during transmission. It can prevent the disclosure of the transaction to unauthorized persons. In addition, it can verify receipt of the transaction by the intended trading partner (authentication and non-repudiation of transactions) [ibid., Chapter 3]. In sum, cryptography can promote the trustworthiness of a system, both in terms of personal information security and security of commercial transactions.

Principally, two types of cryptography exist today: symmetric and asymmetric cryptosystems. Symmetric cryptosystems are secret-key or single-key systems. The same key is used to encrypt and decrypt a message by the sender and receiver, just as one key opens a box. While this system is not necessarily weaker in code security than asymmetric systems, it has one basic flaw: the receiver has to know the code to decrypt a message, and the sender has to transmit it. In other words, the sender has to somehow send the key to the receiver to open the box. This may pose a security problem, especially when sender and receiver are geographically apart. Asymmetric cryptosystems are dual-key systems, similar to a personal safe in a bank. One key, called the public key, is used to encrypt a message. The sender encrypts the message with the receiver's public key. A second key, called the private key, is then used to decrypt the message. Both keys are mathematically related; for example, both keys may be the derivative of a prime number. Only the person who has the fitting private key to a message that has been encrypted with a public key can open the message. Thus, if *I* send you a message, I will use *your* public key to encrypt it, and only you can decrypt the message with *your* private key as you are the only one who has the fitting private key. This system is technically demanding (computing power) and therefore slower than symmetric cryptosystems. However, it has the advantage that noone has to send an insecure key because nobody has an advantage in knowing another person's public key. This system can also be used to distribute secret keys of the symmetric kind to overcome the slower speed of the asymmetric system.

Public-key cryptography can also be used for message authentication by using ”digital signatures”. I could ”sign” my message with my private key. If you use my public key and thereby decrypt the message, then you know that the message can only come from me. Similarly, it can also be used for authentication of the integrity of the message, i. e., to control whether the message has been altered during transmission. I can process my message to you with a ”hashing algorithm”. This algorithm, that works only one way, produces a short digest of the message. I you apply this algorithm as well, and the digest is different, then you know that the message has been tampered with. This is all analytically complex, however, relatively simple to implement in user-friendly software.

Nevertheless, complete security does not exist. Two problems exist with the asymmetric cryptosystem. The first is that one only has security when one protects one's private key. One has to keep in mind that such a key is not what we know from four-digit bankteller cards. Today's computing power enables the decryption of large codes. Thus, the codes that have to be used for secure communications are very long; for example, the public key of the Electronic Frontier Foundation takes up more than half a legal-size page in normal print. The private counterpart of this code would have to be electronically saved on a diskette or a hard disk, or maybe on some form of data-card in the future. The loss of this information requires some backup security infrastructure similar to the credit card system.

The exchange of information demands that each party has the public key of the other. This may be a problem when the parties have never met or when the distance between both is large. The efficient exchange of public keys can be done in clearinghouses. Such clearinghouses could authenticate the validity of the other's public key. The authentication of the key's validity is important because when this key is not validated, a third party could alter the content of the transmitted information and seemingly validate it with his or her own (or a fictitious) key. The receiving person thinks that the provided public key is the one of the original sender, while in reality it is not. Thus, the lack of a trusted clearinghouse is a security problem in those instances in which two communicators do not personally transmit their public keys. A trusted clearinghouse has the following advantages: it validates the identities, provides the ability of users to validate one's own or other's public keys (check whether the keys have been compromised or expired), and acts as a notary to confirm whether transactions have been made or to store certain documents [ibid., Chapter 2].

Political will and legislation could easily promote the implementation of secure and trusted systems. The principle political problem, however, is that the function of cryptography is a completely different one from the previous technological paradigm. Cryptography has long been the domain of military and national security concerns. It has existed for thousands of years; however, recent advances in computing technologies have brought high-security cryptography into everyone's home. Some governments now fear the loss of control over information exchanges. They argue that the national security of the country is in jeopardy; foreign agents could easily conduct espionage, and terrorists can prepare their attacks without fear that they are observed. Consequently, some governments or governmental agencies call for the prohibition of the private use of cryptography, or at least for the limitation of the key lengths so that they can access protected information. In some countries, the issue of cryptography versus privacy has caused substantial political battles, as we will see in the chapter on the United States. Other countries, for example, France, forbid the use of cryptography altogether.

When a user of computer-mediated communication prefers publicity, another problem arises: what is the appropriate conduct in the public sphere of computer-mediated communication? The Usenet has been the principle forum for public discussions. It serves as an alternative news source that can be used for very different reasons, private ones or political ones. Precisely that nature has slowly entered the regulatory mind: the ”free expression, lack of central control, many-to-many communication access, and volunteer effort” is increasingly getting the attention of public authorities, especially Usenet's sex and racist newsgroups [Rheingold, 1993, 130-131]. However, the structure of the Internet as it has grown outside of the public's attention makes it very difficult to get the genie back into the bottle; when newsgroups are censured, they can simply move to other parts of the Internet, for example, on a server outside a particular country’s borders and therefore its jurisdiction.

Existing global networks such as the Usenet or BBSs raise some fundamental questions: who is responsible for newsgroup content and who can censor it on the basis of what principles? Are pornography groups a matter of free speech and free expression? Or are they the virtual counterparts of real society in which cities have banking districts and red light districts? Will authoritative or dictatorial states censor the global networks because they do not want the truth to disseminate? What country’s laws apply in such a network; where the information originates or where it is consumed? These are fundamental political questions, both in the national and international arenas.

In sum, technological advances in computer-mediated communication have consequences for privacy. How can governments secure the informational autonomy of their citizens? What public interests are of such importance that they merit the limitation of informational autonomy, privacy and the right of free expression? Such questions are highly important in the case of computer-mediated communication technologies and the technological development of society. They demand a regulatory response as the self-regulating market is unlikely to achieve a fair outcome that has the support of wide segments of society.

c. Intellectual Property, Copyright and the Fair Use of Information

Computer-mediated communication technologies have a strong impact on the publishing domain. Anything that has been stored on paper, on tape, or on canvas can now be transformed to digital information. Digital information can be easily copied without quality losses, transferred over computer-mediated communication networks, manipulated, and converged with other media. The authors and owners of protected materials thereby potentially lose control over their original works as the illegal dissemination of digital information can hardly be controlled. These facts raise a number of critical questions, as the United States Office of Technology Assessment outlines:

- Who owns the rights to digitize an image, including photographs, images of classic paintings, and other materials?
- If an image or other kind of data is digitized and subsequently enhanced, is the second-generation image protected under copyright?
- To what extent is the linkage of a series of media (for example, images and a soundtrack) copyrightable separately from the images themselves and the soundtrack itself?
- To what extent are libraries (or other networked information providers) liable for contributing to copyright infringement in an electronic information environment?

- Does the rightholder in a work hold all necessary rights to that work's components? What rights have been conveyed through already existing agreements? How are necessary rights acquired?
- Depending on what works are incorporated, and the method by which the product is to be exploited (including manufacture, sale, and distribution), what rights are necessary to each item included in the product [1994, Chapter 3]?

Furthermore, should a distinction exist between commercial and private uses of works? If the authors or owners do not have direct control over their products, do methods exist that ensure remuneration? How are the rights distributed between authors and owners? What technological means exist to protect works, such as encryption (access to works only with the paid-for key), copy protection schemes or contractual agreements such as header contracts [for a description, see Samuelson, 1994]? If these technological means to protect works indeed are implemented, what exemptions exist and how are they implemented? And if the exemptions are implemented, how can it be assured that the underlying technological methods do not proliferate in the public?

To find an answer to these questions is difficult. Consider the multiplicity of directly involved players: first, the rightholders, who are the authors, the creators of databases and software applications, and creative industries as a whole; second, the holders of related rights, including performers, music and movie producers, and broadcasting organizations; third, the manufacturers, distributors and users of services, and network operators and collecting societies; fourth, the public users, including libraries, schools, and universities; and fifth, the private users. The lines between these groups are of such fluidity that an equitable solution to the problem of intellectual property and copyright is almost impossible. Furthermore, in a medium like the Internet, the necessity to protect intellectual property does not end at one country's borders. Presently, however, no international agreement on online or digital intellectual property exists, and if one were to exist, can it be enforced? The following international organizations have responsibility in this issue: the Berne and Rome Conventions, the World Intellectual Property Organization (WIPO), the United Nations Educational, Scientific and Cultural Organization (UNESCO), the Organization for Economic Co-operation and Development (OECD), the Agreement on Trade-related Aspects of Intellectual Property Rights (TRIP), and the World Trade Organization (WTO). Deliberations on this topic are now underway.

In sum, computer-mediated communication technologies have a strong impact on intellectual property and related issues. As before, these questions merit a regulatory response. While progress in the international sphere does exist, the outcome remains open. Below, we will consider how the Triad has been treating the issue domestically.

d. Work and Workers' Rights

Another regulatory aspect concerns the interaction between employers and employees. Computer-mediated communication technologies pose problems on two levels. The first level is of a macroeconomic nature: the rationalization potential of the technology. Herbert Kubicek and Arno Rolf argue that the technology-inherent attributes entail social risks [1985, 280ff]. On one hand, computer-mediated communication enables the rationalization of industry employment. Thus, technology alters the bargaining structure between employers and employees. On the other hand, it does not, as often promised, create a sufficient number of jobs in the service sector to offset the employment losses. A good example is the coming of electronic banking: increased use of computer-mediated communication is slowly causing a significant decline in service jobs. What Kubicek and Rolf find especially disturbing is the temporal and spatial delinking of rationalization measures (the implementation of electronic banking) and their effects (the slow increase of the installed electronic banking user base and the parallel creeping decline of labor demand). Since measures and their effects diverge, employees increasingly lose their influence on enterprise processes, whether they are organized in unions or not [see also Roßnagel, 1990]. The second danger is that increased use of teleworking reduces employees' rights. Up to date, few work protection regulations exist on home employment. And, when they exist, how are they enforceable? If employers insist on implementing control mechanisms to oversee telework, for example, the implementation of devices that measure the amount of time a teleworker actually works, how would this relate to fundamental privacy questions. By being able to regulate the relations between employers and employees, governments have considerable power over basic macroeconomic variables, such as the wage level and machine runtimes. Below, we will explore whether governments have discovered this regulatory instrument to influence the technological development of society.

## III) Preparation for the Next Chapters

The highest political levels in the United States, the European Union, and Japan have presented 'white books' or strategy papers on information and communication technologies. The argument that the terms ”information society” or ”communication society” predominantly have a metaphorical dimension and the introduction of the concept of a ”substantive vision” together form the basis for the discussion of these visionary and strategic policy outlines. The discussion in Chapter 2 of technological and regulatory action areas provides the basis for the analysis of decision-making in the Triad. Certain policy demands exist; we will explore whether decision-makers, governmental and non-governmental, have recognized these policy demands and to what extent they have been implemented in policy initiatives.

# Chapter 3

# Computer-Mediated Communication and Technology Policy in the United States: The ”Information Superhighway”

## I) The Reagan and Bush Administrations

Two significant events distinguish the early era of computer-mediated communication in the United States from that of the 1990s: the end of the Cold War and the slow opening of military and research networks in the late 1980s and early 1990s. These factors promoted an identifiable cleavage between the Reagan/Bush Administrations and the Clinton Administration: a reorientation of the underlying aims and strategies of computer-mediated communication networks. To emphasize that cleavage, this chapter is structured slightly differently than the subsequent chapters on the European Union and Japan: it examines events and processes of each Administration.

### A. The Reagan Administration and the National Security Imperative

National security and military research concerns dominated the Reagan Administration's approach to national and international computer-mediated communication networks. As was introduced in the brief history of computer-mediated communication in Chapter 2, the ARPANET of the 1980s was a continuation of the Department of Defense's efforts of the 1960s and 1970s to install a military- and research-oriented communication network that could survive a massive nuclear attack. Access to the network was largely restricted to predefined levels of security clearance in the early 1980s and was opened to university researchers and scholars only in the second half of the 1980s.

The slow opening of access to the ARPANET during the 1980s increasingly promoted conflicts of interests between different agencies within the Federal government as well as between the defense-oriented system administrators and the scientific community.[21] Considerable overlaps of agency responsibilities between the Office of Management and Budget (OMB), the General Services Administration (GSA), the Commerce Department, and the Department of Defense and its National Security

[21] In 1983, the ARPANET was split into the ARPANET and the MILNET. The Department of Defense controlled the MILNET and the latter was a purely military-oriented network. See, for example, McClure et. al, 1991, 8-12.

Agency (NSA) already existed prior to the Reagan Administration.[22] Especially the NSA's role was controversial during the opening process of the ARPANET as it was responsible for the security of classified and sensitive unclassified information. An Office of Technology Assessment Report of 1991 states that the "overlapping agency responsibilities hindered the development of one uniform federal policy regarding the security of unclassified information, particularly because computer security and communications security historically have developed separately" [Office of Technology Assessment, 1991, Chapter 4]. The Congressional General Accounting Office (GAO) concluded already in 1982 that the concurrent situation failed to provide clear guidance to agencies on minimum safeguard requirements, to clarify the relationship between defense-related national security and information security, and to provide guidance on general telecommunications security [GAO, 1982; cited in ibid., 1994, Chapter 4].

The Reagan Administration interpreted open information exchanges over computer networks as a potential threat to national security. Accordingly, it pursued to further strengthen the NSA's control over information exchanges which had been initiated during the Carter Administration.[23] While the Executive Order 12333 of 1980 had designated the Secretary of Defense as the Executive Agent of the Government for Communications Security, the National Security Decision Directive 145 of 1984 expanded this responsibility to include telecommunications and information systems security. NSDD-145 effectively enhanced the role and influence of the NSA. It thereby intensified the conflict between national security concerns and the mounting desire of academics and scientists for free information exchanges. A second important directive further restricted information exchanges. National Security Adviser John Poindexter's National Telecommunications and Information Systems Security Policy Directive No. 2

[22] The Office of Management and Budget is responsible for computer security; the General Services Administration for the issuance of regulations on the physical security of computer facilities, and for the overview of technological and fiscal security specifications for hard- and software; and the Commerce Department (the National Institute for Standards and Technologies (NIST) and the National Telecommunications and Information Administration (NTIA)) for the development of Federal Information Processing Standards (FIPS) (specific codes, languages, procedures, and techniques that are used by federal information systems managers). See OTA, 1991, Chapter 4.

[23] The relevant executive order is the September 1984 National Security Decision Directive 145 (NSDD-145), the classified National Policy on Telecommunications and Automated Information Systems Security. NSDD-145 established the Systems Security Steering Group and the interagency National Telecommunications and Information Systems Security Committee (NTISSC) which had the task to oversee and implement the executive order. The Office of Management and Budget introduced in 1985 OMB Circular A-130 that revised and clarified definitions of security and information exchanges within

intended to restrict access to ”sensitive but unclassified information” the revelation of which could not only be contrary to national security concerns, but could also impact ”other federal government interests”. These could include economic, financial, technological, industrial, agricultural and law enforcement interests. The policy directive again enhanced the responsibility of the NSA.

In hearings of the House, Raymond Kammer, the Deputy Director of the National Bureau of Standards (NBS, now the National Institute for Standards and Technologies, NIST), criticized this as being a ”totally inclusionary definition. ... [T]here is no data that anyone would spend money on that is not covered by that definition” [House, 1987a; see also House, 1987b]. The 1994 Office of Technology Assessment Report summarizes:

> The Reagan Administration had sought to give the National Security Agency much control over ”sensitive, but unclassified” information, while the public – especially the academic, banking, and business communities – viewed NSA as an inappropriate agency for such responsibility. The Reagan Administration favored an expanded concept of national security. This expanded concept was embodied in subsequent presidential policy directives, which in turn expanded NSA's control over computer security. Questions regarding the role of NSA in security for unclassified information, the types of information requiring protection, and the general amount of security needed, all divided the Reagan Administration and the scientific community in the 1980s [1994, Chapter 4; for examples, see also Relyea, 1994; Office of Technology Assessment, 1987, Chapters 6 and 7; and Soma and Bedient, 1989].

These predominantly Cold War-oriented national security concerns prompted a strong negative public and business response. The Computer Security Act of 1987 was a congressional reaction to the efforts of the Reagan Administration to restrict the governmental control of the ARPANET. It was, in the words of the Committee on Science, Space and Technology of the House of Representatives, the ”civilian counterpart” to NSDD-145 [House, 1987b, 26]. The Computer Security Act (CSA) redefined and redelegated actor responsibilities in the supervision of the ARPANET. It formally cut back the responsibilities of the Department of Defense and the NSA, and it awarded the National Bureau of Standards ultimate authority over the development of government-wide standards and guidelines for unclassified, sensitive information and

---

federal agencies. This circular, superceding the OMC Circular A-71, was criticized for not alleviating these problems. See OTA, 1991, Chapter 4.

the development of government-wide training programs. It furthermore established a Computer System Security and Privacy Advisory Board within the Department of Commerce, and ”require[d] federal agencies to identify computer systems containing sensitive information, to develop security plans for identified systems, and to provide computer security training for all employees using or managing federal computer systems” [Office of Technology Assessment, 1994, Chapter 4].

Despite the formal redelegation of powers from the military to the civilian sector, the Reagan Administration prevented a cutback in the NSA’s powers. Especially the Memorandum of Understanding (MOU) of 1987 between NIST and NSA was of particular importance in guaranteeing that the latter preserved considerable responsibilities. This raised concerns in Congress and elsewhere:

> Observers – including OTA – consider that [the MOU] appears to cede to NSA much more authority than the act itself had granted or envisioned, especially considering the House report accompanying the legislation. … Where the act had envisioned NIST calling on NSA's expertise at its discretion, the MOU's working-group mechanism involves NSA in all NIST activities related to information-security standards and technical guidelines, as well as proposed research programs that would support them. … Thus, the provisions of the memorandum of understanding give NSA power to delay and/or appeal any NIST research programs involving ”technical system security techniques” (such as encryption), or other technical activities that would support (or could lead to) proposed standards or guidelines that NSA would ultimately object to [Office of Technology Assessment, 1994, Chapter 1; see also House, 1989a].

Milton J. Socolar, then Special Assistant to the Comptroller General, confirms this assessment: ”as one reviews the [MOU] itself against the background of the [CSA], one cannot help but be struck by the extent of influence NSA appears to retain over the processes involved in certain areas – an influence the act was designed to diminish” [House, 1989a, 47].

Of particular concern was the oversight process. The Computer Security Act outlined that while the President could not modify or obstruct standards that are not in the public interest, he or she could still notify House and Senate Committees and publicize the reasons for disapproval in the Federal Registry. The Memorandum of Understanding, however, raised interagency negotiations between NIST and NSA above control mechanisms: both agencies could decide without oversight and without the possibility to intervene. The MOU did not only reduce Presidential oversight and influence, but Congress criticized that "[i]mplementation of policy decisions through the issuance of undisclosed directives poses a significant threat to Congress' ability to discharge its legislative and oversight responsibilities under the Constitution. Operational activities undertaken beyond the purview of the Congress foster a grave risk of the creation of an unaccountable shadow government – a development that would be inconsistent with the principles underlying our republic" [House, 1987b, 33]. For example, NSA's hold over encryption policies and the development of technical security standards remained strong throughout the Reagan, Bush and Clinton Administrations. The 1993 Office of Technology Assessment Report even states that NSA's influence on cryptography was so strong that it could delay the implementation of policy for a period of twelve years following first demands for such a policy in 1982.

Both NSA and NIST disagreed with these critical assessments. Regardless of the MOU, they argued, NIST retained full authority. Furthermore, issues such as cryptography are sensitive. The Cold War merited a strong NSA role as the latter controlled critical technical information. Furthermore, any action in the civilian sector had to be consistent with NSA's national security assessments and security demands regarding future systems [see, for example, Senate testimony by NSA Director Vice Adm. J. M. McConnell, Senate, 1994, 1-2].

To conclude, the development of computer-mediated communication networks during the Reagan Administration remained primarily subject to national security concerns despite congressional efforts to redelegate authorities from the military to the civilian sector. Although some commercial networks developed, such as CompuServe or Prodigy, the Reagan Administration concentrated on the technological development of networks for military and military-research purposes. A cumulative economic, social and political societal strategy was non-existent. Nevertheless, this exclusive approach was not overly successful. Distrust in the government mounted in the scientific and business communities and the general public. Classified directives and a stronghold over private developments in encryption technologies prompted many to question the government's right to monopolize the control of information exchanges. Mounting criticism led to a reevaluation of the issue of computer-mediated communication during the Bush Administration.

## B. The Bush Administration, Networks, and Scientific Research

Although the Bush Administration placed not the highest-level priority on computer-mediated communication networks and did not define and provide a societal vision, it recognized the benefits of reducing the pre-eminence of the Cold War imperative and of opening network access to a wider community. Primarily led by the scientific community and certain congressional activists, the concept of an all-encompassing computer-mediated communication network and its societal penetration entered its adolescence in the late 1980s.

The principle initiative rested with Congress. The High Performance Computing and Communications (HPCC) Program and the establishment of a National Research and Education Network (NREN) were the most important policy initiatives. The HPCC program has had the purpose of funding and conducting research for the development of appropriate technologies; to mandate the creation of the NREN and to promote the linkage of over 1000 federal and industrial laboratories, educational institutions (predominantly universities), libraries and other institutions; to promote the development and provision of content (databases, journals, books in digital format, electronic tools, commercial information services, user support, training, etc.); and to fund the development of supercomputers and software that can promote research on so-called ”grand challenges” (large-scale scientific research) [McClure et al., 1991, 2-3]. Specific goals were:

- to provide an advanced information infrastructure linking the Federal government, academia, and the private sector;
- to enhance the economic competitiveness of the United States by facilitating communication among scientists, engineers, and educators, improving scientific and research productivity, and speeding up the rate of technology transfer between research and manufacturing sectors;
- to extend the full range of network resources and services, including supercomputing resources, to all users;
- to support the development of a National Collaboratory;
- to make the research and educational networking transparent to users by standardizing network protocols and procedures; and

- to serve as a testbed for research and development on high-speed networks and high-performance computing [ibid., 12].

The users of existing networks gave the main impetus for a new infrastructure. Scholars, scientists, and researchers were dissatisfied with contemporary network performance. Although the Federal Research Internet Coordinating Committee (FRICC) of the Office of Science and Technology Policy (OSTP) managed the Internet on the federal level, below that level, the system was decentralized and anarchic. This caused the following problems:

- network fragmentation, limited coordination, and deficient standardization which causes unequal access to computing resources;
- limited network capacity and little reaction to increasing demand;
- lack of user friendliness, support, and instruction [ibid., 42].

These problems necessitated a comprehensive approach at the federal level. Despite a high degree of consensus over the establishment of the NREN, the policy process was 'bumpy'. Governmental reports ”indicated high-level Executive branch interest in the idea of networking, recommending that the Federal government establish partnerships with industry and academia to 'coordinate research and development for a research network to provide a distributed computing capability' that links these three sectors” [ibid., citing OSTP, 1987, 21]. Nevertheless, the scope of the network plans was limited to the science and research community.

Al Gore, then Congressional Senator, has been the key player in legislation on high performance computing since the mid-1980s. Already during the Reagan Administration, in 1986, he sponsored S. 2594, the *Supercomputer Network Study Act* to authorize the investigation into the technology of fiber optics and the identification of critical problems and future options regarding the creation of communication networks (this Act became part of the *National Science Foundation Authorization Act for Fiscal Year 1987*). McClure et al. state that this ”mandate was the impetus for [the Office of Science and Technology Policy's] initial 1987 study of high-performance computing” [ibid., 16].

Subsequent legislation failed to pass Congress for several years.[24] Senator Gore and House Representative Walgren introduced companion bills in Congress in several versions between 1988 and 1990. These bills did not pass. The revision process however indicated a trend towards more open access, the integration of more governmental actors, a reduction of NSA responsibilities and an upgrade of NIST's responsibilities, greater interagency coordination, more involvement of industrial actors in the standards-setting process, a wider scope regarding information services, and more commercialization and privatization. The main point of disagreement was the designation of the lead agency, alternating between the National Science Foundation (NSF) and the Department of Energy (DoE). The difference between both legislative proposals was the question of access: the ”NREN that would be built by the DoE would differ from the one envisioned in S. 1076. It would be open to users outside of government, academia, and private industry. Advice would be sought from a wider group of potential users, not just high-profile and prominent network experts. The management of the NREN would be firmly centered in DoE, subject to the directives of the Secretary of Energy. Finally, the future of the network was left open; it could be sold or simply eliminated” [ibid., 23]. S. 1976 also called for the creation of a Federal Interagency High-Performance Computing Task Force that would ”examine agency rules, regulations, policies, and practices to determine which ones inhibited the use of HPC and make recommendations for changes”, and furthermore determine the question of access to the network [ibid.]. Thus, not only a network approach developed that incorporated government, the scientific community, private business and the broader community of users, but also the recognition that institutional changes between and within governmental agencies are necessary. These provisions were subsequently incorporated into the third version of S. 1076, which passed the Senate but was amended in the House to such an extent that it was eventually killed after it was referred back to the Senate. The conflict over the designation of the lead agency continued with the introduction of S. 272 in January 1991 and S. 343 in February 1991. The former

---

[24] This legislation was: S. 2918, the National High Performance Computing Technology Act of 1988 (Senator Gore); S. 1067, the National High Performance Computing Technology Act of 1989 (Senators Gore and Jeffords); H.R. 3131, the National High Performance Computing Technology Act of 1989 (the House companion bill of S. 1067) (Congressman Walgren); S. 1067, the National High Performance Computing Act of 1990 (Senator Gore); S. 1976, the Department of Energy High-Performance Computing Act of 1989 (Senators Johnston, Gore and McClure); S. 272, the High Performance Computing Act of 1991 (Senator Gore).

delegated the principle authority to the National Science Foundation, the latter to the Department of Energy.

The congressional hearings on the High Performance Computing Act (HPCA) and NREN between June 1989 and March 1990 concentrated mainly on technological and procedural aspects. They displayed overwhelming support by all actors and only details were criticized. Thus, the disagreements over the approach towards a computer-mediated communication network were relatively minor in comparison to the later conflicts in the 1990s. Budgetary concerns existed, as well as disagreements over the distribution of responsibilities. McClure et al. summarize this period: ”Despite the apparent dispute over the nature of the Federal Government's commitment to a national computer network, there is an underlying support of the concept of such a network, whether the NREN is managed and operated by NSF and FCCSET, or the Federal High-Performance Computer Network is run by the DoE. This support cuts across political and public and private sector boundaries; this is evident in the Congressional hearings that have been held over the past decade” [1991, 25].

The Bush Administration remained passive but did not obstruct the developments. Its principle concern was that legislation allows a flexible approach regarding the leading agency and the execution of the program. D. Allen Bromley of the Office of Science and Technology Policy represented this view in House hearings:

> Any plan which ”locks-in” programs within specific agencies could prevent flexibility in out-years. Likewise, specifying budgets for individual agencies five years in advance lead to misallocated resources as circumstances and opportunities change, as they surely will. For this reason, I cannot approve of any legislation – however well intentioned – that might constrain even one current reexamination of the Federal High Performance Computing Program [House, 1990, 4-5].

One particularly important aspect of the legislation was the privatization of the Internet. Commercial organizations, principally consisting of an alliance between IBM and MCI, took over the management of important Internet services. Furthermore, the National Science Foundation turned over the assignment of Internet addresses, in other words, its gateway function (to Internet Solutions), the maintenance of directory and database services (to AT&T), and the maintenance of Internet information services, including the development of Internet search tools (to General Atomics). Bush signed the legislation in 1991.

Despite the apparent legislative success, McClure et al. criticize that many underlying assumptions of the policy process were untested. First, the policy process displayed a bias for the positive benefits to the scientific community and to the international competitive position of the supercomputing industry. However, potential problems, such as the protection of information or the issue of international access, were not extensively discussed. Especially the privatization process became to be a highly contested issue. The privatization of an institution, even an informal one such as the Internet, implies its deregulation. Public groups feared that the commercial organizations would subject access and fee calculations only to their commercial interests. Furthermore, very large companies could raise the barriers of entry to those providers that are potential competitors but that do not have the market power to compete in the long-run. Rheingold questions:

> What will people have to pay, and what will we have to agree to say or not say, in order to both feed information to the Net and take information from it? Pricing determines access. What does big business who want to be the chief Net contractors of the future want to control? If they control the conduits for information, the fiber-optic networks and high-speed routers, and they also compete to provide commercial services through that conduit, what effects will that have on their smaller competitors? What should be a fair price for them to charge for continuing network services? And in what ways might these players be tempted to restrain mom-and-pop information providers to compete with them as vendors of content? Government and major business leaders are debating these questions now, which is why the 1990s are a time when the voice of the citizens counts in determining the shape of the technology's future [Rheingold, 1993, 87-88].

Similarly, Journalist John Markoff states: ”Just one week after President Bush signed legislation calling for the creation of a nationwide computer data 'superhighway', a debate has erupted over whether the government gave an unfair advantage to a joint venture of IBM and MCI that built and manages a key part of the network. … People involved in planning for a national data network say it is essential to provide for fair competition, which will lead rival companies to offer creative and entrepreneurial services in the hope of building market share. Without competition, they say, the government will have created a monopoly that has little incentive to innovate” [1991]. Schrader, president of Performance Systems International, Inc., provider of commercial connections to the Internet, said that ”there is no level playing field. It's like taking a federal park and giving it to K mart. It's not right, and it isn't going to stand. As a taxpayer, I think it's disgusting" [in ibid.]. Mitchell Kapor, founder of Lotus and the head of the Electronic Frontier Foundation (EFF), states: "Nobody should have an unfair advantage. This is important because we're talking about something that is in its infancy but that one day could be on the order of the personal computer industry" [in ibid.]

One issue that is highly controversial is that the taxpayers' money financed the creation of the Internet, but that privatization and commercialization implies new costs for customers. The High Performance Computing Act states that providers may charge users for any services provided. Rheingold questions: "First, MCI and IBM jump in. Now AT&T. Have the big boys already made their secret deals? Is a pricing structure being constructed hastily, before anybody but a minority of the population even understand the implications of a privatized Internet" [1993, 88]. He follows up:

> What degree of public regulation is appropriate in an industry in which citizens' rights to communicate about matters of public interest is staked to the price of access? Now that some of the same commercial outfits that weren't interested in developing the technology twenty years ago are competing for contracts to provide it in the future, what rights do citizens have to determine the way this tool is handed off from the public to the private sector?

In sum, the greatest problems that policy-makers have had to solve are twofold:

- who controls the Internet?
- who will have access to it?

These questions emerged again in the deliberations for the Telecommunications Act of 1996, as we will consider in a section below.

A second critical point of the HPCA, as McClure et al. argue, was that much of the euphoria for the computer networks was based on "untested assumptions about the impacts of electronic networks on scientific research, communication, and productivity". Third, the policy process ignored a "plethora of policy issues associated with the NREN that must be resolved". McClure et al. identify the following unresolved questions and consequences:

- potential conflict of interests between the government (which would run the system) and the scientific community;
- unequal access may promote elitism in science, although the contrary may also develop;

- greater burden on scientists due to documentation requirements on the use of the system (for example, charge or performance based elements may complicate the grant-writing process);
- negotiations between scientists may negatively impact collaboration efforts;
- conflict between wider access and security demands of some;
- potential threats to network security and privacy;
- lack of necessary technologies [1991, 42-43].

Furthermore, although the NREN was to pursue a policy of ”open access”, the definition of open access was limited to scientists, researchers, educators, library, and information professionals in the federal government and academia. To what extent, however, the private sector and the private user would benefit was not explicitly outlined.

Nevertheless, these relatively specific concerns are minor in comparison to the basic policy issues outlined in former chapters. As the access to the network widened and as its use became easier and affordable for non-scientists, these basic policy issues detonated later during the Clinton Administration. The only response could be, and was, the introduction of an encompassing societal vision, of a substantive vision.

## II) The Clinton Administration: The Vision of the "Information Superhighway"

> Particularly with Vice President Gore's leadership and with Commerce Secretary Brown chairing the Information Infrastructure Task Force for the government, this administration is providing very senior attention on this issue. That has resulted in something rather unusual that was perhaps best captured for me by a colleague in industry. We were chatting with some people in his company and he said, "Gee, you know, the one thing that actually has happened with the NII is that the government has done the one thing that I could never imagine. They've created a vision". I go to meetings like this one involving all sorts of organizations. Of course, everyone knows that information technology is important. They have known that this revolution was coming. But today those conversations are more focused and there is a broader recognition that we need to be working across industry boundaries, that we need to be thinking about it at a national scale. In fact, we need to be thinking of it on an international scale. That conceptualization is very important, and it has been driven by this administration.
>
> *Dr. Arati Prabhakar, Director of NIST (1994)*

### A. The Vision

In contrast to previous administrations, the public statements, speeches, and policy initiatives of the Clinton Administration show a clear recognition of the changing nature of communication and information and their integration into a comprehensive system. The Clinton Administration has incorporated the following elements into its vision: the change from the broadcast paradigm to the network paradigm, the change from the material aspects of technology policy to the relational ones, the recognition of the trade-off between efficiency and equity, the role of the government in the promotion of competition, on one hand, and the definition of regulatory policy, on the other, and the complexity of its structure and components. The Clinton Administration came to office with a vision of the "Information Superhighway", a substantive vision that the highest governmental level of the United States have officially pursued from 1993 onwards.

Box 3.1: The Vision of the Information Superhighway and Societal Effects

Imagine:

- The best schools, teachers, and courses [are] available to all students, without regard to geography, distance, resources, or disability;
- The vast resources of art, literature, and science [are] available everywhere, not just in large institutions or big-city libraries and museums;
- Services that improve America's health care system and respond to other important social needs [are] available on-line, without waiting in line, when and where you needed them;
- You could live in many places without foregoing opportunities for useful and fulfilling employment, by ”telecommuting” to your office through an electronic highway instead of by automobile, bus or train;
- Small manufacturers could get orders from all over the world electronically – with detailed specifications – in a form that the machines could use to produce the necessary items;
- You could see the latest movies, play the hottest video games, or bank and shop from the comfort of your home whenever you chose;
- You could obtain government information directly or through local organizations like libraries, apply for and receive government benefits electronically, and get in touch with government officials easily;
- Individual government agencies, businesses and other entities all could exchange information electronically – reducing paperwork and improving service [ibid., 3].

Central to the position of the Clinton Administration is the recognition of the network paradigm in which two-way communications, not just one-way information transmission, are increasingly important. As Vice President Al Gore remarked in a speech before the National Press Club in December 1993: ”The challenge is not, in the end, the new technology. It is holding true to our basic principles. Whether our tools were the quill pens that wrote and then signed the Declaration of Independence or the laptop computers being used to write the constitutions of newly-freed countries, ... better communication has almost always led to greater freedom and greater economic growth” [Gore, 1993, 9]. He explicitly recognizes that improved communication has substantial benefits for communities and the society as a whole:

> How do we balance private needs and public interests? It's important in discussing the information age that we discuss not merely technology, but communications. Because from communications comes community. Not long ago, when travel was very difficult, communities were small and communication was personal and direct. It was between families, neighbors, business partners. … It is important in focusing on what's ahead

> in communications, to zero in not on the technology, but what we use technology for. … We'll send and receive, not just on the telephone but across the full range of the new technologies. We'll turn from consumers into providers. In a way, this change represents a kind of empowerment. The quality revolution in the factory treats each individual as a source of added value. The communications revolution recognizes each individual as a source of information that adds value to our community and to our economy [ibid., 1, 2].

In the Agenda for Action on the National Information Infrastructure (NII), the Administration outlines its vision of a future communication society. This vision combines economic, educational, health care, cultural, social, and political benefits. The vision is comprehensive:

> An advanced information infrastructure will enable U.S. firms to compete and win in the global economy, generating good jobs for the American people and economic growth for the nation. As importantly, the NII can transform the lives of the American people – ameliorating the constraints of geography, disability, and economic status – giving all Americans a fair opportunity to go as far as their talents and ambitions will take them [National Information Infrastructure Task Force, 1993, 2].

The Clinton Administration believes that the NII creates jobs, spurs growth, enables new products and services and fosters U.S. technological leadership; reduces health care costs and increases the quality of service in peripheral or underserved regions; delivers higher-quality, lower-cost government services; teaches children the demands of a future workplace; and enables a more open and participatory democracy at all levels of government. Box 3.1 outlines the Administration's vision.

To benefit from the communications revolution, however, requires supplementary governmental actions that emphasize the relational aspect of information technologies. As was argued in previous chapters, relational technology policy recognizes that each technology is embedded within a wider framework of technological, economic, political and social factors. Thus, the mere existence of material technologies, in the case of computer-mediated communication this is the hardware, is not sufficient for the fulfillment of all benefits of a technology. Government has an explicit task to fulfill; a leadership role that defines and determines the regulatory environment. The Clinton Administration recognizes this:

> In order to communicate richly detailed images that allow us to comprehend large volumes of data, we need to combine two technologies. Computers have an ever-growing ability to transform data into recognizable images.

> And we are making greater use of them every year. But to communicate these images among ourselves, we need networks capable of carrying those images to every house and business. We know how to do that technologically, but we have to unscramble the legal, regulatory and financial problems that have thus far threatened our ability to complete such a network [ibid., 3].

The Clinton Administration also endorses government intervention to protect access and fairness. As Gore states, ”[i]t's a 'phase change' – like moving from ice to water; ice is simple and water is simple, but in the middle of the change it's mush – part monopoly, part franchise, part open competition. We want to manage that transition” [ibid., 5]:

> How can you sell your ideas, your information, your programs, if an intermediary who is also your competitor has the means to unfairly block your access to customers? We can't subject the free flow of content to artificial constraints at the hands of either government regulators or would-be monopolists. … [O]ur legislative package will contain provisions designed to ensure that each telephone carrier's networks will be readily accessible to other users. We will create an affirmative obligation to interconnect and to afford nondiscriminatory access to network facilities, services, functions and information. We must also explore the future of non-commercial broadcasting; there must be public access to the information superhighway [ibid.].

The success of the whole depends on the quality of its components: information, applications and software, standards, compatibilities and security measures, privacy concerns and the people that produce and use these components. Important in the future marketplace will be private owners of the highways, producers of appliances (TVs, telephones, computers, new products), information providers (local broadcasters, digital libraries, information service providers, and ”millions of individuals who will have information they want to share or sell”), and information customers who demand privacy, affordability and choice. Consequently, the government must balance aspects of technology policy (subsidization of R&D, provision of a competitive economic framework, network security, government procurement, education, etc.) with aspects of regulatory policy (universal access, privacy and intellectual property rights).

In sum, the Clinton Administration clearly supports an active governmental role in the policy process, however, it does not argue that it can determine the technological future. Its perceived role is twofold: technology policy to promote the components of the future system and define the competitive environment, and regulatory policy to safeguard against the potential pitfalls. However, the elaboration of a mere vision is not sufficient. The achievement of this ambitious vision requires the definition of long-term aims and strategies, as well as concise short- and medium-term policy initiatives.

## B. The Long-Term Aims and Strategy

The long-term aim of the Clinton Administration derives directly from the perceived decline of the American economic competitive position in the global economy as well as from severe problems in the domestic social system, such as the health care and education systems. Furthermore, the Clinton Administration views new computer-mediated communication technologies as a remedy to overcome the declining trust in American democratic institutions.

One of the predominant aims is the restoration of the competitive position of the United States within the global economy. In his campaign for the presidency, Bill Clinton painted a dramatic picture of the American economic and technological competitiveness [1992]. He cited the example of the U.S. electronic components industry: ”its inability to cross-subsidize businesses, its loss of volume markets, its manufacturing problems, and the high relative cost of capital in the United States over the past decade have allowed foreign competitors to dominate many market segments. U.S. industry is weak in actuators, opto-electronic components and hardcopy technology, and it is losing badly in memory chips, electronic packaging and interconnections, and display technologies” [ibid., 3-4]. He outlined a scenario that describes the decline of the American competitive position in computers similar to the decline in television, video, and optical electronics in the 1960s and 1970s. Indeed, in some high technology domains, the United States have had a negative trade balance, as Table 3.1 shows. Other areas, however, such as computer-integrated manufacturing and software, have had a positive trade balance.

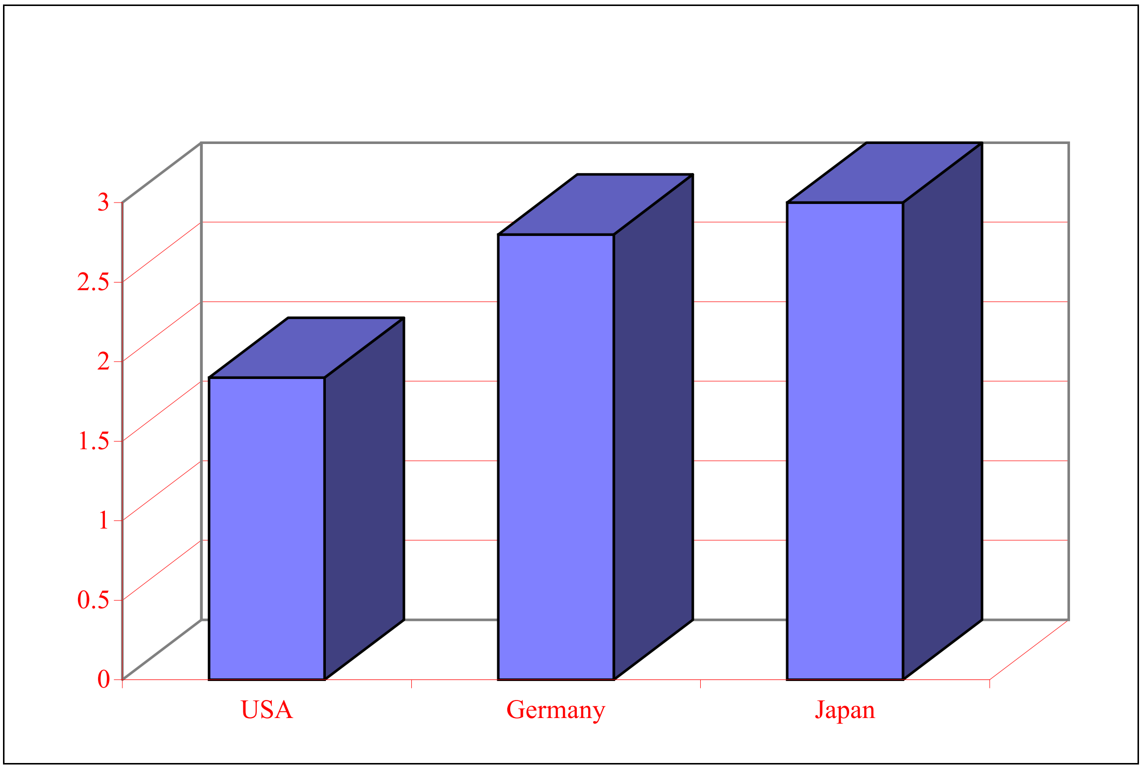
In his campaign paper, Clinton outlined a number of homegrown problems that could be remedied by a consistent and comprehensive technology policy. For example, Clinton argued that American enterprises and researchers invent but others commercialize the results. Also, non-defense R&D investment rates and investments in plants and equipment are lower in the United States than in Germany and Japan (see Figures 3.1 and 3.2). Moreover, ”not enough U.S. students are pursuing training in technical fields" [ibid., 4]. Many foreign students that fill the gaps in the graduate departments of American universities export their knowledge.

Table 3.1: United States Trade Balance in Selected High-Electronics (in mill. $)

| | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|
| Opto-electronics | **–613.9** | **–1410.5** | **–1966.3** | **–1831.3** | **–1607.5** |
| Computers and Telecommunications | 2446,1 | 3002,3 | 505,3 | **–3,411.8** | **–7,019.0** |
| Electronics | **–3,419.8** | **–3,466.1** | 1171,9 | 271,2 | **–104.1** |
| Computer-integrated manufacturing | 1419,1 | 1461,7 | 1728,1 | 1796,4 | 2303,2 |
| Software | 1170,8 | 1429,2 | 1755,9 | 2164,1 | 2594,9 |

Source: National Science Foundation, 1996, Table 6-1.

Figure 3.1: Comparative Non-Defense R&D Spending 1991 in the United States, Germany, and Japan (as % of GDP), as outlined in the Clinton campaign



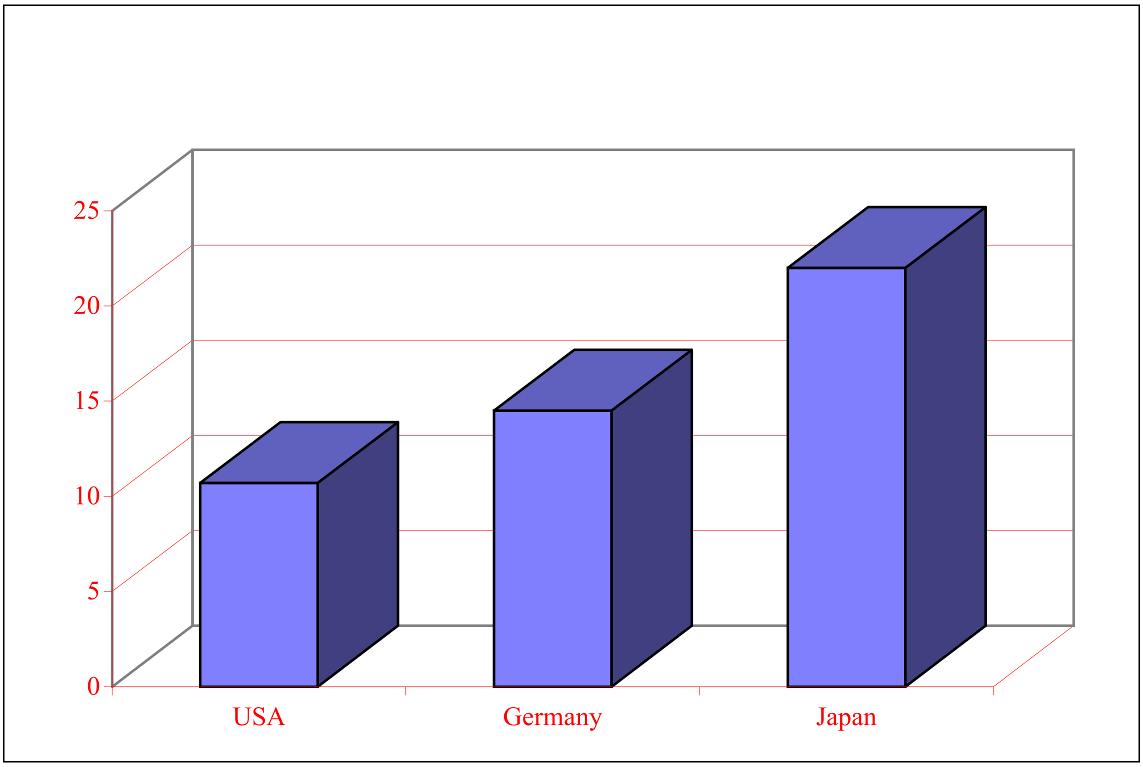

Source: Clinton, 1992.

The statistics used in Clinton's presidential campaign did not offer a precise cumulative picture of the actual state of American competitiveness in high technologies. Higher figures on total R&D expenditures or plant and equipment investment rates do not necessarily imply greater quality or quantity of technological development. Furthermore, as Figure 3.3 shows, R&D expenditures in the United States have been continuously rising. This figure, however, also shows that the governmental investment rates have remained stable since the late 1980s (a later section outlines the shifts within the R&D expenditures). Moreover, considerable R&D investments flow to the defense sector, of which portions spill back to the non-defense sector.

Clinton supplemented his picture of the past with the potential that the NII could pose and used several studies to underline his vision. For example, the Computer Systems Policy Project (CSPP) estimated increased economic growth amounting to $300 billion annually and the Economic Strategy Institute estimated an increase of GDP by $194-321 billion by 2007 and productivity increases of 20-40%. Job creation would reach figures up to 300,000 new jobs per annum in the personal communications services industry in the next ten to fifteen years; a figure that has already been surpassed in the recent years of economic expansion.

The Clinton Administration views the NII as a technology driver for semiconductors, high-speed networking, advanced displays, software, and human/computer interfaces such as speech recognition. The advances would eventually lead to palm-top computing: experts predict computers ”as mobile as a watch and as personal as a wallet, ... [they] will recognize speech, navigate streets, take notes, keep schedules, collect mail, manage money, open the door and start the car, among other computer functions we cannot imagine today” [National Technology and Information Agency, 1993]. The NII as a technology driver would also benefit regional, state and local economic development: ”electronic commerce (for example, on-line parts catalogues, multimedia mail, electronic payment, brokering services, collaborative engineering) can dramatically reduce the time required to design, manufacture, and market new products” [ibid.]. Geographical distance would become negligible.

Figure 3.2: Comparative Investment Rates in Plants and Equipment 1991 in the United States, Germany, and Japan (as % of GDP), as outlined in the Clinton campaign




Source: ibid.

The long-term strategy of the Clinton Administration concentrates on the management of change, the mediation of conflicts and the forging of partnerships:

> Carefully crafted government action will complement and enhance the efforts of the private sector and assure the growth of an information infrastructure available to all Americans at reasonable cost. In developing our policy initiatives in this area, the Administration will work in close partnership with business, labor, academia, the public, Congress, and state and local government. … Forging this partnership will require extensive inter-governmental coordination to ensure that Administration, Congressional, state and local government policy regarding the NII is consistent, coherent, and timely. It also requires the development of strong working alliances among industry groups and between government and the businesses responsible for creating and operating the NII. Finally, close cooperation will be needed between government, users, service providers, and public interest groups to ensure that the NII develops in a way that benefits the American people [National Technology and Information Agency, 1993].

The Clinton Administration views its predominant role in the form of an active mediator, but not as a determinant of the future. It insists that great responsibility rests with the private sector:[25]

> America can compete and win, but only if we have a positive vision guiding our economic policies. Leadership in developing and commercializing new technologies is critical to regaining industrial leadership, creating high-wage jobs, and ensuring our long-term prosperity. Investments in research and development are important not only to high-tech industries such as aerospace and electronics, but to basic manufacturing industries, and to small businesses which must be innovative to survive. Although the government has a role to play in restoring America's competitiveness, most responsibility rests with the private sector. U.S. firms must expand employee involvement and participation, continuously improve their product and process technology, increase their investments in research, development and technology, plant and equipment, and worker training, shorten the time required to bring products to market, and forge better relationships with their suppliers and customers [Clinton, 1992, 1-2].

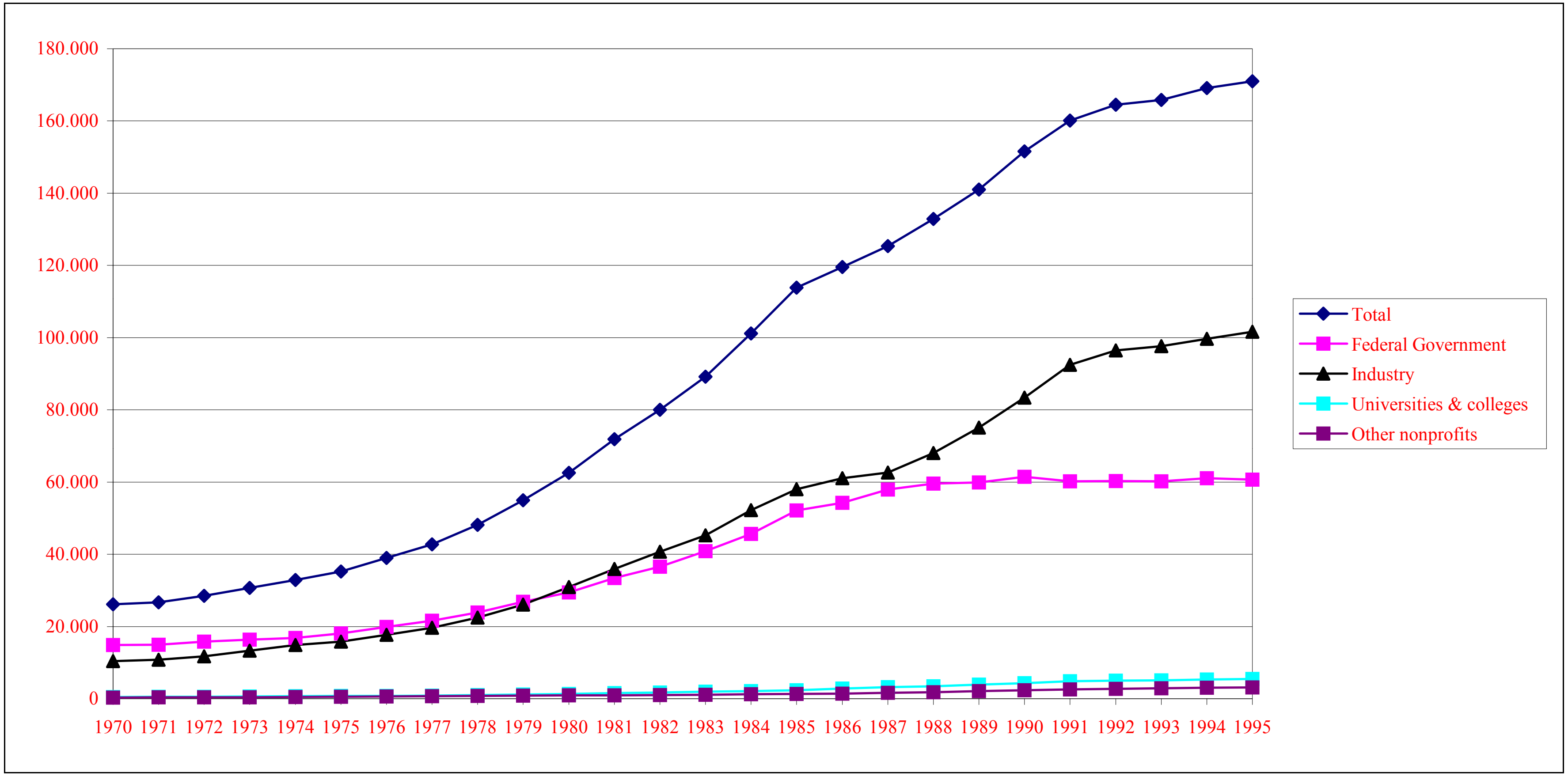
Although the government can promote R&D, it cannot match the necessary expenditures. The private sector invests about $50 billion per annum, but government only $1-2 billion. Despite these low government investment rates, the government has a special role: "carefully crafted government action can complement and enhance the benefits of these private sector initiatives" [NII, 1993, 4]. More concisely, "government has a role in encouraging pre-competitive technology development, encouraging dual-use technologies, supporting industry-led consortia, and making the most of technological advances" [ibid., 1].

Concretely, the Administration's long-term policy strategy regarding the National Information Infrastructure consists of the nine elements outlined in Box 3.2. In sum, the long-term strategy of the Clinton Administration is largely consistent with the theses of Chapter 1: by emphasizing the relational aspects of technology policy, it can gain leeway to overcome financial bottlenecks. The provision of a vision is essential in this strategy because it mobilizes a wide segment of societal actors. In the next section, we discuss to what extent the Administration has been successful in promoting its vision in the, often cumbersome, policy processes, or whether historical constraints have obstructed the implementation of its vision.

---

[25] In early stages, Clinton was a little more ambitious regarding the governmental role. However, negative reactions by industry leaders forced him to back off.

Figure 3.3: United States R&D Expenditures, Source of Funds (current $, in mill.)




Source: National Science Foundation, 1996, Table 4-3.

Box 3.2: The Long-Term Strategy of the Clinton Administration

- Promote private sector investment, through appropriate tax and regulatory policies.
- Extend the "universal service" concept to ensure that information resources are available to all at affordable prices. Because information means empowerment – and employment – the government has a duty to ensure that all Americans have access to the resources and job creation potential of the Information Age.
- Act as a catalyst to promote technological innovation and new applications. Commit important government research programs and grants to help the private sector develop and demonstrate technologies needed for the NII, and develop the applications and services that will maximize its value to users.
- Promote seamless, interactive, user-driven operation of the NII. As the NII evolves into a "network of networks", government will ensure that users can transfer information across networks easily and efficiently. To increase the likelihood that the NII will be both interactive and, to a large extent, user-driven, government must reform regulations and policies that may inadvertently hamper the development of interactive applications.
- Ensure information security and network reliability. The NII must be trustworthy and secure, protecting the privacy of its users. Government action will also ensure that the overall system remains reliable, quickly repairable in the event of a failure and, perhaps most importantly, easy to use.
- Improve management of the radio frequency spectrum, an increasingly critical resource.
- Protect intellectual property rights. The Administration will investigate how to strengthen domestic copyright laws and international intellectual property treaties to prevent piracy and to protect the integrity of intellectual property.
- Coordinate with other levels of government and with other nations. Because information crosses state, regional, and national boundaries, coordination is critical to avoid needless obstacles and prevent unfair policies that handicap U.S. industry.
- Provide access to government information and improve government procurement. The Administration will seek to ensure that Federal agencies, in concert with state and local governments, use the NII to expand the information available to the public, ensuring that the immense reservoir of government information is available to the public easily and equitably. Additionally, Federal procurement policies for telecommunications and information services and equipment will be designed to promote important technical developments for the NII and to provide attractive incentives for the private sector to contribute to NII development.

Source: National Technology and Information Agency, 1993, 1-2.

## C. Policy

> The time for action is now. Every day brings news of change: new technologies, like hand-held computerized assistants; new ventures and mergers combining businesses that not long ago seemed discrete and insular; new legal decisions that challenge the separation of computer, cable and telephones. These changes promise substantial benefits for the American people, but only if government understands fully the implications of these changes and to work with the private sector and other interested parties to shape the evolution of the communications infrastructure.
>
> *National Information Infrastructure Task Force (1993, 5)*

Explicit technology policy in the civilian sector is a novelty in American politics. While the military sector benefited from governmental support in the past half century, civilian sector research has been predominantly undertaken by private enterprises. Two systemic factors have contributed to a shifting emphasis of technology policy: the end of the Cold War and the increasing globalization of technological competition.

Chapters 1 and 2 have outlined technological, economic, and socio-political determinants of the technological development of society, positive and negative societal side-effects, and basic technological components of the information superhighway. The principle argument has been that modern technology policy has to integrate diverse factors. In American politics, the explicit separation of the military and civilian sectors during the Cold War did not enable the articulation of a substantive vision on the technological future of society. Precisely that separation, however, did also not necessitate the integration of technological, economic and socio-political concerns. Following the end of the Cold War, however, the articulation of a substantive vision has become possible. Particularly that added leeway has opened the theme of the technological future to public evaluation on issues that previously had no high public salience. Today, a network approach has become unavoidable. But the developments have simultaneously complicated the decision-making process, in the form of a greater number of influential actors, as well as the policy-making process. This is due to the pervasive nature of today's technologies that span many traditional political compartments and institutions. To what extent American politics copes with these developments is the subject of the following sections.

Before entering the domain of technology and regulatory policy in the United States, let us briefly review the legislative process.[26] Members of both the House and the Senate introduce a large number of bills in each legislative term. Only a minority of these eventually pass both chambers and become law. Following their introduction, the bills go through a number of committees and subcommittees, in which they are evaluated, revised, approved, or rejected [for a full outline of the process, see for example, Woll and Zimmerman, 1989, 121ff]. Subsequently, when the bill has passed this process and is still "alive" (most of them are "dead" at this stage), the Rules Committee passes it on for consideration on the floor. Floor action includes debates, amendments and a vote. If the bill passes the floor, and its counterpart in the other congressional chamber passes as well, both chambers deliberate on a compromise version. If the conference is successful, it passes the bill back to each chamber for a final vote. If both chambers then approve the bill, the President may sign it into law or veto it (in the case of the latter both chambers can override the veto with a two-thirds majority).

What is important is whether the bill includes implementation legislation. In the case that it does not, it often is a declaration of intention without teeth. In the case that it does contain implementation legislation, an executive agency has the task of implementing its provisions on the basis of the outlined implementation schedule. Sometimes, several bills that do not have attached implementation legislation are combined to provide the basis for comprehensive action. As we will see below, this has been the case in legislation on the major telecommunications reform undertaken in the middle of the 1990s.

### 1) Technology Policy

The technology policy of the Clinton Administration contains the following emphases: the shift of federal R&D funds from the military to the civilian sector, the integration of science and technology policy to improve the technology transfer process, infrastructure initiatives, federal research and standardization activities, changes in the

---

[26] The wealth of literature is of course enormous. For a general overview of American politics, see, for example, Ripley and Slotnick, 1989. For strategic considerations in Congressional elections, see Jacobson and Kernell, 1983. For the role of interest groups and their role in policy-making, see, Lowi, 1979 (1969). For American political economy and electoral business cycles, see Hibbs, 1987. For a more journalistic and a "behind-the-scenes" account of the Washington power game, see Smith, 1988.

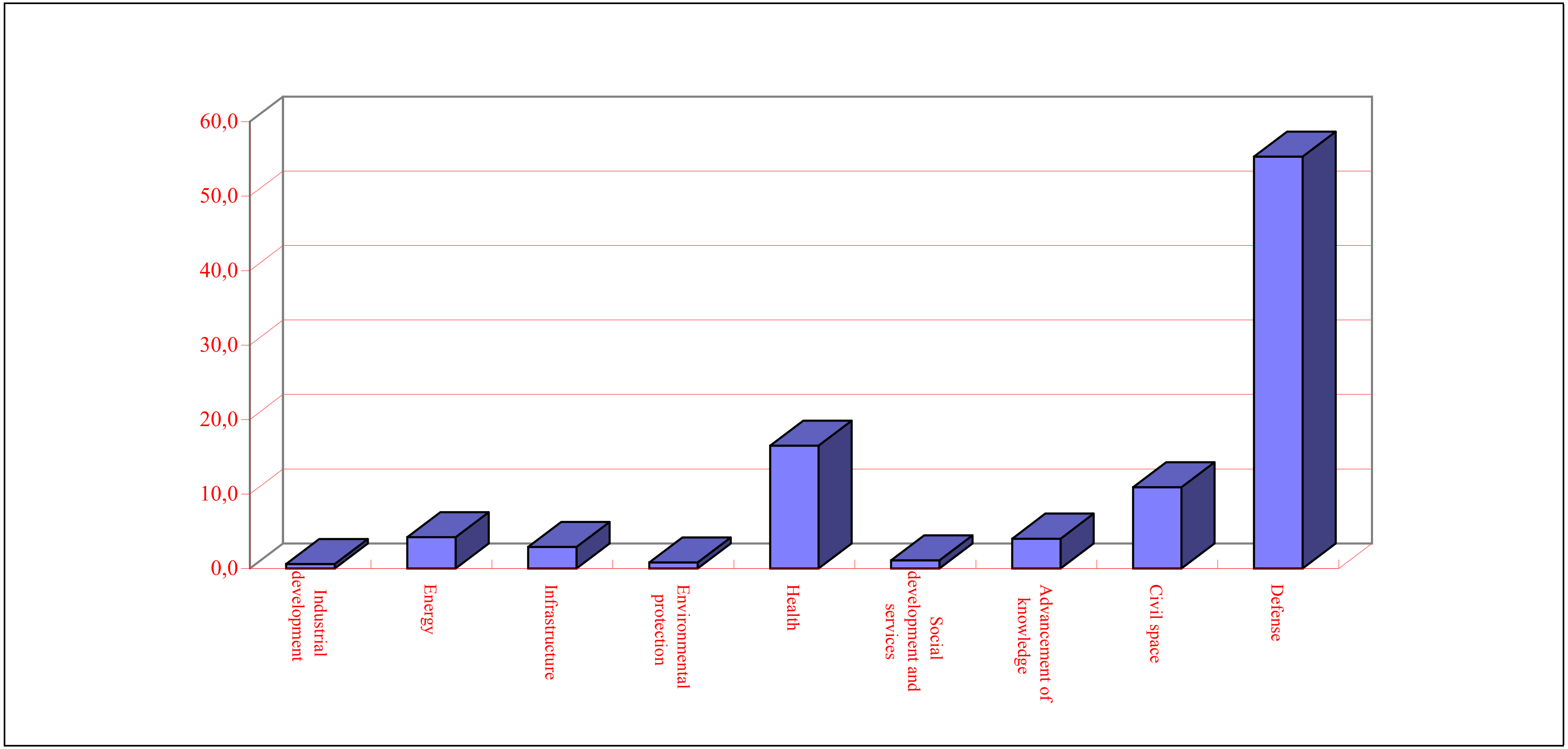
business environment, education and health care initiatives, and international trade actions.

a. The Peace Dividend: The Shift from Military to Civilian Research and Development

To react to systemic political changes on the global level, the Clinton Administration has pledged to reduce the military emphasis of the federal R&D budget and to promote a civilian research program with governmental assistance (Figure 3.4 shows the 1994 R&D expenditures by sector). Already in his presidential campaign, Clinton stated that "[c]urrently, our R&D budget reflects neither the realities of the post-Cold War era nor the demands for a new national security policy. At present, 60% of the federal R&D budget is devoted to defense programs and 40% percent to non-defense programs. The federal government should aim to restore a 50-50 balance between defense and non-defense R&D. That is why I have called for a new civilian research and development program to support research in the technologies that will launch new growth industries and revitalize traditional ones" [Clinton, 1992, 7]. The funds thereby released are estimated to amount to over $7 billion for non-defense R&D. The strategy rests on governmental investments in private sector-led consortia and technology transfer:

> When the private sector creates consortia to share risks, pool resources, avoid duplication and make investments that they would not make without such agreements, government should be willing to do its part. Support for consortia such as the SEMATECH, National Center for Manufacturing Sciences and the Advanced Battery is appropriate. By requiring firms to match federal contributions on at least a 50:50 basis, the government can insure that we are leveraging public dollars and that they are market-led and market-oriented. Often major companies are reluctant to invest in their suppliers and assist them in quality management techniques, because they fear they will go to another company. Private-sector-led consortia allow the major companies to cure that problem by coming together and agreeing on industry-wide efforts to invest in smaller suppliers. Some of these consortia will be funded by the Advanced Technology Program [see below] [ibid., 7-8].

Figure 3.4: Distribution of Government R&D Expenditures by Sector 1994 (in %)




Source: National Science Foundation, 1996, Table 4-32.

Public procurement is the principle means of supporting military-oriented R&D. Clinton has pledged to maintain governmental procurement but to shift the emphasis from the military to the civilian sector. The Clinton Administration deems necessary to reform the Federal procurement process ”to make government a leading-edge technology adopter. The Federal government is the largest single buyer of high technology products. The government has played a key role in developing emerging markets for advanced technologies of military significance; it can be similarly effective for civilian technologies” [National Technology and Information Agency, 1993]. To promote the convergence of the military-civilian R&D process, procurement procedures must change. Especially important is the elimination of barriers: ”These barriers include cost and price accounting, unnecessary military specifications, procurement regulations, inflexibility on technical data rights, and a failure to develop technologies in a dual-use context” [Clinton, 1992, 10].

Box 3.3 outlines the 1994 Guiding Principles for Science and Technology Management of the Department of Defense. Significant is the stronger emphasis on aspects of economic security, on dual use technologies, and on the greater integration of military and civilian technologies. However, as later sections show, some aspects relevant to the National Information Infrastructure (NII) have encountered significant opposition by defense-related agencies. The most prominent one is the issue of cryptography and its civilian and business applications. Thus, the process of a redirection of defense-related standpoints to incorporate civilian issues can be expected to be a long-term process.

In the consideration of expenditures on R&D, no uniform picture emerges. On one hand, the R&D obligations in the defense-related sector are slowly declining since 1992 (see Figure 3.5). On the other hand, non-defense R&D expenditures are declining as well (see Figure 3.6).

Box 3.3: Department of Defense's Guiding Principles for Science and Technology Management

(1) Transition technology to address warfare needs:

- Work with the warfighters;
- Move promising concepts rapidly;
- Insert technology into in-service systems; and
- Prevent technological surprise.

(2) Reduce cost:

- Use the best commercial products, practices, and capabilities;
- Simulate;
- Improve manufacturing processes;
- Consider environmental factors;
- Establish service affordability programs; and
- Reduce the cost of ownership.

(3) Strengthen the commercial-military industrial base:

- Develop dual-use technologies and processes;
- Formalize each service's program in dual-use;
- Sustain investments in priority technologies;
- Exploit commercial technologies;
- Strengthen technology transfer; and
- Develop field selected initiatives to apply technology to societal needs.

(4) Promote basic research:

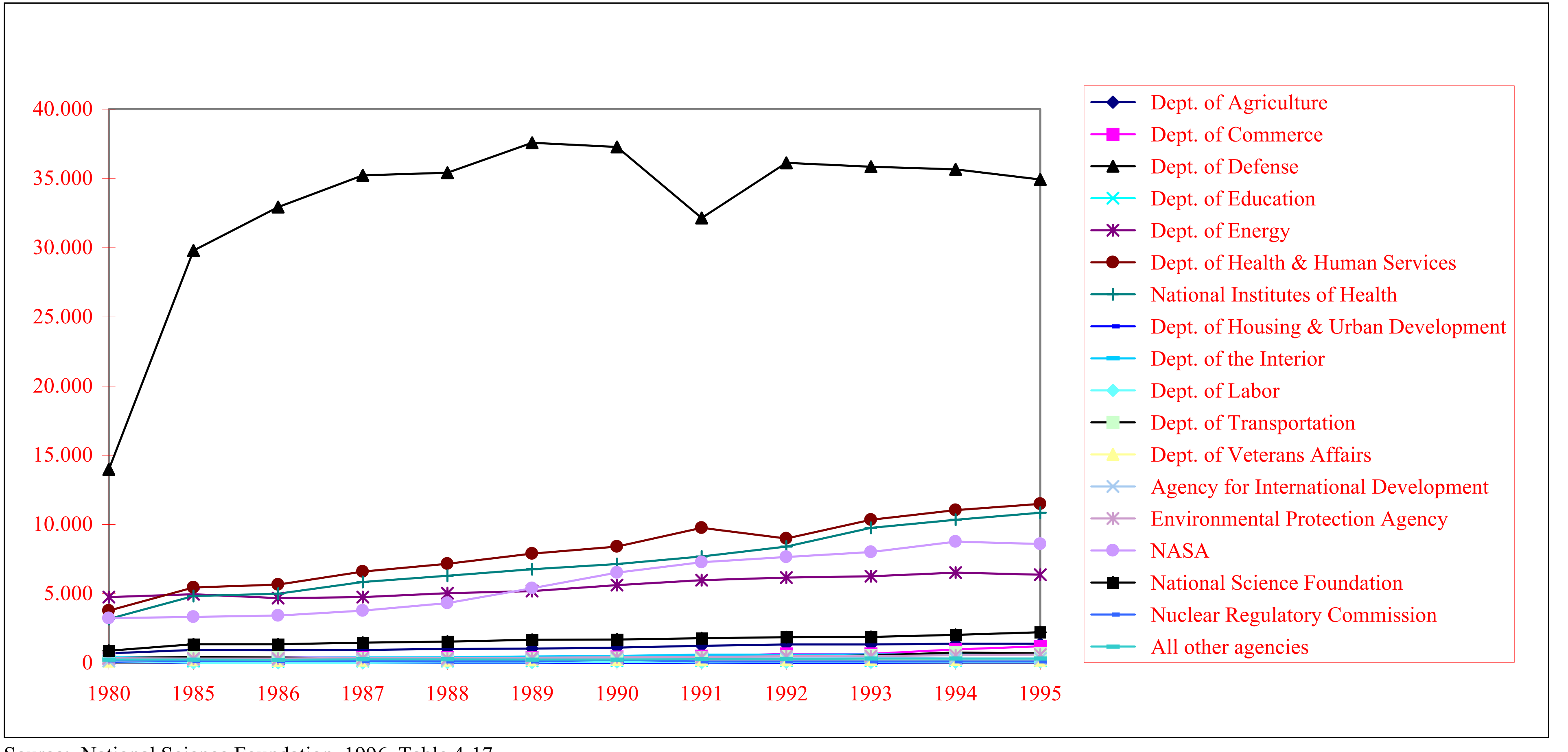
- Support quality basic research;
- Sustain stable research funding;
- Educate future scientists and engineers; and
- Promote teamwork and partnerships.

(5) Ensure quality:

- Downsize, outsource, and restructure the DOD research and development test and evaluation (RDT&E) infrastructure;
- Retain a critical mass of internal expertise;
- Encourage innovation;
- Strengthen project Reliance;
- Enhance the quality of staff and facilities; and
- Monitor and collaborate in international science efforts.

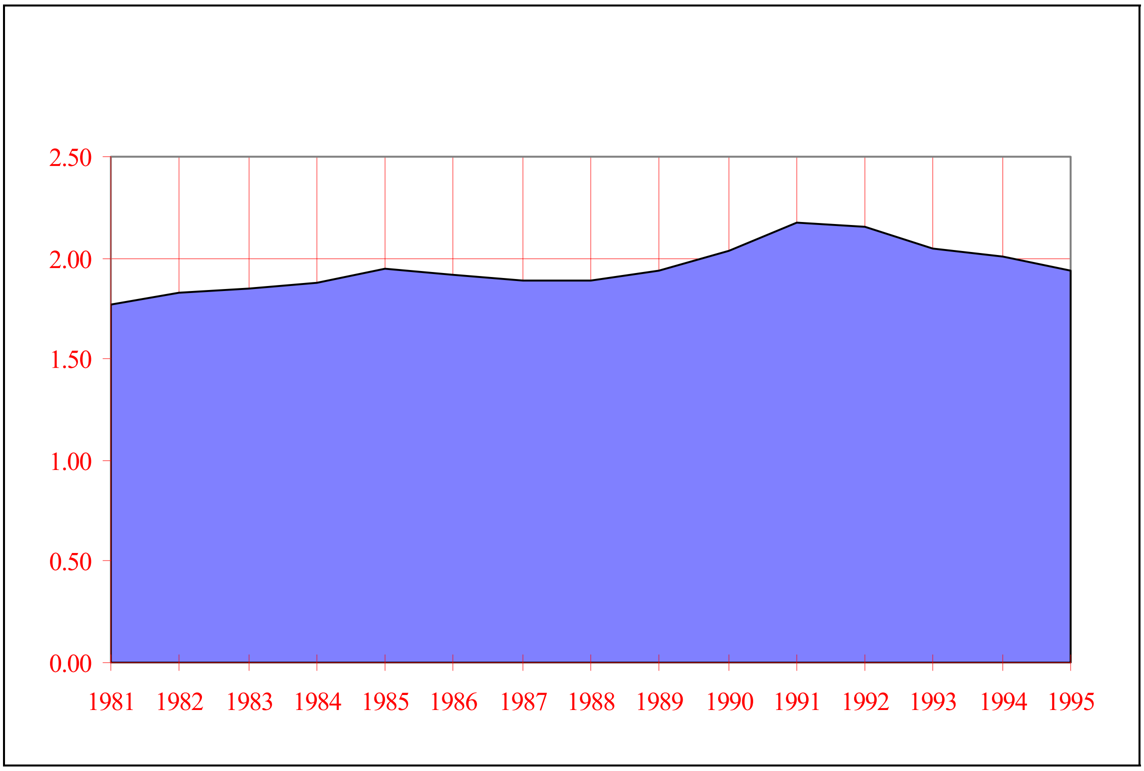
Source: Department of Defense, 1994, in National Science Foundation, 1996, Table 4-34.

Figure 3.5: United States Obligations for R&D, by agency (current $, in mill.)




Source: National Science Foundation, 1996, Table 4-17.

Figure 3.6: United States Non-defense R&D Expenditures (% of GDP)




Source: National Science Foundation, 1996, Table 4-33.

A final judgement on the success of the conversion of defense to non-defense R&D cannot yet be made. For example, the Technology Reinvestment Program (TRP) to promote the conversion progress has met with strong opposition in Congress. Nevertheless, a slow integration of defense and non-defense R&D is evident, even when some issues such as the civilian application cryptography technologies continue to be highly controversial.

b. The Integration of Science and Technology Policy

During its first term, the Clinton Administration has identified the need for a governmental technology policy that complements its science policy. The problem of science policy has been the insufficient market application of scientific discoveries. The results of base research are mostly public goods: they are not patentable, commercial benefits are only likely in the distant future and the use of the results often extends to areas that the research did not target. Thus, those countries that invest heavily in base research enable the free-riding of other countries. Instead of conducting base research themselves, other countries can concentrate on process innovations to exploit scientific inventions. However, these process innovations do not have the same external effects of public goods because they are further down along the scale of base research – applied research – experimental development path. To overcome these problems, the Clinton Administration has pledged to promote the integration of science and technology policy to improve the later stages of the innovation process. Clinton argued that:

> Science policy alone does not address these issues. In essence, science policy is a supply-push policy in which the government supports science education, basic research and some applied R&D that relates to specific national missions. During the Cold War, this policy worked well because U.S. industry dominated world markets and massive U.S. defense spending for high-tech weapons systems provided a big demand for leading edge technology. Today, however, U.S. industry faces intense international competition, and the global civilian market, not the Department of Defense, is the testing ground for most of the new technologies. … Technology policy picks up where science policy leaves off. It is not limited to just research and development. It also focuses on the rapid application of new ideas. The absence of a coherent technology policy is one of the key reasons why America is trailing some of its major competitors in translating its strength in basic research into commercial success, and why America is losing its lead in technology. Even in the technologies where we still lead, we face the challenge of translating the world's best research into the world's best jobs for American workers [ibid.].

The relative spending on the different research phases in the 1990s, however, has not shifted from an emphasis on base research to more applied research and experimental development, as Figures 3.7 to 3.9 show.

Nevertheless, the Clinton Administration has recognized that not only the level of research expenditure is important but that also the removal of obstacles in the technology transfer process is necessary. Systemic changes require parallel policy adjustments. In the civilian sector, obstacles to the integration of technology and science policy exist that military R&D did not encounter. First, governmental technology programs are highly diffused. They span many departments and agencies and are therefore difficult to coordinate and manage. Furthermore, federal technology programs, such as programs undertaken by the Federal Coordinating Council for Science, Engineering and Technology (FCCSET), are often limited to planning activities. Although these programs include diverse actors, such an approach cannot be called a network approach; a network approach also requires the management of relations between these actors. Second, provisions of the Federal Advisory Committee

Act (FACA) and the Freedom of Information Act (FIA) promote the premature release of information about new technologies.[27] Third, the Administration argues that concurrent conflict of interest regulations inhibit the participation of knowledgeable private sector individuals in government discussions. Such regulations restrain a network approach. Fourth, no institution monitors either its own competitive position in high technology industries or the state and utility of foreign scientific and technical information.

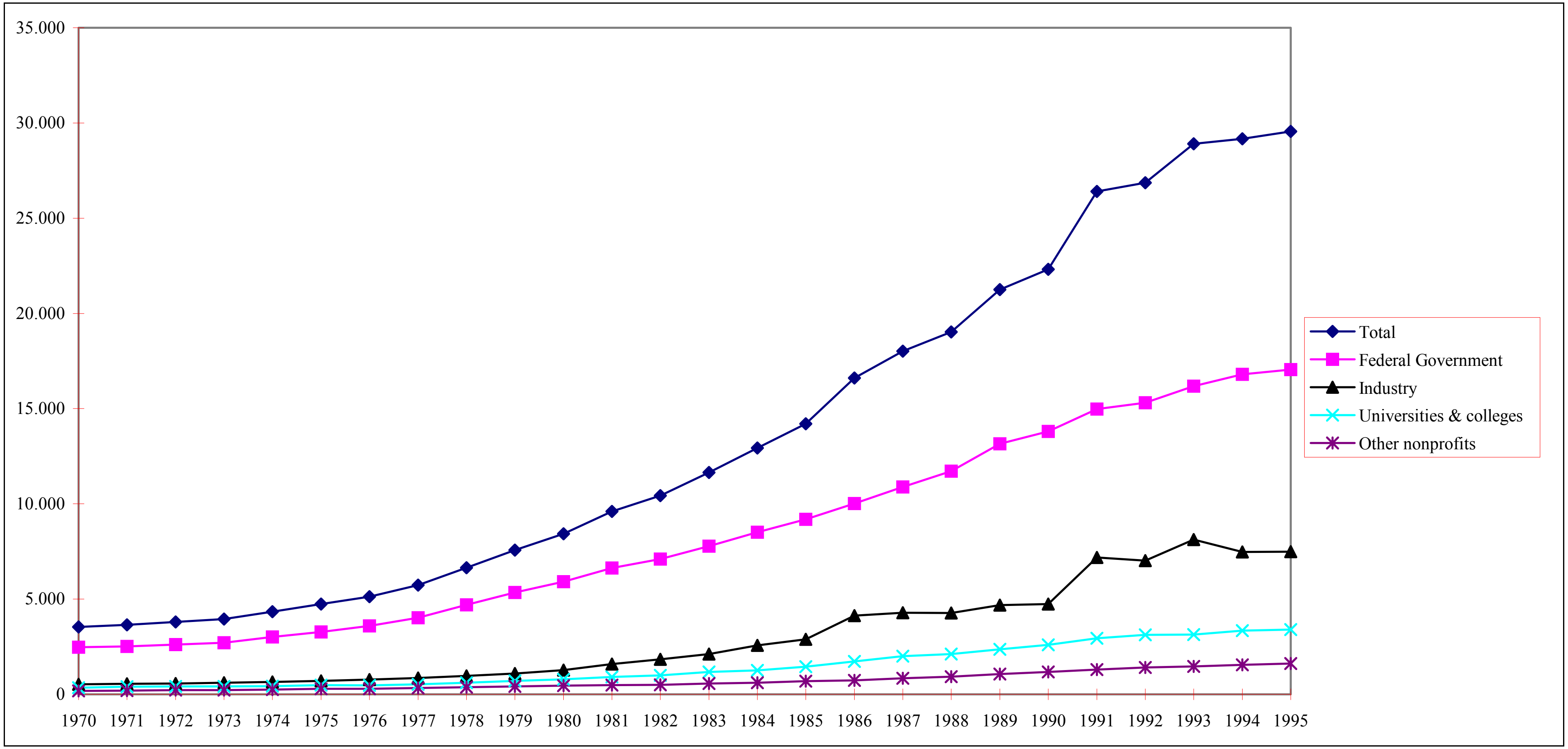
The budget process on the appropriation of R&D funds is another major problem as it underlies no uniformity or comprehensive strategy: "The federal R&D budget is currently considered piecemeal by numerous Congressional authorization and appropriations committees, which makes it nearly impossible to set priorities among competing programs or make trade-offs among related activities. Furthermore, although Congress must exercise oversight over technology programs, micro-management and pork-barrel politics will destroy the effectiveness of these programs" [Clinton, 1992, 5].

To overcome these deficits, Clinton proposed a new framework for technology policy according to which policy becomes subject to top governmental attention: "The Vice President will take on the task of organizing all facets of government to develop and implement my Administration's technology policy. As a first step, he will establish a central focus for the coordination of government activities related to civilian technology and create a forum for systematic private sector input into U.S. government deliberations about technology policy and competitiveness" [ibid., 4]. As part of this policy, the Administration proposed to centralize political authorities in federal agencies such as the Office of Science and Technology Policy (OSTP) and FCCSET.

---

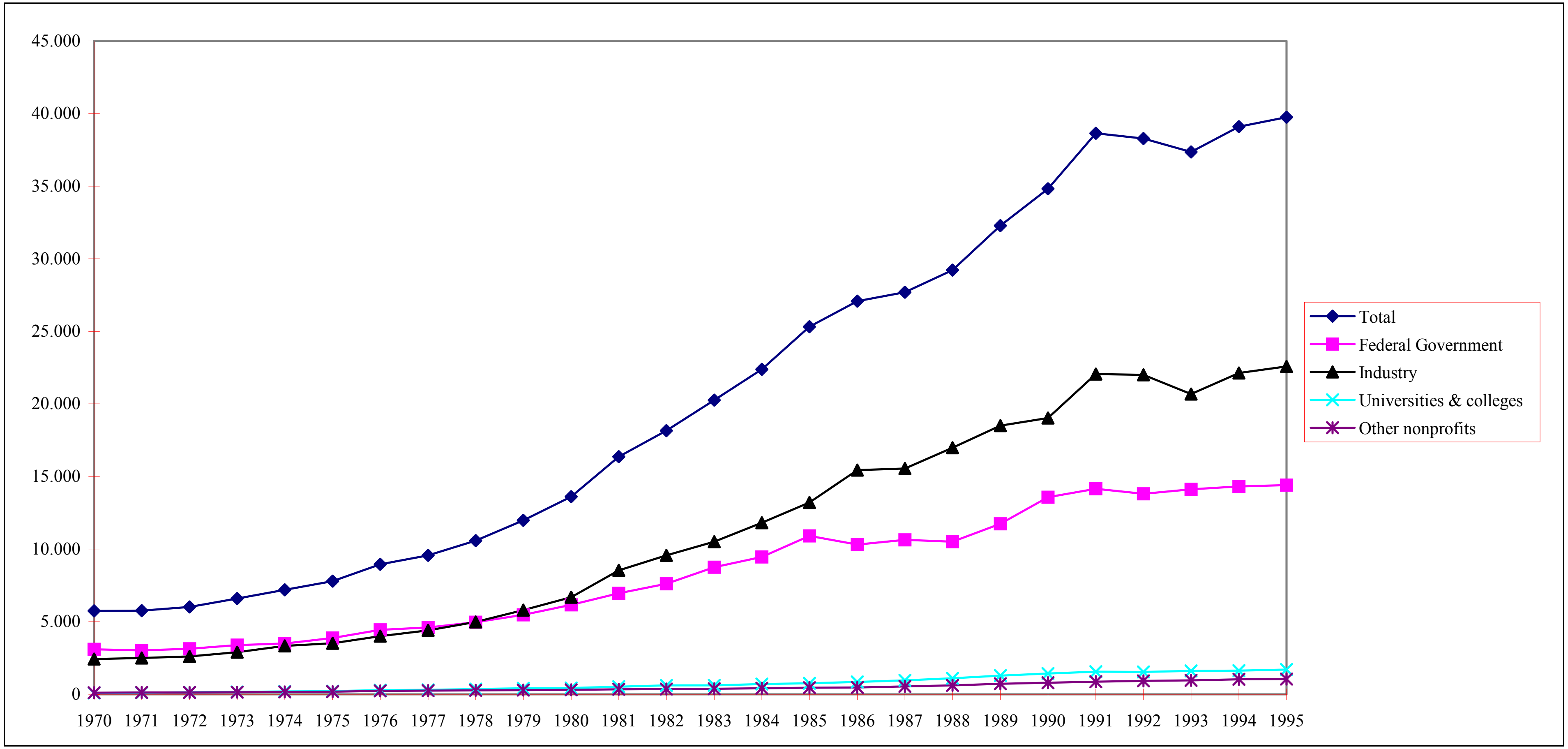
[27] Of course, the latter has the important function of opening public access to secret governmental information and conduct; the premature release of technological information is only a side-product.

Figure 3.7: United States National Expenditures for Basic Research (current $, in mill.)



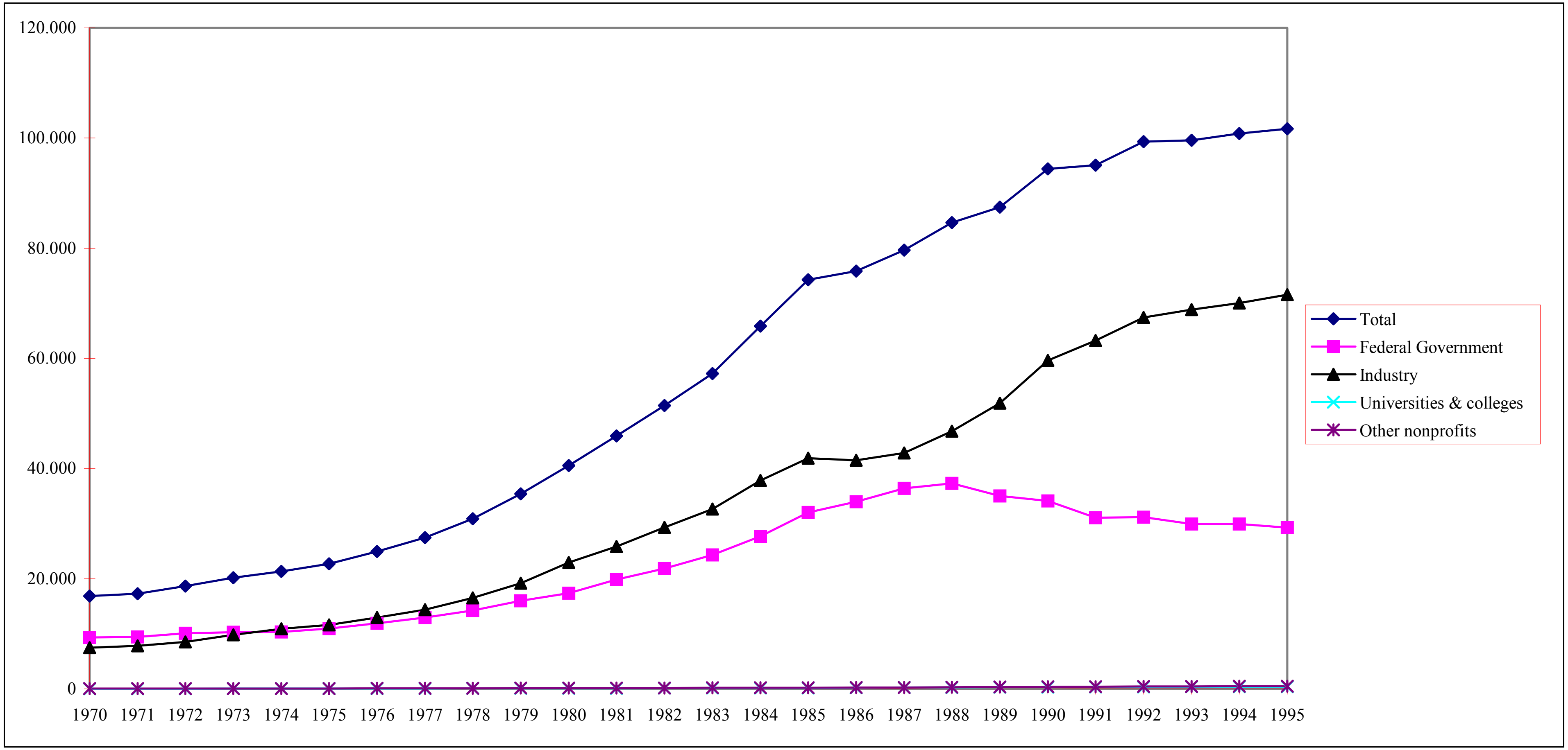

Source: National Science Foundation, 1996, Table 4-5.

Figure 3.8:  United States National Expenditures for Applied Research (current $, in mill.)




Source:  ibid., Table 4-6.

Figure 3.9: United States National Expenditures for Experimental Development (current $, in mill.)




Source: ibid., Table 4-7.

To place technology in such high place on the agenda is a significant development in American politics. Industrial policy generally, and technology policy specifically, is highly controversial in the United States. Dominant figures in economic theory, such as Nobel Prize winner Milton Friedman and the "Chicago School", view industrial policy as an interference in the free market and therefore as 'bad' governmental conduct. It is a curious development in American politics that the domain of computer-mediated communication has not been subject to such criticism, despite the extreme distrust of industrial policy. Perhaps, it has been the intertwining of computer-mediated communication technologies with military applications that promoted the acceptance of governmental interventionism. The delinking of information and communication technology policy from the defense sector can be expected to lead to a new round of conservative criticism of the Clinton Administration's technology policy. Nevertheless, the list of potential arenas of governmental intervention that the Clinton Administration envisions is quite extensive: basic infrastructure programs, competition and its regulation, programs to promote small businesses, education and health care initiatives, and a stronger approach on trade issues.

c. The Infrastructure of the Information Superhighway

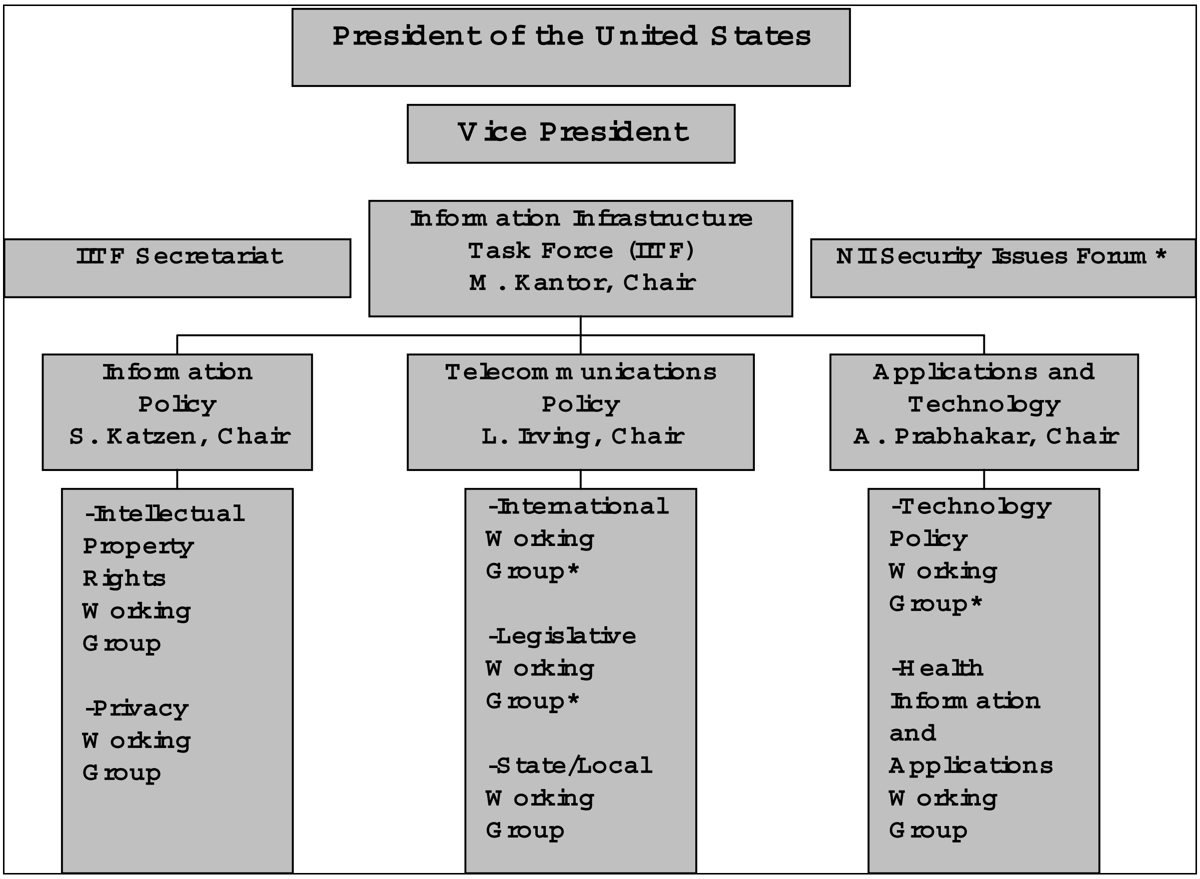
Federal policy on information infrastructures consists of two principle strategies: first, the creation of the infrastructure in a cooperative effort between the government, the research community and business, and second, the maintenance of security on the infrastructure from outside intrusion or manipulation. The second issue is of a regulatory nature; therefore, we return to that issue in the section on regulatory policy.

The National Information Infrastructure initiative (NII) is the centerpiece of the Clinton Administration's strategy. The infrastructure program contains five elements: funding the establishment of key networks and demonstration projects, benchmarking U.S. programs against those of other major industrial nations, establishing standards and a regulatory climate that fosters private sector investment, involving the federal labs, companies, and universities in conducting R&D on key technical issues, and providing training for users of networks and databases. President Clinton has delegated the Information Infrastructure Task Force (IITF), that consists of high level representatives of Federal agencies and the NII Advisory Council (NIIAC), that consists of 25 members from various constituencies and interested parties that are impacted by the NII (business, labor, academia, public interest groups, and state and local governments), to execute the NII-program of the Administration. Both the IITF and the NIIAC are supposed to work together in a consensus structure, or, in other words, a network approach. Figure 3.10 shows the structure of the IITF.

The IITF and its constituent federal agencies have the task of developing comprehensive telecommunication and information related policies. Furthermore, it has the responsibility to coordinate government efforts regarding the NII: the linkage of government applications to the private sector, the settlement of disputes, and the implementation of government policies. The Advisory Council ”shall advise the IITF on matters related to the development of the NII, such as: the appropriate roles of the private and public sectors in NII development; a vision for the evolution of the NII and its public and commercial applications; the impact of current and proposed regulatory regimes on the evolution of the NII; privacy, security, and copyright issues; national strategies for maximizing interconnection and interoperability of communications networks; the strengthening and streamlining of Federal communications and information policy-making agencies ... ; and universal access” [National Technology and Information Agency, 1993].

While the IITF and the NIIAC are principally advisory and coordinating institutions, the National Institute of Standards and Technologies (NIST) and National Telecommunications and Information Administration (NTIA) are federal executive institutions. The High Performance Computing Act of 1991 (see the discussion of the Bush Administration above) assigned NIST the principle authority in the High-Performance Computing and Communications Program. NIST has the task ”to accelerate the development and deployment of high-performance computing and networking technologies required for the NII; to apply and test these technologies in a manufacturing environment; and to serve as coordinating agency for the manufacturing component of the federal HPCC Program” [Office of Technology Assessment, 1994, Chapter 4]. NIST Director Arati Prabhakar outlines the ”big picture”: ”In tackling with industry key tasks that companies cannot accomplish on their own, NIST provides timely, indispensable support that companies themselves fashion into competitive advantages – new or more reliable processes, innovative products and services, new R&D capabilities, shorter product-development cycles, and improvements in quality” [National Institute of Standards and Technology, 1995, Foreword].

Figure 3.10: Information Infrastructure Task Force (IITF) Structure




Source: http://www.iitf.nist.gov/iitf-images/iitf-org.map, * cross-cutting issues.

NIST operates four "industry-driven" programs: the Advanced Technology Program (ATP), the Manufacturing Extension Partnership (MEP), NIST Laboratories, and the Baldridge National Quality Program. These programs focus on high performance computing systems, advanced software technology and algorithms, the National Research and Education Network (NREN) and information infrastructure technology and applications. ATP and the activities of the NIST Laboratories are of particular interest in the context of this study.

The ATP concentrates on competitive elements, cost-sharing between NIST and participating companies, pre-product development phases and industrial processes. NIST Director Prabhakar describes the ATP as follows: "ATP is industry-oriented. While government provides the catalyst – and in many cases, critical technical support – industry conceives, manages, and executes each ATP project. Industry proposals are based on the private sector's understanding of market trends and future opportunities. All projects are selected on the basis of both technical and business merit through a fair and rigorous competition that draws on both government and private sector expert reviewers” [Senate, 1995]. Its purpose is to foster technological developments, to accelerate the development of new technical capabilities, to promote industrial alliances, to create opportunities for companies of all sizes, and to promote job creation [National Institute of Standards and Technology, 1995, Foreword].

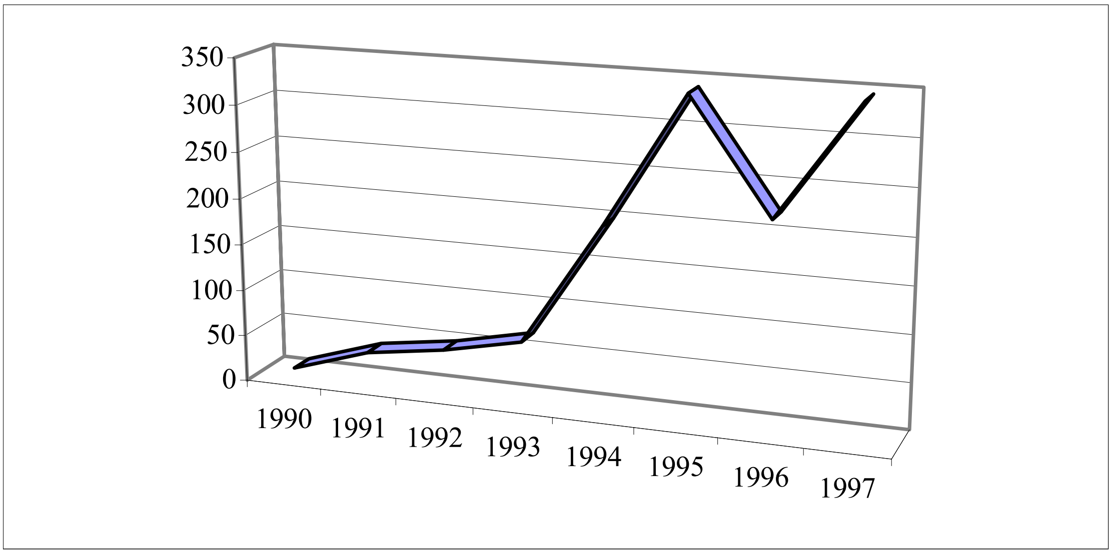
Furthermore, the ”focused-program strategy” (since 1994) ”creates a critical mass of collaboration, encouraging industrial cooperation to overcome early-stage technical obstacles common to prospective competitors in a young, but commercially promising technology area” [ibid.]. Prabhakar describes one program example:

> Take our focused program in Information Infrastructure for Healthcare. The ATP will help industry lay the foundation for the more efficient use of computer technology in doctors' offices, hospitals and clinics by cost-sharing with industry the development of innovative new enabling technologies – technologies that will allow the medical community to reduce paperwork, improve the quality of diagnosis and treatment, and bring better medical care to rural areas. This program includes, for example, figuring out ways to transfer complex medical records instantly from one facility to another even though those facilities use different record formats and different computer systems. The beneficiaries of this ATP focused program extend well beyond the individual companies and consortia that are cost-sharing and conducting the research. If the technical challenges can be overcome, the benefits will reverberate throughout the economy and the beneficiaries will be our entire citizenry, which ultimately picks up the $1 trillion annual tab for medical spending. A full 20 percent of today's healthcare costs is related to the processing of information, and information technology is an important ingredient for reducing those costs by many billions of dollars [ibid.].

Independent studies provide evidence on the benefits of ATP. The program has improved enterprises’ ability to engage in high-risk, long-term research with high-payoff potential. Furthermore, by promoting industry-industry, industry-government, and industry-university collaborations, it has enabled cost and time savings, improved productivity and competitiveness, and encouraged the formation of strategic business alliances. Moreover, it has improved enterprises’ ability to attract external investors.

Despite these benefits, the ATP program has come under assault by Congress. Figure 3.11 shows the budget history. While President Clinton requested $430.7 mill. for 1995, the program only received $340.5 mill. Similarly, for 1996, Congress scaled back funding to $221 mill. The budget request for 1997 moves up again to levels of 1996; however, whether Congress will appropriate these funds, is not clear yet.

Figure 3.11: ATP-Budget History (in mill. $)




Source: http://www.atp.nist.gov/atp/repcong/appendxa (1997 refers to the requested funding).

NIST Laboratories serve "as an impartial source of expertise, developing highly leveraged measurement capabilities and other infrastructural technologies that are: beyond the reach of individual companies; needed widely by industry, as determined in assessments of industrial priorities; and likely to have high economic impact if provided" [National Institute of Standards and Technology, 1995, Foreword]. The laboratories concentrate on infrastructure tasks that are beyond the capabilities of private industry, on consultation processes on relevant technologies, on competitive processes within NIST programs and on periodic program evaluation. They emphasize processes that are market-close, and that facilitate the cooperation between the government, research labs, universities, and enterprises.

Another NIST activity is the pursuit of standardization initiatives. As was outlined in Chapter 1, standards and compatibilities promote the adoption and diffusion of technologies. Whether standards are preferable to market-developed compatibilities is controversial in the economic literature and in American political circles. However, the Clinton Administration places a high emphasis on governmental activities in the standardization process of new technologies:

> To assure interoperability and openness of the many components of an efficient, high-capacity NII, standards for voice, video, data, and multi-media services must be developed. Those standards also must be compatible with the large installed base of communications technologies, and flexible and adaptable enough to meet user needs at affordable costs.

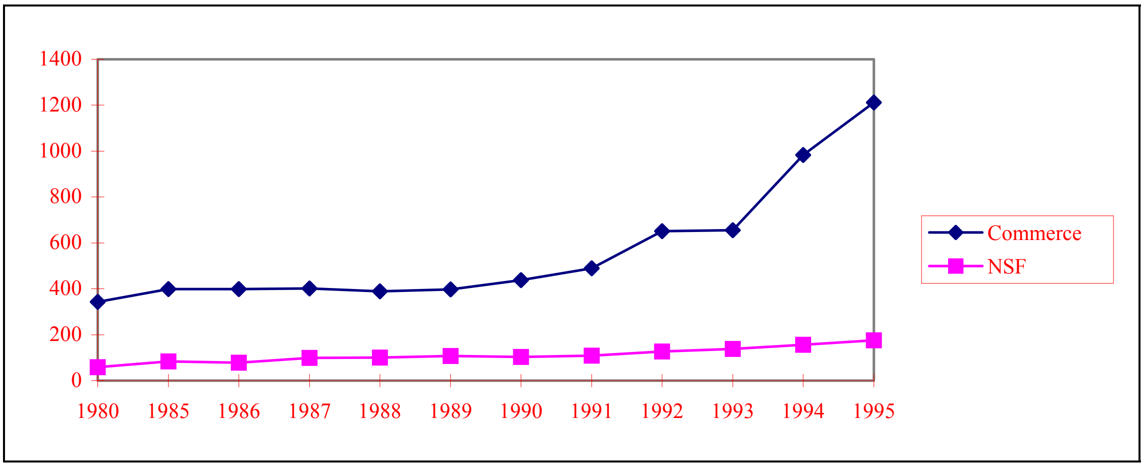
> The United States has long relied on a consensus-based, voluntary standards-setting process in communications. Particularly in the area of information and communications technology, where product cycles are often measured in months, not years, the standards process is critical and has not always worked to speed technological innovation and serve end-users well. Government can catalyze this industry-driven process by participating more actively in private-sector standards-writing bodies and by working with industry to address strategic technical barriers to interoperability and adoption of new technologies [National Technology and Information Agency, 1993].

Below, we will expand on some of the standardization activities of NIST in the context of cryptography technologies.

The Department of Commerce does not only pursue the development of technologies under NIST, but also their application in the context of pilot and demonstration projects. The National Information Infrastructure Pilot Projects Program enables the matching of grants to state and local governments, health care providers, school districts, libraries, universities, and other non-profit entities: ”The grants will be awarded after a competitive merit review process and will be used to fund projects to connect institutions to existing networks, enhance communications networks that are currently operational, and permit users to interconnect among different networks. Funded projects will demonstrate the potential of the NII and provide tangible benefits to their communities. Equally important, they will help leverage the resources and creativity of the private sector to devise new applications and uses of the NII. The successes of these pilot projects will create an iterative process that will generate more innovative approaches each year” [ibid.]. An integral part of this program is the periodic review and inventory of existing NII application projects as well as the wide dissemination of the study results in the public.

On October 12, 1994, Secretary of Commerce Ronald H. Brown substantiated the program. He announced that the DoC's National Telecommunications and Information Administration (NTIA) is to grant funds to public institutions, such as schools, hospitals, libraries, social service organizations, museums and state and local governments. The purpose is to promote the deployment of a nationwide, high speed, interactive infrastructure. The aim is access to the Information Superhighway for all Americans. Brown said that ”[t]he Telecommunications and Information Infrastructure Assistance (TIIAP) program will help public institutions deploy their services more efficiently. In addition, they will serve as catalysts for further developing the NII by providing models for communities throughout the nation to follow" [quoted in EFFector Online, 7-14, 1994].

Figure 3.12: United States Federal R&D Obligations for the Department of Commerce and the National Science Foundation (current $, in mill.)




Source: National Science Foundation, 1996, Table 4-17.

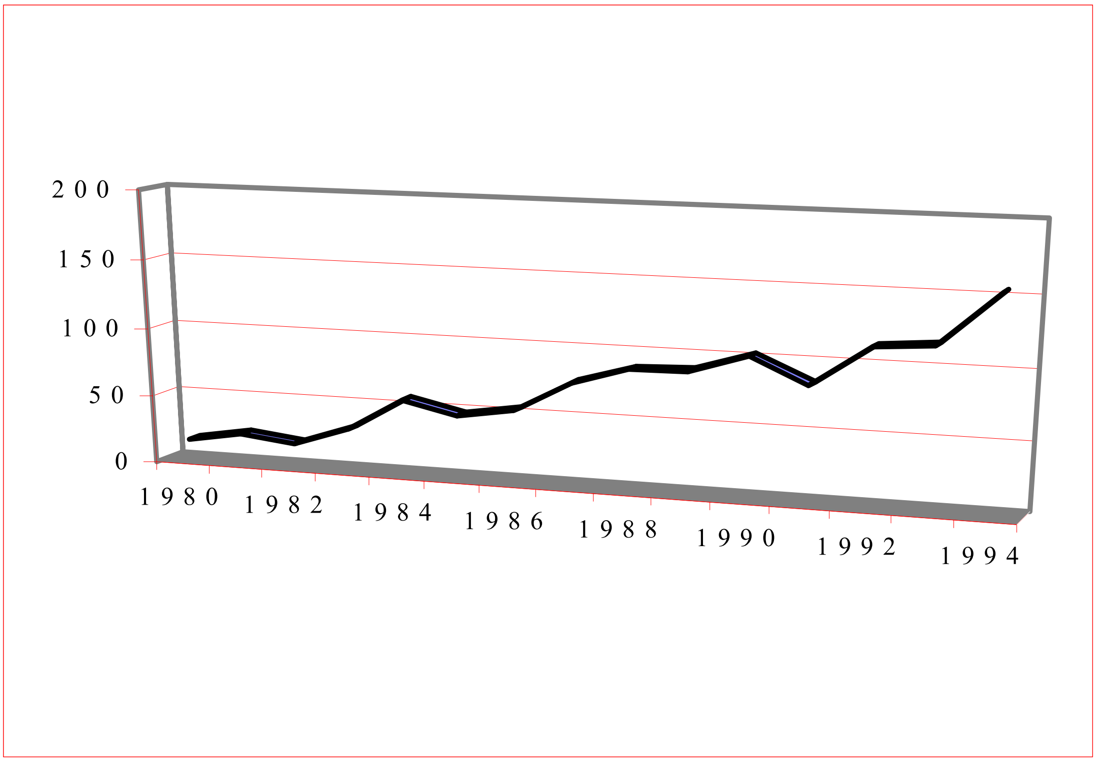
The TIIAP is based on the principle of matching of funds within collaboration projects. The focus of the almost 100 grants has included rural telemedicine projects, environmental education including the collection and dissemination of data, inner city development telecommunications projects, and school and citizen access to information technologies. Larry Irving, the assistant secretary for communications and information of the U.S. Department of Commerce and administrator of NTIA, comments: "Funding a program such as TIIAP, which is built on the concept of public/private partnerships, is the appropriate role for government to play in helping every American access the information superhighway – one of the goals of this Administration" [quoted in ibid.].

Overall, Federal funds for infrastructure-related institutions and projects have been rising, especially those allocated for the Department of Commerce (see Figure 3.12). This is a clear sign, that DoC's activities have had a high position on the Administration's agenda.

d. The Business Environment and Technology Policy Instruments

While in the military sector, direct R&D subsidization has been prominent, the use of direct technology policy instruments in the civilian sector has not been extensive in the United States. As we have seen in previous sections, the Clinton Administration has stepped up efforts to strengthen the government's role in the development of civilian technologies. The pledge to shift governmental R&D expenditures from the military to the civilian sector and thereby achieve a 50-50 balance is a clear sign. However, not only active measures have been an emphasis of the Clinton Administration, but also passive improvements of the business environment. General and passive instruments have become increasingly popular with policy-makers because they are believed to prevent market imperfections, and especially important, they are neutral in budgetary terms. This is particularly important in periods of budgetary bottlenecks, as in the 1990s. As we have seen in Chapter 1, general and passive instruments impact the general economic framework and are therefore not discriminatory, in other words, they are public goods. The state can provide public goods such as general and higher education, general tax incentives, infrastructures, support human capital and base research, and reduce bureaucratic or licensing obstacles. Some of these issues, we have already discussed above.

Figure 3.13: Enterprise Alliances in the United States in Information Technologies

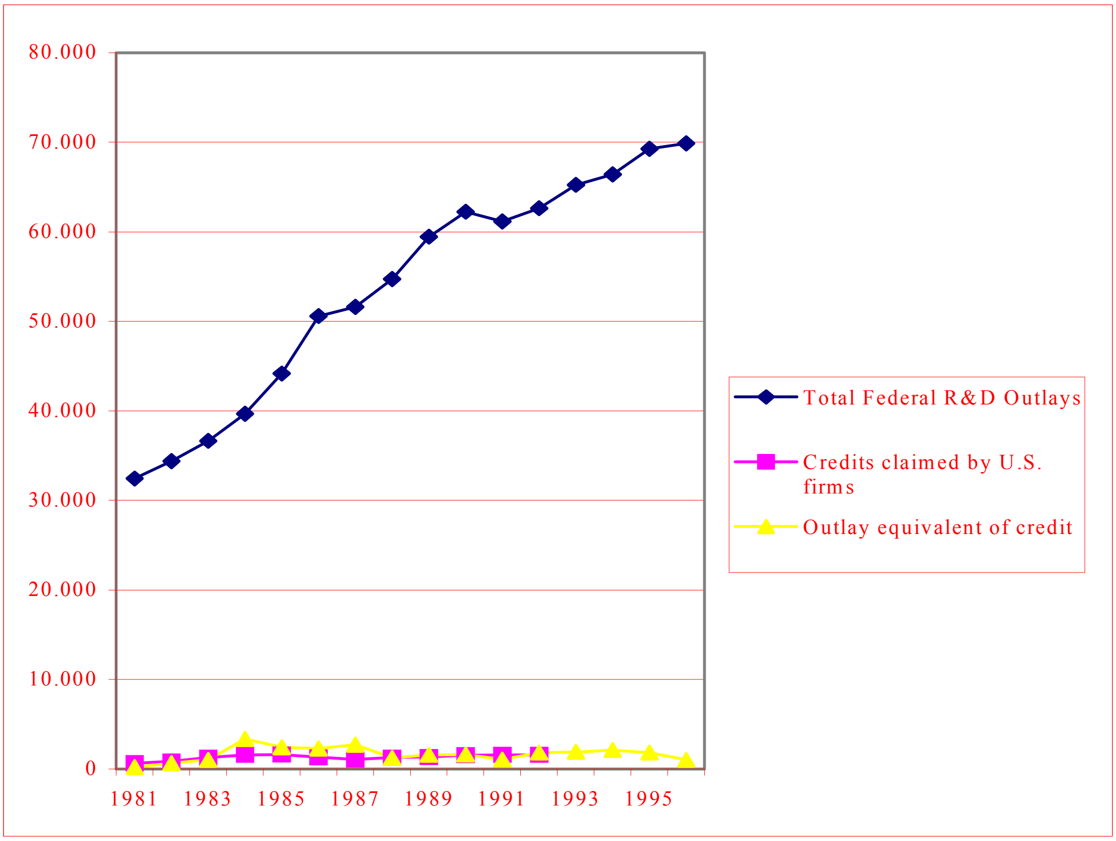



Source: National Science Foundation, 1996, Table 4-38.

In his presidential campaign, Clinton argued that changes in tax, trade and regulatory policies are necessary to promote the development of the NII:

> Changes in America's tax, trade and regulatory policies are [..] needed to help restore America's industrial and technological leadership. In a global economy in which capital and technology are increasingly mobile, we must make sure that the United States has the best business environment for private sector investment. Tax incentives can spur investment in plant and equipment, R&D and new businesses. Trade policy can ensure that U.S. firms have the same access to foreign markets that our competitors enjoy in the U.S. market. Antitrust reform will enable U.S. firms to share risks and pool resources. Strengthening commercial sections of our embassies will increase our ability to promote U.S. goods abroad. Streamlining export controls will reduce the bureaucratic red tape which can undermine competitiveness. And an overhaul of cumbersome defense procurement regulations will strengthen both our civilian and defense industrial bases [Clinton, 1992, 9].

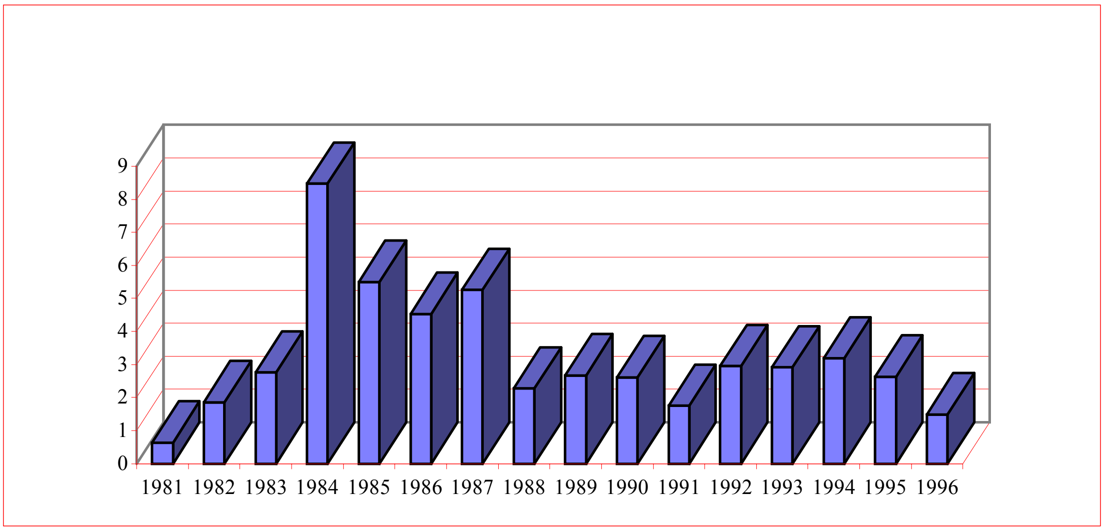
Figure 3.14: Total Federal R&D Outlays, Credits Claimed and Received by US Firms for Tax Experimentation Credit (current $, in mill.)




Source: National Science Foundation, 1996, Table 4-16.

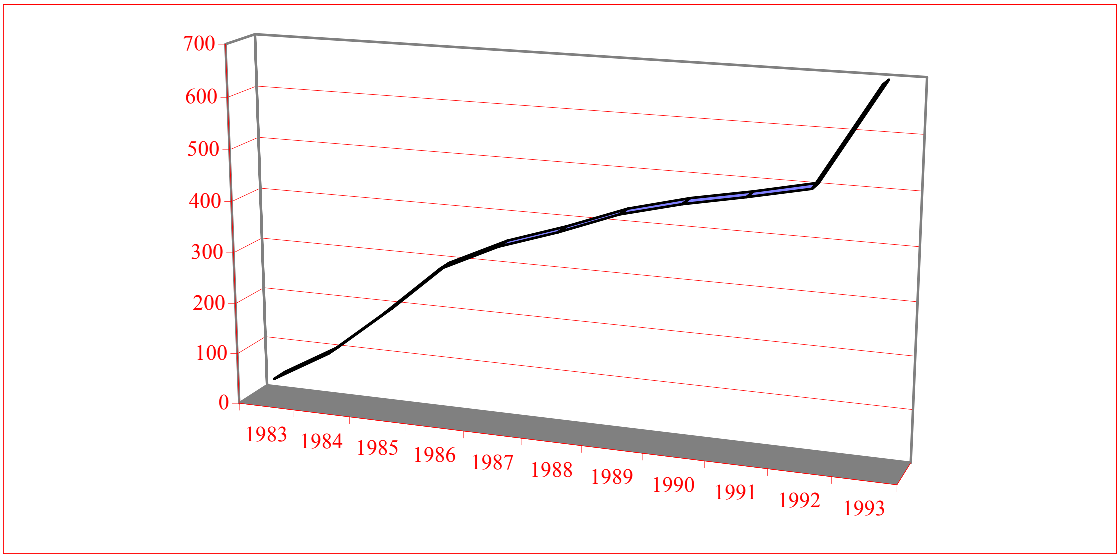
Clinton made a number of campaign pledges regarding taxes and their role in R&D activities: an extension of the National Cooperative Research Act of 1984 with the purpose to additionally cover joint production ventures, a permanent extension of the R&D tax credit for the development of new technologies, the imposition of a permanent moratorium on Treasury Regulation 1.861-8 that effectively increases R&D taxation, the provision of a targeted investment tax credit on new equipment, a revision of depreciation rates to reflect the rapid technological turnover, and the provision of a 50% tax exclusion on long-term investments to small businesses and entrepreneurs [Clinton, 1992, 9].

Figure 3.15: Federal Research and Tax Experimentation Credit in Proportion to R&D Outlays (in %)




Source: ibid.

Figure 3.16: Small Business Innovation Research (SBIR) Awards (current $, in mill.)




Source: ibid., Table 4-15.

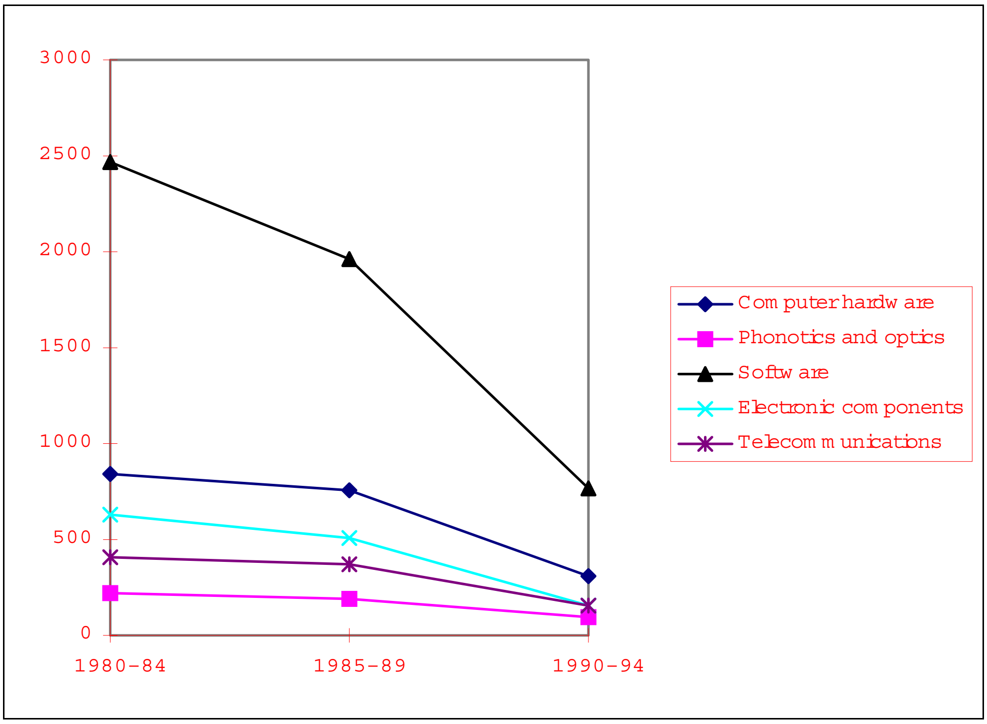
To what extent the Clinton Administration was able to implement its specific campaign pledges is a matter of further research. Some general assessments can be made regarding intra-regional alliances and R&D tax credits. As Figure 3.13 shows, intra-regional alliances in information technologies have risen continuously, but especially since 1993. Whether this is a direct result of the Administration's actions is not clear, however, it is in line with its plans. On the other hand, Figure 3.14 presents the increases of the federal R&D budget, the Tax Experimentation Credits claimed and received by US firms. While the outlays for R&D have risen, the outlays for the Tax Experimentation Credit have remained relatively stable. Thus, as Figure 3.15 shows, credit provision in proportion to general outlays has fallen since 1994. This contradicts the Administration's intentions. Figure 3.16 exhibits the increases in the Small Business Innovation Research Awards, which seemingly confirm the Administration's plans. However, on second sight, as Figure 3.18 displays, the bulk of the increases came from the Department of Defense.[28] As Figure 3.17 shows, the overall number of high technology enterprises formed in the United States has fallen significantly since the 1980s, which is a sign for the reduced opportunities for start-up enterprises and for the rising concentration in the high technology field.

Other important factors in the general business environment are the health and education systems as these impact the productivity of employees. To quickly summarize these areas, the major health reform that Clinton pledged to implement in his first term failed completely. The Administration expected great benefits of a health reform; experts estimated cost reductions of $36-100 billion per annum. Individual health care projects within the context of the NII-initiative include the application of telemedicine, unified electronic claims, personal health information systems, and computer-based patient records [for further information, see http://nii.nist.gov/nii/applic/health/hlthhs.htm].

---

[28] One can only speculate on this development. On one hand, these increases in the military sector may be a reaction to the Gulf War and the greater demand of innovative small-scale military technologies. What is more likely, however, is that these increases compensate the reduction of direct federal R&D outlays in the military sector. This may be an interesting topic for further research.

Figure 3.17: The Formation of High Technology Enterprises in the United States, Selected Technologies




Source: National Science Foundation, 1996, Table 6-16.

For his second term, Clinton announced a major education initiative to develop national education standards and the further penetration of computer-mediated communication technologies in schools and universities. Already in his first campaign, Clinton emphasized the potential benefits of the use of the NII for education purposes:

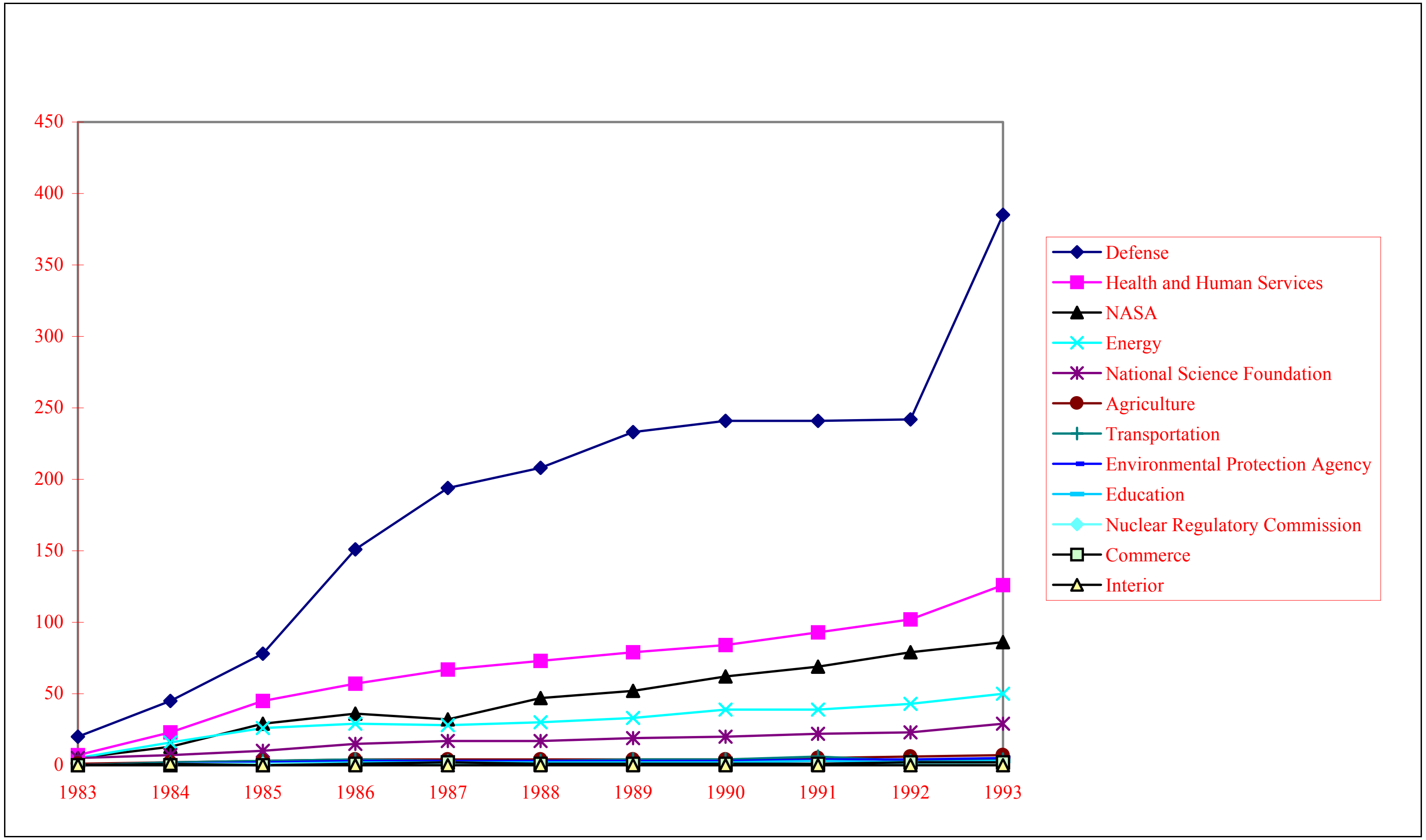
> Students and teachers can use the NII to promote collaborative learning between students, teachers, and experts; access on-line ”digital libraries”; and take ”virtual” field trips to museums and science exhibits without leaving the classroom. … The smaller districts can now access NASA, leave messages for the astronauts, browse around in libraries larger than they will ever be able to visit, discuss the Superconducting Supercollider project with the physicist in charge, discuss world ecology with students in countries around the world, read world and national news that appears in newspapers that are not available in their small towns, work on projects as equals and collaborators with those in urban areas, and change the way they feel about the size of their world. This will create students that we could not create otherwise. This is a new education and instruction [National Technology and Information Agency, 1993].

It remains to be seen, to what extent Clinton will be able to implement his ambitious education initiative. A national education system has historically been opposed, and states and individual localities maintain considerable autonomy over the education content and processes.

New computer-mediated communication technologies have strong implications for the conduct of government, a factor that the Clinton Administration is now exploiting to improve government services and democracy in general. The Administration pledged to improve government and the government's interaction with citizens by means of a nationwide system. First, such a system can deliver government benefits electronically, such as federal retirement, social security, unemployment insurance, AFDC and food stamps. Second, such a system can provide electronic access to government information and services "to improve the delivery of government information to the taxpayers who paid for its collection; to provide it equitably, at a fair price, as efficiently as possible" [ibid.]. The catchword has been civic networking: "A country that works smarter; enjoys efficient, less costly government, guided by a well-informed citizenry; that produces high quality jobs and educated citizens to fill them; that paves a road away from poverty; that promotes life-long learning, public life and the cultural life of our communities. This is the promise of the National Information Infrastructure" [Center for Civic Networking, quoted in ibid.].

To exploit these new opportunities, the Administration pledged to fund software used for browsing, searching, describing, organizing, and managing information. The central element of this policy has been to improve the accessibility to government information. IITF working groups have been reviewing the following tasks: the identification and cataloging of existing government information, the identification of present provision problems, the promotion of easy and usable interfaces for access, and the review of the suitability of the infrastructure for transmission, such as the Internet, local bulletin boards or local and field offices of federal agencies that are turned into "Interactive Citizen Participation Centers". The Administration has also recognized the necessity to teach federal employees to use the system. The NII Task Force states that "[o]ur goal is to make government information available and easily accessible to the public. As we move towards our goal of rapidly expanding our national information infrastructure, we want to ensure that the public is kept aware of our activities" [Larry Irving, Assistant Secretary of Commerce for Communications and Information; quoted in EFFector Online 7.2/94].

Figure 3.18: Small Business Innovation Research Awards(current $, in mill.)




Source: ibid.

On the acquisition, use, and distribution of government information by Federal agencies, the Office of Management and Budget (OMB) redefined its policies in June 1993. For example, the fees for the access to government information should not exceed the cost of dissemination of the information; therefore, it should not include the cost of the creation of information or its collection. Senator Wendell Ford outlines the plans as "one more way we can make government more accountable to the American people. [Access] puts information about the government right at the public's fingertips. Whether they live in a rural area in Eastern Kentucky or the big cities of New York, San Francisco and Chicago, anyone will be able to access government documents through their home computer or a local depository library." [quoted in Rheingold, 1993, 96].

To enhance the competitive position of American companies in the world market, the Clinton Administration has undertaken or considered a number of trade and trade-related measures. These include the enactment of a stronger and sharper Super 301 (which had been designed in the middle of the 1980s to open foreign markets on the basis of equal mutual access); the completion of the Uruguay Round on the reduction of tariffs; efforts to achieve the universal acceptance of copyrights and the rejection of unfair trade practices; a survey of the adherence to trade agreements by other nations and the possible imposition of sanctions, especially in the sectors of telecommunications, computers and semiconductors; the promotion of manufactured goods exports by small and medium companies by strengthening the commercial sections of embassies; the promotion of trade associations to observe foreign standards-setting organizations; and the streamlining of exports controls to balance national security interests, such as the prevention of the proliferation of nuclear, biological and chemical weapons, with business interests.

Export controls on high technology products have been particularly strong, from outright export prohibitions to massive bureaucratic obstacles. In many cases, for example, in encryption technologies, unilateral export controls exist on technology that is widely available in world markets. Business organizations have often criticized such export controls as they hinder exports. The Clinton Administration has pledged to streamline current decision-making process for export controls, especially the "lengthy bureaucratic turf wars between the State Department, the Commerce Department, the Pentagon's Defense Technology Security Agency, the Arms Control and Disarmament

Agency, the Department of Energy, and the National Security Agency" [ibid.]. We will further consider these issues below on the section of regulatory policy.

2) Regulatory Policy

One premise of the NII is its pervasiveness. As was argued in Chapter 1, a paradigmatic technological shift requires supplemental reevaluation and adjustments of the underlying regulatory structures. The Office of Technology Assessment describes this necessity regarding new computer-mediated communication technologies:

> Laws develop in response to society's needs. They evolve in the context of the mores of the culture, business practices, and technologies of the time. The laws currently governing commercial transactions, data privacy, and intellectual property were largely developed for a time when telegraphs, typewriters, and mimeographs were the commonly used office technologies and business was conducted with paper documents sent by mail. Technologies and business practices have dramatically changed, but the law has been slower to adapt. Computers, electronic networks, and information systems are now used to routinely process, store, and transmit digital data in most commercial fields. As the spread and use of information technologies in the business world have quickened, the failure of current laws to meet the needs of a digital, information-based society has become apparent [1994, Chapter 3].

The subsequent sections examine the following regulatory domains: universal service and access, competition policy, infrastructures and network security, the highly controversial and contradictory issue of cryptography, privacy, and intellectual property and copyrights.

a. Access to the "Information Superhighway": Universal Service

As was introduced in Chapter 2, universal service concerns communications networks to which all users have access regardless of whether they can afford it or where they live. Universal access, open platforms, or interconnection requirements concern the access of service providers to networks, whether they do not themselves own the networks or whether they compete with the providers of the networks. Let us first consider the issue of universal service.

In the era of regulated telephone markets, the government granted the local phone operators a so-called natural monopoly. To ensure universal service, the government imposed fee caps on local service, both in terms of monthly fees and usage-based charges. At the same time, it permitted higher charges for long-distance and business services. The government partially deregulated the telephone provider market with the breakup of AT&T in 1982. While competition developed in the long-distance markets, the principle of natural monopolies and the obligatory provision of universal service persisted in the local telephone markets. The Telecommunications Act of 1996 has now fully liberalized the provider markets. Despite deregulation, the Clinton Administration insists on the continual obligation to provide universal service:

> As a matter of fundamental fairness, this nation cannot accept a division of our people among telecommunications or information ”haves” and ”have-nots”. The Administration is committed to developing a broad, modern concept of Universal Service – one that would emphasize giving all Americans who desire it easy, affordable access to advanced communications and information services, regardless of income, disability, or location [National Technology and Information Agency, 1993, 7].

Gore adds:

> Today, we must choose competition again and protect it against both suffocating regulation on the one hand and unfettered monopolies on the other. … We expect open competition to bring lower prices and better services. But let me be clear: we insist upon safeguards to ensure that new corporate freedoms will not be translated into sudden and unjustified rate increases for telephone consumers [Gore, 1994, 4].

On the other hand, Gore also cautioned against the implementation of hasty regulation before the implications of the new paradigm are fully understood. As the ”Information Superhighway” implies a completely new economic game, past regulatory structures must come under review as they are important long-term obstacles.

Planned government intervention to safeguard equity includes geographical equity, as Gore outlines: ”We must work to ensure that no geographic region of the United States, rural or urban, is left without access to broadband, interactive service. Yes, we support opening the local telephone exchange to competition. But we will not permit the dismantling of our present national networks” [ibid.]. He defines the role of providers as follows: ”It is critically important, therefore, that all carriers must be obliged to contribute, on an equitable and competitively neutral basis, to the preservation and advancement of universal service” [ibid.]. He also pledges a flexible approach on the definition of universal service: ”There will be universal service; that definition will evolve as technology and the infrastructure advance; and the FCC will get the job done” [ibid.].

The Telecommunications Act requires local phone companies to provide equal access, interconnection (with reasonable compensation), and affordable telecommunication services. The issue of how to finance universal service has not been resolved. Between 1986 and 1993, a Universal Service Fund (USF) already existed in the United States, but it has expired. In his 1997 State of the Union speech, President Clinton has pledged to renew the USF. On November 7, 1996, the Federal Communications Commission (FCC) and the Federal-State Joint Board on Universal Service have released a Recommended Decision on this issue [Federal Communications Commission/Federal-State Joint Board, 1996]. This document principally confirms the Administration's standpoint on guaranteeing basic services to all needy. It also calls for the maintenance of competitive neutrality. A final judgement on the likely content of a future universal service policy cannot yet be made as a number of dissenting views have been voiced. Nevertheless, a wide debate has been initiated; the FCC and the Joint Board have already involved industry and public groups in the consultation process. As this issue is complicated, it is likely to demand a considerable amount of time until it is finalized.

b. Policy Strategy on Providers: Competition, Regulation, and Interconnection

The early 1990s have witnessed extensive merger and acquisition activities in computer-mediated communication-related sectors. In the United States, these activities concentrate on infrastructure providers, such as cable and telephone companies, as well as on content providers from the broadcasting (television and movie industries) and network media (online services). While some argue that only giant corporations and alliances can handle the massive investments necessary for the establishment of the NII, others counter that excessive market concentration will lead to harmful monopolies or oligopolies.

To accommodate both arguments, the Clinton Administration has pursued a double strategy: deregulation to improve the competitive environment and re-regulation to prevent barriers-to-entry and monopolies. The aim has been a comprehensive policy that provides for a transparent market structure in which companies can operate on the basis of long-term calculations: "By establishing reasonable standards and a constructive regulatory environment, the government can send clear signals to industry about important, emerging markets and spur private sector investment" [Clinton, 1992, 6]. A central strategic element was the passage of communications reform legislation that updates the Communications Act of 1934. Deregulation of monopolized telecommunications markets has been a centerpiece of reform, as Vice President Gore outlined the Administration's plans for 1993 and beyond:

> [T]he Administration will support removal, over time, under appropriate conditions, of judicial and legislative restrictions on all types of telecommunications companies: cable, telephone, utilities, television and satellite. We will do this through both legislative and administrative proposals, prepared after extensive consultation with Congress, industry, public interest and consumer groups, and state and local governments. Our goal is not to design the market of the future. It is to provide the principles that shape that market. And it is to provide the rules governing this difficult transition to an open market for information [Gore, 1993].

The plan implied that cable, long distance and electric utilities companies would be allowed to offer two-way communications and local telephone services, and thereby compete in the monopoly markets of the regional phone companies, the "Baby Bells". Deregulation had the basic purpose to create the basic conditions and incentives for a strong private sector role in the creation of the NII.

From the beginning, the Clinton Administration inisted that legislation must balance deregulation and basic regulatory demands. It assigned the Federal Communications Commission as the central actor in the evaluation process: the FCC will have "the future authority, under appropriate conditions, to impose non-discriminatory access requirements on cable companies. As cable and telephone service become harder and harder to distinguish, this provision will help to ensure that labels derived from past regulatory structures are not translated into inadvertent, unfair competitive advantages" [Gore, 1994]. Furthermore, interconnection and the benefits to consumers have been central components:

> As different services are grouped within a single corporate structure, we must ensure that these new, combined entities are not caught in a cross-fire of conflicting and duplicative regulatory burdens and standards. This Administration will not let existing regulatory structures impede or distort the evolution of the communications industry. In the information marketplace of the future, we will obtain our goals of investment, competition and open access only if regulation matches the marketplace. That requires a flexible, adaptable regulatory regime that encourages the widespread provision of broadband, interactive digital services. [..] *But in return, they would provide their services and access to their facilities to others on a nondiscriminatory basis.* The nation would thus be assured that

> these companies would provide open access to information providers and consumers and the benefits of competition, including lower prices and higher-quality services, to their customers. This new method itself illustrates one of our five principles – that government itself must be flexible [Gore, 1994, emphasis added].

Congress introduced two bills that would turn the Administration's intentions into law: H.R. 3626, the Antitrust Act of 1993 (later the Antitrust and Communications Reform of 1994), also called the Brooks-Dingill Bill, and H.R. 3636, the National Communications Competition and Information Infrastructure Act of 1993, also called the Markey-Fields Bill (to other elements of the Telecommunications Act, for example the infamous Communications Decency Act, we return to below). The Antitrust Act finalized the deregulation in the communication provider market that began in the early 1980s. In 1982, the government had ended the AT&T monopoly. AT&T was broken up into several regional phone companies and one larger long-distance division. The ”Modification of Final Judgment” (MFJ) upheld the local monopoly status for the ”Baby Bells”. Long-distance services, however, were opened for competition, a market in which AT&T, MCI, Sprint, and also many other smaller and regional providers compete. The Act also focused on the removal of local and regional monopolies. The MFJ arrangement initially restricted the service provision by baby bells in the long-distance telephone business, the manufacture of telephone equipment, and, until the early 1990s, from entering into electronic publishing. The House Energy and Commerce Committee's version of H.R. 3626 outlined the removal of these restrictions; with the exception that the Attorney General would continue to oversee whether the Baby Bells use their monopoly powers to restrict competition in the market, for example, by means of cross-subsidization between different business operations. The version propagated by the Judiciary Committee was more restrictive as it planned tighter requirements on the provision of intrastate long distance and interstate resale.[29] In July 1994, the House passed H.R. 3626 by an overwhelming majority of 423 to 5.

The underlying purpose of the National Communications Competition and Information Infrastructure Act was to allow competition between cable and telephone companies in each other's business domains. The legislation contains the ”Open Platform” provisions that ensure an open and accessible network to residential and

---

[29] Both the Energy and Commerce Committee and the Judiciary Committee have jurisdiction over the issue.

business users. If a telephone company enters the cable market, it must offer video services so that other providers are able to present their programs. On the other side, the Act enables cable operators to interconnect with the public-switched telephone networks. That provision ensures that all potential customers have access to all the services that the NII has to offer.

In its effort to define the concept of universal access, the Administration initiated public hearings in 1993 held by the Commerce Department's National Telecommunications and Information Administration (NTIA). Following these hearings, the IITF, the Advisory Council on the National Information Infrastructure, and state regulatory commissions have been working on the development of an universal access concept. The aim has been the promotion of seamless, interactive, and user-driven operations. The FCC is the principle evaluatory institution for this issue. A Joint Federal-State Board, consisting of FCC members and state regulators, defines a framework that ensures continual universal service, and that promotes access to advanced telecommunications technologies. Individual state boards can then flexibly implement the basic guidelines.

While the above standpoints and legislative actions concern wire-based communications, the Clinton Administration also pledged to improve the procedures and management of the radio frequency spectrum. A strong emphasis rested on the creation of more competition. The central legislative action was the Omnibus Budget and Reconciliation Act of 1993 to streamline government use of spectrum and to distribute spectrum to the public efficiently. The measures included greater flexibility in spectrum allocation, including increased sharing of spectrum between private sector and government users, increased flexibility in technical and service standards, and increased choices for licensees in employing their assigned spectrum. A central aim was the promotion of market principles in spectrum distribution; however, with the simultaneous qualification to ensure access by entrepreneurs and small, rural, minority- and women-owned businesses.

The public reaction on these positions was primarily positive. The Electronic Frontier Foundation and other civil liberty groups support open platform services as they provide open access to applications such as telemedicine, telecommuting, and distance learning. It opposes trends in which carriers intend to offer only one-way services such as pay-per-view, home shopping, and 500 TV-channels. Daniel J.

Weitzner, Deputy Policy Director of EFF, said: ”Guided by Congress, FCC action to cause deployment and tariffing of Open Platform services will dramatically enhance Americans’ access to multimedia information sources” [quoted in EFFector Online 7-12/94]. Mitchell Kapor, Chairman of the Board of the Foundation, said that an information infrastructure ”built based on Open Platform principles will be a vibrant web of communications and information that enhance free speech and democratic discourse. Open architecture will also enable the NII to be the site of innovation, economic growth, and job creation” [ibid.].

Congress passed the comprehensive Telecommunications Act of 1996 in March of that year. Most of its provisions will be implemented in 1996 and 1997 [see Federal Communications Commission, 1996]. To conclude, the telecommunications reform has been successful in the United States and opens the way for private sector investments. In 1996, the United States were therefore far ahead of its major competitors in Europe and Japan. Nevertheless, as we will see below in the section of privacy, a number of regulatory issues remain unresolved.

c. Information Infrastructures and Network Security

To ensure the credibility of information infrastructures, network security must be fundamental but invisible. In an effort to promote network security, the Clinton Administration has enacted the National Communications System (NCS) ”to reduce the vulnerability of the nation's telecommunications systems to accident, sabotage, natural disaster, or military attack”. The NCS implements a cooperative structure in which the 23 Federal agencies cooperate with the Information Infrastructures Task Force and industry. Thus, the issue of network security has received top level political attention in the United States.[30]

Security breaches have alerted the Internet community and relevant agencies. For example, the discovery of the ”password sniffer” program that was able to obtain access to systems and passwords has steered up fears about network reliability in the United States. This incident, however, has also demonstrated that safeguards are operational and that fast and coordinated responses can protect from damage and

[30] Other relevant groups are the Network Reliability Council that consists of industry and user representatives and that assists the Federal Communications Commission, and the National Security Telecommunications Advisory Committee, which is an advisory committee to the President that

proliferation of such attacks. Central to the defense from such attacks have been so-called Emergency Response Teams. NIST's F. Lynn McNulty described the password sniffer incident to the Subcommittee on Science Committee on Science, Space, and Technology of the House of Representatives,: ”Despite the serious impact of this incident, it should be viewed as a clear and major success for organized incident response activities. The existence and cooperation of several operational security incident response teams was instrumental in identifying this as more than a 'routine' incident and ensuring rapid response to it” [House, 1994a]. He outlined the lessons learned:

- Effective incident response teams and alerting mechanisms can (and, in this case, did) play an important role in minimizing the impact of such incidents.
- Traditional user authentication by means of re-usable passwords does not provide strong security in today's networked environment – with or without encryption;
- Exploitation techniques (and software which automates such techniques) are rapidly shared across the network and can be easily used by otherwise unskilled miscreants. In other words, you don't have to be smart (or ambitious) enough to build these ”weapons” to be able to obtain them and use them against others;
- Any host system, if improperly configured or managed, can become an ”unwitting” platform for an attack against other systems in a network. Therefore, we need to minimize the need for reliance on the integrity of individual hosts for the security of other hosts and users on the Internet;
- System administrators (which, because of the growing number of workstations on the net, include an increasing number of relatively unskilled users) need better awareness, skills, and competence in protecting their systems;
- The importance of security to users of the Internet (and by extension the evolving national information infrastructure) can no longer be seen as secondary. If this valuable national resource is to achieve its full potential, its users must have confidence in the security of their data and activities on the network [ibid.].

---

coordinates with the NCS and the Network Reliability Council, and that cooperates with the NII Advisory Council.

To systemize the defense against network attacks, response teams have been also initiated within governmental institutions, such as the Department of Defense's Automated System Security Incident Support Team (ASSIST) and the Department of Energy's Computer Incident Advisory Capability (CIAC) at Lawrence Livermore Laboratory, and within universities, industry, computer manufacturers and non-US institutions. Initially, these teams were fragmented; however, NIST led efforts to form a coalition of response teams, the Forum of Incident Response and Security Teams (FIRST). The operational concept of FIRST is that each team ”serv[es] its own constituency, but work[s] with the others to share information, provide[s] alerts, and provide[s] mutual support in the response to incidents and potential incidents” [ibid.].

Internet security response teams collect highly sensitive information. On one hand, these teams must alert users of concurrent dangers from attacks, on the other, they must prevent that malicious hackers use precisely that information to intensify their attack on the system. Furthermore, the response teams collect sensitive information on the system and participating individuals. The concept of FIRST has been to publicize details of the incidents only when a solution has been found. Trust between the different members is imperative. It remains a political task to institutionalize a functional system that transcends international borders.

While response teams are reactive, NIST also pursues proactive security strategies. It has the following tasks in this domain: risk analysis, formal models, new products, solutions to existing vulnerabilities, standards, product evaluations, system certifications, generally accepted principles, training and certification of information security professionals, the public-key infrastructure, emergency response, the outline of ethical principles, and the education of the public [Office of Technology Assessment, 1994, Chapter 2]. Furthermore, NIST leads efforts to create a system that includes a number of services that have been defined within the framework of the International Standard 7498-2 (the specification of security aspects of the Open System Interconnect (OSI)). These services include:

- Authentication – Verification of the claimed identity of a computer or computer network user;
- Access Control – Verification and enforcement of the authorized uses of a computer network by a user subsequent to authentication;

- Data Integrity – Verification that the content of a data item (for example, message, file, program) have not been accidentally or intentionally changed in an unauthorized manner;
- Data Confidentiality – Protection of the information content of data from unauthorized disclosure;
- Non-repudiation – Protection against denial of sending (or receiving) a data item by the sender (or receiver) [outlined in ibid.].

The final aim to standardize access security issues is the elaboration of Generally-accepted System Security Practices (GSSP).

To deter attacks on system security and other criminal actions related to computer-mediated communication and their underlying infrastructures, the penal structure has been changing to incorporate new technological realities. Initially-proposed guidelines were heavy-handed. All computer crimes would have been subject to a single guideline without discretionary powers by judges. For example, a first time offender could receive a sentence of 10 to 16 months without parole for accessing a computer without authority and copying a non-protected file.

Strong public criticism prompted the elaboration of new legal guidelines. The United States Sentencing Commission (USSC) proposed that in the determination of the sentence, the defendant's intention must be central. The USSC thereby reacted to dissenting comments by the Electronic Frontier Foundation (EFF), the Society for Electronic Access (SEA), Computer Professionals for Social Responsibility (CPSR), and others. Under the new guideline, if the crime is committed without pecuniary or malicious intent, the sentence can range from 0 to 6 months. Crimes with the intent of financial gain or to harm the system can be punished with a sentence between 10 and 16 months in prison. The EFF has claimed a major victory in influencing this change:

> New communications technologies, in their earliest infancy, are becoming the subject of precedent-setting litigation. Overly strict sentences imposed for computer-related fraud and abuse may have the effect of chilling these technologies even as they develop. Until there are more cases on which to base a guideline, individual sentencing decisions are best left to the discretion of the sentencing judge, who presumably is most familiar with the facts unique to each case. Legal precedents, particularly the application of a sentencing guideline to violations of the Computer Fraud and Abuse Act, can radically affect the course of computer technology's future, and with it the fate of an important tool for the exchange of ideas in a democratic society [EFFector Online, 7-1/94, 2].

To conclude, the issue of network security has been a top level issue on the agenda to create the NII, not only for national security reasons but also for reasons relevant for the development and acceptance of technologies. It has been under review by both executive and judiciary institutions. Legislative action is still pending at the time of writing. Slowly, the consensus has developed that the new technologies of computer-mediated communication require public responses to ensure their security and reliability, which is a significant novelty in the history of computer-mediated communication in the United States and from the approaches of the Reagan and Bush Administrations.

d. Privacy

No other issue in the creation of the NII has attracted so much attention of the public, the mass media, and various governmental institutions than the one of privacy. Privacy cuts right through the fabric of American society: the desire for free expression and the strong emphasis on individualism, the free conduct of business, the strong role of national security concerns, the desire for protection from governmental ”big brother” activities, and the desire for protection from indecent behavior and speech. Accordingly, these issues have been subject to extensive executive, legislative, and public attention, paralleled by the expectation of a strong judicial response from the Supreme Court.

*i) Privacy and Cryptography*

The issue of cryptography has raised considerable political and public attention. Cryptography, although existing for thousands of years in different formats, has traditionally been the domain of the defense community (see Chapter 2). The shift of the technological paradigm, the increase of computing power and the spread of encryption software throughout the world, have opened the use of cryptographic technologies to the general public. Controversies concern the tradeoff between a) national security concerns, such as military security, the fight against terrorism (a prominent issue following the bombing of the World Trade Center and the Oklahoma building, both of which fell into the period of political discussions), and organized crime, b) the freedom of speech, and c) the security and authenticity of economic transactions. The Office of Technology Assessment describes the conflicting issues as follows:

> Cryptography has become a technology of broad application; thus, decisions about cryptography policy have increasingly broad effects on society. The effects of policies about cryptography are not limited to technological developments in cryptography, or even to the health and vitality of companies that produce or use products incorporating cryptography. Instead, these policies will increasingly affect the everyday lives of most Americans: cryptography will be used to help ensure the confidentiality and integrity of health records and tax returns; it will help speed the way to electronic commerce; and it will help manage copyrighted material in electronic form [1994, Chapter 1].

However, many consider the proliferation of cryptography as a fundamental societal threat:

> Within the United States, cryptography is increasingly portrayed as a threat to domestic security (public safety) and a barrier to law enforcement if it is readily available for use by terrorists or criminals. There is also growing recognition of the potential misuses of cryptography, such as by disgruntled employees as a means to sabotage an employer's databases. Thus, export controls, intended to restrict the international availability of U.S. cryptography technology and products, are now being joined with domestic cryptography initiatives intended to preserve U.S. law-enforcement and signals-intelligence capabilities [ibid.].

A number of control regimes exist in the United States that are consistent with the perceived demands of the Cold War era: 1) control of research in cryptography and especially in cryptoanalysis (code-breaking), 2) control of publication in cryptography and related fields, 3) control of patenting of cryptographic inventions (new techniques for encryption and/or new ways of implementing these in useful products) and 4) export controls on the proliferation of cryptography-based products and expertise [ibid., Chapter 4].[31]

Pressured by both the military and critical public groups, the Clinton Administration has been pursuing a policy compromise: to open cryptography to the public, but at the same time, maintain control over its use. Neither side has yet been satisfied by the proposals of the Clinton Administration; and a compromise that achieves satisfaction on both sides is unlikely. The conflict has demonstrated how fundamental the issue is within American society.

---

[31] On the issue of cryptography, see also Landau (1988), House (1987b), Bamford (1983), Ferguson (1982), Public Cryptography Study Group (1981), House (1980), Kahn, (1967), and Office of Technology (1987).

Cryptography policy is both relevant for technology and regulatory policy. In the context of its technology policy, the Administration has pursued the development of controllable cryptography hard- and software. Activities have concentrated on the following themes: the development of standard encryption capabilities and digital signatures for sensitive, unclassified data, and the pursuit of information security devices in sensitive, unclassified systems. In an early outline of its cryptography policy, Gore stated that ”our policy is designed to provide better encryption to individuals and businesses while ensuring that the needs of law enforcement and national security are met” [Gore, quoted in EFFector Online 7.3/94]. The White House Press Secretary comments:

> Advanced encryption technology offers individuals and businesses an inexpensive and easy way to encode data and telephone conversations. Unfortunately, the same encryption technology that can help Americans protect business secrets and personal privacy can also be used by terrorists, drug dealers, and other criminals. In the past, Federal policies on encryption have reflected primarily the needs of law enforcement and national security. The Clinton Administration has sought to balance these needs with the needs of businesses and individuals for security and privacy [quoted in ibid.].

The Administration’s early cryptography policy contained two principle emphases: first, the enforcement of a unitary system in the United States, consisting of two parts. On one hand, the Administration attempted to enforce a unitary system for federal information flows by defining a Federal Information Processing Standard (FIPS). On the other hand, it has pursued the establishment of a public key infrastructure under the authority of designated executive departments. The plans promoted the implementation of specific crypto-technologies that enable surveillance by national security and law enforcement agencies. And second, it has pursued the relaxation of certain export regulations (which we will review in the subsequent section).

In April 1993, the Clinton Administration announced its Key Escrow Initiative and established the interagency Working Group on Encryption and Telecommunications in February 1994. This Working Group has been responsible for the implementation of the Administration's cryptography policy. The Office of Science and Technology Policy (OSTP) and the National Security Council (NSC) both have had leadership functions in the Group. The Working Group has cooperated with the Information

Policy Committee of the IITF. Other participants have included the State Department, Justice Department, Commerce Department (including NIST), the Department of Defense, the Treasury Department, the Office of Management and Budget, the National Security Agency, the Federal Bureau of Investigation, and the National Economic Council. Private sector input was also included from the beginning, however, all participants were required to maintain secrecy. Truly open processes could therefore not develop. The early efforts of the Administration on cryptography policy reflected the dominance of the Cold War-paradigm in future policy formulation. One can only speculate on the content of behind-the-scenes developments; however, as the discussion of the underlying technologies below shows, the NSA appears to have had a strong role in subsequent policy developments.

Within the framework of congressional hearings in February 1994, the Administration specified its plans on the Key Escrow Initiative and the accompanying Clipper Chip encryption scheme. Central has been the approval of the Escrowed Encryption Standard (EES) as a voluntary Federal Information Processing Standard under the authority of NIST. Based on this standard, government agencies would be able to implement the accompanying Key Escrow Chip (also called Clipper) in its communication devices. The second element of the Initiative entailed the designation of the key escrow agents that would store the keys that are necessary for the decryption of communications. Designated executive agencies were NIST and the Automated Services Division of the Treasury Department. The Department of Justice was assigned to define guidelines on the release of keys to assure that Americans would be protected from unauthorized wiretaps. The Department of Commerce approved the EES as a federal standard in February 1994.

Let us briefly discuss the underlying technology of the Clipper to highlight its function within the context of national security concerns. The purpose of the EES is its "voluntary" use within federal institutions to protect unclassified information. It can encrypt voice, facsimile and computer data within the telephone system. The Clipper Chip utilizes a classified algorithm for encryption on a tamper-resistant hardware basis to be implemented in telecommunications and computer equipment. To monitor communications, Clipper enables a Law Enforcement Access Field (LEAF). A LEAF is the principle means to wiretap and decrypt information. An analogy to a LEAF is a door to which specified actors have a key.[32] The Office of Technology Assessment describes the scheme as follows: "Each EES chip has a chip-specific key that is split into two parts after being programmed into the chips. These parts can be recombined to gain access to encrypted communications. One part is held by each of two designated government keyholders, or 'escrow agents'. When surveillance has been authorized and the intercepted communications are found to be encrypted using the EES, law enforcement agencies can obtain the two parts of the escrowed key from the escrow agents. These parts can then be used to obtain the individual keys used to encrypt (and, thus, to decrypt) the telecommunications sessions of interest. The LEAF is transmitted along with the encrypted message; it contains a device identifier that indicates which escrowed keys are needed" [1993, Chapter 4, Box 4-2].[33]

Attorney General Janet Reno offered the following assessment of the Initiative in Congressional hearings: "Key Escrow Encryption ... strikes an excellent balance between protection of communications privacy and protection of society. It permits the use in commercial telecommunications products of chips that provide extremely strong encryption, but can be decrypted, when necessary, by government agencies conducting legally authorized wiretaps" [quoted in EFFector Online 7-3, 1994]. Dorothy E. Denning, Professor and Chair of the Department of Computer Science of Georgetown University, and a participant of advisory councils, expressed support for this scheme:

> As we move into an era of even greater electronic communications, we can and must design our telecommunications infrastructure and encryption systems to support our needs as a nation for secure communications, individual privacy, economic strength, effective law enforcement, and national security. The Clipper Chip is an important step towards meeting all our national needs, and the government should continue to move forward with the program. … If in lieu of Clipper, the government were to adopt and promote a standard that provides strong encryption without government access, society could suffer severe economic and human losses resulting from a diminished capability of law enforcement to investigate and prosecute organized crime and terrorism, and from a diminished capability for foreign intelligence. ... [T]he government rightly concluded that it

---

32 As we discussed in the context of the Reagan Administration's policy, the infamous Memorandum of Understanding of 1987 awarded the NSA a strong role in NIST's standardization activities.

33 The Electronic Frontier Foundation comments: "The LEAF is used to verify chip serial numbers, create a session key for encryption, and validate the session key. Law enforcement or intelligence agents could use a recording of a Clipper conversation, or a copy of Capstone-encoded data, to identify the chip serial number, and obtain copies of the keys held by the 'escrow' agents. Using these keys, they may decrypt the message or data at will - and the idea of the government holding the keys to personal privacy has been the primary objection to the EES scheme" [EFFector Online 7-10/94].

> would be irresponsible to promote a standard that foils law enforcement when technology is at hand to accommodate law enforcement needs without jeopardizing security and privacy. Moreover, through the Administration's commitment to Clipper or some other form of key escrow, escrowed encryption may dominate in the market, mitigating the effect of unescrowed encryption on law enforcement [House, 1994b, 6-7].

The principle reasoning behind the Administration's Clipper scheme has been that if it succeeds in making Clipper a national standard, it can forestall the development and distribution of alternative schemes that are inaccessible to the NSA and law enforcement agencies.

Critics argue that the attempts to make future communications ”wiretap-friendly” reduces the informational autonomy of individuals [Berman, in EFFector Online 7.3/94]. Second, some criticize that the Administration 'sells' the Clipper as a voluntary scheme while the NSC, the NSA, the Department of Justice, and the FBI clearly support a mandatory enforcement of the scheme.[34] Not all FIPS are accepted on the private market; thus the government would lack control over communications if the scheme would not be mandatory. Third, some criticize that the designated key escrow agents are both executive agencies. The proponents of ”fair cryptosystems” argue in favor of splitting the secret keys into multiple components which then can be assigned to multiple trustees. These trustees must not only be government agencies; for example, banks or similar institutions could become trustees. This would significantly reduce the surveillance abilities of executive agencies such as the NSA. In such a system, law enforcement agencies would have to acquire a court order before they could obtain all key parts. This would not necessarily have to be the case within executive institutions. Fourth, Jerry Berman of EFF criticizes the lack of legal penalties for abusive behavior within the executive escrow agents:

---

[34] The EFFector reports: In a ”briefing document” titled ”Encryption: The Threat, Applications and Potential Solutions”, and sent to the National Security Council in February 1993, the FBI, NSA and the Department of Justice concluded that: ”Technical solutions, such as they are, will only work if they are incorporated into all encryption products. To ensure that this occurs, legislation mandating the use of Government-approved encryption products or adherence to Government encryption criteria is required.” Likewise, an undated FBI report titled ”Impact of Emerging Telecommunications Technologies on Law Enforcement” observes that ”[a]lthough the export of encryption products by the United States is controlled, domestic use is not regulated”. The report concludes that ”a national policy embodied in legislation is needed”. Such a policy, according to the FBI, must ensure ”real-time decryption by law enforcement” and ”prohibit cryptography that cannot meet the Government standard” [EFFector Online 8-16/95].

> As currently written, the escrow procedures insulate the government escrow agents from any legal liability for unauthorized or negligent release of an individual's key. This is contrary to the very notion of an escrow system, which ordinarily would provide a legal remedy for the depositor whose deposit is released without authorization. If anything, escrow agents should be subject to strict liability for unauthorized disclosure of keys. The Administration has specifically stated that it will not seek to have the escrow procedures incorporated into legislation or official regulations. Without formalization of rules, users have no guaranty that subsequent administrations will follow the same rules or offer users the same degree of protection. This will greatly reduce trust in the system [House, 1994b, 5].

Fifth, technological shortcomings of the initial scheme existed. AT&T Bell Labs researcher Dr. Matthew Blaze found a flaw that enabled the creation of a fake serial number to alter the LEAF. Sixth, the closed processes surrounding the Clipper scheme were criticized. For example, Whitfield Diffie of Sun Microsystems testified before a Senate Committee:

> In my experience, the people who support the key escrow initiative are inclined to express substantial trust in the government. I find it ironic therefore that in its conduct of this program, the Administration has followed a course that could hardly have been better designed to provoke distrust. The introduction of mechanisms designed to assure the government's ability to conduct electronic surveillance on its citizens and limit the ability of citizens to protect themselves against such surveillance is a major policy decision of the information age. It has been presented, however, as a technicality, buried in an obscure series of regulations. In so doing, it has avoided congressional consideration of either its objectives or its budget. The underlying secrecy of the technology has been used as a tool for doling out information piecemeal and making a timely understanding of the issues difficult to achieve [Senate, 1994, 10].

Similarly, David J. Farber, Professor of Telecommunications Systems at the University of Pennsylvania, testified before the same committee:

> While I recognize that a small part of cryptography will always be classified, most of the development of the proposed escrow system has been taking place in those room[s] (not smoke-filled any more). This process must be brought out into the sunshine of the technical and policy community. Proposals like Clipper must be evolved, if they are to have any chance of success, with the co-operation and understanding of the industrial and academic community and their enthusiastic cooperation rather than their mistrust. This penchant for openness must not be seen as a power struggle between industry and government, or as an excuse for revisiting a decision that technologists dislike for political reasons. Rather it is a reflection of a deep faith in open design processes and a recognition that closed processes

> invariably lead to solutions which are too narrow and don't last [House, 1994b].

In an analysis of the Administration's cryptography policy, the Office of Technology Assessment agreed with these assessments:

> More open policies and processes can be used to increase equity and acceptance in implementing cryptography and other technologies. The current controversies over cryptography can be characterized in terms of tensions between the government and individuals. They center on the issue of trust in government. Trust is a particular issue in cases like cryptography, when national-security concerns restrict the equal sharing of information between the government and the public. Government initiatives of broad public application, formulated in secret and executed without legislation, naturally give rise to concerns over their intent and application. The process by which the EES was selected and approved was closed to those outside the executive branch. Furthermore, the institutional and procedural means by which key-escrow encryption is being deployed (such as the escrow-management procedures) continue to be developed in a closed forum [1994, Chapter 1].

In reaction to public pressures, the Administration opened its policy processes. The subsequent Key Escrow Encryption Workshop in June 1994 entailed the invitation of alternative approaches to encryption schemes, the establishment of joint industry-government working groups under the leadership of NIST, the invitation to public seminars and workshops, and the preparation of a report to promote public discussions of the issue. The Administration also pledged to conduct further research that reflects the standpoints of the critical community, including the examination of existing vehicles for collaborative government-industry research and development, the development of criteria for determining the suitability of encryption algorithms to be used in conjunction with key escrowing, the examination of intellectual-property and royalty issues related to alternative key-escrowing techniques and the creation of a government key-escrowing task force to manage and expedite the search for key-escrow alternatives.

Congress also reacted to concerns over closed processes. In October 1994, Representative Brown introduced a draft for H.R. 5199, the Encryption Standards & Procedures Act of 1994, in the House Science, Space, and Technology Committee. The principle purpose of this legislation had been to "pursue a more open public process on governmental encryption schemes" and to strike "the proper balance between the public's right to private and secure communications and the government's need to decipher information obtained through lawful electronic surveillance" [quoted in

EFFector Online 7-14/94]. This legislation would authorize NIST to develop new escrowed encryption standards that are relevant for privacy, security and the authenticity of domestic and international electronic communications, without eliminating the surveillance capabilities of the government. The bill emphasizes public input to raise general support for such standards.

Critical public groups responded immediately. The EFF argued that the draft bill shows considerable overlaps with the Clinton scheme: it emphasizes the absolute preservation of law enforcement and national security access, offers only weak privacy protection, and increases the role of the National Security Agency in civilian privacy and security matters [ibid.]. The implementation of alternative proposals would make surveillance activities far more difficult. One proposition is the tripling of existing Data Encryption Standard (DES) standard as an alternative to Clipper or other key-escrow based standards. Its proponents argue that the algorithm of the DES has proven to be a strong encryption device and that the tripling of the key length extends this security.[35] Novel business applications implement this principle; remarkably introduced by a Japanese company.

Due to the inability of the Clinton Administration and the considerable public opposition, the battle over the future of cryptography and its public applications seems to be decided, at least in the domestic context. The use of cryptography products is free for every American as long as no foreigners or foreign countries are involved. This brings us to the topic of cryptography and exports; an issue which turns out to have a much greater impact on the domestic use of cryptography products than one would expect.

*ii) Cryptography Policy and Exports: Business v. National Security*

In the United States, two regulatory export regimes exist: for military products, and for dual use products that have overlapping military and civilian applications. Civilian exports are not regulated. The Department of State administers the military export regime within the context of the Arms Export Control Act and International Traffic in Arms Regulations (ITAR). The Department of Commerce supervises the dual use regime within the confines of the Export Administration Act (EAA) and the Export

---

[35] The DES has been the operational federal standard on encryption. Due to increasing computing power, its security is believed to be overcome by 1997.

Administration Regulations (EAR). While both regimes control goods and services that are of primary interest to national security and foreign policy, the licensing requirements for these goods and services underlie different restrictions.[36] The licensing process depends on the good; when it has been defined to be a military good, the exporter must obtain a license from the Department of State (which is normally far more restrictive), and when it is a dual use good, the exporter must obtain a license from the Department of Commerce.[37] The categories which define a good to be either of military or dual use are set in the Munitions List and the Commerce Control List.

Hard- and software for cryptography have been traditionally considered to be military goods to be controlled by the Department of State (with a few exceptions). The overlap between the different control lists is considerable and thereby creates fundamental uncertainties for exporters, often to the extent that it *de facto* prohibits the export of cryptography products. While hardware cryptography concerns real products that can be controlled at the borders, software cryptography adds a complication: the mere publication of source code has been treated as an export. Thus, no public discussion of theoretical and technological issues had been possible, especially not on the globally-accessible Internet.

With the rise of commercially available cryptography goods within the United States and abroad, the categorization of cryptography as a military good has been increasingly controversial. On the one hand, export controls diminish economies of scale, hurts sales in foreign markets, and, what has been a particularly troubling feature of the post-Cold War period, forces U.S. companies to maintain dual security systems for their own operations between domestic enterprises and their subsidiaries abroad as the latter employ foreign employees. Furthermore, business travelers may violate controls when they use their laptop with encryption software overseas. On the other hand, other countries have less stringent controls on cryptography products and are therefore fierce competitors in the highly lucrative security markets. U.S. companies and business groups complain that these restrictions obstruct their access to foreign markets [for example, see Business Software Alliance, 1994; Software Publishers

---

[36] Both military and dual use goods are subject to either specific or general licenses. This distinguishes them from other goods that have no export restrictions.

[37] Relevant institutions are the Bureau of Export Administration which administers controls on dual-use items, the Office of Export Licensing that makes licensing determinations, and the Office of Technology

Association, 1994; Hoffman, 1994; and Messmer, 1993]. As Stephen T. Walker, President of Trusted Information Systems, testified before the Senate Committee on the Judiciary:

> Our experience ... has demonstrated conclusively that U.S. business is at a severe disadvantage in attempting to sell products to the world market. If our competitors overseas can routinely ship to most places in the world within days and we must go through time-consuming and onerous procedures with the most likely outcome being denial of the export request, we might as well not even try. And that is exactly what many U.S. companies have decided. And please be certain to understand that we are not talking about a few isolated products involving encryption. More and more we are talking about major information processing applications like word processors, databases, electronic mail packages, and integrated software systems that must use cryptography to provide even the most basic level of security being demanded by multinational companies [Senate, 1994, 18].

In other words, although the U.S. government is not authorized to control the use of cryptography products in the United States, ”through strict control of exports they can deter industry from building products that effectively employ cryptography, then they have achieved a very effective form of internal use control” [ibid., 26]. Thus, export controls do not only hurt overseas sales, but they obstruct the domestic development and evolution of cryptography technologies. Not only export controls are a problem, but critics complain that the export process is complicated, often contradictory and outright unconstitutional. Especially, they charge that export controls violate the First Amendment of the Constitution. Free speech is subsumed to vague restrictions, the registration of publications on this topic is mandatory and publications can simply be forbidden without any judicial review.

Initial efforts to ease the restrictions during the Bush Administration had been obstructed by the Department of Defense and the NSA. Instead of permitting the redelegation of authorities from the State to the Commerce Department, the NSA and the State Department relaxed some controls but secured the main authority over the issue. Specifically, they streamlined controls by expediting the review of software with

---

and Policy that develops licensing policies and provides technical support in maintaining the Commerce Control List. See OTA, 1994, Chapter 4.

public key algorithms; with a restriction on the key length to 40 bits which is far below the technologically-achievable rate.[38]

In the context of its Key Escrow Initiative, the Clinton Administration announced procedural reforms for the existing export regime. Department Assistant Secretary of State Martha Harris stated that a reform ”should have the effect of minimizing the impact of export controls on U.S. industry” [quoted in EFFector Online 7-3/94]. The reform plan entailed license reform measures including the rapid review of export applications with a goal of a turnaround of 10 days, the opening of exports to ”approved” countries and regions without the necessity of individual applications, and temporary personal use exemptions for U.S. citizens for travelling. Nevertheless, the Administration continues to insist on export controls of advanced cryptography devices, as the White House Press Secretary elaborates: ”We understand that many in industry would like to see all encryption products exportable. However, if encryption technology is made freely available worldwide, it would no doubt be used extensively by terrorists, drug dealers, and other criminals to harm Americans both in the U.S. and abroad. For this reason, the Administration will continue to restrict export of the most sophisticated encryption devices, both to preserve our own foreign intelligence gathering capability and because of the concerns of our allies who fear that strong encryption technology would inhibit their law enforcement capabilities” [quoted in EFFector Online 7-3/94].

In Senate hearings, a number of people criticized this insistence on export controls [Senate, 1994]. First, as Steve Walker testified, over 340 foreign encryption alternatives exist that make controls superfluous. Restrictions only hurt U.S. exporters. Second, Senator Leahy doubts that ”any sophisticated criminal or terrorist organization is going to use the one code endorsed by the U.S. Government and for which U.S. Government agents hold the decoding keys”. Third, Sun Microsystems' Diffie warned against the establishment of a large bureaucracy and against impediments against free speech and informational autonomy.

Congress has also reacted to criticisms about the existing export control regimes. Representative Maria Cantwell introduced H.R. 3627 to amend the Export Control Act. This legislation has the purpose of liberalizing export controls on encryption software.

---

[38] The maximal allowable bit-rate of encryption has recently been extended to 56 bits as well as to 128 bits for specified agents in the financial business.

It re-delegates the supervision over software with encryption capabilities from the Department of State to the Department of Commerce. This redelegation would solve some of the problems that overlapping responsibilities and contradictory regulations cause. S. 1846, introduced by Senator Patty Murray is the counterpart in the Senate. On H.R. 3937, the Omnibus Export Administration Act, conflicting reports circulate: the House Committee on Foreign Affairs included sections to delegate the Commerce Department the responsibility for computer software, including encryption products. The House Permanent Select Committee on Intelligence, however, replaced this section with language that delegates the responsibility to the President.[39]

As in the Escrowed Encryption Scheme, the Clinton Administration reacted to concerns over export controls. In an open letter to Cantwell in July 1994, Gore announced a ”new phase” that would consider economic effects of export regulations and alternative schemes:

> The real question is whether our policies will allow encryption to be built into the fabric of our national and international infrastructure, to provide significantly increased individual privacy, improved financial privacy, increased financial security, enhanced freedom of association, increased individual control over identity, improved security and integrity of documents, contracts, and licenses, reduced fraud and counterfeiting, the creation of significant new markets for buying and selling of intellectual property, and a lessened ability to detect and prosecute victimless crimes [quoted in EFFector Online, 7-12/94].

He proposed a network approach to include government, industry and privacy groups: ”Entering this new environment, private industry, law enforcement, and private citizens must work together to balance the requirements of both liberty and security” [ibid.]. On October 1, 1996, Gore outlined the Administration’s future standpoint on cryptography exports. First, export permission has been granted for cryptography products with a key-length up to 56 bit, ”contingent upon industry commitments to build and market future products that support key recovery” [Gore, 1996]. Following a one-time review of the product, a general license will be awarded. Second, commercial cryptography

[39] House of Representatives, Omnibus Export Administration Act of 1994, H. Rept. 103-531, 103d Cong., 2d sess., Parts 1 (Committee on Foreign Affairs, May 25, 1994), 2 (Permanent Select Committee on Intelligence, June 16, 1994), 3 (Committee on Ways and Means, June 7, 1994), and 4 (Committee on Armed Services, June 17, 1994) (Washington, DC, U.S. Government Printing Office, 1994); and H.R. 4663 (Omnibus Export Administration Act of 1994, June 28, 1994). For the cryptography provisions, see Omnibus Export Administration Act of 1994, Part 1, 57-58 (H.R. 3937, sec. 117(c)(1)-(4)). See also

products will no longer be treated as arms. Following consultations with Congress, jurisdiction over cryptography exports will be transferred from the State Department to the Commerce Department. Third, the Administration will propose legislative provisions for commercial key recovery. And fourth, the Administration plans legislation to punish improper key recovery by the designated agents and protection of these agents when the keys are properly released.

Opposition to these plans developed quickly. Senator Leahy criticized two main points. First, outlines do not yet exist defining who can legally decrypt messages and under which circumstances. A critical point is the international path of a message. The Administration states that ”access to keys would be provided in accordance with destination country policies and bilateral understandings” [ibid.]. Leahy comments that ”the weakest link in a key recovery system may be the country with the weakest privacy protections. Internet users, who can send messages around the globe seamlessly, do not want the privacy of their encrypted communications to be at the mercy of a country that ignores the Fourth Amendment principles we enjoy here” [Leahy, 1996]. Second, Leahy argues that the contingency policy is an attempt to ”control the marketplace for high-tech products. Only those companies that agree to turn over their business plans to the government and show that they are developing key recovery systems, will be rewarded with permission to sell abroad products with DES encryption” [ibid.]. Third, the two-year limit to the export permission creates uncertainty for customers.

Furthermore, as the EFF comments, the movement of authority from the State to the Commerce Department would have been commendable if the Administration would not have subsequently changed the Commerce Department’s regulations: ”The new regulations have the same effect [as the International Traffic in Arms Regulations], using the International Emergency Economic Powers Act, the Export Administration Regulations, and a ‘state of national emergency’ that President Clinton declared in 1994 and has re-declared annually” [EFFector Online 9-16/96].

The conflict over the publication of cryptographic codes has also been taken into the courts. For example, Daniel J. Bernstein, formerly graduate student in the Department of Mathematics at the University of California at Berkeley and now Assistant Professor at the University of Illinois in Chicago, and a developer of

---

Omnibus Export Administration Act of 1994, Part 2, 1-5 (H.R. 3937, sec. 117(c) (1)-(3)). All cited in OTA, 1994, Chapter 2.

cryptographic algorithms, has sued the government for the right to publish his encryption algorithms and programs. His principle argument was that export controls restrain his First Amendment rights. In December 1996, a San Francisco court decided in favor of Bernstein. The final impact of this court decision is yet unknown, but it may force the Administration to withdraw its plans to control cryptography altogether.

Thus, the battle over cryptography and its control continues to be open. The opposing camps remain irreconcilable. The national security camp attempts to carry the principles of the Cold War and the national security imperative over to the next stage of technological development of society. The other camp rejects these principles as they fear that they could hamper the development of new technological stages.

*iii) Privacy, Data Security, and Confidentiality*

The issue of privacy concerns the protection of personal data in daily transactions between the government, enterprises and individuals. Especially critical is the issue of data storage and reuse. First, how does the government attempt to prevent breaches of confidentiality in the context of its own information collection? Second, how does government protect its citizens from breaches of confidentiality by third parties?

The Privacy Act of 1974 guarantees ”to provide legal protection for and safeguards on the use of personally identifiable information maintained in federal government record systems” [Office of Technology Assessment, 1994, Chapter 3]. Its general principles are:

- There must be no secret personal data record-keeping system.
- There must be a way for individuals to discover what personal information is recorded and how it is used.
- There must be a way for individuals to prevent information about themselves, obtained for one purpose, from being used or made available for other purposes without their consent.
- There must be a way for individuals to correct or amend a record of information about themselves.

- An organization creating, maintaining, using, or disseminating records of identifiable personal data must assure the reliability of the data for its intended use and must take reasonable precautions to prevent misuses of the data [ibid.].

The Office of Technology Assessment has criticized the Act's effectiveness: notification procedures are ineffective, no government oversight system nor restrictions on the internal use of information in federal agencies exist, penalties in the case of abuse are inadequate, and greater computing power have enabled agencies "to use, manipulate, and pursue information" (for example, the matching of data between agencies to detect fraud, abuse or waste[40]) [ibid.]. To overcome the limitations of the Privacy Act, it has already been amended during the Bush Administration to:

- ensure that information is protected commensurate with the risk and magnitude of the harm that would result from the loss, misuse, or unauthorized access to, or modification of such information;
- limit the collection of information that identifies individuals to that which is legally authorized and necessary for the proper performance of agency functions;
- limit the sharing of information that identifies individuals or contains proprietary information to that which is legally authorized, and impose appropriate conditions on use where a continuing obligation to ensure the confidentiality of the information exists; and
- provide individuals, upon request, access to records maintained about them in Privacy Act systems of records, and permit them to amend those records that are in error, consistent with the provisions of the Privacy Act [Office of Management and Budget, 1993].

The Clinton Administration has awarded privacy protection and confidentiality a high status in the context of the NII-program. The Working Group on Privacy of the Information Infrastructure Task Force (IITF) has developed a work plan that addresses the tradeoff between the necessity to ensure individual privacy and the legitimate societal needs for information, including those of law enforcement. On January 26-27,

---

[40] The Computer Matching Act is designed to prevent matching abuses by establishing an oversight board within an agency, however, the OTA seems to doubt that such a board is effective considering technological changes, especially increased networking capacities: "Some commentators suggest that the act be overhauled to reflect the technological changes that have occurred since the 1970s and the new uses of information enabled by those changes".

1994, the Office of Consumer Affairs held public hearings on the relationship between privacy issues and issues such as law enforcement, financial services, information technology, and direct marketing.

Simultaneously, governmental institutions have been designing new ways to collect information. One application is the introduction of so-called smart cards. Smart cards can authenticate one's identity or serve as a means of payment. One such card is the United States Postal Service (USPS) & Internal Revenue Service (IRS) Mull National Identity Card, designed for identity authentication in e-mail, the transfer of funds, and the interaction with governmental agencies (for example, the IRS, the Veterans Administration and the Department of Health and Human Services). While such a card may improve the efficiency of government services, some people have voiced concerns over their privacy and confidentiality. At the time of writing, it remains uncertain how the government can implement efficient administrative systems and accommodate privacy and confidentiality concerns.

Second, privacy and confidentiality also concern the protection of individuals from private information collection by third parties. Unlike the European Union, the United States has no explicit regulations for the private collection of private information; the Privacy Act only covers information collected in Federal institutions. Thus, the government does not explicitly protect its citizens unless other rights are breached by such activities. Principally, enterprises can sell private information about their customers without restrictions.

Another modern privacy problem has been the question of who owns the content of e-mail, the company or the employee. This question has until now been exclusively addressed in court, mostly in favor of enterprises: principally, companies can read any mail within its network, even what may be considered private mail. Whether the company is then responsible for the content its employees' e-mail is another question that is now being tested in the courts. Cases exist in which companies have been sued because employees have made racist jokes or other slanderous comments. Thus, on one hand, enterprises reserve themselves the right to access its employees' e-mail without their consent or even knowledge, and on the other, they do not want to be held liable for the conduct of their employees, even if they have knowledge of it.

Civil law suits have proven to be an effective method in the United States to decide societal issues without legislative actions (whether such a system is always equitable and fair is debatable). It is probable that many cases surrounding the question of privacy in private interactions will be solved in court, especially since the government also plans no action on this issue. Similar hypotheses can be made on the question of the working environment and workers' rights.

*iv) Privacy, Free Speech, and Indecency*

While the government plans no protection of its citizens from privacy breaches in the use of personal data, the government has been pursuing another type of individual protection: the protection from the exposure to "foul" language and "filthy" pictures. For some, the Internet is a meeting place for sado-masochists, prostitutes, pedophiles, and homosexuals. These are, in their view, in one way or another delinquent, and must therefore be controlled and punished by the government. This issue has become the perhaps most-contested area in the legislative history on the NII as it touches on the most fundamental of American rights: the freedom of speech.

To make indecent conduct on computer-mediated communication networks punishable by law, Senator Exon introduced S. 314, the Communications Decency Act (CDA). The principle purpose of the CDA is to extend existing regulations on telephone and broadcasting services to computer-mediated communication. The provisions that presently regulate broadcasting services prohibit obscene or harassing telephone calls and the dissemination of so-called "indecent" materials. According to the Act, the access providers become liable for the content they carry and for the conduct of users within the system. In other words, the government attempts to implement a self-regulating mechanism: provider self-regulation.

Critics argue that the CDA is excessively restrictive: It

- subject[s] all online content to the interpretation of ill-defined "indecency" law;
- irrationally equate[s] Internet communications with radio and TV broadcasting, and unconstitutionally impose[s] on computer networks indecency restrictions that are more severe than those applied to any other medium;
- actively hinder[s] the on-going development and refinement of real solutions to problems such as online harassment and parents' needs to supervise their own children's online access;

- in all probability [..] establishes broad FCC regulation of the Internet, with all of the attendant problems that will entail;
- create[s] a new ”access crime”, equating the posting of material on a web site, or even the provision of basic Internet access, with willful transmission of indecent material directly to minors – harming the online service industry, and retarding the development of the electronic press;
- afford[s] no effective legal protection for system operators, creating a speech-chilling liability no more sensible than holding librarians and postmasters responsible for the content on bookshelves and in parcels;
- weaken[s] the privacy of all Internet users by turning system operators into snoops and censors;
- criminalize[s] even classic works of literature and art, or medical and educational materials on breast cancer or sexually transmitted disease. Obscenity law, not the indecency law used in the Telecom Bill, considers literary, artistic or scientific value. Indecency law makes no such exceptions [EFFector Online 9-2/96].

The EFF warned against the enactment of the CDA:

> If enacted, S. 314 would compel service providers to severely restrict your online activities. Your access to email, discussion lists, usenet, the world wide web, gopher, and ftp archives would be substantially reduced or cut off entirely. The bill would also force providers to closely monitor and pre-screen your electronic mail, and refuse to transmit any message or other content which may be considered to be indecent. This bill poses a significant threat to freedom of speech and the free flow of information in cyberspace. The bill also raises fundamental questions about the right of government to control content on communications networks, as well as the locus of liability for content carried in these new communications media [EFFector Online 8-3/95].

In June 1995, the House and the Senate passed the CDA. It subsequently became part of the Telecommunications Act of 1996. The Senate held no hearings on the issue; it seems unlikely that the potential impact of this legislation was known among senators: ”There have been no public hearings on this legislation. Neither the CDA, nor the larger Telecom Bill have been presented openly to the public. As a result, Congress has neither heard expert testimony about the medium and industry, nor allowed constituents to review and comment on what their 'representatives' are doing. No conference committee report or final bill text was made available for review, except to committee staffers and innermost lobbyists until after passage. Despite repeated promises from House Speaker Newt Gingrich, Congress has failed to provide online public access to committee reports and ‘live’ bills” [EFFector Online 9-2/96]. Critics furthermore charge that senators neither had the time to read the bill nor had been presented a correct review; lobbyists ”sold” the bill as one that would protect children from pornography although the content of the bill did not specifically address that issue.

A number of other elementary and fundamental critiques exist. The first concerns the First Amendment free speech rights. CDA-opponents argue that computer-mediated communication is not a one-too-many medium as broadcast media. Thus, one cannot equate personal expression in computer-mediated communication networks with expression in broadcasting systems. The computer-mediated communication media are not pervasive because the content is ”pulled”, and not ”pushed”. In other words, the content is ”driven by user-choice”. And finally, the common carrier principle does not apply to content providers because they do not have to ”take all comers”. In sum, critical voices, such as the EFF and other civil rights and free speech organizations, oppose the application of broadcasting principles to computer-mediated communication. Furthermore, critics argue, content that would be regulated on networks is often freely available on public newspaper stands. Moreover, the First Amendment requires that limits to free speech must employ the ”least restrictive means”. The CDA, however, criminalizes any speech that some consider as indecent. In general, the NII Advisory Council share the view of the critics: ”The government should not be in the business of regulating content on the Information Superhighway. It should defer to the use of privately provided filtering, reviewing, rating mechanisms and parental supervision, as the best means of preventing access by minors to inappropriate materials” [Edward R. McCracken and Delano Lewis, Co-Chairs of the NIIAC, letter to Commerce Dept. Secretary Ron Brown, quoted in EFFector Online 8-22/95].

Immediately following enactment of the bill as part of the Telecommunications Act of 1996, courts suspended the provisions of the CDA and reconfirmed the primate of free speech. The Administration appealed this court decision, and in December 1996, the Supreme Court agreed to hear this landmark case in March or April of 1997.

The history of censorship attempts has shown that they largely remain ineffective (see also Chapter 2). Censorship critics argue that a much more effective means to protect children from "indecent" materials are tools that restrict online access. With these tools, parents can control what children can see, or how long they can stay online. H.R. 1978, The "Internet Freedom and Family Empowerment Act" by Cox and Wyden is intended to encourage industry to develop such tools.[41]

To conclude, the issue of privacy is hotly contested in the United States. The future of these issues is now predominantly in the hands of the courts that have to decide about cryptography, free speech, confidentiality, and appropriate conduct on computer-mediated communication networks.

e. Intellectual Property Rights and Copyright

In its initial policy outlines, the Clinton Administration pledged to review and redefine domestic copyright laws, international intellectual property treaties on the prevention of piracy, the protection of the integrity of intellectual property, and the concepts of fair use of new media. Furthermore, the IITF is exploring methods to identify and reimburse copyright owners. The issues are: standards for the identification of copyright ownership of information products in electronic systems (for example, electronic headers, labels or signature techniques), the development of an efficient system for the identification, licensing and use of work, and the development of a system for the royalty payments for copyrighted products delivered or made available in online networks. The Administration's principle position has been that "[t]he broad public interest in promoting the dissemination of information to our citizens must be balanced with the need to ensure the integrity of intellectual property rights and copyrights in information and entertainment products. This protection is crucial if these products – whether in the form of text, images, computer programs, databases, video or sound recordings, or multimedia formats – are to move in commerce using the full capability of the NII" [National Technology and Information Agency, 1993].

The Information Infrastructure Task Force's Working Group on Intellectual Property Rights has undertaken a study of contemporary copyright law, and publicized its recommendations within a "White Paper" in September 1995. The legislative initiatives S. 1284 and H.R. 2441, also called the NII Copyright Protection Act of 1995,

---

[41] Since the beginning of 1997, the so-called V-Chip is mandatory for newly-sold televisions. When such devices become mandatory for computer-mediated communication equipment is not yet clear,

have adopted the language of the Administration’s Working Group. The NII Copyright Protection Act, sponsored by Senator Orrin Hatch and Charles Moorhead, is written to amend the Copyright Act of 1976. It extends the exclusive rights to the owner of copyrighted works when these works are transmitted electronically. Furthermore, it prohibits the manufacturing and distribution of devices that can ”circumvent any process, treatment, mechanism, or system which prevents or inhibits the violation of any of the exclusive rights of the copyright owner”. Moreover, it prohibits the distribution, removal or alteration of copyrighted works or the management information and defines criminal charges when these provisions are violated.

Critics have attacked the NII Copyright Protection Act on several points, predominantly charging that the proposed legislation lacks technical feasibility. On the restriction to reproduce copyrighted works in the electronic environment, Peter Jaszi, Professor of Law at the American University, argues that any browsing activities in online media would be a potential breach of protection laws as the act of browsing implies the loading of data into the computer’s memory, even if that storage is only temporary in the random access memory (RAM) [1995]. Furthermore, providers speed up the access to popular web sites by providing proxy services that store the content of web sites, thereby storing, without their explicit knowledge, copyrighted materials. Similarly, modern Web-browsers use “cache” systems to speed up the access to frequently accessed sites [for an examination of these issues, see Cyberspace Law Institute].[42] These activities, which are accepted procedures for almost all participants, would be illegal under the guidelines of the Protection Act. Providers would have to expect a flood of lawsuits, as a result of their pursuit of technological solutions that have been developed over the period of several decades. A redraft of H.R. 2441 added some limitations on the liability of providers. Nevertheless, the bill has been ”postponed indefinitely”. The future of the bill is uncertain at the beginning of 1997. However, negotiations in the context of the World Intellectual Property Organization (WIPO) add a sense of urgency to the issue.

Another important issue concerns the protection of databases. H.R. 3531, the ”Database Investment and Intellectual Property Antipiracy Act of 1996”, introduced in

---

however, the enforcement of such devices is probable in the future.

[42] A cache is a method to accelerate the retrieval of repeatedly requested information by automatically storing it on a hard disk for a predefined period.

May 1996 by Charles Moorhead, has the purpose of awarding databases an intellectual property right status that is independent of the rights over the individual content. This initiative resembles the European Union Directive on Databases (see Chapter 4) and the efforts currently undertaken by the WIPO. It awards protection to any database that was ”the result of a qualitatively or quantitatively substantial investment of human technical, financial or other resources in the collection, assembly, verification, organization or presentation of the database contents”. This definition includes CD-ROMS, online databases and reference works. The only exemption would be databases ”made by a governmental entity”, an exemption that does not include the creation of databases with public or governmental information by private enterprises or governmentally-ordered database collections. The initiative would prohibit the unauthorized extraction, use or reuse of the contents of a database when this extends beyond the ”normal exploitation”. Protection would cover 25 years and could be extended for another 25 years each time that a substantial investment has been made to upgrade the content.

Jaszi argues that this legislation ”would create a strong new form of *sui generis* intellectual property protection – an unprecedented right ‘of its own kind’, distinct from and additional to copyright” [1996]. If the legislation is passed, it would pave the way for a ”pay-per-use” system that would hurt especially the educational and research community. Neither fair use nor the first sale doctrines would apply to databases. Furthermore, Jaszi warns, the similarity to proposals in the context of WIPO negotiations could promote a premature adoption of these provisions without having been subjected to a societal debate in the United States.

Other legislative initiatives concerning intellectual property and copyright include S. 1961, the ”Omnibus Patent Act of 1996”, introduced by Senator Orrin Hatch, H.R. 1861, the ”Copyright Clarifications Act of 1996”, H.R. 2674, the ”Intellectual Property Antitrust Protection Act of 1995, and S. 1122, the ”Criminal Copyright Improvement Act of 1995”, introduced by Senators Leahy and Feingold. Some of these initiatives failed to pass Congress before the session’s end. Overall, legislation on copyrights and intellectual property is still in its infancy. Opposition groups criticize most of the legislation for ignoring the concept of 'fair use', a factor that has been prominent in the United States, but not in the international context. The second critique has been the excessive bias for the large-scale copyright holders as opposed to the content creators and artists.

The issue will most likely evolve with changes in control and authentication technologies (see Chapter 2). However, since it is in the state of deliberations on the international level, some fear that initiatives with uncertain implications will be implemented without a wide societal discussion. Resistance to the outlines of the WIPO-treaty and the similar plans of the Administration has been mounting. In the context of the United States, this could imply litigation that might employ the Supreme Court for years to come.

## Conclusion

The conflict between two technological paradigms has been the predominant source for legislative battles in the United States, between the Presidency and Congress, between executive departments and congressional committees and subcommittees, and between executive departments: in the technological paradigm of the Cold War, autonomous information and communication were restricted to conventional mail or analog media, implying that the total volume of information exchanges was relatively limited. The domestication and proliferation of computing power in American society has changed the nature of information as people can now utilize powerful digital transmission means, a process that especially the military, intelligence, and law enforcement communities have actively opposed. In the declining period of the Cold War, during the Reagan Administration, NSA, NIST, and Congress had legislative conflicts on the issues of national security and public access to computer-mediated communication networks. The recognition of the importance of computer-mediated communication networks for civilian science and research emerged during the Bush Administration, as well as the recognition that institutional changes between and within governmental agencies are necessary to exploit the benefits of computer-mediated communication technologies for science, research, and development. However, the principle initiative rested with Congress, especially with Senator Gore. In this phase, the institutional and organizational struggles spilled over from the defense community towards different civilian departments, most prominently the National Science Foundation and the Department of Energy. The Bush Administration did not politicize the issue of defense, but remained passive towards computer-mediated communication. In other words, it had no substantive vision. The question of network operation raised a number of follow-up questions that have not been considered in contemporary legislation, such as privacy and data security: legislative initiatives and subsequent public hearings with a high degree of actor inclusion yielded significant progress on the recognition of related important issues. Most prominent was the privatization of the networks, with the subsequent issues of who controls the networks and who has access to them. These questions posed no concurrent problems, however, they identified policy issues with considerable subsequent salience that demanded a legislative response. This relatively open process on computer-mediated communication development differentiates decision-making processes in the United States from those in the European Union and Japan where computer-mediated communication related issues received only limited public attention.

The Clinton Administration, with Al Gore at the forefront, did not only respond to specific policy demands that the privatization of computer-mediated communication networks yielded, but it reacted with the development of an overarching vision. This substantive vision presented an outline of a desirable future society (”collective projection”) and promoted the formation of actor coalitions (”synchronous preadaptation”). Whether that vision has served to substitute existing rules and decision-making logic (”functional equivalent”) cannot be confirmed; the platform for legislative activities has remained stable and no alternative forms, such as online elections have yet emerged (with the exception of some localized initiatives in some communities and universities).

Within specific policy domains, actor coalitions have developed that have not at all been fragile. Between policy domains, however, these actor coalitions were unstable. For example, while business, consumer, and civil rights groups allied on the issues of the use of cryptography products and their exports, they opposed each other on the issues of universal service and access provision. This coalitional variation has had consequences for political representatives and institutions, from Clinton, whose rhetoric and subsequent initiatives had in a number of cases been inconsistent, to the defense and intelligence communities, who not only had to acknowledge technical limits to the supervision of communication, but also the considerable public opposition to governmental control mechanisms. The issues of national security (support of the Clipper scheme) and the promotion of international competitiveness and personal autonomy (export of software and the freeing of the use of cryptography software within the United States) collided in legislative initiatives. Not only did the different branches of government pursue different interests, but also within the branches discord developed: between executive agencies, which, on one hand, have strongly opposed the release of cryptography systems (NSA), and others, which, on the other hand, pursue the deregulation of their exports (Department of Commerce). Accordingly, these issue areas have been subject to a high degree of variation and conflict and have by no means been resolved. But also in Congress, these issues were subject to legislative struggles and amendment activities. These struggles were not of a partisan nature; senators and representatives of different parties cooperated and struggled against members of both parties. This latter point demonstrates that the technological development of society has political consequences that extend beyond classic partisan constituencies.

In the context of cryptography policy, the Administration underestimated the force of the new technological paradigm: with the power of modern computers, every citizen has access to uncontrollable communication. Only later, the Administration realized that control is extremely difficult to achieve because the technical feasibility of control simply does not exist. One obstacle to control is the immense expansion of computing power in connection with powerful software-based mathematical algorithms. A more important obstacle, however, is the sheer volume of information and communication that makes control infeasible. Nevertheless, the Clinton Administration continues its stronghold over the issue until today, citing terrorist threats and the conduct of industrial espionage by its major economic competitors. Simultaneously, it also recognizes that the export dimension is highly important for subsequent technological developments and their chances on the world markets. To react to strong public criticism, with civil rights groups at the forefront, the Administration abandoned its approach to keep processes closed, and Congress reacted as well. Nevertheless, the final outcome is unresolved. Analogously, in defense-oriented technology policy, rhetoric has diverged from practice. For example, Clinton pledged the conversion from military to civilian R&D, however, both military and civilian R&D are declining together, with no clear evidence of a shift. In efforts to promote SMEs, the Department of Defense has been the most prominent governmental agency, with steeply rising support rates. On the other hand, the Department of Commerce has received a significant funding increases since Clinton's election. This seems to signify an emphasis shift towards the commercial application of existing networks, especially since the NSF has received stable, but not increased funding for backbone infrastructures. Similarly, small business innovation awards have been steeply rising (already since the Reagan Administration), reflecting the recognition that small businesses have been highly innovative and important drivers of technological development, especially in the context of computer-mediated communication. What is less clear is Clinton's desire to support more applied research and experimental development; no evidence of a shift away from base research exists. Unclear is where most base research is conducted. In theory, small businesses have fewer research capacities; therefore, it seems likely that large corporations in the defense sector continue to receive significant funding for base research.

Overall, the Clinton Administration has emphasized a societal technology policy. Most prominently, the Administration has promoted a high degree of actor inclusion in policy deliberations. The emphasis of a societal technology policy, however, is not surprising in the American context. After all, such a policy emphasis does not entail direct governmental promotional activities, specifically, the direct funding of specific technologies. Rather, societal technology policy is relatively passive, with an emphasis on coordination. The Clinton Administration has accordingly accentuated passive technology policy instruments, mostly in form of tax incentives and innovation awards, at least in the civilian scientific and research sector. Regulatory, or better deregulatory, policy remains at the center of political activity. Decision-makers have concentrated on the removal of prohibitive obstacles, most prominently, the alteration of the Communications Act that was designed in the 1930s for analog technologies.

Nevertheless, a number of obstacles remain for the achievement of a societal technology policy: first, governmental programs remain highly diffused; many departments and agencies are involved without a recognizable coordination structure. Accordingly, the budget process of the appropriation of R&D funds remains highly diffused, no comprehensive strategy is recognizable. Furthermore, restrictions remain on the exchange of relevant information. Second, NIST has been successfully conducting and coordinating industry-oriented programs, however, such programs remain controversial. For example, ATP has been under assault despite verifiable successes, mainly for ideological reasons; the placement of (civilian) technology policy high on the agenda remains controversial. Third, important supplemental programs, such as a reorientation in health policy, failed, or in the case of Clinton’s federal education initiative, are likely to fail. Fourth, the regional aspect has not been explicitly considered; the development of high technologies is concentrated in a few regions, while other regions indeed seem to become or remain ”extended workbenches”. The principle of institutional competition appears to be dominating the regional context; some states or regions can offer substantial tax incentives and thereby attract national and international enterprises, while other regions clearly de-industrialize without being able to counter this trend.

Not only particular technology policy initiatives have been controversial, but also most of the deregulatory activities. A few but highly important issues linger in the background that could potentially undermine the achievement of the substantive vision of the Clinton Administration. In its competition policy on providers, the Clinton Administration has recognized that larger enterprises may dominate smaller competitors, and that the latter may need protection. However, some regulatory activities clearly lag behind deregulatory activities. Most prominent in this context is the issue of the access to information networks. While deregulation has provided for strong financial investment incentives and the emergence of very large industrial alliances, smaller competitors often do not have a chance. Giant mergers potentially promote the formation of oligopolistic markets that squeeze out the smaller competitors. It has been a clear trend of the 1990s for large enterprises to buy out smaller competitors, often with the purpose of obstructing the market success of particular competitive products and pursuing vertical integration.

The provision of universal service, the access to computer-mediated communication networks, has been a strong emphasis in the vision of the Clinton Administration. The Administration invited public groups to define the universal service concept, however, action seems too late for the subject’s importance. No decision on a universal service fund has been made, reflecting the low priority that social equalization payments enjoy in the United States. Whether a subsidization method is preferable in the federal context is questionable anyway; theoretically, the state level seems to be more appropriate for provisional activities. Accordingly, joint federal and state level initiatives are now underway. Nevertheless, action in this context is negligible, raising the critical question whether unequal access will eventually undermine the superhighway and indeed create islands of the information-rich. The only countertrend rises from below: many cities aim to create free city nets.

The quest to make government more transparent has been highly successful in the United States. Initiatives have been undertaken for the dissemination of governmental information; from the federal to the local level, information in legislative and executive activities is available online. This dissemination of information has been made possible by a heavy emphasis on the redefinition of information policies. Unclear in this context, however, is the issues of privacy: no explicit laws exist on data protection. With the unclear legal status of privacy, the issue has mostly been settled in court. Similar is the issue of free speech and its censorship: it was not subject to congressional hearings and the extensive conflicts over the issue have appeared mostly in the media and in the courts.

In sum, the record has been mixed. Overall, the activities by the Clinton Administration have moved the United States ahead of its major competitors. Economic activity in the context of computer-mediated communication technologies has been rising continuously, probably because the proliferation of these technologies is high. The Clinton Administration was successful in involving itself in an important public debate and in assuming a leadership role. The greatest success of the Clinton Administration is its emphasis to promote a public debate and a high degree of actor inclusion, even if it displayed an initial reluctance to do so. However, some important issues have not been acted upon: most prominently is the issue of universal service and the role of large enterprises in their relationship with smaller competitors. Giant mergers continue the concentration trend in the industry, and the Attorney General Office has only regulated a few of these. The issue of data security has only been addressed in the context of the relations between governmental institutions and citizens, but not between private institutions, enterprises, and citizens. Many issues will only be settled in court. Thus, the substantive vision of the Clinton Administration has mobilized a large variety of actors, but due to the inconsistencies posed by a paradigmatic technological change, it has not been able to consistently implement its vision.

# Chapter 4

# Computer-Mediated Communication and Technology Policy in the European Union: The ”Information Society”

## I) Introduction

The structure of the European Union implies a highly-complicated political process between the supranational and national political levels of the fifteen member states. The delegation of political authorities between the supranational and national political levels has been a controversial issue and one which is relevant for technology policy and its regional implications. To outline the delegation of governmental authorities, we must differentiate between exclusive, competitive, and parallel competencies. Exclusive competencies of Union institutions imply that the member states may not unilaterally make or change laws in particular issues.[43] The Treaty of Rome defines customs, trade, and elements of commerce and fishery policies as exclusive competencies. Competitive competencies imply that the member governments can undertake unilateral actions until the Union becomes active in a particular issue. The majority of communal actions, such as agricultural policies, policies concerning the freedom of movement of persons and services, the regulation of state aid, tax laws, and guidelines, legal harmonization, environmental protection, and social policies, fall under competitive competencies. Once the Union does take action in the particular issue area, the members are bound to adopt the regulations and to discontinue practices not compatible with Union law. Nevertheless, the member governments retain a certain amount of discretion in the execution of Union policies when they are in the form of a directive (for the specific policy outputs, see below); they are bound by the aim, but not by the form and method of execution. For example, the member states have to implement consistent value added tax mechanisms, but the level of the taxes does not have to be equal. Parallel competencies are those in which the Union and the lower governmental levels share functions.

---

[43] The European Union is a complicated construct; in the following, we set Union institutions equal to Community institutions, although that is not completely correct: the economic and technology policy issues we will address are technically a matter of communal actions, which are only one of the three pillars of the European Union. The other two pillars concern home affairs and defense, in which other majority instruments operate. For the early history of the European Union, see, for example, Camps, 1966; Feld, 1966, 1981; Friedrich, 1969; Inglehart, 1967, 1970; Orvik and Pentland, Eds., 1983; Weinstock, 1973; and Willis, 1968. On more contemporary institutional and decision-making issues, see, for example, Council, 1995, 1996, 1997, European Parliament, 1996; Groeben, 1987a, 1987b; Groeben and Möller, Eds., 1980, Keohane and Hoffmann, Eds., 1991, and Weidenfeld and Wessels, Eds., yearly. For strategic political aspects, see Franzmeyer, Everling, Joerges, and Hrbek, 1991; and Weidenfeld, 1988. For insight accounts of processes during the 1980s and 1990s, see, for example, Cockfield, 1994; and Grant, 1994.

The delegation of competencies has been continually controversial. Following the ”bumpy” adoption of the Maastricht Treaty, the ”subsidiarity principle” has received wide attention. In theory, we can distinguish the principle of subsidiarity between two sets of meanings that are potentially contradictory. The first set differentiates between the ”efficiency” or ”effectiveness principle” and the ”necessity principle”. The efficiency principle indicates that general *and* specific powers should be delegated from the periphery to the center when the center is more efficient in the definition and administration of policies. The necessity principle implies the delegation of powers from lower levels of government to higher ones *only* when the lower levels fail to solve a *particular* problem. Assuming the necessity definition of subsidiarity, the second version considers whether subsidiarity insinuates greater power for the national governments *vis-à-vis* the supranational center, or whether the sub-units of the member states, especially in the federal states, should be included in the political process and thereby become important political authorities. In sum, the first set concerns political competencies, the second political structure.

Subsequent to the adoption of the Maastricht Treaty, but prior to its ratification by the member states, the Commission viewed the subsidiarity principle primarily as a reinforcement of its competencies that had been defined in past treaties, and not as a principle to *re*delegate political authority. Past actions and tasks presently delegated to the Commission are not subject to reevaluation. Underlying this interpretation is the assumption that exclusive and competitive competencies have been allocated. Initially, the Commission outlined its exclusive rights and stated these had been confirmed by the European Court of Justice. It assumed that the Single European Act delegates exclusive authority to the Commission in areas concerning the removal of barriers, common trade policies, competition rules, the organization of agricultural markets, fishery policies, and central elements of commerce policies. In these areas, the Commission claimed, it does not have to justify its actions.

Such an interpretation of the principle stands on shaky ground. The original Article 235 of the Treaty of Rome defined rights exclusive to the Commission, however, it was not as exclusive as the Commission has claimed. In particular, the content of Article 8 on the achievement of a common market would have given the Commission almost exclusive economic policy competencies; no room would have been left for an application of the subsidiarity principle. Despite the Commission’s claims, these issues have not yet been defined according to exclusive and competitive competencies within a treaty. To argue that the authorization to pursue *general aims* endows the Commission with the sole authority for *specific policies* is questionable. In sum, in the phase following the enactment of the Maastricht Treaty, the Commission clearly leaned towards the efficiency reading of the subsidiarity principle and therefore expected to have a mandate to deepen its competencies.

This standpoint was not sustainable *vis-à-vis* the European public. The initial rejection by the Danes of the Maastricht Treaty and the close vote in the French referendum particularly alarmed the governments of the member states. At the subsequent Birmingham Summit of the European Council in Summer 1992, the government leaders firmly rejected the Commission's standpoint and concluded that policy should be undertaken by the lowest level possible and that the Commission should only take action on issues it is specifically delegated by treaties, and then only when "appropriate" and "necessary".[44] Below, we will explore the implications of this decision for the conduct of industrial and technology policy in the European Union. We will discuss exclusively the political developments on the supranational level. Unfortunately, this discussion will only present half of the "story"; however, to examine the actions on the national levels of all fifteen member states is not manageable in the context of this study and its aims.

## II) The Politics of the European Union and the Creation of an "Information Society"

### A. The Vision

The European Union has been developing a substantive vision of the future "Information Society" since the early 1990s. During the 1980s, supranational technology policy rested on piecemeal creation and support of technological artifacts, such as high definition television (HDTV), the "intelligent home", and the production of

[44] Although this statement seems to lean towards the necessity principle, it does not remove the lack of clarity of Article 3 (b) 2. Critics have charged that the definition is nothing more than a "formula compromise" [Grimm, 1992; Hummer, 1992, 81], implying that the negotiators agreed to prevent a justiciable reading of the principle. The formulation is a "typical European compromise" by "adjoining two contradictory elements" [Borkenhagen, 1992, 37].

computer chips. Since the early 1990s, the Commission has emphasized a societal approach that integrates technology and regulatory policy. Not the technologically-achievable artifacts stand at the center of attention, as they have in the past, but the practical benefits to all in the European Union. Regulatory policy initiatives on the supranational level, however, also have important implications for national sovereignty; thus, we can expect conflicts between the different political levels as some regulatory domains are not clearly defined as to whether they are subject to exclusive or competitive competencies. Subsequently, we will chronologically examine the evolution of the European Union's vision, partitioned according to the principle publications: The 1993 White Paper with the title ”Growth, Competitiveness, and Employment”, the report ”Europe and the Global Information Society. Recommendations to the European Council”, also called the ”Bangemann Report”, prepared for the Council Summit at Corfu on June 24-25, 1994, and the 1996 Green Paper ”Living and Working in the Information Society: People First”.

In the 1993 White Paper, the Commission presented a first general outline of its vision on computer-mediated communication and telecommunications [Commission, 1993]. First, the Commission recognizes the permeability of future technologies:

> Information and communication technologies (ICTs) are transforming dramatically many aspects of economic and social life, such as working methods and relations, the organization of companies, the focus of training and education, and the way people communicate with each other. They are resulting in major gains in productivity in industry, and in the quality and performance of services. A new ”information society” is emerging, in which management, quality and speed of information are key factors for competitiveness: as an input to industry as a whole and as a service provided to ultimate consumers, information and communication technologies influence the economy at all stages [ibid., Chapter 5, Introduction].

Second, in the Commission’s conception, the Information Society consists of several inseparable features: a) the existence of electronic information, general devices, components and software to process that information, b) a physical infrastructure composed of (coaxial or fiber optic) cables, broadcasting networks, and satellites, c) base telecommunication services, such as e-mail and data transmission, d) interactive services such as access to data banks and interactive numerical imagery exchange services, e) highly transparent applications that can store, edit, and transmit information, and that are flexibly adjustable to users individual needs, and f) users with know-how and a conception of the wider opportunities and implications of such a highway [ibid., Chapter 5.2]. The combination of these features promotes the development of a new system of interaction, especially in the economic sphere:

> In the not too distant future, the telecommunications networks will be capable of instantly transporting and processing voice traffic, text and images between any locations, be they homes, offices or businesses, thanks to digitization techniques and electronic processing of information. These networks will therefore constitute the nervous system of the economy, and more generally of tomorrow's society. With the aid of these new networks, it will be possible to transmit myriads of texts (commercial messages, newspapers, correspondence, training courses, catalogues, technical notices, etc.), images (films, medical images, graphics, etc.) and sound transmissions (voice traffic, music, etc.), stored and combined in databases, for use in the most diverse applications (leisure, education, medical care, tourism, manufacturing activity, etc.) [ibid., Chapter 3.6].

The economic sphere was the White Paper's principle focus. First, the Commission has been expecting substantial changes in the interaction of organizations and people. The success in the Information Society depends on the enterprises' ability to flexibly respond to structural changes; when the access to information is more simple, it lowers the barriers-to-entry to economic activity. With modern computer-mediated communication systems, economic actors can evaluate the market and enter the competition when they detect a chance for their products or services, especially in economic niches. This process leads to an intensification of market pressures and forces enterprises to improve productivity and mobilize performance reserves. In sum, the Commission argues that new information and communication technologies lead to greater productivity and therefore international competitiveness.

In the subsequent 1994 "Bangemann Report", the Commission further substantiates the importance of new technologies but also identifies other important policy action areas [Commission, 1994a]. The Bangemann Report aims to "complete the agenda" that had been initiated in the White Paper, entailing the introduction of other relevant policy areas such as the protection of intellectual property rights, privacy, encryption, legal protection, security, media ownership and competition policy. It emphasizes that the benefits of an Information Society are not only of an economic nature, but beneficial to all of Europe's citizens and consumers: possible is a "more caring European society with a significantly higher quality of life and a wider choice of services and entertainment" [ibid.]. The principle message of the Bangemann Report concerns the social challenge of computer-mediated communication. On one hand:

> The widespread availability of new information tools and services will present fresh opportunities to build a more equal and balanced society and to foster individual accomplishment. The information society has the potential to improve the quality of life of Europe's citizens, the efficiency of our social and economic organization and to reinforce cohesion.

On the other hand:

> The main risk lies in the creation of a two-tier society of have and have-nots, in which only a part of the population has access to the new technology, is comfortable using it and can fully enjoy its benefits. There is a danger that individuals will reject the new information culture and its instruments. Such a risk is inherent in the process of structural change. We must confront it by convincing people that the new technologies hold out the prospect of a major step forward towards a European society less subject to such constraints as rigidity, inertia and compartmentalization. By pooling resources that have traditionally been separate, and indeed distant, the information infrastructure unleashes unlimited potential for acquiring knowledge, innovation and creativity [ibid.].

To contain the problems caused by structural economic changes, the Report states that the principles of fair access and universal service must be enforced. The responsibility to implement a clear competitive framework rests with the political domain on the supranational level. Simultaneously, the Report urges an open public discourse. In sum, the Bangemann Report introduces and specifies political action areas that extend beyond technology policy. Especially social and regional cohesion have historically been highly salient issues in the European Union. As the Commission states in its White Paper, it wants to "use the Information Society to strengthen social cohesion and enhance people's ability to participate fully in every aspect of social and economic life, to make it a tool for the creation of an inclusive society. The Information Society should be about people and it should be used for people and by people to unlock the power of information, not to create new or reinforce existing inequalities between the information rich and the information poor" [Commission, 1993, Chapter 5].

The Commission deepens the discussion of these societal issues by expanding on democracy, empowerment, equality of opportunity, healthcare, and social integration in its 1996 Green Paper "People First" [Commission, 1996a]. Perhaps the most important statement of the Green Paper is the call to turn the presently existing barriers-to-entry that distort European markets into an advantage. The system of national states has been a barrier to the creation of a truly European society; the Information Society and its implications reduce these barriers *without* causing the dilution of existing cultural diversities:

> The European Union is built on a strong tradition of cultural diversity, political democracy and market economy. The member states have developed social models with many common features including strong social rights and independent social partners, able to take responsibility for working conditions and for fair distribution. In the framework of the European Union the member states have created one Single Market of 370 million consumers with some 16 million enterprises – the largest economic entity in the world. The European social model is built both on competition between enterprises and solidarity between citizens and member states. The European Information Society must draw strongly from this economic, social and cultural strength, linking technological, economic and social aspects together in the creation of new opportunities for all its citizens. The Information Society represents the most fundamental change in our time, with enormous opportunities for society as a whole, but with risks for individuals and regions. The way we develop it must reflect the ideas and values which have shaped the European Union. These ideas and values should be transparent and coherent with social justice in order to win the support of citizens. To this end, the Commission invites all interested parties to reflect on the possibility of formulating a set of common Community principles for the development of the European Information Society [ibid., Chapter 6].

To conclude, within a relatively short amount of time, the Commission has changed its vision: initially, the economic benefits of computer-mediated communication stood at the center, consistent with its focus on the creation of the European Single Market. Subsequently, it has recognized that new computer-mediated communication technologies can also aid the achievement of the wider aims that European integration has pursued since its beginnings: the reduction of differences between the member states in important economic, political, and social questions. The strongest vision is that the diversity of cultures and peoples, by many considered to be a principle obstacle to European integration, may be the principle asset of the future Information Society. This vision recognizes that it is content that will be the principle component of the Information Society, and not only infrastructures. Content and its underlying ideas are the extension of cultural activity; diverse cultural activities should yield better content and products. This factor had been monopolized by the United States that was able to offer an open and free society that, combined with great cultural diversity, promotes the cross-fertilization of ideas, one of the fundamental sources of its technological successes.[45] Nevertheless, these considerations also have an important side-effect that the Commission is likely to welcome. The Commission has recognized that in this particular stage of technological development across Europe, it can increase its power *vis-à-vis* the national level of the member states. Fundamental structural changes imply fundamental changes of power. The Commission has incorporated this recognition in very subtle ways into its long-term strategy on the achievement of the Information Society.

## B. The Long-Term Aim and Strategy

The fundamental economic aim of the European Union has historically been the abolition or reduction of market segmentation. Market segmentation is defined as the existence of non-market price differentials, causing a lack of arbitrage opportunities. Customs, border controls, barriers to market entry and mobility, and quota systems cause market segmentation. The segmentation of markets represents a means to control and steer economic activity within national borders and is a principle means of maintaining economic (and political) autonomy. Tariffs and quotas openly discriminate against foreign products. Non-tariff barriers, especially those that concern the technical regulations of products, de-segment markets as well, but they also are part of the national regulatory framework. Nevertheless, they often amount to hidden discrimination: they only discriminate products as long as enterprises do not adjust them to conform with national regulations, a demand that often undermines the competitive position of foreign enterprises as conforming to regulations raises product prices. While the Single European Act of 1985 has provided the groundwork for the free movement of goods, services, capital, and people, a truly single market has not been achieved. This is especially the case concerning new computer-mediated communication technologies, as a number of regulatory and technical barriers continue to separate markets: insufficient interconnectivity and interoperability between the various national telecommunication systems, lacking mechanisms for a coherent systems administration, and a general lack of services. In the past, most member states have monopolized communications markets and implemented their own technological preferences, frequently for industrial policy considerations. While some member states

---

[45] See, for example, Allen J. Scott's agglomeration economies thesis, Scott, 1995, 1996.

were able to invest considerably into these infrastructures, others could not. Today, highly differential penetration rates of the various technologies exist. Furthermore, the uncertainty over the societal impact of these technologies has raised the possibility of national reregulation; in almost all member states, national policy initiatives are now being undertaken to regulate different aspects of computer-mediated communication. These initiatives have a decisive influence on the policy activities of the supranational level.

The Commission has proposed a general three-prong strategy to overcome these problems. The first strategy concerns the promotion of European enterprises to become global players. Principle elements of this strategy are the support of the international connectivity of enterprises, the development of open systems and international norms, the opening of markets that are now closed to European enterprises, and the rejection of economic discrimination. The second strategy concentrates on the exploitation of the European features of multilinguality and cultural diversity. The third strategy is the encouragement of strategic thinking in a European dimension. This entails the creation of new service markets by removing financial, legal and norm-specific obstacles, the transfer of public services to the private sector (including education), and the acceleration of administrative decision-making.

The Commission has emphasized that its role is confined to the elaboration of the basic framework. The member states are to maintain their power and sovereignty according to the necessity principle of subsidiarity. However, the action areas that the Commission has identified entail a substantial redelegation of power towards the supranational level as they demand considerable policy harmonization between the member states. The rising power of the Commission in the 1980s and the early 1990s has led to new conflicts over whether it should actively steer economic activities and development, or whether it should only ensure the proper functioning of markets, provide the necessary legal and operational infrastructure, and enable a convergence of general macroeconomic policies. With the Maastricht Treaty, the Union once again attempts to make two complete opposites compatible: the promotion of competition by the definition and implementation of a general economic framework and the conduct of a common macroeconomic policy, and the achievement of international competitiveness by means of an active industrial and technology policy.

## C. Policy

Before entering the policy domain of the European Union, we need to briefly consider its political outputs and their implications for the member states. Generally, for output by the Council, the principle political decision-making institution, one can distinguish between a Regulation, a Directive, and a Decision. According to the Treaty of Rome, a Regulation is ”binding in its entirety and applicable in all member states”, a Directive is ”binding, as to the result to be achieved” but lets the member states choose the form and methods of implementation, and a Decision is ”binding in its entirety upon those to whom it is addressed”. Additionally to these three political outputs, the Council and Commission can make non-binding Recommendations or Statements. The European Parliament has slowly increased its powers; following the Treaty of Amsterdam in 1997, the Council cannot make a decision without the Parliament’s final consent. The introduction of legislation, however, remains in the hands of the Commission.[46]

The principle actors in the policy-definition process are the Commission and its various Directorates Generals (DGs), of which DG III (industry and the internal market), DG XIII (telecommunications policy), and DG V (societal and work issues) hold the principle responsibilities for the promotion of computer-mediated communication. Within a White Paper, the Commission first outlines a general vision of future tasks and aims. In a Green Paper, it then specifies individual action areas. A Green Paper functions as an initiator for discussion as it outlines the relevant issues, aims, actors, the state of the competitive and regulatory environment, and possible options for action. Work or expert groups contribute to their content. Subsequently, the Commission initiates further expert discussions and hearings in a semi-public setting. When the basic policy issues have been defined and action areas have been introduced, the Commission sends a Communication to the Council and the Parliament that entails a formal policy proposal. The Council may then react with one of the policy outputs outlined above, and the Parliament may return a Resolution. The national governments have to implement the decision to the degree that the legislative output demands (see above). In the case that a Council output and national law collide, the European Court of Justice may examine the national policy on its compatibility with Union law, and issue a Judgement of the Court. Of course, the policy process is far more complex and includes complicated consultation processes and periods between various supranational, national, and independent actors. The detailed description of these processes, however, is beyond the scope of this study.[47]

For the creation of the Information Society, the European Union has produced a large number of Regulations, Directives, and Decisions, as well as Recommendations, Statements, Resolutions and Judgements, not all of which can be treated here. The output is considerable and covers almost all relevant areas of the Information Society. The Commission has also initiated a "high level group of experts" to assess the probable impact of the Information Society. This group has been addressing issues such as employment and the working environment, changes in everyday life and leisure time, urban and rural development, the improvement of the education and health care systems, cultural aspects such as television and cinema programmes as presentations of cultural identity, linguistic issues, and the tailoring of programs to regional or specialized audiences. The Commission has identified a large number of specific action areas: computer-mediated communication networks (Euro-ISDN, integrated broadband communications, mobile communications and satellite communications), basic services, applications and content in the audiovisual sector, and the information industry and market. On regulatory, competitive and legal issues, it has concentrated on the competitive environment. This includes infrastructure liberalization, the establishment of a competition oversight authority at the European level, standardization, interconnection and interoperability, tariff adjustment and financing mechanisms to safeguard universal service, the worldwide dimension of telecommunication services, intellectual property rights in Europe and the world, privacy, the protection of electronic transmission, and the legal protection of encrypted broadcasts. We return to the latter issues in the next section.

### 1) Supranational Policies in their Historical Context

Economic and political integration reshuffles governmental authorities and competencies. John Pinder defines economic integration "as both the removal of

---

[46] For a review of the policy process, see European Parliament, 1997.

[47] This is not the place to outline the political process in the European Union. For a good description, see Pinder (1991).

discrimination as between the economic agents of the member countries, and the formation and application of coordinated and common policies on a sufficient scale to ensure that major economic and welfare objectives are fulfilled. It follows that economic union is a state in which discrimination has been largely removed, and coordinated and common policies have been, and are being, applied on a sufficient scale" [1968, 90]. Pinder follows Jan Tinbergen's distinction between "negative" and "positive" integration [1954]: the former "consists of the removal of discrimination". The latter is the "formation and application of coordinated and common policies in order to fulfill economic and welfare objectives other than the removal of discrimination". While negative integration does not require a formal institutionalization of relations, positive integration does. Positive integration implies the supranational accumulation of power to enforce the members' compliance with supranational policies. Therefore, the transition from negative to positive integration has, by definition, implications for governmental authorities and national sovereignty.

To overcome the problems of market and regulatory fragmentation, the Commission has pursued the strategy of harmonization, with varying success. To understand the principle problem of harmonization, we need to review its place in the history of European integration.[48] While the integration initiatives of the 1950s and 1960s largely consisted of negative integration in form of the removal of trade and tariff barriers between the member states, the approach of the 1970s embodied what Jacques Pelkmans has called an "ambitious harmonization programme" [1987, 251]. To evaluate this program, we must distinguish between *ex ante* and *ex post* harmonization. *Ex ante* harmonization refers to the convergence of national regulations before trade is liberalized. It implies the elimination of market segmentation because all economic players become subject to the same rules. *Ex post* harmonization describes the *de facto* convergence of methods and processes as a *consequence* of market pressures; consumer preferences for certain products force producers to satisfy these preferences unless they

[48] The literature on integration theory is extensive. See, for example, Börzel, 1997; Cameron, 1981, 1992; De Vree, 1972; Diez, 1997; Garrett, 1992, 1996; Groom and Tayllor, 1978; Haas, 1957, 1958, 1959, 1961, 1963, 1964, 1969, 1970a, 1970b, 1975, 1976, 1990; Haas and Schmitter, 1964; Haas and Whiting, 1956; Hansen, 1969; Hoffmann, 1989; Huelshoff, 1994; Hughes and Schwarz, 1972; Lindberg, 1970; Lindberg and Scheingold, 1970, 1971; Nye, 1965, 1968a, 1968b, 1970, 1971; Sandholtz, 1993; Sandholtz and Zysman, 1989; Scheingold, 1970; and Schmitter, 1970.

prefer to be driven out of business. Consumer preferences thereby function as a quasi-regulatory mechanism.[49]

*Ex ante* harmonization was the standard policy from the late 1960s until the adoption of the SEA in 1985. Civil servants and experts had the task of harmonizing national regulations, however, ”many of these directives focus on specific *aspects* of products and they therefore fail to solve all the problems of access in product markets” [Pelkmans, 1987, 251]. Conseqently, the effort was ”inefficient” because it was excessively focused on technical specifications of products, and ”ineffective” because the mutual market access was not much improved.[50] The failure of this method contributed to the so-called Eurosclerosis. Pelkmans sums up the experience with *ex ante* harmonization:

> The policy climate in which the elimination of technical barriers to trade in the EC had to be realized was such that the individual protectionist was thriving whereas the dynamic exporter, attempting to encroach upon other markets, was hampered. Of course, the opposite climate should characterize European market integration for the benefit of the Community's economy at large [ibid.].

Political authority remained with the national governments, especially as a result of the unanimity requirement in the Council and the Council of Ministers that created a *de facto* veto right for individual governments. The scope of harmonization policy was predefined, but perhaps over-ambitious, leading to relatively few agreements per year. However, it would be wrong to assume that this constitutes an inherent failure of this integration method. Rather, it seems to have been the members’ deliberate choice to maintain maximal sovereignty. The political will for integration was lacking.

At the height of ”Eurosclerosis” at the beginning of the 1980s, the Community replaced the inefficient and ineffective *ex ante* harmonization approach with the principle of mutual recognition of national standards, otherwise known as the ”country-of-origin principle”. This principle was primarily a consequence of the *Cassis de Dijon* case before the European Court of Justice. The 1979 court decision stated that if a

---

[49] The quality of this regulatory function depends on the available information for consumers.

[50] Pelkmans cites nine drawbacks of the task [1987, 252-253]: time-consuming and cumbersome procedures; excessive uniformity requirements; unanimity requirements; the failure, except rarely, to develop a linkage between the harmonization of technical regulations and European standardization, leading to wasteful duplication, useless inconsistencies and time lost; the slowness of European harmonization and standardization relative to national regulation and standardization; a neglect of the

product passed the minimum regulatory standards of the member country in which it was produced, it could be sold in all member markets even if it did not conform with the specific product regulations in these markets. The country-of-origin principle practically eliminated the need for *ex ante* harmonization and enabled each country to maintain its own level of standards and regulations for its producers as long as these did not conflict with the basic principles of the SEA. Nevertheless, a Community-wide minimal standard was necessary whenever fundamental health, safety, or environmental deficiencies in products or processes became apparent.

A crucial difference in the new strategy when compared with the old one is the policy output. *Ex ante* harmonization policy has been in the form of a Directive, leaving the legislative and bureaucratic responsibilities on the national level. This meant that the process was subject to considerable domestic political complexities. Legislatures feared the loss of political autonomy, bureaucracies feared a loss of power and purpose, and interest groups feared for their politically enforced market advantages. The new approach divides political responsibilities differently. The supranational level is responsible for the harmonization of basic health, safety, and environmental standards. These regulations are binding for the member states, and not subject to their interpretation or implementation considerations. The supranational level, however, has delegated the definition of other standards to *private* institutions, such as the *Centre Européen de Normalisation* (CEN) and the *Centre Européen de Normalisation de Electrotechnique* (CENELEC). While the principle of mutual recognition prevents market segmentation due to diverging regulations, the output of the standardization institutions provided a non-binding basis for the harmonization of standards.

The adoption of qualified majority voting in the Council of Ministers was crucial in formulating and passing agreements to establish minimal standards: the change in the voting procedure raised the principle decision-making power on minimal standards from the national to the supranational level. Qualified majority voting overcame national blockades by preventing single countries from boycotting unpopular initiatives (except for those that countries consider to be ”vital” to their national interests, an argument that has frequently been used, but which decreasingly fits into the supranational political culture).

---

problems of certification and testing; the incapacity to solve the third country problem; implementation problems in member states; and a lack of political interest by the ministers.

The success of the SEA is also attributable to the concentration of the supranational level on designing a basic economic framework that is applicable to all, while leaving active policy initiatives to the member governments. Loukas Tsoukalis undertook a case study of four integration 'arenas', concentrating on the level and scope of policy-making by the different political authorities [1991, Chapter 5]. He focused on competition policy, policy on financial services, tax harmonization, and national and European standards, and identified a relatively flexible approach of the supranational level with the outcome depending on the issue area. He also confirms, however, that the big players, especially Germany (anti-trust policy) and Great Britain (liberalization of financial services) were able to push their own preferences. He summarizes:

> At least in some cases, the creation of the internal market will, inevitably, involve the adoption of a new regulatory framework at the EC level and, therefore, the transfer of powers to Community institutions. There will be more market in the new economic order, but also more European state; and the trade-off between the two will be determined in the future by a combination of economic and political factors, both internal and external to the EC. This is what we may call the political economy of liberalization and regulation. It is about the distribution of economic power between different levels of political authority as well as the distribution of economic power between private and public agents, the two being closely interrelated. But it is also, more indirectly, about allocation of resources; choices between efficiency and stability or between production and protection of the environment; it is about relations between producers and consumers; and last, but not least, it concerns the ownership and control of the means of production. These are all highly political issues which come under the more general theme of economic order [1991, 88-89].

In other words, the wider implications are not yet clear because market de-segmentation causes a redistribution of economic activity and political power.

In sum, we have witnessed a reshuffling of level and scope of policy-making responsibilities: the new approach clarified the power of member states to maintain own standards, however, the Commission and the Court of Justice oversaw that members did not violate the principle of mutual recognition and the agreement on minimal standards. This phase came to be regarded as the most successful and far-reaching phase of European integration. The technical issues of market de-segmentation were taken off the agenda of the Commission, leaving capacities for other initiatives. The Commission subsequently concentrated on the fiscal portion of the 1985 White Paper: a reordering of public purchase methods, state aids, and value added taxes (VAT), as well as a rethinking of the external dimension of trade. In short, the Commission was able to attend to the remaining market segmentations because the member states delegated authority to it without maintaining a specific right to veto single issues.

2) Technology Policy

a. Instruments

Pierre Buigues and André Sapir identify two primary instruments of industrial policy in the European Community [1993]: budgetary and regulatory measures. Budgetary measures are expenditures out of the Union budget in form of R&D assistance and structural funds. Regulatory measures are the definition of standards, public procurement rules, trade and competition policy, and state aid supervision. Policy action is twofold: either the Commission supplements existing national or regional programs or it undertakes alternative programs. The first type of activity was especially prominent following the establishment of the structural funds in 1974 until their first reorganization in 1979. Critics [Klodt and Stehn, 1992, et al., 56; Waniek, 1992, 50ff], however, charged that: first, not only the less developed regions received assistance, but also the more developed ones; this amounted to a *de facto* rebate of membership fees for the latter. Second, the criteria for assistance were too narrow to respond to individual regional demands. Third, since national regional programs presupposed sufficient national budgets, regions in poorer countries were disadvantaged because they lacked the funds to initiate programs. In other words, the qualification for communal support presupposed a minimum of affluence. The 1979 reform initiated the possibility for centralized programs, but it did not fundamentally remove the disadvantages that existed before. Since 1985 and the SEA, the Commission has assumed greater discretionary powers, especially concerning control over the size of funding. Furthermore, it has reduced emphasis on individual projects and has moved towards holistic approaches. By 1988, the portion of the regional funds of the Community budget had increased from 16% to 25%.

Four principle technology policy instruments exist in the European Community: direct, indirect, concerted, and horizontal flanking actions [Starbatty and Vetterlein, 1990, 80f; Starbatty, 1994, 153]. For direct actions, the Commission holds the immediate financial responsibility for projects that are too large for an individual enterprise to carry out but that are expected to have considerable positive externalities. These projects primarily concern collective goods, such as research on energy, climate change, or environmental protection. To conduct such research, the Union runs nine research institutions that have their seats in different member countries. Direct actions may have regional policy implications; a particular locational decision may be positive for some regions but negative for others. Since research institutions tend to attract industries, they may attract them from regions that are themselves struggling to entice high technology enterprises.

Indirect assistance entails cost-sharing programs and contract research with enterprises and research institutions in pre-competitive stages. Normally, the Commission finances 50% of the research spending. The spectrum of projects ranges from base research to research in complex technical procedures. Since the Commission does not have to consult the Council and the European Parliament, it has greater autonomy than in other technology policy activities. Programs include ESPRIT (see below) and EUREKA. The Commission can act unilaterally and directly affect enterprises' and research institutions' research choices. Indirect actions, however, entail hazards: research institutes may compete less with one another, and they may place excessive emphasis on a small selection of issues and thereby ignore other potentially important research areas. The institutionalized cooperation between enterprises, and between enterprises and research institutions, may lead to long-term dependencies that negatively impact the competitive environment and overshadow the benefits of cooperative efforts. The regional implications are similar to those of direct actions: these activities may lead to the concentration of economic activities in certain regions, while others remain disadvantaged.

Concerted actions concentrate on the coordination of national research programs with a limited financial contribution by the Commission. The purpose of research coordination is to prevent duplicate research in the various member states and to forestall the execution of contrary national programs. The Commission's financial part is limited to the reimbursement of costs accrued from traveling and administration. The Commission functions as a coordinator and thereby indirectly influences national research policies. It does not, however, directly alter the research choices. Therefore, the execution of research policies remains on the national level.

Horizontal flanking measures are primarily general infrastructure, education, and information network programs that improve the economic framework conditions for enterprises and the mobility of labor. Infrastructure programs include the Strategic Programme for Innovation and Technology Transfer (SPRINT), the Community Programme for the Development of Certain Less-Favoured Regions by Improving Access to Advanced Telecommunications Services (STAR, until 1991), the Community Initiative Concerning Regional Capacities for Research, Technology, and Innovation (STRIDE, until 1993), the Long-Term Programme for the Use of Telematics for Community Information Systems Concerned with Imports/Exports and the Management and Financial Control of Agricultural Market Organizations (CADDIA, until 1992), Coordination of the Activities of the Member States and the Community Institutions for Setting up a Community Inter-Institutional Information System (INSIS, until 1992), the Communications Network Community Programme on Trade Electronic Data Interchange Systems (TEDIS, until 1994), and the Information Market Policy Actions Programme (IMPACT). Education programs are European Community Action Scheme for the Mobility of University Students (ERASMUS), the Trans-European Mobility Scheme for University Studies (TEMPUS), Education of Training for Technology (COMETT), and the Action Programme to Promote Foreign language competence in the European Community (LINGUA, until 1994). Some cooperation activities are flexible, and often include enterprises from third countries (for example, European Cooperation in the Field of Scientific and Technical Research (COST) and EUREKA).[51]

The European Union's regional and social policies are further instruments of industrial and equalization policy. The three main programs are European Fund for Regional Development, the Social Funds, and the activities of the European Investment Bank (EIB). With the adoption of the Maastricht Treaty, these activities' functions have been upgraded. In terms of the European Fund for Regional Development, three (of the five) Aims of the fund are important in the context of industrial and technology policy: Aim 1 calls for the assistance and development of structural change in regions with developmental deficiencies; Aim 2 calls for the restructuring of regions that are negatively affected by declining industries; and Aim 5b calls for the development of

---

[51] For the acronyms of European Union programmes, see http://www.cordis.lu/en/src/pgahpen.htm.

rural regions. The fund finances productive investments for the creation or maintenance of long-term employment, infrastructure measures, measures to exploit the endogenous potentials of the regions (with emphasis on small- and medium-sized businesses and the efficiency maximization of local governments), pilot projects for regional development (especially in border regions), and it provides for preparatory studies and research. A potential disadvantage of such assistance is that the emphasis on the maintenance of employment may give labor-intensive industries an undue advantage, and divert resources from other sectors that potentially have greater long-run benefits. The Social Fund emphasizes the schooling and retraining of employees to reach higher levels of qualification in the workplace. Since the Maastricht Treaty, the fund places a higher emphasis on preemptive actions: when future economic problems are visible, a preemptive approach may reduce the necessity for subsequent interventionist industrial policies and accelerate structural changes (Bangemann interview in *Die Zeit*, February 25, 1992). The European Investment Bank provides low-interest loans and guarantees for regional development and the modernization of enterprises. It is therefore similar to the structural fund with the difference that it only gives loans, not subsidies.

An important aspect of competition policy is the Commission's ability to prohibit subsidies and other forms of economic assistance from national and regional governments.[52] The aims of state aid supervision are the creation of the same competitive framework in the Single Market, the reduction or elimination of state aids that distort competition, the prevention of subsidy spirals, and the guarantee of a functioning competitive environement. A European cartel office, however, has not yet been created. To improve the oversight capabilities of the Commission, the Treaty of Rome prohibits autonomous economic assistance to private enterprises and productive sectors by national or regional governments, including the subsidization of economic activity, and the provision of grants, loans with low interest rates, or land. Exceptions are subsidies that do not undermine competition and that are not incompatible with the principles of the Single Market, and that therefore have a neutral effect on trade relations between member states. General actions that affect all enterprises in a particular region, such as infrastructural or educational actions, are not prohibited.

---

[52] Article 92 of the Treaty of Rome.

To ensure that regional and local support is justified, the Treaty of Rome institutes a Commission review board and obligates lower levels of government to provide complete information about planned projects.[53] If the Commission finds regional or local actions to be incompatible with the principles of the Single Market, it can initiate a control proceeding. A ”de-minimis-rule” defines assistance caps; below these caps the Commission undertakes an accelerated review when assistance is not likely to fundamentally threaten competition or trade relations. This exception leaves leeway for local action. Economic assistance is also acceptable when economic assistance benefits areas with an exceptionally low standard of living or with excessive unemployment. On the other hand, the Commission can assume a restrictive view of economic assistance, for example, if it finds that a form of assistance may *potentially* have effects on the trade relations between members. In the case of the latter, however, a decision by the European Court of Justice in the case of economic assistance by one of the German *Länder* (Nordrhein-Westfalen) states that the Commission has the burden of proof; it must provide evidence of the alleged distortion of competition.[54]

The existence of some objective evaluative criteria have not eliminated the potential for conflict. In the review of state aid, the Commission evaluates the assistance intensity by dividing the amount of the assistance over the total project costs. In base research, the intensity level can be as high as 50%; in stages closer to market introduction, the percentages are lower. Exceptions are granted for small- and medium-sized enterprises (less than 500 employees), less developed regions, high risk projects, and when the results have positive externalities for other sectors. One conflict is preprogrammed by the intensity levels: for example, Germany frequently provides state aid above 50% and beyond non-competitive stages, consequently, it has been subject to sanctions by the Commission.

A fundamental problem of state aid supervision is that the process is excessively time-consuming. Although it should only take two months, the Commission often delays the process as it lacks information (the two month period only counts following the receipt of ”complete information”). Klodt et al. have determined that the process actually takes between six and twelve months [1988]. Klodt argues that ”it can not be surprising that the national governments interpret the state aid supervision as an obstacle

---

53 Article 93 of the Treaty of Rome.
54 Germany vs. Commission, Res. 248/84, October 14, 1987.

to technology policies" [1989, 29]. Thus, state aid supervision is not fully feasible and can amount to a considerable obstacle. Some also criticize the fact that the mechanism does not display the consistency which it should have. For example, Klodt argues that in the approach in the 1980s, the Commission did not oversee infrastructure measures [1992]. This has implied that more developed regions could undertake considerable infrastructure improvements, make growth-inducing tax cuts, and provide economic settlement assistance. Certainly, according to the principle of fiscal equivalency, these actions are justifiable. They have, however, also undermined the principle of regional cohesion and the aims of state aid supervision. In sum, the aim of regional cohesion has caused considerable complications in the European Union.

b. From Traditional to Societal Technology Policy?

Until the early 1980s, active industrial policy was practically non-existent on the supranational level of the European (Economic) Community, at least in its explicit forms beyond the confines of the Community's regional, structural (especially in the steel and coal sector), investment, and medium-term economic policies. In the early 1980s, the so-called Davignon Group embarked upon the first industrial policy initiative in the high technology arena. Commissioner Count Davignon and the twelve largest European electronics enterprises founded the European Strategic Programme for Research and Development in Information Technologies (ESPRIT), thereby launching a cooperative effort.[55] The aim was to close the perceived technological gap between the European Union and the United States and Japan. Until then, the fragmentation of technology policy activities across Europe had been a major obstruction to the creation of a trans-European technology policy approach that could truly exploit economies of scale and scope. The strategies of technological actors had been diffuse, causing divergent and uncoordinated activities of enterprises, universities, and research institutions.

The Commission has identified the following causes of failures: insufficient relations between universities and industry, a lack of high risk capital to support enterprises in the development phase, a lack of risk-taking in new technologies with an

---

[55] Sandholtz and Zysman argue that this is evidence for an elitist alliance between the Commission and business in Europe [1989]. On the strategic implications of European Union technology policy, see Meyer-Stamer, 1995; Bagger, 1993; Freytag, 1995; Weidenfeld, Klodt, Sälzer, and Grewlich, 1992; Weidenfeld and Turek, 1993.

uncertain future, a failure to adequately incorporate R&D in enterprise strategies, deficient development of communal strategies between universities, enterprises and bureaucracy, a lack of promotion or even an outright obstruction of scientists' efforts to establish enterprises, a lack of mechanisms to commercially use research results from the defense sector, the excessive concentration on confined national markets, and a false perception of supply and demand conditions in relevant future markets. The exploitation of R&D to create marketable products was "the greatest weakness": "its comparatively limited capacity to convert scientific breakthroughs and technological achievements into industrial and commercial successes" [Commission, 1993, Chapter 4].

Table 4.1 compares the expenditures for research and development in the Triad in 1991. Table 4.2 compares the number of scientists and engineers. One particular problem is the great divergence of R&D investment within the European Union. For example, in 1991 Germany spent 2.6% of its GDP, Greece or Portugal only 0.7%. The enterprise share of R&D had been much weaker in the European Union (52%) than in Japan (78%). The R&D emphases and governmental R&D budget appropriations within the European Union had been diverse, as Figures 4.1 – 4.4 show. Such divergences are not necessarily a negative factor as they could point to a division of labor between different research arenas. Troubling, however, has been the low degree of coordination that persists throughout the Union until today.

The real thrust for industrial and technology policies came with the expansion of the Commission's competencies following the adoption of the SEA. By emphasizing *ex post* harmonization (the definition of common standards), the Commission aimed primarily at the liberalization and enlargement of the European market to promote greater economies of scale and competitiveness. The Single Market initiative contained three basic actions: the elimination of material barriers (border controls), technical barriers (technical norms, preferential treatment of public procurement, settlement controls, economic procedures), and tax barriers (differential tax methods and divergent tax rates) [Streil and Weyringer, 1991, 294]. In sum, an expansion of competition has been promoted to lead to an expansion of competitiveness. Nevertheless, although the Commission has received greater access to policy instruments such as regional and structural funds, the SEA has amounted more to an indirect policy approach.

Since 1984, in an effort to overcome the problems of double research and a low degree of R&D coordination, the Commission has launched four technology programs. The First Framework Programme, from 1984 - 1987, consisted of policies relevant for the energy, information and communication, and bio-tech sectors, as well as on the modernization of traditional industrial sectors. The Second Framework Programme, from 1987 - 1991, reduced the energy policy portion (to 22% of the assistance), and increased the information and communication technology portion to 42%. The individual 32 programs amounted to a sum of ECU 5.4 billion. The Third Framework Programme, from 1990 - 1994, pursued 15 projects. The greatest emphasis was placed on so-called enabling technologies (more than 50% of the ECU 5,700 million), including information and communication technologies as well as telematics (ECU 2,221 million), and industrial and materials technologies (ECU 888 million). Cost-sharing programs (indirect assistance), cooperative research, and the joint research centers had been the principle focus.

As the first three program budgets were miniscule in comparison with the member states' national R&D budgets, the Fourth Framework Programme has a significantly higher budget for the period between 1994 and 1998 (ECU 13.1 billion) to underline the importance the Commission and the Council attributes to the central coordination of R&D. This budget, although still low in comparison to the R&D spending of the individual member states, has been controversial, especially due to the budgetary constraints imposed by the pending Economic and Monetary Union (EMU). In the Fourth Framework Programme, the Commission has emphasized so-called key-technologies: microelectronics, software development, molecular biology, and efficient transportation, as well as the continuation of previous programs. Characteristic of all programs is the strict supranationality.[56] Funding is only awarded when the project participants are of different nationalities. However, to concentrate on projects that exceed national capacities, to execute them in accordance to the subsidiarity principle, and to insist that the research participants come from different member states, is a difficult task (many aims, few instruments; see Chapter 1).

[56] The three consultative institutions, CREST (*Comité de la recherche scientifique et technique*), CODEST (Committee for the Development of Science and Technology), and IRDAC (Industrial Research and Development Advisory Committee), consist of representatives of industry, science, and administration from different countries.

A number of internal conflict dimensions exist in the European Union regarding the conduct of technology policy [Junne, 1992]. First, a considerable North-South divergence in technology funding exists. The three largest members, France, Germany, and Great Britain, account for 75% of all research spending in the Union. Since the larger member states predominantly finance and execute EUREKA projects, such projects contribute to more economic divergence in the Union instead of reducing it; technology and regional policy are thus potentially contradictory.

Second, frictions exist between European and national programs. Often, one country's enterprises compete not only with Japanese or American enterprises but also with enterprises from other member states, a situation which may prompt national governments to promote domestic enterprises. Furthermore, as stated above, European programs amount to only a fraction of the funds that national governments distribute. The contributions of the European Union have been comparatively small; in 1990, they amounted to 4.5% of all R&D spending by the member states. For example, the combined contribution to ESPRIT, Advanced Communications Technologies (RACE), and Basic Research in Industrial Technologies for Europe (BRITE) were smaller than the research budget of Siemens.

Third, divergent interests exist between small and large countries. Large countries have the resources to conduct research in a great number of areas, while small countries have to limit their efforts to a few specific foci. Industries in large countries depend less on European efforts than smaller ones as the domestic scientific base is broader. Consequently, the governments of the larger member states are more skeptical of European cooperative efforts, and they often undermine the programs by refusing funding increases.

Fourth, until the 1990s, European funding initiatives had a clear bias for large enterprises as they had received funding without having a real need. According to a poll in the Netherlands, only 29% of large enterprises would have discontinued their (subsidized) projects if funding had been cut [Tulder, 1990, 674-675]. In comparison, three-quarters of the projects in small enterprises would not have been undertaken, implying a much greater dependency of small- and medium-sized enterprises on funding initiatives.

Fifth, an inherent conflict exists between EUREKA- and ESPRIT-projects. EUREKA projects are requested by individual enterprises and primarily nationally funded, while ESPRIT has certain requirements built in that conform to supranational principles. Critics argue that "nobody can really say what the EUREKA-label really means beyond a certain preferential distribution of national funding. In the framework of EUREKA, no additional funding is provided. The subsidies come from national budgets for research and development. EUREKA can be interpreted as a successful public relations coup rather than a successful technology program. Beyond the requirement of cross-national research and 'high tech', no other demands are made" [Junne, 1992, 296]. The result is that often ESPRIT and EUREKA undertake similar projects; thus, the Union has not fulfilled its aim to prevent double research.

Sixth, a conflict continues to exist between globally operating enterprises and national governments. As already addressed in Chapter 1, should a government subsidize an enterprise that has global interests, for example, an enterprise that receives technology assistance, but that then produces outside the country or the Union and subsequently imports these goods, thereby negatively impacting employment and the trade balance?

In an analysis of the European telecommunication industry of the 1980s, Rob van Tulder and Gerd Junne confirm some of these criticisms. Frequently, small countries are subject to a squeeze from not only less developed countries that increasingly overtake the production of base technologies but also from the larger countries that dominate high technology trends. Tulder and Junne have identified three types of squeezes on small countries in the telecommunication industry: financial, communal program, and standardization squeezes [1988, 174-180]. The financial squeeze results from the rising financial demands for hardware and software in the telecommunication sector and the related R&D. Rising costs have two consequences for small countries: first, the public telecommunication enterprises and the government are unable to fully participate in the next generation of generic technologies because the projects become too large to handle for small countries with confined markets. Second, smaller countries cannot match the export subsidies and the political support for financial assistance in the larger countries. Philips' chairman Wisse Dekker complained in 1985 that the larger countries provided disguised subsidies to the national champions in form of higher compensation per line of installed switching equipment, and that the Netherlands' government did not support exports by granting exports credits or development aid [Dekker, 1985, cited in Tulder, 1988, 175].[57] The financial squeeze led Philips to form an alliance with AT&T, an American telecommunication provider and one of the big global players.

A second pressure on small countries is the communal program squeeze. A first arena is government procurement in telecommunication. Since the middle of the 1980s, the Commission has pursued the liberalization of national telecommunication markets to create an integrated European market. The telecommunication sector has been only partially opened with the Single Market initiative; complete liberalization is scheduled for January 1998. While the foreign share of governmental procurement already amounted to 80% in small countries, the share in the larger countries was even less than the negotiated 10%. Thus, according to this argument, the markets of the smaller countries were open and competitive, while the markets of the larger countries in the telecommunication sector remained closed and protected, with the consequential disadvantage for the producers from smaller countries. Whether the smaller member states are able to transform legislation into reality more quickly, or whether the larger members only react quickly to supranational initiatives when they conform with their own domestic interests, is open to speculation.

The Technology Framework Programs cause another type of communal squeeze. The issue of communal program funding caused a struggle between smaller and larger member states that lasted almost two years, from 1986 to the third quarter of 1987. While the smaller countries emphasized the importance of communal programs, especially to prevent duplicate research, the larger countries preferred national and bilateral programs without a strong supranational component. The budget struggle, with the outcome being closer to the preferences of the big countries, also had implications for other European programs. For example, RACE underwent a budget cut because Germany in particular opposed the program. Siemens had already been highly innovative in the field of wide-band communications and opposed cooperating with others because it did not want to share its innovations. Enterprises from the larger member states preferred projects such as EUREKA because it entailed a weak central role in almost all projects, with the following consequence for smaller countries: ”the

---

[57] The Netherlands’ government appears to have changed its approach following these complaints; in 1987, the AT&T Philips cooperation received substantial financial backing from the government. See Tulder, 1988, 182 fn.2.

elimination of an independent role for the European Commission shapes an environment where only the strongest cooperate and the principle of *juste retour* which has been particularly beneficial for the smaller countries is abandoned" [Tulder, 1988, 178].

The last type of pressure on small countries is the standardization squeeze. The countries with larger domestic markets determine telecommunication standards, without much input from the smaller countries (for example, French, German, and Italian cooperation on CEPT). This trend is intensified by the cooperation of the larger countries in the European Space Agency that enables the larger countries to dominate satellite technologies.

For these reasons, smaller countries tend to be more in favor of supranationally organized and coordinated programs than the larger ones. Whether these squeezes have indeed been a major obstruction to the technology policy efforts of the smaller member states is not certain. The deregulation initiatives in the European Union have now reversed the situation: smaller countries, such as the Netherlands, and new members, such as Sweden and Finland, have proven to be highly successful in the telecommunication sector. Especially market niches and novel developments such as mobile telephony have been a source of great success for these countries. Deregulation and especially the prohibition of preferential public procurement have reduced the initial advantages of the larger member states.

Another criticism is that the first phase of European technology policy placed excessive emphasis on technological progress, and too little on improving the research capabilities of enterprises [Vetterlein, 1991, 62ff]. The focus on the scientific outcome weighed more heavily than wider strategic and market implications. Moreover, the subsequent project review process was too uncritical. The approach of using independent panels has been problematic because these panels have had little political legitimacy other than being selected by the relevant Director General of the Commission (who has, of course, no interest in selecting someone who is overly critical of Union policies and actions). Uwe Vetterlein argues that: "They judge projects not according to their scientific quality (which other panels already do before), but according to their political and societal value. On the basis of this they formulate – following their personal interest and experiences – propositions for the future of a program that has nearly binding characteristics. The political evaluation or the evaluation of the utility for society in comparison with other political options are nothing but political acts that should [..] be undertaken only by legitimated decision-makers" [ibid., 77]. To overcome these problems, Vetterlein proposes that the European Parliament implements an independent review process as it presently accepts the panel judgement as "god-given": "Maybe the parliament is not even aware that by accepting the panel judgements they voluntarily give up a part the power of which it has little anyhow" [ibid., 99].

Henning Klodt points out that in 1987 Commission R&D funding almost completely neglected base research (only 1.8% of total research funding), while the individual member states invested on average 20% [1989, 20-21]. The brunt of assistance fell on the production, distribution and usage of energy (51.6%), and industrial productivity and technology (33.2%).

Table 4.1: Research expenditures in the European Union, the United States, and Japan

| | EU | USA | Japan |
|---|---|---|---|
| Spending in billion ECU | 104 | 124 | 77 |
| Spending in proportion to GNP, in percent | 2 | 2.8 | 3 |
| Spending per citizen, in ECU | 302 | 493 | 627 |

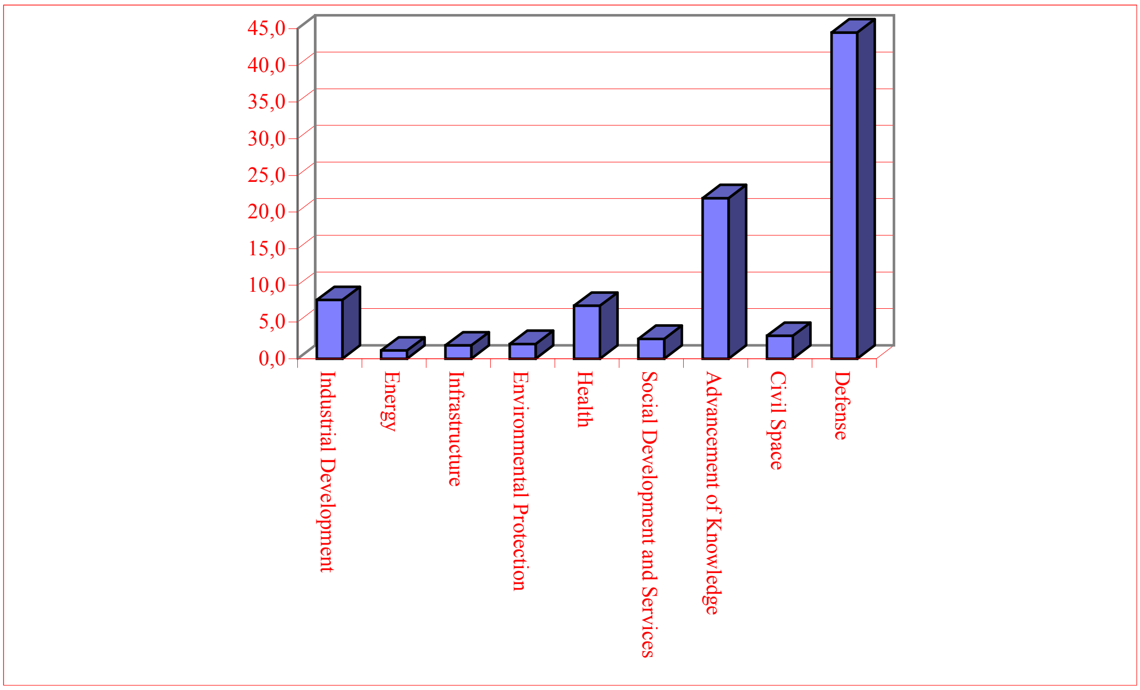
Source: Commission, 1993, Chapter 4.2.

Table 4.2: Number of Scientists and Engineers, Comparison

| | EU | USA | Japan |
|---|---|---|---|
| Number of researchers and engineers, in thousands | 630 | 985 | 450 |
| Researchers and engineers in proportion to employees, per thousand | 4 | 8 | 9 |

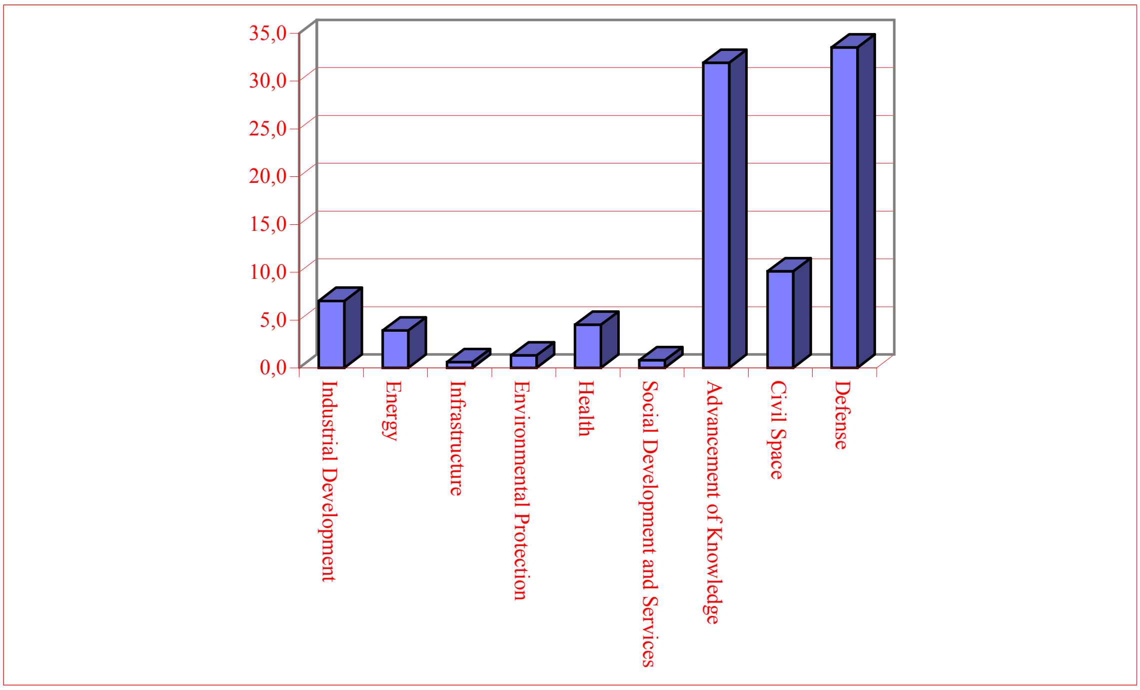
Source: ibid.

Figure 4.1: Distribution of Government R&D Budget Appropriations, United Kingdom 1994 (in %)



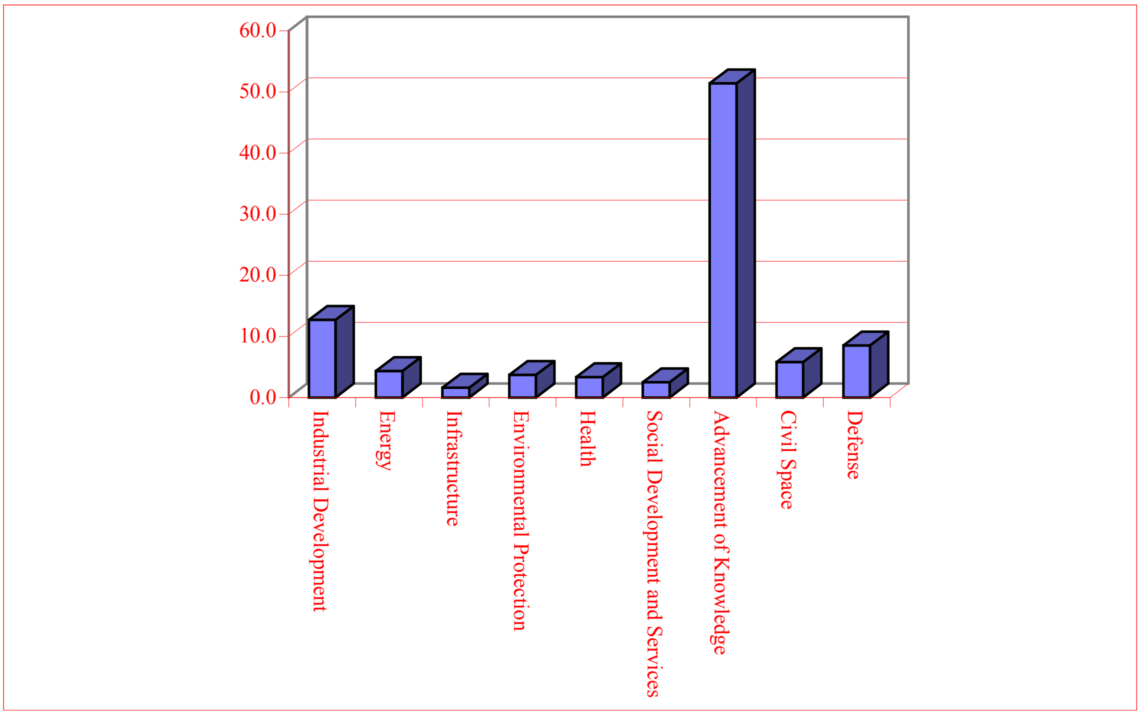

Source: National Science Foundation, 1996, Table 4-32.

Figure 4.2: Distribution of Government R&D Budget Appropriations, France 1993 (in %)



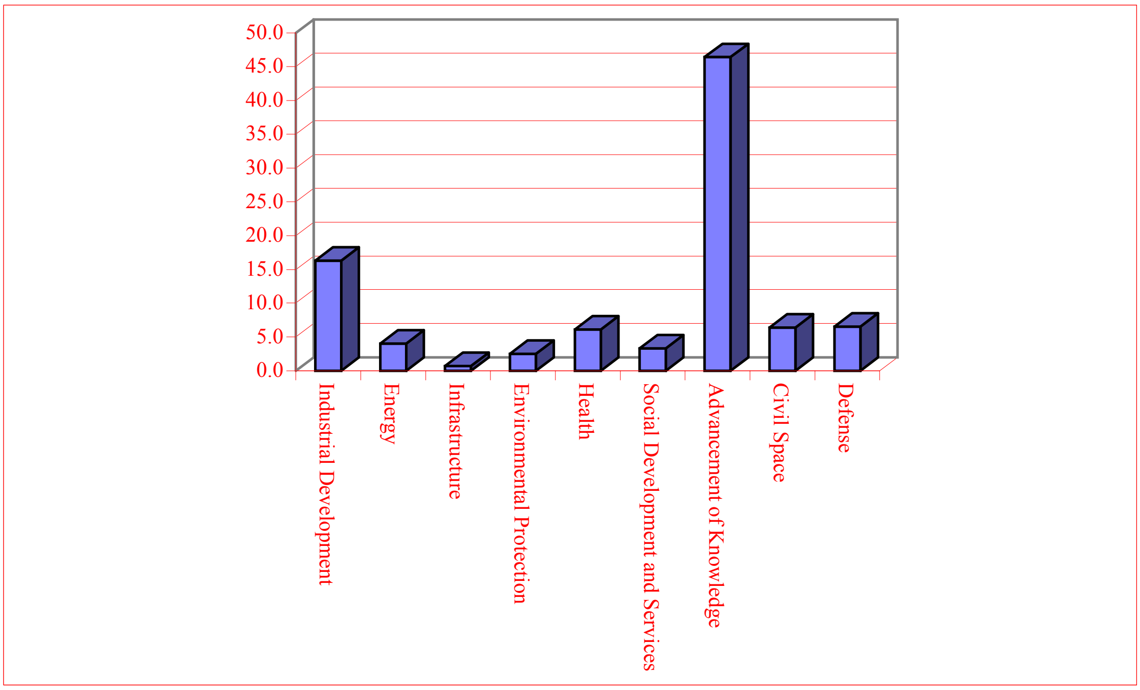

Source: ibid.

Figure 4.3: Distribution of Government R&D Budget Appropriations, Germany 1993 (in %)




Source: ibid.

Figure 4.4: Distribution of Government R&D Budget Appropriations, Italy 1993 (in %)




Source: ibid.

In the late 1980s, under pressure from national governments, the Commission shifted its technology policy approach. In the early 1990s, the Commission found itself in a paradox situation: on the one hand, the initiatives of the late 1980s culminated in a formal strengthening of the Commission's powers. The negotiators of the Maastricht Treaty awarded the Commission with substantial powers, in particular in the context of Article 130. Possibly foresight concerning projected problems in the Treaty's ratification process led to the Commission's reluctance to exploit its formal powers. Instead of pursuing a technology policy that is largely a derivative of industrial policy and that promotes individual technological artifacts, the Commission concentrated on promoting positive externalities; it called the new horizontal industrial and technology policy approach "industrial policy in an open and competitive environment".

The proponents of the new approach have pledged a reduction of central economic steering and intervention, greater emphasis on the support of structural change and less on the maintenance of declining structures, more regional than sectoral emphases, and a greater integration of the different economic policies of the member states. Furthermore, Commissioner Bangemann has accentuated the pursuit of generic technologies that have wide applicability instead of the concentration on a small range of selected high technologies [1993, 26ff]. He has argued that the Union would become a catalyst to create a balance between the following elements: a) the creation of a long-term economic framework, including the maintenance of a competitive structure; b) a high level of education; c) environmental and social protection; d) the development of certain catalysts for structural adjustment, consisting of the pursuit of common norms and product quality, public procurement, and the elimination of national quotas; e) a coherent legal structure for economic activities and trans-European networks; f) the creation of instruments for the acceleration of structural adjustment, including research and development, innovation, and the reeducation of workers; g) an emphasis on small- and medium-sized enterprises; and h) enterprise consulting services. These plans were far less interventionist than many feared after reading the Maastricht Treaty.[58]

---

[58] Critics argue that the Maastricht Treaty is a change of paradigm of the approach towards industrial policy [Barbier, 1992]. For example, the Treaty awards the achievement of international competitiveness and improvement of research and development receive an equal status with the maintenance of a system of unimpeded competition, implying that competitiveness is not a mere effect of competitive markets, but an aim in itself that can be achieved with direct actions.[58] To achieve these aims, the Treaty awards the Commission expanded competencies, including policy initiation rights to coordinate the member countries' policies and the power to declare policy emphases. Joachim Starbatty argues that this gives the

The Commission has also outlined its own role in the innovation process by emphasizing its coordination function. The coordination of communal and national R&D would promote a better utilization of research results on the European level. To institutionalize coordination, it has planned to implement some ”operational mechanisms” on national and supranational levels. These mechanisms should simplify administrative processes in the R&D-funding application process and improve the diffusion and utilization of R&D results. Such an approach could improve norming and standardization activities, as well as the technology transfer process between universities and enterprises, within industry, and between the civil and defense sectors.

The policy shift may also be evidence for the changing nature of the innovation process during a paradigmatic technological change. The Commission may have realized that its expanded powers are futile. In its White Paper on Growth, Competitiveness, and Employment, the Commission has argued that the ”economic impact of technological progress on growth and employment depends on the innovation process, which has become interactive. The linear model of innovation, with the innovative act being isolated, has in today's world been replaced by complex mechanisms: innovation requires constant and organized interdependence between the upstream phases linked to technology, and the downstream phases linked to the market” [Commission, 1993, Chapter 5.1]. In sum, the old, vertical industrial policies were primarily sectorally oriented: to maintain economic sectors by repelling market tendencies (which has the effect of decreasing competitiveness). The new, horizontal approach is holistically oriented: preempt market developments to improve competitiveness.

Thus, the Commission has pursued a centralization of R&D coordination, but not a centralization of executive and administrative efforts. The member states retain the responsibility for indirect measures such as the award of tax subsidies for research activities (for example, to induce enterprise to finance university research), the reduction of social security costs of enterprises in return for the creation of new R&D

---

Commission ”control and veto power over all other political arenas” [1994, 163]. Helen Winter assesses: ”The industrial policy approach of the EC repeats the mistakes of the national policies. In the 1970s, the EC-countries contrived concerted actions, subsidized shrinking industries, and created ”national champions” to solve their growth problems. ... In the 1980s, the member countries and the EC concentrated on technology policies. In the beginning of the 1990s, however, the old strategy, combined with protectionism, is becoming a present-day occurrence again, and the call for help of the ”lame ducks” and for ”picking winners” is as popular as never before” [1994, 136].

employment, financial incentives for education, the promotion of enterprise founding by scientists, and the modification of public financing instruments to provide more risk capital, especially for small- and medium-sized enterprises. These are precisely the areas in which the Commission has not had powers and is unlikely to receive more in the near future. The conduct of a common economic policy, despite the plans for EMU, has been removed from the immediate European Union agenda. Nevertheless, in a number of issue areas, as will be outlined below, the Commission has been pursuing a stronger institutionalization of its role in technology policy.

Critics question whether the ”new” approach is indeed novel. The Fourth Framework Programme, the conception of which fell into the time frame of the horizontal approach, seems to be rather a continuation of older programs. Furthermore, the Commission still emphasizes the assistance of specific economic sectors, such as the automobile, electronics, information and communication, and textile industries. Some criticize the ”new” horizontal approach as appearing to be another rhetorical split, especially in view of the greatly expanded industrial policy competencies of the Commission:

> Common to ”old” and ”new” industrial politics is that the structural development is not left to the actors in the markets alone, but that politics takes an active role in the innovation process: By means of horizontal actions and financial incentives the ”new” industrial policies assist those sectors that are interpreted by the Community to be of central importance in the quest for European competitiveness. ”Old” and ”new” industrial policies patronize selected industries and thereby discriminate other industries, either because one wants to protect declining industries from competition or because one wants to prepare key technologies for competition. However, can the ”new” industrial policies avoid the negative secondary effects that are attributed to the ”old industrial policies” [Starbatty, 1994, 158]?

Programs such as ESPRIT, critics argue, are industrial targeting programs in the high technology area that are not consistent with the promotion of the competitive environment. The consequence is that ”the sectoral structure will be distorted: large firms in selected industries, benefiting from the Single Market due to economies of scale and the size of the market, will receive special treatment relative to the small and medium-sized firms. ... In order to avoid distortions, it would be much better not to use a sector-specific approach, but to improve conditions for research and development in general” [Siebert, 1990, 69]. The Union’s Economic and Social Committee criticizes the program because it places too little emphasis on the regional and social dimension, and that regions that are already disadvantaged will fall behind even further [Wirtschafts- und Sozialausschuß, 1992, 33].

To evaluate the Commission's activities and to review whether some of the criticisms are warranted, let us now examine specific technology policy activities in the European Union.

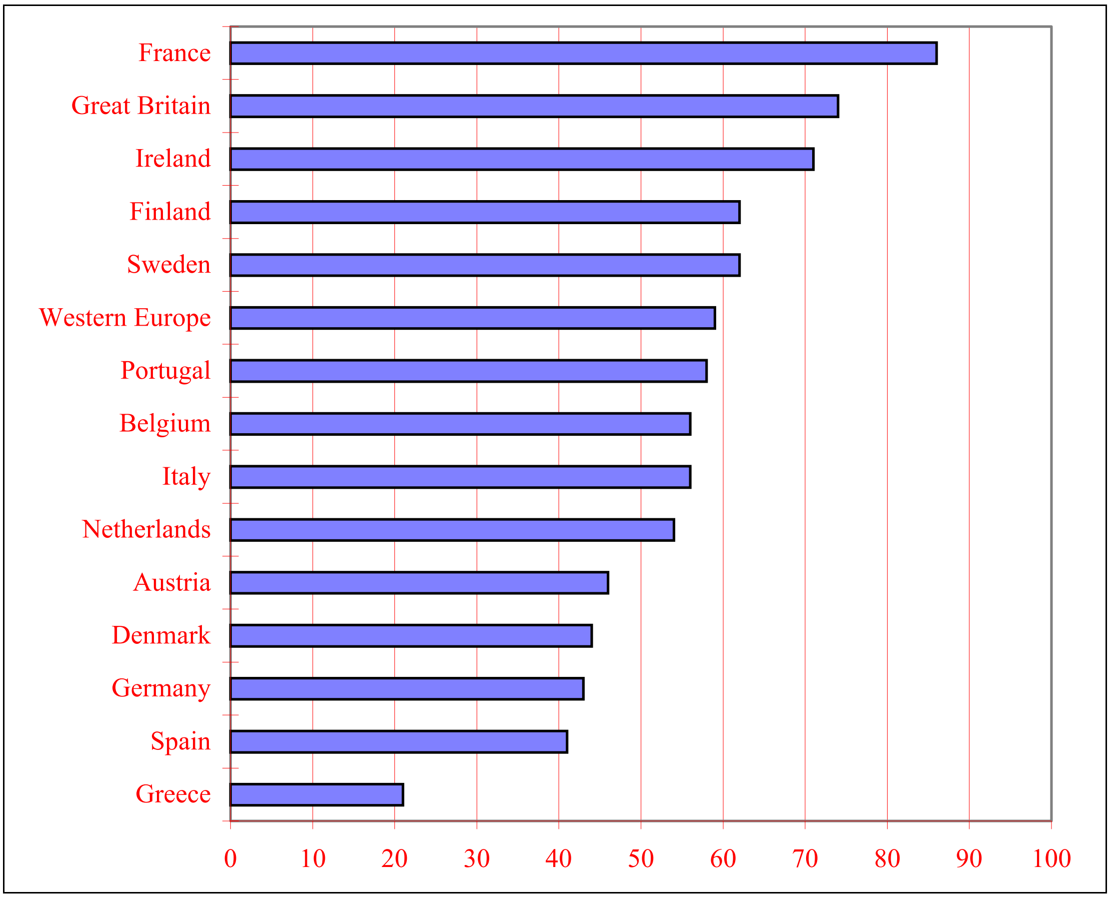
### c. The Infrastructure for the Information Society: Networks and Content

The Commission has undertaken a two-prong strategy regarding the infrastructure of the Information Society: the expansion of existing basic information transmission networks, and the promotion of applications and content.

#### *i) Information Transmission Networks: The Hardware*

The principle technical problem that confronts trans-European communication networks is a lack of compatibility and interoperability between the individual national networks. A critique of the state aid supervision mechanism is that while the Commission evaluates the compatibility of research programs of the member states, it does not oversee their infrastructure measures. Indeed, as Figure 4.5 shows, the digitization of underlying telecommunication technologies diverges to a great extent in the European Union. In recognition of this problem, the Commission has emphasized the creation of trans-European transport, energy and information networks: ”the implementation and the development of trans-European telecommunication networks aim at ensuring the circulation and the exchange of information across the Union; … this is a pre-condition to make possible the establishment of the 'Information Society', which will result from the availability, for each citizen, company or public authority everywhere in the Union, of any kind and quantity of information they need” [Commission, 1995a]. The Commission foresees a total investment need of ECU 150 billion, of which ECU 67 billion should be spent for ”priority” projects (see Table 4.3). Projected spending on interconnected advanced networks amounts to ECU 35 billion, which is a little more than half the spending on all priority information-related investment projects. Unclear, however, are the specifics. In the Communication ”Methodology for the Implementation of Information Society Applications”, a policy proposal for a Council and Parliament Decision, the Commission identifies the following spending parameters: a) for the period of 1994-1999, ECU 450 million for trans-European telecommunication networks, and b) for the period of 1994-1998, ECU 3.62 billion for information and communication technologies within the Fourth Framework Programme [Commission, 1995a]. The latter funds are partitioned into ESPRIT-funds of ECU 2.044 billion for information technologies, ACTS-funds of ECU 673 million for pre-competitive research in advanced communications technologies, and TELEMATICS-funds of ECU 902 million for telematics applications. Thus, the sum invested by the European Union amounts to less than 10% of the envisioned investments required . To what extent the member states, industry, the European Investment Bank (EIB) and the Structural and Regional Funds contribute to the remainder of the envisioned expenditures is not clear.

Figure 4.5: Digitization of Telephone Networks in the European Union, 1994 (in %)




Source: Eito/Fachverband Informationstechnik, in BMWi, 1995, 65. Similar to other technological penetration rates, the degree of digitization has changed considerably in the past years.

Table 4.3: Financing Proposal for Information-Related Investment Projects, 1994-1999

| | **Target Area for Investment Projects** | **Required 1994-1999 (in billion ECU)** |
|---|---|---|
| Interconnected advanced networks | establishment of high-speed communication network | 20 |
| | consolidation of integrated services digital network | 15 |
| General electronic services | electronic access to information | 1 |
| | electronic mail | 1 |
| | electronic images: interactive video services | 10 |
| Telematic applications | teleworking | 3 |
| | links between administrations | 7 |
| | teletraining | 3 |
| | telemedicine | 7 |
| TOTAL | | 67 |

Source: Commission, 1993, Chapter 3.

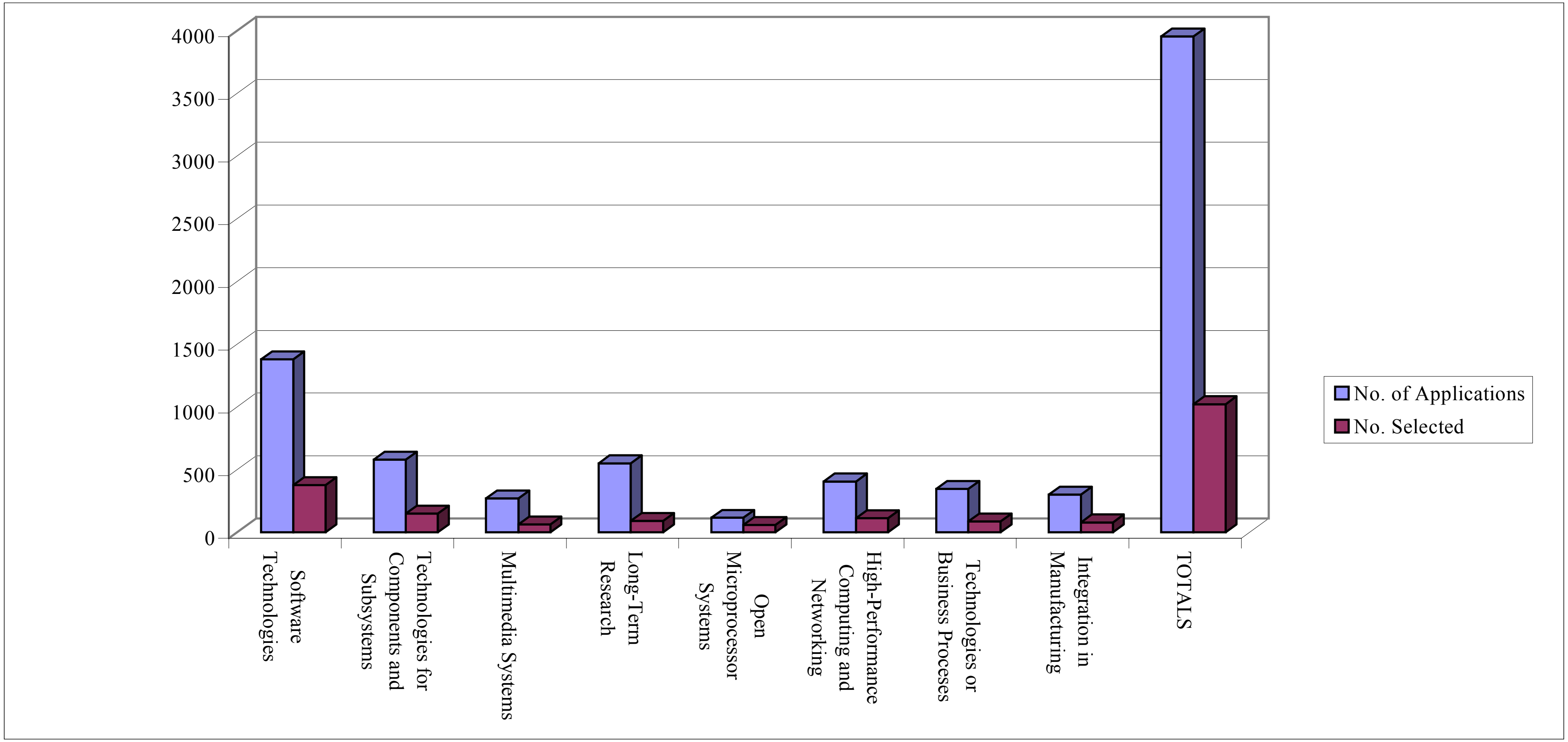
ESPRIT, operated by the Directorate General for Industry (DG III), covers eight research areas in the context of computer-mediated communication: long-term research in new and potentially important technologies, software, technologies for components and subsystems, multimedia hardware, the Open Microprocessor Systems Initiative (OMI), high-performance computing and networking, technologies for business processes, and the integration of technologies in manufacturing. The program has been emphasizing technology transfer, cooperative approaches to research and development, and the online dissemination of research results. The cooperative approach involves the adoption of a dialogue between so-called Industrial Advisory Panels with an emphasis on the user side and industrial groups.[59] This discussion forum also serves for the periodic reevaluation of programs, the formulation of pilot applications, and the preparation of long-term scenarios. Additionally, ESPRIT promotes the adoption of technologies, for example, within the framework of the FUSE-Programme (first users). Thus, it has moved further along the research and development path; an action that has long been demanded but that has also been controversial (see Chapter 1). Figures 4.6 and 4.7 summarize the applications and the allocation of resources over the different research domains.

ESPRIT is end-application-oriented; in contrast, ACTS focuses on infrastructure technologies such as photonic technologies, high-speed networking, mobile and personal communications networks, intelligence in networks and service engineering, quality, security and safety of communications services and systems, interactive multimedia services, and horizontal actions. It brings together individual enterprises, public sector organizations, research institutes, and schools and universities. The aim is the establishment of individual project consortia and the pooling of knowledge and resources for specific projects. As ESPRIT, it encourages the involvement of researchers, enterprises, and organizations from non-European Union countries. While ESPRIT and ACTS are integral parts of the Fourth Framework Programme, the RACE-Programme for research in broadband technologies has expired. Its purpose was to integrate the various national strategies on the introduction of ISDN and to develop a strategy on the introduction of broadband networks in the European Union. Whether the discontinuation of the program is a sign that it has achieved its aims is not clear. It is conceivable that the further development and introduction of advanced systems will be left to the private market. Some of the program elements of RACE have also been incorporated in ACTS.

---

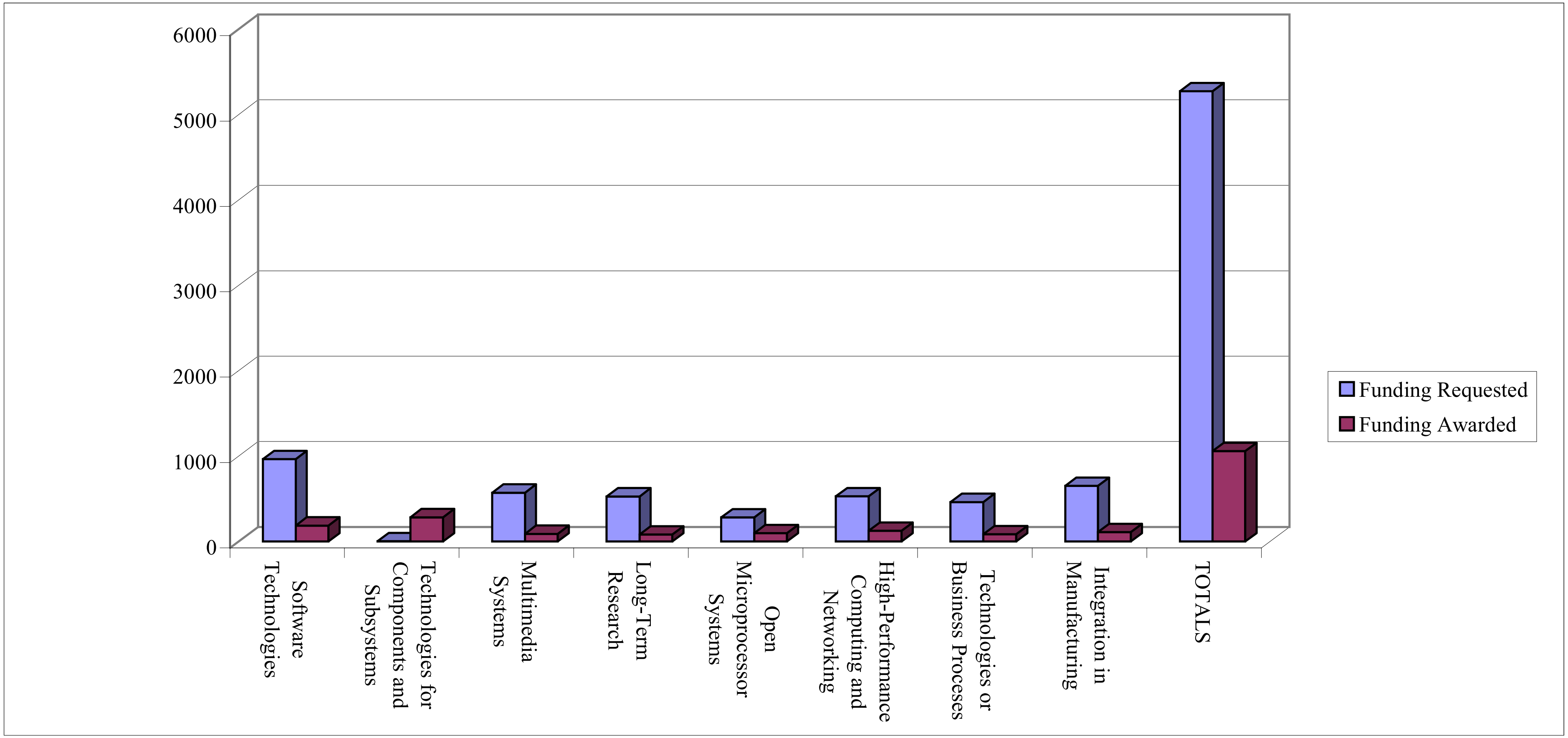
[59] According to Chapter 1, the interests and aims of both groups are often contrary.

Figure 4.6: ESPRIT-Projects, Applications (Call 1-6)




Source: http://www.cordis.lu/esprit/src/intro.htm; reference to ESPRIT in figures.

Figure 4.7: ESPRIT-Projects, Funding Requested and Awarded, Call 1-6 (in mill. ECU)




Source: ibid.

To supervise infrastructure and hardware developments in Europe, the Council has enacted the ”European Information Infrastructure Task Force”. Its purpose is to define guidelines and priorities, as well as an action calendar. The task force consists of members of the Commission, governmental representatives of the member states, members of the European Parliament, high-level representatives of industry, service providers, users, and financiers. The new technology policy approach of the European Union thus incorporates a multiplicity of actors and differentiates itself from the closed-door processes of the era of pursuing prestigious large-scale projects.

While hardware development, especially in the telecommunication sector, has been successful (many internationally leading technologies have originated in Europe), the Commission criticizes that the market structure and organization are so fragmented that no ”European” provider of telecommunication services exists and that no European base services such as e-mail, data exchange, data bank access, or interactive picture exchange services have been offered. Provider markets remain fragmented and the Internet is the only overarching network. Accordingly, the second active technology policy initiative concerns software applications and content.

*ii) Applications and Content: The Software*

The record of the European trade position in computer-mediated communication technologies with third countries has been mixed. In computer, office equipment, and consumer electronics, the trade balance with the rest of the world declined from ECU -8.8 billion in 1983 to ECU -26 billion in 1993. The trade balance with the United States in the audiovisual sector was negative in 1994, amounting to ECU -3.1 billion. The balance with the rest of the world only improved in the publishing sector, from ECU 1.2 billion in 1983 to ECU 2.1 billion in 1993. Despite the predominantly negative trade balances in the computer-mediated communication sector, the Commission foresees substantial future market opportunities. For example, it estimates the market growth in audiovisual products as exceeding 6% per annum, and the portion of copyright and related issues as adding 3 - 5% to gross domestic product in the Union.

The Commission argues that the European Union possesses particular strengths that would aid an eventual market success: overall market size and population, the presence of world-ranking information and media conglomerates, a long-established publishing tradition, a rich content base, large established markets in key industrial sectors, and a rich cultural and linguistic diversity [Commission, 1993, Chapter 5]. The European Union has not been able to exploit these strengths because markets remain fragmented along cultural, linguistic, and national lines, telecommunication services are expensive, especially between the member states, access to and exploitation of public sector information is difficult, the demand for advanced information services is low, and most content providers are nationally or regionally oriented [ibid.]. To exploit the potential strengths, the Commission has been promoting common application platforms for basic applications, such as user-friendly and openly-accessible information services and data bases, e-mail and interactive digital video services in work, leisure, and education. It views its role in the promotion of a critical mass that serves as a catalyst for the market and has argued that it can assist this process by contributing to the definition of norms and by preventing the dispersion of incompatible applications.

To disperse what the Commission calls ”best practice”, the wide adoption of optimal methods throughout the Union, it promotes a number of projects: applications projects in public administration for data exchange between administrative units, and large-scale projects such as the integrated flight control system and the European road traffic management system, European medical information services, online research networks, the European distance learning service, the ”computers-in-school” program, and the European civil protection system. To disperse economic activity into peripheral and structurally-weak regions, the Commission has also been assisting the initiation of a Europe-wide project on teleworking and telepartnerships. User demands and the coordination of public efforts are central components. Table 4.3 outlines the projected expenditures between 1994 and 1999 for general electronic services and telematic applications (the other half of the earlier-cited ”priority” projects).

Besides the creation of *new* services, the Bangemann Report awards *traditional* services considerable attention because the service sector in the United States has proven itself capable of creating new high-value employment opportunities. More cheap mass-market services instead of high-cost services, more expanded and individualized services to the business community, and an expansion of services and applications in existing infrastructures such as cable television and telephone networks, are the aim. To improve the service sector, the Bangemann Report suggests supporting the demand-side instead of, as has been the past practice, subsidizing the research of larger corporations. A number of barriers-to-entry in the service and multimedia markets persist in Europe, partially because of its historical structure of nation-states and linguistic frontiers. These barriers include (in addition to the general ones introduced above): financial and organizational weakness of the European programme industry, the linguistic fragmentation of the market, and obstructing and partially obsolete regulations that diverge between the member states and that create considerable uncertainty.

The principle problem, however, remains an insufficient software base; most standard operating and application software originates in the United States: ”Unlike its competitors, Europe's [information and communication technologies] industry does not have a firm hold on its home market. Europe must be given the applications necessary to meet its needs and the ability to devise the requisite applications software. A solid software industry base is inconceivable without close cooperation with equipment suppliers and early knowledge of how their equipment performs. Because of the speed of new developments, it is essential to know the specifications of equipment and components before they are available on the market, otherwise it is possible only to follow developments, which leaves very little scope for initiative” [Commission, 1993, Chapter 5.3]. The White Paper does not specify its foreseen close cooperation method; however, ”early knowledge” of the performance of systems that are not yet on the market potentially implies the premature release of proprietary information. Whether the enterprises indeed cooperate in this procedure is uncertain as the computer-mediated communication markets move at high speeds.

In an attempt to overcome concurrent problems, the Commission has initiated the INFO2000 program, the principle program for the content industry. INFO2000 has three long-term strategic objectives: the facilitation of the development of the European content industry, the optimization of the contribution of new information services to growth, competitiveness, and employment in Europe, and the maximization of the contribution of advanced information services to the professional, social and cultural development of the citizens of Europe: ”INFO2000 aims at stimulating the emerging multimedia content industry (a large part of which comprises small and often new enterprises) to recognize and exploit the new business opportunities that will be created. Its focus is on the transition from print to electronic publishing and on the interactive multimedia information services that are emerging” [Commission, 1996b]. The policy strategy has four ”action lines” (see Table 4.4 for the summary budget distribution table for 1996-1999):

- stimulating demand and raising awareness;
- exploiting Europe's public sector information;
- triggering European multimedia potential;
- support actions [ibid.].

First, the stimulation of demand and the raising of awareness includes the implementation of Multimedia Information Demonstration and Support (MIDAS) nodes. The Commission foresees 20 of these nodes that have demonstration, dissemination, and communication purposes, especially for small- and medium-sized enterprises. Furthermore, by means of their networking, they can promote cooperation, technical support, and the development of a common image for the network. The nodes are expected to create clusters of pan-European user groups by implementing an integrated electronic infrastructure. Second, INFO2000 assists the exploitation of public sector information. The first action line concerns the outline of policies for accessing public sector information. The creation of better information management, efficiency, and transparency are the central elements. The second action line aims at the linkage between the different European databases. Access has been hampered by a ”lack of transparency, cumbersome procedures and lack of interconnectivity between different national access routes”, as well as by insufficiently-implemented search routines and lingual divergence [Commission, 1996c]. The third action line affects the use of public content resources. The Commission plans to make available the content of museums, libraries, copyright and patent deposit systems, educational and training bodies, historical archives and architectural objects. Fourth, the triggering of the European multimedia potential entails four action areas. First, to exploit the potentials inherent in the cultural heritage, the program encourages new educational and *edutainment* tools that improve the understanding of Europe’s cultural assets, and new databases that contain cultural heritage information: ”The variety of Europe's cultural and linguistic traditions makes economies of scope and scale (economies made through being able to address a large Single Market with customized products) difficult to achieve and constrain product development. In addition, many surveys point to a limited awareness of content available to users across Europe. The aim here is to create new markets and to encourage clusters of pan-European users" [Commission, 1996b]. Second, it plans to improve the supply of information to enterprises, especially to SMEs, by implementing multi-lingual access. Third and fourth, it intends the dissemination of geographic, as well scientific, technical, and medical information.

The Commission expects the following benefits from these initiatives in the applications and content industry: higher employment (in 1994, an estimated 2 million fewer unemployed and an estimated turnover of ECU 150 billion), added competitiveness through greater efficiency and productivity, the safeguard of cultural and linguistic diversity, and higher quality, easily accessible and usable information services. The program should also assist in overcoming some comparative disadvantages of the industry. High telecommunication costs are the most prominent disadvantage; the gap to the United States is estimated to amount to 3 - 5 years. Complicated trading processes of multimedia rights are another prominent disadvantage, as well as limited and complicated access to public sector information, and the excessive regional and national orientation of content providers. Furthermore, "[f]or this market to take off the content must be attractive to the user, i. e. easy to access, well presented and with adequate transaction and payment mechanisms. Solutions for electronic advertising, electronic markets and digital revenue collection mechanisms need to be identified, evaluated and encouraged at the European level" [ibid.]. The Commission sums up: these "actions aim at accelerating market uptake of multimedia products and services; at unleashing the economic and cultural potential of public sector information; and at strengthening the international and pan-European dimension of the emerging European multimedia content industry" [ibid.].

The targeted companies for support include all actors along the value chain of multimedia products and services: a) content producers that create the source material including images, text, graphics, music and sound; b) content developers of databases, electronic books, CD-ROM/CD-I titles, game titles and interactive TV programs; c) content packagers that offer information services such as online databases, videotext-, audiotext-, and fax-based services, books, newspapers, magazines, interactive TV services, electronic books, CD-ROM/CD-I information, and infotainment products; d) content distributors that use the various delivery channels such as optical and magnetic media, cable, satellite and telephone networks, mobile networks and paper; and e) the end-users such as large and small businesses, public sector administrations, professionals, researchers, the education and training sector, consumers, and citizens.

Table 4.4: INFO2000 Summary Budget Distribution Table 1996-1999

| Action Line | Focus | % of Budget |
|---|---|---|
| 1.1 | Creating new markets by raising awareness at the European level with specific user groups | 25.2 |
| 1.2 | Encouraging clusters of pan-European user groups | 0.3 |
| Total 1 | | 25.5 |
| 2.1 | Developing policies to access and exploit European public sector information | 2.0 |
| 2.2 | Linking directories to public sector information | 5.5 |
| 2.3 | Making use of content resources in the public sector | 10.5 |
| Total 2 | | 18 |
| 3.1 | Catalyzing high quality multimedia content | 44.0 |
| 3.2 | Trading multimedia intellectual property rights | 4.6 |
| Total 3 | | 48.7 |
| 4.1 | Observing and analyzing the multimedia content market | 3.2 |
| 4.2 | Spreading the use of multimedia content standards | 1.5 |
| 4.3 | Encouraging skills development at European level | 3.1 |
| 4.4 | Developing and exchanging best practice | |
| Total 4 | | 7.8 |
| TOTAL | | 100 |

Source: Commission, 1996c.

In sum, the Commission pursues an assertive approach to promote the development of applications and services. This prompts the important question whether it continues to favor vertically-integrated enterprises as it had practiced in the past in the context of hardware-oriented prestige projects, or whether SMEs indeed receive more attention.

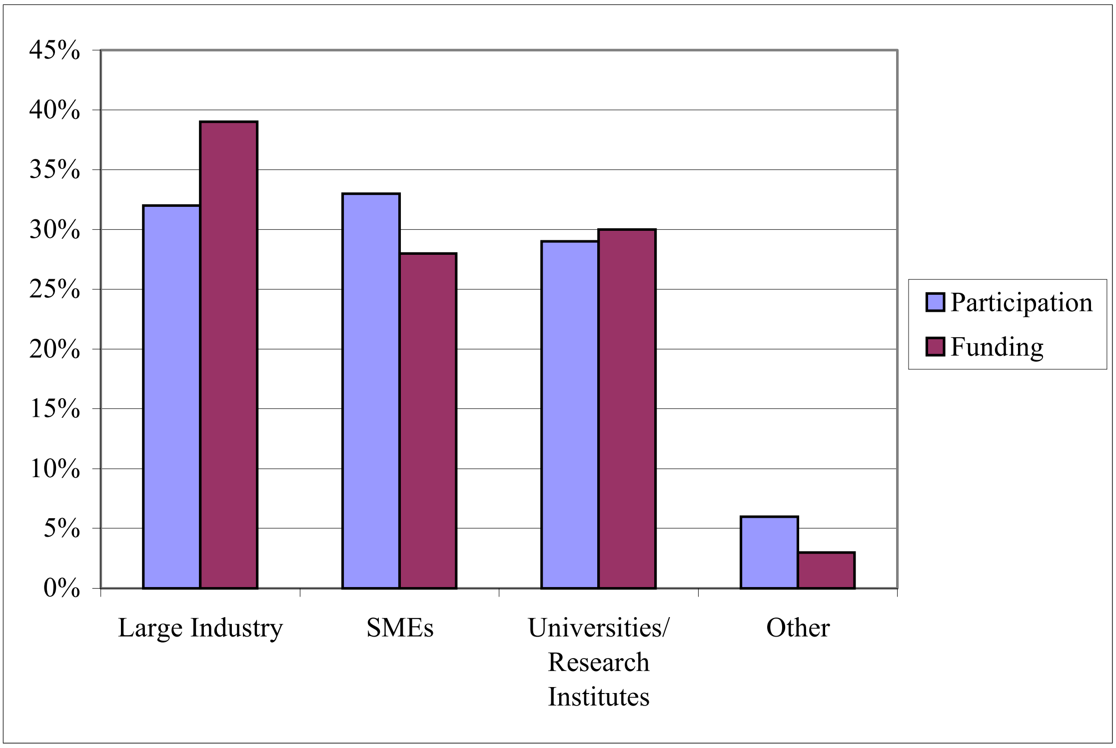
c. Small-and Medium-Sized Enterprises

In the European Union, small- and medium-sized enterprises (SMEs) have net revenues smaller than ECU 750 million and fewer than 500 employees, and less than one-third are owned by larger enterprises. 99% of all 15.7 million enterprises in the European Union fall under that definition, employing about 70% of all persons in the non-primary sector. 90% employ fewer than 10 persons.

The Commission argues that since SMEs produce more innovations per employee or per ECU invested, technology policy must consider their special demands and problems. As opposed to larger corporations, SMEs often do not have the capability to identify appropriate funding schemes or potential partners. The Commission has pledged to fill that gap. It has concentrated on consulting and the undertaking of action programs that include coordination. During the 1980s, the Commission established Euro Info Centers in larger cities and implemented information networks. It also promoted a greater SME share in public procurement projects and greater access to European R&D programs. Success, however, had been limited, partially because of insufficient utilization by enterprises [Winter, 1994, 97-99]. As a consequence, the Commission has enacted a number of action programs within the context of the CRAFT-initiative of the BRITE-EURAM Programme (in other words, not part of the Framework Programmes). The first action program (1987) facilitated enterprise cooperation and access to research institutes, and the second (1989) aimed to improve the economic framework and to assist enterprise development and inter-enterprise cooperation. Eligible enterprises were those that held less than 5% market share and did not exceed revenues larger than ECU 200 million.

The Commission has continued these efforts in the context of the Fourth Framework Programme. It has allocated ECU 700 million for Technology Stimulation Measures for SMEs for the period of 1995 - 1998. It grants ”exploratory awards” up to ECU 45,000 or 75% of total costs, but it also demands that at least two foreign partners participate in the project. These awards assist the proposal preparation phase, including work program definition, partner search, economic impact assessment, and novelty verification (Stage 1). Stage 2 is the research preparation phase: the Commission awards funding up to ECU 500,000 or 50% of total costs. Interested SMEs can either spend these funds on their own market research, or delegate third parties to undertake that function (the Commission calls these "RTD Performers"). The Commission has furthermore supplemented SME-research efforts by providing local "Focal Points" and the "ARCADE-server", both of which assist the search for partners. Up until 1996, 600 of the 1500 Exploratory Awards and 120 of the 250 CRAFT projects have been approved. The fact that over 70% of the 2000 participating SMEs are new to supranational projects is claimed by the Commission as a major victory. It points out that the barriers-to-entry in research programs have been lowered by means of the research initiation aid.

Figure 4.9: ESPRIT Participation and Funding in the European Union, until March 1996 (in %)




Source: http://www.cordis.lu/esprit/src/intro.htm; reference to ESPRIT in figures.

Specifically, ESPRIT allocates funding for SMEs. Let us evaluate these allocations in the context of the charge that large corporations have been treated preferentially in the European Union. As Figure 4.9 shows, ESPRIT-participation of large industry, SMEs, universities, and research institutes are almost equally distributed (32%, 33%, 29% respectively). Funding, however, is not quite as equal; large industry received about 10% more funds than SMEs. Thus, larger enterprises indeed have an advantage over SMEs. The charge, however, that ESPRIT concentrates on the creation of national champions is not valid in the 1990s; the funding approach is relatively balanced. In sum, SMEs have indeed received greater attention than during the European Union's early technology policy.

d. Supplementary Technology Policy

The efforts in the context of the Economic and Monetary Union (EMU) have to date concentrated on the creation of a monetary union and less on the implementation of an economic union. Economic policy remains in the hands of the member states. Consequently, the supranational level of the European Union does not have the power to alter the general economic framework. The use of passive technology policy instruments, such as tax incentives or lower governmental debts to encourage lower interest rates, has therefore not been an option for the Commission. The conduct of a common economic policy will be a highly salient political issue in the near future, especially in the context of the pending European Monetary Union. For the time being, however, the nationally-oriented conduct of economic policy initiated a potentially destructive race to provide the best possible economic framework.[60] Similarly, the Commission does not have authority over the issues of education, training, or health care.

The Commission argues that one reason why the new technologies have not increased productivity is that their introduction into enterprises has not been supplemented by adequate organizational transformation in these enterprises, often due to a lack of incentives. To overcome this problem, the Commission has proposed within its Green Paper "People First" to improve the linkage between education, training, and organization during the introductory process of new technologies [Commission, 1996a]. The Commission argues that Europe's "weakness … has been in combining technological and organizational innovation. High-quality, high-

[60] For a dissenting view, see the literature on institutional competition and its potential benefits for the business environment reviewed in Chapter 1.

performance strategies require enterprise-level training, careful job design and rapid implementation of innovations” [ibid.]. In this context, the Commission has pursued two strategies. The first strategy is the promotion of new employment skills: ”employment policy must become more focused on human resource investment” [ibid.]. The problem, however, is the ”already existing mismatch between skill supply and the demand for new skills – the two-speed labor market” [ibid.]. Thus, Europe needs a fundamental overhaul of its education and training system and ”a new architecture of life-long education and training” [ibid., Chapter 4]. The Green Paper outlines four action areas to enhance employability. First, the Commission wants to create interconnected European school networks with multimedia educational content to enhance their attractiveness. A central element is the awareness and training of teachers. Second, learning, not teaching, should be the central focus, the Commission argues. This implies a reorientation in teaching methods towards the consideration of business and industry needs [for more information on these two points, see the Action Plan ”Learning in the Information Society”, Commission, 1996e]. Third, enterprises should place more emphasis on learning-by-doing, which implies that working people use ”their electronic access to knowledge and information to update their skills”. And fourth, before people become long-term unemployed, they should be retrained pre-emptively. The second strategy has focused on vocational training. Vocational education should integrate computer-mediated communication regardless of whether it is directly relevant to the vocation at hand. This promotes a wide base knowledge that is sufficient for activities in the Information Society. Accordingly, the Commission recommends that methods be found to maximize common knowledge and computer literacy.

Nevertheless, education and training questions remain the responsibility of the national and subnational levels of the member states. Especially within federally-organized states, a common approach to education does not exist; to delegate the responsibilities to the Commission may be desirable with respect to common computer-mediated communication skills and the support of equal opportunities across Europe. But a common approach on education and training does not seem feasible in the short- or medium-term. Similar concerns apply to health policy and to social policy generally. Although the Commission approves of common approaches to telemedicine, both in terms of skills and regulatory safeguards, this issue is likely to remain embedded in the social policies of the member states. In sum, due to its complicated quasi-federal political structures, the Commission has little power over supplementary technology policy issues. Nevertheless, as we will see in the next section, in the domain of regulatory policy it pursues a harmonization approach that goes beyond the mere mutual recognition of standards.

2) Regulatory Policy

Due to its multinational configuration, the European Union encounters particularly difficult problems in the conduct of regulatory policy: on the one hand, in its pursuit of the Single Market, it wants to achieve a long-term harmonization of policies on the supranational level, either *ex ante* or *ex post*. On the other hand, according to the subsidiarity principle, it wants to permit sufficient leeway for the conduct of autonomous national and regional policies. To overcome this contradiction, the Commission has proposed the institutionalization of mechanisms that promote regulatory transparency on the supranational and national political levels.

Contemporary transparency mechanisms are based on mutual information procedures: when member states plan new regulatory initiatives, a consultation procedure of three to eighteen months exists during which the member states or the Commission can comment on proposed initiatives. A committee of member states' representatives has the purpose of improving dialogues and cooperation. In the context of Information Society services, the Commission "is keen to develop a legal framework enabling *inter alia* the new services which will be provided in the Information Society to benefit from the opportunities afforded by the area without internal frontiers, while bearing in mind both the fundamental objectives to be pursued in the general interest and the social, societal and cultural factors that come into play" [Commission, 1996d, Executive Summary].

The Commission fears that "without co-ordination at Community level, there is every reason to believe that these new rules and regulations in the member states will be highly divergent from one member state to another, each of them being motivated by concerns of their own stemming from a different perception of the general interest objectives to be pursued. This future regulatory activity thus creates a serious risk of refragmentation of the Internal Market, that is to say, of the introduction of new, unjustified or excessive obstacles to the free movement of services between member states and to the freedom of establishment for the providers of such services, which might, moreover, have repercussions at Community level in the form of over-regulation or mutually inconsistent regulations” [ibid.]. Thus, the policy demands of computer-mediated communication necessitate a new debate over the appropriate conduct of the supranational and national political levels, both in technology and regulatory policy. As we have seen above in the outline of its vision, the Commission has identified a considerable range of action areas that principally demand a considerable degree of harmonization if the Single Market is not to be undermined. While the Commission’s strategy is not necessarily a fallback to the *ex ante* harmonization approach of the 1970s, it clearly awards the factor of Union-wide standards a high status. The regulatory demands of computer-mediated communication are fundamental and include moral, cultural, and historical questions; the Commission claims the responsibility for the implementation of harmonized policy as many issues pertain to the Single Market and competition policy, although it does not claim final authority over the execution and administration of these efforts. Whether the principle of mutual recognition suffices for issues that extend beyond the trade of individual products is not certain.

In the domain of computer-mediated communication, the Commission has been active in the issue areas of competition policy and interconnection, universal service, privacy, and workers’ protection and rights.

a. Competition Policy and Interconnection

The centerpiece of competition policy in the European Union in the telecommunication sector has been deregulation. As of January 1, 1998, the European telecommunication operators, many of which are still state-operated monopolies, become subject to free competition. The European Union thereby jumps one stage that the telecommunication sectors in the United States and Japan undertook during the 1980s.[61] Already, trans-European and trans-Atlantic alliances in this sector have been emerging to prepare for market liberalization. To what extent the different operative areas of the large monopolists will be broken apart is not clear yet.[62] For example, the oversight institutions of the European Union are presently examining whether the

[61] The United Kingdom has permitted more competition already since the early 1990s, and other countries have liberalized certain elements, for example, the provision of certain business services.

[62] The state monopolies often operated simultaneously in postal services, cable provision, and telecommunications.

Deutsche Telekom will have to sell its extensive cable network that it operates in addition to its telephone network. This points to continual unclarity in the status of cross-operation of computer-mediated communication-relevant technologies.

More generally, competition policy in the European Union is a highly complicated matter. The first problem is the differentiated approach towards competition policy in the various member states, ranging from the French preference for rather lax anti-trust policy to the German aversion of cartels (although neither are persistent in the execution of their preferences). The second problem which has already been addressed above is that what may be a large enterprise on the national level is perhaps only a small player in global markets. Accordingly, conflicts often arise between the supranational and national political levels when larger national and European enterprises merge. Sometimes, the Commission prohibits the merger of two enterprises in one nation because they would achieve market dominance in that confined market. On other occasions, the Commission allows the merger of enterprises that come from different member states. Since mergers, in particular, often entail regional implications in terms of employment, open conflicts between the Commission and national or subnational governments have emerged. An independent supranational cartel authority, however, has been controversial for two reasons, firstly, should one exist at all, and secondly, what powers it should have.

The underlying problem in the domain of computer-mediated communication is that the divisions between historically distinct economic sectors are becoming blurred. Infrastructure-related industries, hardware and software industries, and audiovisual and content industries, are blurring. As the Commission recognizes, the ”many take-overs, mergers, joint ventures and strategic alliances taking place, particularly in Europe and in the United States, between the different communications and media-related businesses, are a clear proof of the changing environment the content industry will be facing in the years to come” [Commission, 1996b]. These structural changes cause new players from other markets to enter the content provision market, thereby linking previously separated markets. For example, several telecommunication providers and operators as well computer, consumer electronics, and software companies, have been offering their own online services, pointing at considerable vertical integration. Only in the artistically-oriented content production market, enterprises have not extensively merged [KPMG, 1996].[63]

Overall, as the various multinational mergers in the computer-mediated communication business demonstrate, anti-trust regulation has declined in the European Union. Some welcome this development:

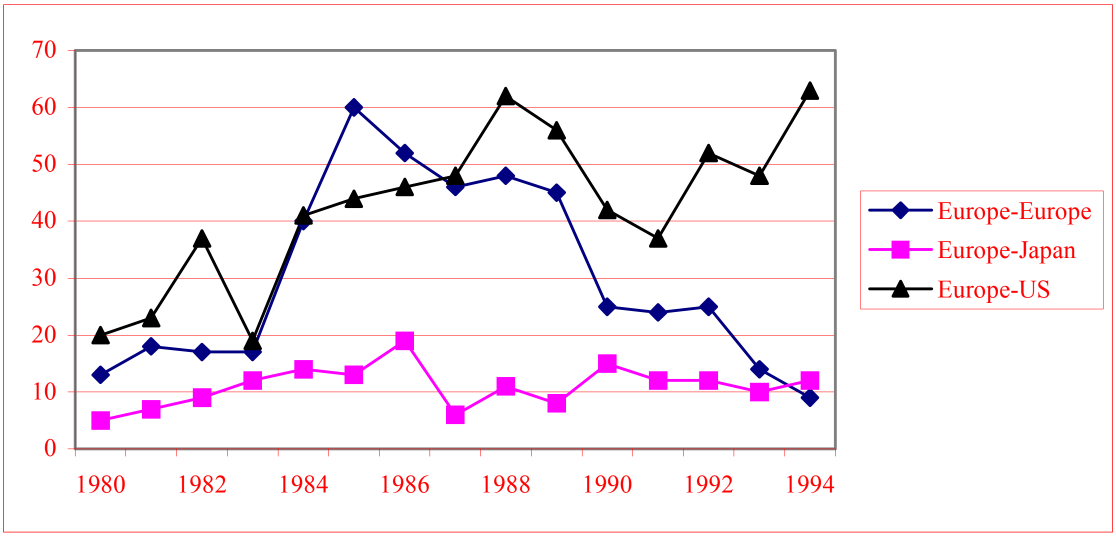
> National antitrust regulation has increasingly come under pressure as a result of the internationalization process. The more national markets become internationalized, the less it seems justified to take market shares in the domestic market as the basis for antitrust regulations. Recent technological developments have put another time bomb under antitrust regulation. With the blurring of boundaries between different economic sectors caused by the development of new basic technologies, it becomes increasingly difficult to delineate relevant markets. Companies from neighboring branches that have experience in the same basic technologies become at least potential competitors in other branches as well. In spite of the concentration process, therefore, competition in many areas seems to have increased rather than diminished. The need for strict antitrust measures accordingly is felt less. In fact, the restrictions on mergers and intercompany cooperation imposed by antitrust legislation are more and more regarded as obstacles on the way to improving the competitiveness of national companies. National governments as well as the European Community, therefore, have taken steps to relax antitrust regulation in order to secure a better position for domestic companies in the international restructuring race [Tulder and Junne, 1988, 198].

The data on alliances in information technologies shows an inconsistent picture. As Figure 4.8 shows, European alliances in information technologies rose in the 1980s but subsequently declined. Alliances between European and American enterprises, however, have risen since the early 1990s. What this implies is not clear; one may speculate that a trans-Atlantic division of labor appears in which American and individual European enterprises share their markets. Paradoxically, the creation of a European market may thereby be achieved by American enterprises, as they are the only ones who are horizontally entering the markets of the member states. In contrast, the European enterprises appear to remain in their own market (with a few exceptions), in combination with a market entry in the United States. In other words, important trans-European players in information technologies, with the exception of American enterprises, do not exist and are unlikely to be created in the short- and medium-term.

---

[63] The KPMG-study speculates that a cause of this reluctance to take over the more artistically-oriented sections of the value chain has been the negative example of the Sony buy-in in Hollywood and other

Figure 4.8: Intra- and Extraregional Alliances in Information Technologies




Source: John Hagedoorn, Co-operative Agreements and Technology Indicators Data Base, "Maastricht Economic Research Institute on Innovation and Technology", unpublished tabulations, in National Science Foundation, 1996, Table 4-38.

Although the Commission has been relatively inactive in controlling vertical alliances, it nevertheless reserves the right to prevent excessive vertical integration in the future, specifically between the access provision and content elements of the value chain:

> Future policy will have to tackle the potential bottleneck created by content, the raw material for many future services. The Commission will in particular ensure that cooperation across traditional divisions of industry does not reinforce current dominant positions in the separate markets for content, technical facilities and services. The Commission has already refused to allow a merger aiming to combine delivery networks with ownership of programmes and films since this would, in particular, have allowed the incumbent (EU) telecommunications operator involved to reinforce its dominant position in the market for cable network service, in which the operator had already extended its dominant position in the separate market of voice telephony. The ultimate test will be whether competitors could still reasonably enter the market if the cooperation was allowed. This test should always be applied to the least competitive market involved, which is, currently, the market for the provision of communications networks [Commission, 1995b].[64]

---

failures of vertical integration.

[64] The Commission here refers to its decision on the Media Service Gmbh of November 9, 1994, see Press Release IP/94/1045, 9.11.94.

The centerpiece of the Commission’s strategy on telecommunication is the implementation of an Interconnection Directive.[65] First, the Commission argues, the directive should provide clear rules on the rights and obligations of public telecommunication infrastructure providers, including a framework for interconnection. Second, while national regulatory authorities (NRAs) should supervise interconnection agreements, the principle priority should rest on voluntary negotiation processes between the actors. Third, the minimal regulatory framework should include common rules for promoting fair competition, the transparency of interconnection agreements, voluntary technical standards, and compliance with other basic requirements. Fourth, the Commission plans common dispute resolution mechanisms at both the national and European levels. The Commission states that the interconnection fees are a matter of negotiation between the involved parties. The national regulatory authorities maintain a supervisory function with the right to intervene ”if necessary”.[66] The interconnection charges are supposed to be cost-based and not designed to restrict market entry. Other principles include that the cost of operational inefficiencies should not be passed on, interconnection charges should be published, and losses from tariff imbalances from uneconomic customers or emergency service provision should be identified separately.

Consistent with its overall approach on the Information Society, the Commission wants to achieve a convergence of the regulatory frameworks. Based on this framework, the national regulatory authorities are executive and administrative organs with oversight responsibilities. Specific oversight processes include the screening of interconnection agreements, the review of access and pricing conditions, the monitoring of joint ventures, the assessment of finance schemes relating to universal service, the guarantee of open and nondiscriminatory access to rights of way, and the review of the effects of the cross-ownership of different networks including the joint provision of networks and services. The common framework would apply to the negotiation of interconnection terms and charges, and outline a dispute resolution procedure at national and European levels.

The Commission has also planned a common regulatory framework for the licensing of telecommunication providers, executed by the national regulatory

---

[65] An Open Network Provision Directive supplements the efforts.

[66] For example, in October 1997, the German authority intervened on behalf of smaller operators to reduce the interconnection charge foreseen by the Deutsche Telekom by more than half.

authorities but nevertheless coordinated with other member states. The framework foresees open, nondiscriminatory, and transparent licensing procedures in which regulatory and operational functions are clearly separated. Openness and transparency will be assured by the application of identical assessment procedures ("unless there is an objective reason for differentiation"), by the advance notification of all selection criteria and conditions, by reasonable time limits, and by an effective and rapid appeal procedure. Only two licensing restrictions will exist: existing Union laws on rights of way and on the availability of frequency. For private infrastructures, only "essential requirements" can limit the number of licenses. These essential requirements include "network security, network integrity, prevention of frequency interference, the effective use of the frequency spectrum, environment protection, rights of way and, in justified cases, interoperability of services and data protection, and in the case of terminal equipment, user safety and the safety of the employees of the operator" [Commission, 1995b]. To avoid complicated multinational licensing procedures, the principle of mutual recognition of licenses would be enforced.

To initiate a public discourse on the principles of the Green Paper on Liberalization of Telecommunications Infrastructures and Cable Television Networks [ibid.], the principle paper on the future competitive environment, the Commission conducted a consultation process between October 1994 and March 1995. In May 1995, it sent a summary of this process to the Council and the Parliament [Commission, 1995c]. The purpose of this process was "to obtain the views of all interested players on the future regulatory framework for a fully liberalized telecommunications environment" [ibid.]. The process included about 100 written comments from telecommunication-related European and national organizations, enterprises and individuals, consultation meetings, mostly consisting of provider representatives, and a meeting with trade union officials [see the Annex of ibid. for the participating actors].

In sum, the Commission does not want to completely control enterprise mergers, but rather supervise their principle operations to ensure the maintenance of a competitive environment. To balance this strategy, which is primarily beneficial for large corporations, the Commission also assists small- and medium-sized enterprises.

Cumulatively, critics argue, competition in the European Union has been eroded. As supranational laws "break" national laws, mergers and cartels that perhaps could not be passed on the national level now become possible. Buigues and Sapir find that the Commission circumvents limitations:

> In principle, the EC regulation on mergers and acquisitions cannot be used as a tool of industrial policy since it contains no ‘efficiency defense’. Proposed mergers must be assessed solely on the basis of their impact on effective competition, regardless of cost savings or other potential efficiency gains. In practice, however, the Commission retains some room for maneuver for industrial policy considerations. This arises from the fact that the regulation is somewhat fuzzy on the methodology for assessing the impact of mergers on competition and that, ultimately, the decision to approve or reject mergers is a political one [1993, 32].

According to Tulder and Junne, the strategy is the following: the combination of ‘anti-antitrust measures’ and controlled deregulation on the national levels are measures to reduce the subsidy race between the member states. A dilemma confronts national governments in the provision of subsidies: either governments do not discriminate between enterprises in subsidization, which has the disadvantage that they might subsidize duplicate projects, or they do discriminate to the disadvantage of competitors. The solution is to let enterprises cooperate, and where ”antitrust legislation stays in the way of such cooperation, it has to give way to in most cases in the interest of international competitiveness” [1988, 198ff]. Whether deregulation indeed offsets competition reductions is questionable because while deregulation initially improves competitiveness, the question is whether that improvement is not only a one-time, static event. With the argument to improve competitiveness by increasing the economies of scale, the Commission has given individual or group exemptions for mergers and acquisitions, and has permitted cartels (on the basis that they have certain benefits for innovation or to consumers) [for examples, see Commission, 1992]. Siebert criticizes the Commission's conception of competition policy on the grounds that the Commission equates it to industrial targeting in the high technology area with programs such as ESPRIT [1990, 69]. The consequence is that ”the sectoral structure will be distorted: large firms in selected industries, benefiting from the Single Market due to economies of scale and the size of the market, will receive special treatment relative to the small and medium-sized firms .... In order to avoid distortions, it would be much better not to use a sector-specific approach, but to improve conditions for research and development in general”.

In sum, the Commission accepts a reduction of competition. Its policies create an artificial competitive advantage that poses the question whether the allocation of resources is efficient, and whether it does not extract resources from other activities that have a greater overall welfare benefits. Especially in the long-term, less anti-trust control may backfire because cooperative ventures and mergers would be more difficult to break in the future once they had been legalized. The Commission has accepted that enterprise mergers are necessary at this stage of technological development because only large corporations can afford the massive necessary investments. The emphasis of the Commission lies on the deregulation of infrastructures, including telephone, cable, satellite, and mobile phone infrastructures. The aim is the "removal of current restrictions on the interconnection of all types of communications infrastructure, comprising public and private networks" [Commission, 1995b]. As it has recognized that fundamental constraints limit the ability to control large European and non-European enterprises, it has shifted its competition policy emphasis towards developing procedures and safeguards on infrastructure provision. The question is no longer whether large conglomerates reduce competition because they concentrate market power, but rather what can the Commission do to prevent abusive behavior by these conglomerates in their relations with smaller competitors.

b. Universal Service

In 1993, the Council and the Parliament declared the provision of universal service to be a principle priority [Council, 1993a; Parliament, 1993]. The Council Resolution "recognized the importance, for the individual consumer and for the competitiveness of industry and commercial users, of a Union-wide telecommunications system offering to all users, including specific social groups, reasonable and affordable charges for access and use, high quality of service and technological innovation" [Commission, 1995b]. In the Green Paper on the Liberalization of Telecommunications Infrastructure and Cable Television Networks, the Commission proposes a discussion on three components of universal service: the elements that comprise universal service, the methods for evaluating the costs of universal service, and the means of financing the uneconomic aspects of universal service provision in the competitive environment.

In this Green Paper, the Commission has outlined the basic principles for universal service within a liberalized infrastructure: first, universal service obligations should extend only to communications-related services. Second, cost and financing evaluation mechanisms and schemes must be transparent. Third, in calculating costs, the national regulatory authorities should include the ”net cost of providing service to uneconomic customers, plus any costs associated with the uneconomic provision of public telephones, emergency services and other social obligations”. Fourth, particular elements of universal service should be financed by national universal service funds or by access charges. Operators and service providers should proportionally contribute to the service funds. Fifth, financing schemes should be subject to regulatory control. Furthermore, the Commission may oblige providers to offer special tariff packages or options for needy and uneconomic customers. The Commission places a strong emphasis on the provision of universal service ”on the basis of a common minimum set of services and infrastructure” [ibid.]. The national political levels are to be responsible for the administration of universal service provisions, based on a common European framework. To account for rapidly changing markets and market conditions, the Commission argues, the national regulatory authorities and the Commission should regularly evaluate the main indicators, such as the penetration of residential lines, application waiting times, public pay phones as well as the availability of targeted schemes for the beneficiaries of universal service provisions.

The calculation of the cost of providing universal service is complicated by the uncertain future technological developments. To calculate this cost on the basis of concurrent cost structures may be inadequate, the Commission argues, as these cost structures do not incorporate technological advances and productivity increases. First, advances in satellite and mobile communications technologies reduce the necessity of installing the expensive local loop in remote areas, assuming that providers can choose the appropriate technologies. A second mitigating factor derives from economies of scale, both in terms of transmission and switching equipment for the local loop and of new and superior services. A third mitigating factor is that the combination of different technologies may reduce costs, such as the integration of telecommunication and cable television services. These factors, combined with general technological advances in the telecommunication sector, are leading to a shift from usage- and distance-sensitive costs to fixed costs, a fact that the NRAs and the participants have to consider in the calculation of prices. Overall, the Commission wants a flexible approach that accounts for technological advances.

The cost of universal service ”in well developed networks is relatively low and generally only a few percentage points of overall turnover” [ibid.]. With the exception of the Southern member states, it does not exceed more than 3% of revenues. In the Green Paper on liberalization, the Commission proposes that ”a common and progressive approach is required at a European level, even though the costs involved will be different in different member states” [ibid.]. Within the setting of national monopolies, the national operators have pursued the method of across-the-board subsidies for access to the network or for local calls. A new system would replace this method with an approach ”based on a calculation of the net cost to the operator of serving customers in terms of (i) the revenue generated by a customer (including rental and call charges paid by the customer, and the revenue generated by incoming calls to that customer), and (ii) the actual cost of providing service to that customer. The calculation of universal service costs must also recognize the fact that even low-profit customers have a marketing 'value' to a commercial organization” [ibid.]. Tariff re-balancing or target schemes for the needy may be alternatives to across-the-board subsidies.

The Commission suggests treating the universal service obligation as a common cost; providers of both infrastructures and services should take financial responsibility. Costs could be recovered by an access charge on top of the interconnection charge that is imposed on those that interconnect with basic networks. This system would reduce bureaucracy and transaction costs because no new administrative structures have to be implemented. Nevertheless, some disadvantages exist as well, especially when the actors have different market power: conflicts of interest exist between dominant providers and those that connect onto the dominant provider’s network. For example, the dominant provider has little pressure to reduce universal service costs because it can pass them on to its competitors. This would be an effective barrier-to-entry for new competitors.

The alternative suggestion of the Commission is the establishment of a universal service fund. This would involve the setup of a new institution, but once the fund is established it would have certain advantages over the access charge approach, the Commission argues: less market distortions, greater productivity increases due to more competitive incentives, and more flexibility in both the geographical and temporal sense as entitlement schemes can be regularly reviewed and adjusted.

The public reaction on the Commission's plans was generally favorable and underlined the importance of universal service provision [Commission, 1995c]. A number of the hearing's participants, however, were skeptical on how the provider would estimate the costs of providing universal service to uneconomic customers. They feared that the incumbent providers would overestimate them to lower their subsequent contribution. Providers, on the other side, feared that uncertainty over how to estimate the actual costs would pose significant risks that could obstruct future infrastructure investments. They also underlined that they should not be obligated to subsidize non-telecommunication services. On the issue of tariff re-balancing and targeted schemes, participants stressed that tariff re-balancing should move at a politically-acceptable speed, not undermine the affordability of universal service, and promote the improvement of operational efficiency. Furthermore, the customer should be at the center of attention. The governments should reduce political interference and implement *independent* and neutral regulatory authorities if they have not already done so. On the issue of funding mechanisms for universal service, the participants agreed that any implemented mechanism should not distort markets but improve competitive pressures. They preferred the creation of a universal service fund to which all market participants contribute. This would free the providers from direct obligations in universal service provision. They disagreed, however, on the operation of such a fund. Some proposed that the fund should finance services for the needy and uneconomic customers who could then decide themselves on which operator they prefer. Others argued for a direct payment to the providers for the services they offer. Hybrid forms were also proposed; providers could list particular areas or customers they do not wish to serve but would have to pay into the universal service fund (the "pay-or-play-principle"). Competitors could then bid for these areas or customers.

While the costs of providing universal service are relatively low in developed networks, the costs in less developed networks are higher. To forestall regional disadvantages, the Commission wants to grant the southern member states and Ireland a five-year transition period (members with a very small network two years) during which distorted tariff structures may persist. During this period, these countries receive additional support from the Community Support Framework, the European Investment Bank, and the Structural Funds.

No final decisions on this issue have been made yet. The problem of the existing regional divergence complicates the initiation of a common universal service structure, at least in the near future. To what extent temporal exemptions will be made in special cases is not clear; that they will be implemented is almost certain.

c. Privacy

*i) Privacy and Personal Autonomy*

While the privacy laws of the United States do only pertain to the interaction between governmental authorities and citizens, the European Union has been planning comprehensive privacy laws that cover both governmental interactions with its citizens and private interactions. Such laws already exist in some of the member states. In the context of the proposed Council Directive on the Protection of Individuals with Regard to the Processing of Personal Data and on the Free Movement of Such Data of July 1990, it has outlined specific guidelines on data storage. While this directive has not been adopted, piecemeal integration of the plans have occurred in the context of specific directives.

The guidelines on data storage are envisioned as follows: data must be accurate, up-to-date, relevant to the individual task, usable only for the particular task for which it has been collected, not to be stored longer than necessary, non-discriminatory, and subject to the consent of the individual. Furthermore, individuals must be able to attain access to their personal data (with a few exceptions, for example, for national security reasons, public safety or criminal proceedings). Independent supervisory authorities in the member states would oversee whether these principles are adhered to. A civil liability system could contain abusive behavior; however, this possibility has not yet been seriously discussed.

The Council Directive of 1990 covers primarily telecommunication services [for a comprehensive review, see Kubicek (Ed.), 1993]. In an effort to apply these laws to computer-mediated communication, the Commission has argued for the application of common rules in the context of the ”General Data Protection Directive”. Currently, however, it has only identified key issues within its ”Action Plan: Europe’s Way to the Information Society” [Commission, 1994b], but not implemented specific policy guidelines. On encryption as a method to protect personal privacy, the Commission has not yet acted. Although very different national initiatives and laws exist, for example, France completely forbids the use of encryption technologies while others impose no restrictions, no communal action is under way. The final shape of this regulatory area is not yet decipherable; member-specific solutions remain dominant.

*ii) Free Expression and Indecency*

Changes in the media structure pose new challenges. One of these challenges is the definition of the appropriate conduct on computer-mediated communication networks. To outline the action area, the Commission has published a Green Paper on the Protection of Minors and Human Dignity, in which it declares the protection of minors from indecent materials as a major task:

> The fight against the dissemination of content offensive to human dignity and the protection of minors against exposure to content that is harmful to their development are of fundamental importance in enabling new audiovisual and information services to develop in a climate of trust and confidence. If effective measures to protect the public interest in these fields are not rapidly identified and implemented we run the risk of these new services not reaching their full economic, social and cultural potential [Commission, 1996g, Summary].

This issue, however, does not have the same public magnitude as in the United States. The Commission has adopted a relatively moderate standpoint that emphasizes freedom of speech and expression; a standpoint that is not controversial in the member states. It has argued that one must distinguish between the challenges that are inherent in the media and the challenges that are inherent in the content. For example, many of the activities that have recently received considerable attention, such as the dissemination of child pornography over online networks, are already illegal. The basis for the Commission's position are the definitions of the European Convention of Human Rights (ECHR), which guarantees the freedom of expression. Although the conception of the right to freedom of speech does not strongly diverge between the European countries, they leave room for interpretative flexibility. The ECHR-Convention outlines certain limits to free speech that are open to interpretation:

> The exercise of these freedoms, since it carries with it duties and responsibilities, may be subject to such formalities, conditions, restrictions or penalties as are prescribed by law and are necessary in a democratic society, in the interests of national security, territorial integrity or public safety, for the prevention of disorder or crime, for the protection of health or morals, for the protection of the reputation or rights of others, for preventing the disclosure of information received in confidence, or for maintaining the

> authority and impartiality of the judiciary [ECHR, quoted in ibid., Annex III].

The member states have interpreted these limits differently. A prominent example has been the dissemination of racist materials such as Nazi-propaganda over the Internet. For example, while in Denmark, the restrictions on such materials are few, in Germany, they are prohibited. German restrictions have historical roots; however, in Denmark, limits to the freedom of speech are seen as more costly than the benefits of restricting certain materials. Since the European Union consists of ”grown” national states, a variety of historical issues could potentially forestall a consistent implementation of a common approach.

To limit interpretative flexibility, and according to its overall internal market strategy, the Commission wants to establish a common regulatory basis. The Commission guarantees the freedom of providing service, but in recognition of the particular concerns of the member states about the protection of minors and human dignity, it proposes a network approach that involves the national governments, industry, and consumer and private groups. Its strategy is twofold: the pursuit of proportionality between freedoms and restrictions in the case that member states initiate their own regulations, and self regulation supplemented by technological devices that enable parental control of their children’s online activities.

In its pursuit to achieve regulatory proportionality, the Commission plans to improve the cooperation between the Commission and the member states. Measures include the systematic exchange of information, joint analysis of national legislative provisions, the establishment of a common framework for self-regulation, recommendations for cooperation in judicial aspects and home affairs, and the establishment of common orientations for international cooperation. In the protection of human dignity, the member states already converge in their approach: they restrict child pornography, violent pornography, and incitements to racial hatred, violence, or both. Nevertheless, differences exist on specifics; for example, some countries punish the possession of certain materials while others only punish their sale [for an outline of existing laws in the member states, see ibid., Annex III].

The bottom-up strategy to protect children from an exposure to indecent or illegal content concentrates on self-regulation. To categorize the necessary action areas, the Commission distinguishes between new broadcasting services, online services, and open networks. New broadcasting services, such as pay-per-view, are based on the principle of conditional access. These services have to be individually ordered and are therefore subject to contractual mechanisms that prevent unintended access to harmful materials. As opposed to conventional broadcasting over airwaves, subscription to such a service is a first mechanism that enables control over the content. Since new broadcasting services are more expensive than traditional broadcasting, it is not likely that a subscriber does not know what content such a service offers. If parents want to protect their children, they do not need to subscribe. A second mechanism is the educational responsibility of the provider. It is in the interest of a provider to pursue the strategy of a trustful relationship with the client; it is a fundamental marketing rule that to keep a customer is ten times cheaper than to attract a new one. For example, a provider could offer additional information on the content. A third mechanism is the provision of particular control features, such as access only with password, special identification cards or credit cards.

Online services can be transmitted over closed or over open networks. Closed networks, including online video-on-demand services or proprietary systems such as America Online, CompuServe, Microsoft Network, the various national systems such as Minitel or T-Online and others, involve contractual links similar to those between new broadcasting providers and their customers. Assuming the conduct of editorial control by the provider, electronic program guides can identify and classify controversial materials. Personal identity cards can prove the age of the viewer before sending the content. Furthermore, the users can preemptively opt out of certain program categories. And finally, technical devices can be installed to prevent the transmission of unwanted contents.

Open networks, such as the Internet or access to the Internet via proprietary services, involve a problem that goes beyond those of contractual relationships between provider and user: the medium is global and the content is often not punishable by national laws or regulations. Nevertheless, a number of control options exist to prevent access to questionable content: parental restrictions on the use of the home computer, mechanisms that log activities for a subsequent review of the visited sites and their content, the automatic interception and blocking of certain materials by specifying unwanted keyword or file types, and the systematic blocking of particular sites.[67]

These mechanisms enable the self-control of the users, supplemented by actions of the service providers. Content providers can offer another mechanism to control contents by labeling these materials and independent review agencies can label content as well. One such system could be the Platform for Internet Content Selection (PICS) that offers the flexible classification of materials according to the specific locational or personal situation of the user. For example, materials that are offensive in one country may be acceptable in another; the classification follows accordingly and automatically. Three basic mechanisms are conceivable: black lists, white lists, and neutral labeling. The authors of black lists collect those sites that offer unwanted content. The user implements these lists in his or her browser software to automate the processes, for example, based on certain keywords that appear in the material. The disadvantage of black lists is that the user must continuously update these lists. White lists enable the access to only specified sites and are therefore highly restrictive. Editorial services can also provide neutral labeling that is based on own selection criteria. All these mechanisms involve certain degrees of trust between providers and users.

Technological options to restrict the viewing of controversial materials therefore exist. One problem that remains is the definition of what type of content should be related to what type of obstructive mechanism. Another problem is the necessary creation of a critical mass of preferable technologies, as the Commission recognizes. The Commission has proposed a network approach to solve the operational problems of technological devices. In addition to political cooperation between the member states, industry should cooperate on a code of conduct and common standards for labeling. Such a common approach may promote the creation of a critical mass of users. Furthermore, users and user associations should participate in labeling procedures and market surveillance. Finally, supplementary efforts should be undertaken to educate and raise the awareness of users and parents on the existing risks (awareness raising campaigns on the Union level).

---

[67] In the United States, various control mechanisms have already been introduced. Experience shows that they are not perfect. However, perhaps the expectations are misplaced: while one can perhaps control access to questionable material in one's own home, it cannot be realistically be prevented that children go to their friends house and view such contents there, whether they be on the Internet or in the parent's printed Penthouse.

In sum, the Commission's strategy to control illegal and harmful contents is twofold: the pursuit of illegal activities regardless of the medium, and self-regulation in combination with technological devices and educational activities, implemented by the member states. The Commission claims responsibility for the achievement of a basic common framework and informational mechanisms.

d. Intellectual Property Rights and Copyrights

The issue of intellectual property and copyrights has received considerable political attention in Europe since the late 1980s, more than cryptography or privacy issues. In 1988, the Commission published the Green Paper on Copyright and the Challenge of Technology, the first principle outline of the issue area [Commission, 1988]. In January 1991, it approved the "Follow-up to the Green Paper: Working Programme of the Commission in the field of Copyright and Related Rights" [Commission, 1991]. In 1994, it published a Green Paper specific on the audio-visual industry [Commission, 1994c] and subsequently held hearings on the issue [Commission, 1994d]. The Commission argues that the "protection of copyright and related rights has become one of the essential components in the legislative framework which underpins the competitiveness of the cultural industries. Only if these rights are properly protected will there be the incentive to invest in the development of creative and innovative activity, which is one of the keys to added value and competitiveness in European industry. It has become clear that industry will invest in creative activity only if it knows it can prevent the results from being improperly appropriated, and can enjoy the fruits of its investment over the period of protection conferred by copyright and related rights" [Commission, 1995d, 11].

The Commission has been pursuing a common approach on issues such as the exhaustion of rights, the reproduction right, public communication and private use, and other related themes. Let us briefly review the laws and guidelines that exist in the European Union regarding intellectual property rights and copyright.[68] The first important issue concerns the exhaustion of rights. When the authors or owners of intellectual property sell copyrighted material in the internal market, then they lose the right to subsequently control these materials. In other words, the works can be further resold or distributed without restrictions. If, however, the author or owner attaches a service to the material, such as a performance or a broadcast, then he or she must authorize each transaction and can restrict further distribution. The Commission argues in its 1995 Green Paper on Copyrights that this principle should be extended to Information Society services: "Unlike the distribution right for material items, the different rights attached to services transmitted by electronic means can hardly be made subject to exhaustion. In fact, every service supplied (e.g. broadcasting, rental, or lending) is an act which must be authorized separately, without prejudice to future forms of exploitation" [Commission, 1995d, 48]. Presently, it is not clear whether the exhaustion of rights applies to different media types. Take the following example: a major weekly magazine publishes a CD-ROM version of its printed materials, including copyrighted pictures. Have the creators exhausted their rights by selling the pictures to the publishers, or is the transformation of the photographs a transformation of copyrighted material that is protected by the moral rights principle? This case, which indeed happened and which is concurrently under legal consideration in Germany, necessitates a common legislative response.

The reproduction right is another important element in the Information Society. Principally, the rightholder has the right to authorize or restrict the reproduction of copyrighted materials. When control is not possible, one could impose levies on equipment or recording media. For example, consider the new medium of a Digital Versatile Disk (DVD), a high-capacity CD-ROM. In the medium term, it will be possible to copy these disks, thereby complicating the owner's control. A levy on playing and recording devices could secure the income of the rightholders.[69] The present problem is that the reproduction right is not clearly defined in the European Union. Member states can individually determine what amounts to unreasonable exploitation, as Paragraph 2 of the Berne Convention states: "It shall be a matter for legislation in the countries of the Union to permit the reproduction of such works in certain special cases, provided that such reproduction does not conflict with a normal exploitation of the work and does not unreasonably prejudice the legitimate interests of

---

[68] This discussion relates only to supranational guidelines, mostly those that pertain to the internal market. Additional laws or guidelines may exist on the national level, as long as they do not obstruct the operation of the internal market.

the author” [quoted in ibid., 51]. While the Commission acknowledges that this is a complex issue, it promotes the protection of digitized works. This is similar to the legislative initiatives in the United States. A public response, however, does not exist as this issue attracts almost no publicity at all, despite the Commission’s substantial legislative activities. Furthermore, no common position exists between the member states. The Commission pledges therefore for a common response to prevent market fragmentation.

A communication to the public, the third issue, includes the publication of works in broadcasts, plays, and performances. The Commission plans to protect the holders of direct and related rights. On the private use of these works, some uncertainty exists. The Commission recognizes that private use of materials becomes increasingly important in the Information Society; the works become an important economic variable to an extent that did not exist before. Thus, the problem is one of balancing rights: ”If it is too broad, rightholders will hesitate to allow their works to be used on the networks. If it is too narrow the public may well stay away from the information superhighway in disappointment” [ibid., 54]. As in the other aspects, the Commission pursues the achievement of a common approach in all member states.

The fourth issue is the digital dissemination or transmission right and the concept of fair use for educational facilities. In this case, the Commission calls for a balance between public interests and those of the rightholders. How to specifically achieve this balance has not yet been clarified.

The fifth issue concerns the moral rights of the author. Moral rights regulate the modification and adaptation of digital works. Principally, the rightholder can authorize or prevent any modification or adaptation. While the principle of the exhaustion of rights is relatively clear when pertaining to complete and un-modifiable works, it is not when works can be modified to an extent that they lose their integrity.[70] In hearings on this issue (November 30 - December 1, 1992), a conflict surfaced between authors and performers, and publishers, press, broadcasters and employers. One side argued that the

---

[69] Whether specific country codes that inhibit illegal copying, or other copy control mechanisms, will be implemented is not yet clear. In the history of computer-mediated communication, almost all copy control mechanisms were cracked, at least those of mass-market products.

[70] The manipulation possibilities are enormous today. In the past, the manipulation was mostly limited to photo collages or the cutting of films. Otherwise, the manipulation devices were far too expensive for private use. Today, one can cheaply undertake substantial manipulations. A good example is the movie Forrest Gump, in which the actor Tom Hanks shakes President Kennedy’s hand.

overprotection of moral rights would create uncertainty and obstruct investments of those who publish and disseminate the works. The ADMedia Report of November 1995 criticizes that publishers have the least rights; the present status ”does not reflect the levels of creativity or investment made by publishers, particularly those of new multimedia products” [ADMedia, 1995]. Authors and performers, on the other side, fear for the protection of their creative work and the undue advantages for producers.

The sixth issue on the regulatory agenda concerns the acquisition and management of rights. In the multimedia and online world, the problem exists of identifying and remunerating the authors. One possible method is licensing and management by a collection society. The present problem is that in some member states, the presumption exists that the producer has the management right, without having to prove this. The Commission’s position is that a common framework is needed, but also leeway for a flexible response to account for particular technologies. It rejects mandatory schemes or compulsory licenses. It rather stresses the freedom of contract. Accordingly, the Commission promotes cooperative approaches between the relevant actors. The last issue concerns technical systems of protection and identification. Principally, as in the issue of rights acquisition and management, the Commission opposes compulsory schemes. Furthermore, it rejects the idea that manufacturers enforce proprietary programs that are predominantly in the interest of the manufacturer. One identification method could be the initiation of a system that is similar to the ISBN-system for books, although the Commission recognizes that such a system may be inadequate for digital works as parts can be extracted or manipulated. To substantiate its positions, the Union has been evaluating technological identification systems in the context of CITED, an ESPRIT program. This program has the purpose of developing safeguards for digital technologies.

The European Union has passed several directives on intellectual property and copyright. Four of these are relatively uncontroversial: the ”Computer Programs Directive” on the protection of software programs [Council, 1991], the ”Rental Right Directive” on rental and lending rights [Council, 1992], the ”Satellite and Cable Directive” concerning copyright in terms of satellite broadcasting and cable retransmission [Council, 1993], and the ”Terms of Protection Directive” that harmonizes the terms of protection of copyright to 70 years and certain related rights to 50 years [Council, 1993b]. These directives are relatively uncontroversial because they do not involve the redelegation of rights between the various actors involved. The "Databases Directive", however, is controversial [Council, 1993c]. It protects databases to an unprecedented extent; especially Americans have criticized its extent (for the American reaction and its legislative equivalent of this directive, see Chapter 3). The Commission argues that "considering the considerable investment of human, technical and financial resources necessary to create a database, and given that those databases can be copied at a much lower cost than that of their development, such legal change is important. Unauthorized access to a database and the extraction of its contents are thus acts which can have grave technical and economic consequences" [Commission, 1995d, 32]. The directive defines the protection of databases as extending to 15 years unless "there has been substantial new investment", in which case the protection is extended for another fifteen years [ibid.]. This directive is controversial because it awards protection for electronically-upgrading information that is often in the public domain, for example, official governmental data that has been collected at the taxpayer's expense. Furthermore, it creates a separate right for database owners that is distinct from the creators of works. On the other hand, the indexing of data is an expensive task that requires protection.

While the issues of intellectual property and copyrights are highly complicated, they have an added dimension in the European Union: very different traditions exist in the member states that are likely to cause very different responses. The Commission's plans are not uniform: on one hand, it proposes a harmonization on the Union level because without such a harmonization it fears the re-fragmentation of the internal market. On the other hand, is also promotes the application of the principle of mutual recognition. What demands will be derived from the technology itself and from the legal traditions, and what final shape the approach of the European Union will have, is not yet clear. Since, however, the European Union has been active in this issue for quite a time, it has been able to influence the international World Intellectual Property Organization-negotiations. These negotiations may thus yield a satisfactory outcome, especially as they may force a common European position that forestalls individual exemptions.

e. The Workplace and Workers' Protection

Many member states in the European Union have a strong social-democratic tradition that the United States and Japan lack. The definition and execution of these traditions has been a matter of the member states. The Commission, however, wants to strengthen its role in social issues. A component of the Maastricht Treaty was the Social Charter that calls for the harmonization of basic social issues. One of the harmonization issues is work relations between employers and employees. The Commission pledges to provide "the right legal and contractual framework (labor law, collective agreements, industrial relations etc.) to allow firms and individuals more flexibility, while providing adequate security to workers" [Commission, 1996a, Chapter 3.5]. It argues that such a framework must be implemented on the supranational level because "Member States' labor laws based upon the standard model of full time, workplace-based employment of indefinite duration, can no longer respond entirely to the needs of a more knowledge-based production of goods and services" [ibid.]. New technological developments create substantial definitional problems that did not exist in the classic industry-based economy:

> New work organisation practices tend to blur the central element of the classic employment relationship: the notion of employer is becoming more complex (groups of undertakings, joint ventures, networks, subcontractors); the location of work has diversified; working time practices have been individualized to respond to particular needs and requirements; time-based remunerations may in some cases be replaced by task-specific remunerations and the scope of workers' autonomy enlarged. In other words, wage employment and self-employment are tending to converge, rendering the scope of labor law unclear and reducing its effectiveness in certain fields (non-standard contracts, telework and where work is outsourced or externalized) [ibid.].

The Commission argues that a new framework for the Information Society "requires a more sophisticated and fundamental debate on the institutional framework which can shape this new world of work" [ibid.]. The new forms of work, such as part-time work, temporary work, fixed term contracts, teleworking, and new forms of employment relationships must be defined to an extent that they remain compatible with the principle of social security. Flexible employment should not imply a loss of employment, social and health benefits, and safety protection.

To explore the wider societal implications of computer-mediated communication, the Commission has enacted the High Level Group of Experts on

Social and Societal Aspects of the Information Society. Among the six priority themes, one theme concerns working conditions and organization. In January 1996, it published a first assessment of the issues in "Building the European Information Society for Us All" [Commission, 1996f]. This report calls for policy action in areas such as retirement and work times, the organization of social relations, remuneration systems, and home-based teleworking.

The harmonization of social issues, however, does not seem feasible in the short- and medium-term. While social issues, especially issues on the workplace, pertain to the completion of the internal market and the removal of market barriers, member states are already reacting on the national level to the implications of labor mobility.[71] Thus, the assessment of this issue is similar to the one of supplementary technology policies: a harmonization of guidelines may be desirable for the completion of the internal market, but their enforcement is not likely in the near future. Economic policy continues to diverge strongly between the member states; related social issues are likely to diverge as well.

## Conclusion

Politics on computer-mediated communication has not had the same salience in the European Union as in the United States. Although the European Commission has addressed the principle political issues of computer-mediated communication, it has not been able to attract wide public interest for its positions and plans. When legislative or administrative issues appeared in public at all, they have mostly been subsumed to the perennial struggle over political competencies and authorities between the different political levels in the European Union, from the supranational to the national and subnational ones. The struggles between involved actors have not originated from the changeover from old to new technological paradigms. Neither the defense implications nor the issue of law enforcement have yet been subject to political initiatives on the supranational level, in clear contrast to what has happened in the United States since the end of the Cold War. The member states have acted, if at all, predominantly on the national level.

---

[71] For example, Germany has implemented minimum wage levels that apply to all construction workers; a practice which may not confirm with Union law.

While in the United States, Congress has been the principle initiator and promoter of political action, supported by the interested President and Vice President, in the European Union, the Commission has assumed the same role, but with a different approach and intensity. Subsequent to the turbulent after-effects of the ratification process of the Maastricht Treaty, the Commission has been forced to maintain a low profile as the public in many member states feared excessive political centralization. The Commission understood that a centralization and active technology policy approach would be politically futile, especially as a consequence of the implementation of the subsidiarity principle. It recognized that its active role was constrained due to its limited funding capabilities and as the member states clearly dominated technology policy, both in its active and passive options. Instead of taking a visible role, its various Directorate Generals have worked laboriously to define and initiate legislation.

To accommodate these underlying political currents, the Commission's approach changed significantly in the early 1990s from the support of large-scale projects and high-end technologies, the practice of the previous decade, to a promotion of wider societal penetration and integration of these technologies. The proponents of the new, "horizontal" approach pledged a reduction of central economic steering and intervention, a greater emphasis on the support of modern industries and less on the maintenance of declining ones, more regional than sectoral emphases, and a greater integration of the different economic policies of the member states. Rather than acting functionally and unilinearly, and thereby assuming that these technologies can principally raise technological, and thereby, economic competitiveness, the Commission recognized that a socially-integrated strategy, or, in other words, a substantive vision, can aid in overcoming historic problems that have existed in the history of the European Union. The Commission also assumed greater coordinating activities, supplemented by institutionalized transparency mechanisms designed to improve the oversight process. The diffusion and utilization of innovations, rather than their direct subsidization, standardization activities, and technological transfer processes became the centerpieces of the Commission's strategy of the 1990s.

The Commission's vision has been that the promotion of computer-mediated communication could assist the long-term aim to create an European identity and thereby reduce, by means of an improved communications infrastructure, national economic cleavages. Furthermore, the Commission recognized that what had previously always been considered as a principle obstacle to European integration, the existence of multiple cultures, linguistic traditions, and economic and social systems, could prove to be an important input in the production of substantive visions. This is “collective projection”, the recognition that the Single Market initiative could be forcefully supplemented by a visionary outline of a future “Information Society”. The successes of the United States, which have built on a high degree of diversity, could possibly be reproduced in the European context. “Synchronous preadaption”, the linkage of different actors with various evaluation mechanisms, has been successful, at least to a certain degree. The outputs of the European Commission prove this: they cover the subject areas with a higher degree of subject knowledge, actor inclusion, and comprehensiveness than they have in the past and than the legislative products of the member states. While the member states have focused predominantly on isolated islands of the subject matter, the Commission has had a superior overview of European developments, especially as its underlying political mandate has been the achievement of the Single Market. “Functional equivalent”, the recognition and preparation that decision-making rules have to change in the emerging paradigm, however, has not been achieved: the strongest obstacle to a complete substantive vision has been the failure to redesign rules and decision-making procedures, away from national predominance towards a real supranational polity that does not only involve the bureaucrats and legislators of the member states, but also new forms of political participation.

In its technology policy approach, the Commission has concentrated on a three-prong strategy: the expansion of existing basic information transmission networks, the promotion of applications and content, and especially, to overcome what has been a significant bottleneck, the promotion of the compatibility and interoperability between the individual national networks. The newly enacted European Information Infrastructure Task Force has supplemented these efforts by defining guidelines and priorities. The technology policies of the members, however, continue to diverge, both in subsidization levels and emphases. Additionally, in supplementary technology policies, the member states have not actively pursued the integration of their economic policies generally, and their technology policies specifically. Social, health, and education policies remain in the domain of the member states, or even a level below – which is not a disadvantage *per sé* as a centralization of all decisions and processes in these issue areas would oppose the principle of subsidiarity, but which makes a supranational approach to the management of a paradigmatic change more difficult. The pending monetary union, envisioned to be enacted with a parallel convergence of economic policies, has been reduced to coordination and integration of the currency domain. The Commission has no power over passive technology policy instruments such as tax incentives or interest rates by means of budgetary policies. It cannot flank its technology policy measures as general economic policies vary across the member states. Thus, the Commission has limited influence over supplementary technology policies.

Regulatory questions arise especially during a paradigmatic technological change. These regulatory questions demand transnational or even global responses. They cannot be solved without forcing wide societal debates as such debates could improve the information base of decision-makers. In this context, the Commission has confronted a dilemma, as has been mentioned above: if it pursues an open public trans-European discourse on computer-mediated communication, it may also force a public debate on its appropriate competencies. Such a debate may or may not be decided in its favor, depending on what version of the subsidiarity principle ”wins”, the necessity or the efficiency version. Thus, to force a public discourse is risky for the Commission and for the Union. With the maintenance of a low-key approach, however, no trans-European debate can develop on important issues such as privacy, protection from harmful materials, or intellectual property rights as these issues are embedded in national and cultural traditions. Markets refragment as a consequence of non-action; barriers-to-entry remain higher and economies-of-scale lower than with a unified approach to regulatory policy, or at least to minimal regulatory standards. Unsolved political competencies currently obstruct a societal approach; many necessary political actions remain in proposition format. The Commission has outlined a substantive vision and precise action plans, but without a public supranational debate, the feasibility to actually implement these policies in a consistent and timely manner is low.

The failure to provide a trans-European discussion forum is also a consequence of the old technological paradigm. Broadcast and information systems have been predominantly nationally-oriented. Advances in computer-mediated communication now theoretically enable the creation of a trans-European information space; for example, many of the activities in the Internet have a recognizable trans-European dimension, in commerce, politics, and research. The national governments, however, continue to treat the subject matter in the national context, and the information that circulates on the initiatives of the neighboring countries is limited. The action plans of the Commission to improve the level of information that circulates, such as information days and materials, have been met by an interested, but rather small group of listeners. No visible leaders, either political or those coming from the relevant industries, have been able to bundle the Commission's vision.

The Commission's approach to regulatory policy has been consistent across the different issue areas: it wants to achieve a harmonization of minimal standards, leaving the execution and administration of policies to the member states. The deregulation of the telecommunications sector is the most straightforward and least controversial regulatory issue. Deregulation has been widely accepted in the European Union as it is argued that it enables competition and thereby greater welfare. Nevertheless, other regulatory issues are likely to pose problems in the future. For example, the different opinions over anti-trust policy and the permission or obstruction of national, European, and European-non-European enterprise mergers, especially as previously clearly separate and identifiable economic sectors have begun to intermesh in the new technological and economic paradigm. The Commission does frequently accept mergers that implicate a concentration of market power. It has recognized that at this stage of technological development, the concentration of market power is required so that the necessary investments are made. Instead of preventing such mergers, it has focused on the prevention of abuses by the newly-created giants. The Commission has punished violators by imposing fines, however, this instrument is often not effective as large enterprises "with big purses" often prefer to pay the fines while continuing the punished practice.

Other issues remain unsettled, despite the advanced state of policy considerations. Among these are the European-wide universal service concept, encryption as a method to protect personal privacy, the protection of minors and human dignity, intellectual property rights and copyrights, and workplace issues. Complicated trading processes of multimedia rights and the excessive regional and national orientation of content providers are other prominent problems, as well as limited and complicated access to public sector information. The source of the stagnation is not clear; on one hand, politicians in the member states have displayed a considerable lack of knowledge – even the most fundamental Internet application, the use of e-mail, has been a rarity among policy-makers. On the other hand, national traditions have promoted the articulation of different responses. The Commission itself appears to be highly informed as it has consulted various experts from industry and associations and as it has closely watched the developments in the United States. The quality and detail of its proposals speaks for itself. The communication of this knowledge to the parliaments and executives of the member states, however, does not function well. Most national leaders have responded with the attempt to apply existing laws to novel issues, thereby risking the refragmentation of the internal market. The principle remaining basic conflict areas, however, originate in the concurrent diverse structure of the European Union:

- the pursuit of the subsidiarity principle while promoting a harmonization of policies;
- the efforts of the Commission to centralize base research to overcome the logic of collective action while having only limited budget authorities;
- the desire to overcome the considerable North-South divergence in technology funding without thereby violating economic efficiency considerations;
- divergent interests between small and large countries: the latter have greater resources and therefore depend less on supranational efforts, resulting in conflicts over communal technology policy strategies;
- the implementation of Union regulation: frequently, larger member states stall on decided deregulation, while smaller countries are more open and already more deregulated; this may forestall the development of competition in the internal market.

Despite these problems, the prospects of the European Union to successfully manage the paradigmatic change towards the "Information Society" are good. The Commission has been able to integrate its strategy on computer-mediated communication technologies in its Single Market strategy. The bottom-up dynamic is strong, especially as falling barriers have contributed to multicultural exchanges and the unleashing of creative potentials. The developments have been lagging behind those in the United States – some estimate this lag to be three to five years, especially in the service domain – however, the lag is unlikely to persist in the medium-term. The problems that exist in the European Union, regional divergence and low degrees of labor mobility, are less problems of the management of paradigmatic changes, than the inability to solve the undecided political competencies between the supranational and national political levels.

# Chapter 5

# Computer-Mediated Communication and Technology Policy in Japan: The ”Intellectually-Creative Society”

## I) Introduction

Following four decades of one-party rule of the Liberal Democratic Party, the Japanese political system has been in a process of fluctuation and change, leading to a greater formal opening of the Japanese political system. The strong role of the bureaucracy, however, has preempted fundamental changes, both in terms of the ruling party and of underlying laws and processes. Unlike other democracies that place strong emphasis on the balance of power between the legislative, executive, and judicative branches of government, in Japan bureaucratic leadership and public-private coordination dominate the public policy process, especially in the domain of economic policy [Japan Economic Research Institute (JERI), 1995].[72] Four important cultural factors underlie such political processes [ibid., Chapter 2]. First, groups are highly autonomous: "It is assumed that any group possesses the resources to make decisions concerning matters within the group's sphere of responsibility. Only if the group cannot reach a sufficiently well-supported decision by itself will an appeal for assistance be made to some higher authority". The bureaucracy in particular exhibits a strong group character that is highly immune to external penetration and influence, even that of the executive that formerly stands above the bureaucracy. Second, the decision-making process within groups emphasizes three factors: the group must be sufficiently large, decisions must be unanimous, and "unanimity in decision making results in the ability to render an almost unlimited range of decisions considered valid by the group". While unanimity in the decision-making process underlines the validity of the decisions made, a highly important factor in "selling" political ideas to the public, it can also suppress alternative opinions and ideas. Third, a tendency exists "to blur the distinction between reality and the way reality is described and viewed". This is also called "Japanese monism", the philosophy that sincerity and hard work lead to the desired outcome, and that speaking of undesirable possibilities should be avoided as that could provoke their occurrence. JERI argues that "[s]uch phenomena as boundless Japanese faith in technology may also have their source in this way of thought". Fourth, "hermeneutic thinking" (Yasusuke Murakami) describes the adoption of different philosophies and

---

[72] On the Japanese political system, see Abe, Shindo, and Kawato, 1994; Curtis, 1988; Hrebenar, 1992; Ishida and Krauss, 1989; Kevenhörster, 1993; Kishimoto, 1982; Kishimoto, 1988; McCormack and Sugimoto, Eds., 1986; Menzel, Ed., 1989; Pempel, 1992; Pohl and Mayer, Eds., 1994; Ward and Yoshikazu, Eds., 1987.

viewpoints to accommodate ”a multiplicity of coexisting ways of thought”. The Japanese Economic Research Institute summarizes the influence of these cultural factors:

> These four cultural elements may have contributed significantly to the emergence of the Japanese-style market economy, with the egalitarian tendency derived from autonomy of groups fertile soil for the growth of redistribution policy adopted as part of the developmentalist agenda in order to prevent dropouts, the emphasis on consensus-based decision making having led to the system of bureaucratic leadership based on public-private harmony, the do-your-best approach of Japanese monism having fostered the sentiments of ”companyism”, and hermeneutic thinking having led to the adoption of a mixture of the economic systems of various countries [1995, Chapter 2].

The Japanese-style market economy with its egalitarian tendencies, as just described, has clearly been a success factor in the catch-up years following World War II. High growth and low unemployment rates, supplemented by a high degree of unanimity and consensus on the methods and aims of the political system, have enabled Japan to become one of the most successful economic actors of this century. Recent signs of economic and political distress, however, point to a slow but forceful downward trend that may have its source in the changing technological paradigm, a paradigmatic change that calls for more individuality and flexibility, and even for dissention, factors that have not been deeply engrained in the Japanese political system.

Although its influence has lessened since the beginning of the 1970s, the bureaucracy holds a strong role in the policy-making process.[73] It does not only administer policy, but it also formulates it, as Chalmers Johnson describes: ”the elite bureaucracy of Japan makes most major decisions, drafts virtually all legislation, controls the national budget, and is the source of all major policy innovations in the system” [1982, 20-21]. The Prime Minister and his cabinet have little control over the bureaucracy, as William Nester outlines: ”As a political appointee, the minister's main job is to ratify policy and budget decisions made below him, and then lobby for their enactment. So the cabinet is more a collection of ministers than an institutionalized decision-making body” [1990, 82].[74] Parliamentary powers are limited, as well.

---

[73] On the role of the bureaucracy, see Campbell, 1989; Inoguchi, 1991; Johnson, 1989; Pempel, 1989, 1992.

[74] Other authors offer a different assessment of ministerial power: for example, ministers have to pass a number of obstacles on their way to power, such as intra-party fractional fights. Furthermore, they

Parliament ratifies, but does not formulate policy. Policy battles are usually already decided in the ministries and their bureaucracies before they enter the Diet. One reason that the bureaucracy holds a strong position is that the executive cannot appoint key bureaucratic officials and thereby alter the bureaucratic policy strategy. Furthermore, the ministries have significant budgetary autonomy. Johnson offers the following assessment of the political process in Japan:

> Politicians reign but do not rule, the actual decision makers are an elite bureaucracy of economic technocrats; the system works by serving those interests that are necessary to perpetuate it … but it otherwise excludes parochial interest that would deflect it from developmental goals; and since bureaucrats are guided by principles of economic rationality and *raison d'etat*, they ultimately serve national economic interests and are legitimized by popular nationalism [1988, 87].

A by-product of this political mechanism of strong bureaucratic power is that the different bureaucracies exhibit considerable rivalries in the articulation of economic policy, mostly because of increasingly overlapping interests in an increasingly complex world.[75] We will return to this important point below.

Another feature of the public policy progress is the large number of intermediate semi-public, semi-private institutions and forums. Their principle purpose is to mediate between the public and private sectors to promote the exchange of information and opinions [ibid.]. Such interaction often achieves a high degree of consensus before a policy proposal enters the legislative process and thereby avoids the often time-consuming and conflicting processes that are characteristic of other democracies. The interaction between the bureaucracy and the private sector is highly pragmatic in which ”[b]ureaucrats have not simply implemented laws and regulations but have used their discretionary authority to build agreements with the industries they regulate, conducting unofficial contacts grounded in mutual trust before coming out with official decisions” [ibid.]. Part of this process is the emphasis of an industrial policy that promotes the development of industries, limits competition, and rather stresses the cooperation between enterprises ”to avoid dropouts” [ibid.]. A redistributive policy supplements

---

maintain their own power base as they have a direct influence over other's careers. See for example, Park, 1986.

[75] Neuschwander notes that the power struggles are understandable. When a ministry obtains greater responsibility in a certain domain, that also reduces the power of the other ministries. The changes in industrial structures therefore promote a structural change in politics [1994, 69]. Hollerman adds that

this developmentalist strategy. JERI describes the Japanese-style market economy and the governmental role therein as follows:

> If we were to attempt to encapsulate the Japanese-style market economy in a single set of phrases, we could say that it consists of the use of developmentalist policies and systems as the medium for a calibrated combination of centralized control and direction by a vertically divided bureaucracy seeking planned rationality and decentralized, autonomous activities by private-sector corporations, particularly those in high-productivity sectors. A still more abbreviated description might be a skillful balance of competition on the one hand and coordination among companies and intervention by the government on the other, in a marketplace divided into orderly segments by the regulators [ibid., Chapter 2].

The close interaction between the bureaucracy and the private sector benefits large corporations and punishes newcomers and smaller enterprises. Large corporations can more efficiently organize their political resources. They often benefit from the entry of bureaucrats into the enterprise following their retirement. These bureaucrats-turned-consultants provide important insights into political processes and maintain considerable influence on their former colleagues in the ministries.[76] Additionally, some higher corporate employees enter the political process, but remain loyal to their former employer. Consequently, the policy process often remains closed and not transparent to the public, often raises corporate interests above consumer welfare and interests, and sometimes appears to be arbitrary to outsiders. This was especially problematic in view of the decades-long monopoly on government by the LDP. Thomas Neuschwander comments that LDP's power monopoly has lead to vertical relationships between ministries and the benefactors of industrial policy.[77] Other ministries or groups have had few opportunities to influence these policies. Interest groups' and disenchanted enterprises' only recourse was to support the opposition, which was mostly without benefit and which often prompted a revengeful reaction by the LDP-dominated ministries [1994, 88-89].[78]

---

"Japanese government ministries operate as though they were firms in oligopolistic competition" [1988, 9].

[76] See, for example, Allinson and Sone, Eds., 1993; Bernstein and Fukui, Eds., 1988; Calder, 1989; Harari, 1974, 1988; Johnson, 1982, Chapter 2; Park, 1972; Pempel, 1974; Schwartz, 1993; Schaede, 1995.

[77] On the LDP and its rule, see Baerwald, 1986; Kohno, 1992; Pohl, 1989, 1994; Tomita and Hrebenar, 1992.

[78] On the role of the opposition, see Hrebenar, 1992; Ishikawa, 1994; Shiota, 1994; Stockwin, 1982, 1989. On LDP's loss of power and the subsequent government, see Anderson, 1993; Ando and Angel, 1994; Foljanty-Jost, Ed., 1996; Foljanty-Jost, 1996; Inoguchi, 1993.

This chapter introduces the Japanese vision of an ”Intellectually-Creative Society”, the strategy and aims, and the policy process since the 1980s. A new technology policy style emerges, however, mechanisms from the past, especially the feature of closed negotiation processes, have yet slowed down the political promotion of computer-mediated communication technologies and their proliferation throughout society. On the other hand, strong technological constraints have developed, most prominently in the software domain where the United States and, to a lessor degree, the European Union have been dominant. These constraints have limited choices and influenced the technological and regulatory developments of Japanese society.

## II) Japanese Politics and the Creation of an ”Intellectually Creative Soviety”

### A. The Vision

Since the 1980s, the Japanese government has been pursuing an integrated, long-term strategy to promote the technological development of society. Computer-mediated communication has become a centerpiece of this strategy, at least rhetorically. Unlike the United States, the Japanese government has pursued a top-down strategy originating in the bureaucracies of various ministries, especially the Ministry of Posts and Telecommunications (MPT), and the Ministry of International Trade and Industry (MITI). While this strategy emphasizes the strong input of enterprises, they are often forced to await policy action by the Japanese government. Concrete policy action, however, has been slow.

The principle, long-term vision is the creation of an ”Intellectually-Creative Society”. The Telecommunications Council, an advisory committee to MPT, defines an Intellectually-Creative Society as ”a society in which intellectually creative activities play a dominant role and become economic assets” [Telecommunications Council, 1994, Introduction]. If intellectually creative activities become major economic assets in the future global economy, ”then the only path open is to shift to a new paradigm leading to the next century and build such a society. This society will require that information and knowledge, which are the products of human intelligence, be freely generated, circulated, and shared, in place of the consumption of massive amounts of energy and goods". In this context, a high-performance computer-mediated communication infrastructure is essential in the achievement of such a society as it enables the free and unimpeded flow of information:

> The approach of capitalizing on info-communications means a change from the 20th century's dependence on goods and energy to the 21st century's focus on creativity born of information and knowledge. In the Intellectually-Creative Society based on high-performance info-communications expected in the 21st century, information and knowledge will necessarily become the most important social and economic resources, and the free creation, circulation, and sharing of these will become the very cornerstones of society. … Japan needs to create a social environment that can fully capitalize on information and knowledge in order to resolve the increasingly more complex problems facing the country and to build a society that emphasizes intellectually creative activities. To facilitate this resolution, it will be essential to have a new, high-performance info-communications infrastructure in which both information and knowledge can be freely created, circulated and shared. Accordingly, a shift in perspective is already occurring in which the goods- and energy-oriented society is giving way to one oriented toward information and knowledge [ibid., Section 1].

One impetus for action is the perception that Japan has fallen behind the developments in other nations, especially those in the United States. An improved computer-mediated communication infrastructure – Japan has had considerably lower proliferation rates of computer-mediated communication equipment (see Figures 5.1 and 5.2) – could not only promote internal demand, but also reduce trade surpluses that have become a conflictual issue in international relations, especially in the economic relations with the United States. Moreover, environmental problems are increasingly global. A computer-mediated communication infrastructure could promote a shift away from resource-intensive consumption and reduce emissions from business traveling.

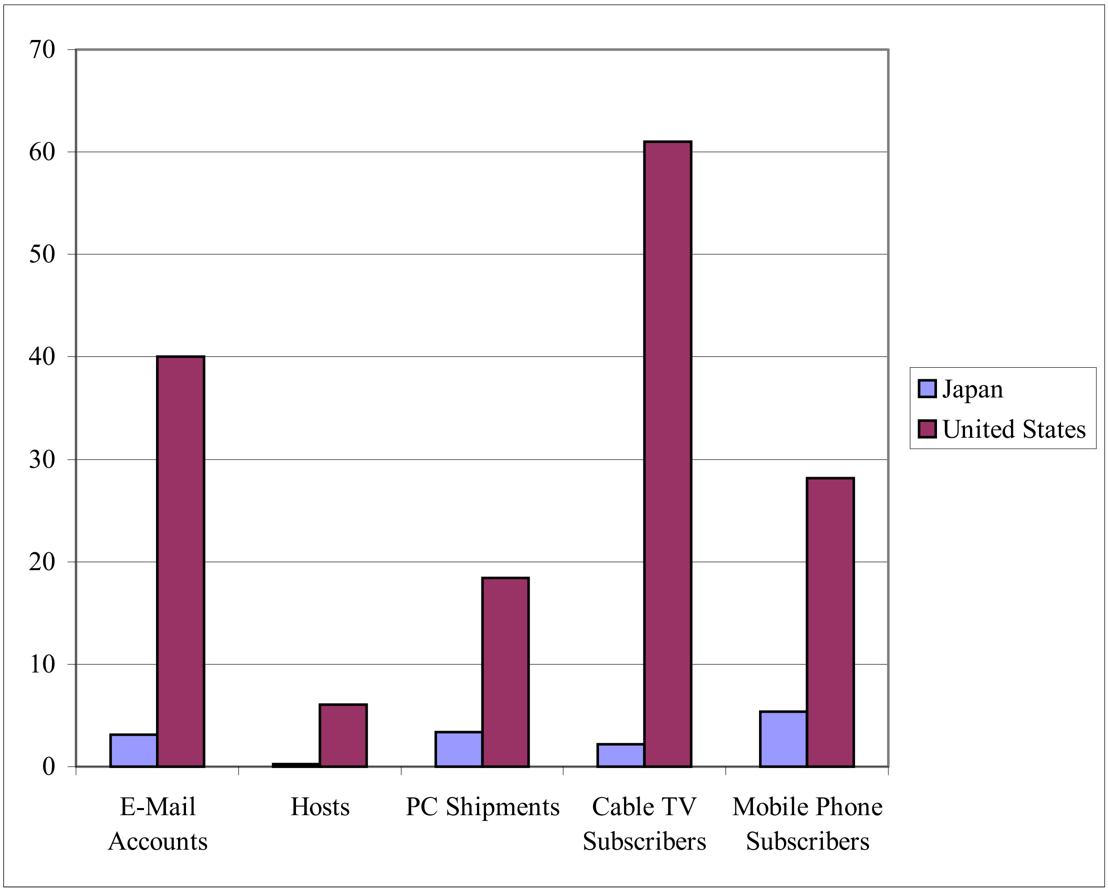
Not only international considerations but also long-term domestic developments serve as an impetus for action. First, the Telecommunications Council, the principle advisory council to MPT (see also Figure 5.5 below), cites the aging population. An aging population eventually requires a reform of medical and welfare systems because these systems had been designed for other demographic realities. Furthermore, an aging population causes a decline of economic activity. This trend necessitates greater productivity by those who work to maintain the same living standard for all; greater participation by the elderly, and better health care and nursing services such as remote care and diagnosis, could promote societies productivity in the future. A second impetus for action is the congestion of urban areas. Congestion causes higher housing and living expenses, environmental problems, and greater susceptibility to natural disasters. Furthermore, congestion explicitly implies a depopulation of rural areas, often to the extent that rural areas cannot offer basic services. A computer-mediated communication infrastructure, the Telecommunications Council argues, could create employment opportunities in rural areas, for example, by means of virtual or networked enterprises, improve health and education services, reduce information disparities, and promote more information exchanges. A third motivation for action derives from the globalization of the economy and consequential structural adjustment necessities in the country. An intellectually-creative society would be based on a resource-saving economic framework with new leading industries in the areas of information and communication, the application of computer-mediated communication technologies in traditional sectors, the implementation of new methods and processes in distribution, manufacturing and services, and greater efficiency in the office and in research and development processes. Fourth, an improved information infrastructure could promote a more comfortable living style. The streamlining of public services in health care, education, government administration, counter-disaster systems, road-traffic systems, and sports reservation systems, could create more leisure time.

In May 1994, the Ministry of International Trade and Industry (MITI) released a rival report on the creation of an advanced information technology infrastructure [MITI, 1994]. The report's purpose is "to clearly define MITI's concept of the directions that the advanced information infrastructure society should take, and to propose specific policy programs for each field in which information technology is being promoted in cooperation with the related ministries, based on the recognition that in the development of the new trend, the promotion of information technology has evolved from a simple vision to the stage of actual implementation" [ibid.]. The report also presents MITI's vision:

> As a result of rapid technological advancements in the information and communications fields in recent years, the advanced information infrastructure society has evolved from the realm of possibility toward becoming a reality in the near future. Although drawing a clear overall image of the advanced information infrastructure society is difficult at present, the simplest definition is that the significant decrease in costs of information transmission and processing, along with major reductions in time and space constraints related to information, will allow everyone to

obtain, process, and transmit information equally in the advanced information infrastructure society. … In the new information infrastructure society, anyone will ultimately be able to obtain and process information from anywhere in the world no matter where they are located, through a variety of media, and to easily transmit their own information to any point in the world. The pace of progress toward such a society, however, varies in the industrial, household, and public sectors according to the emergence of actual needs, cost trends, and development of application software [ibid., Chapter 1].

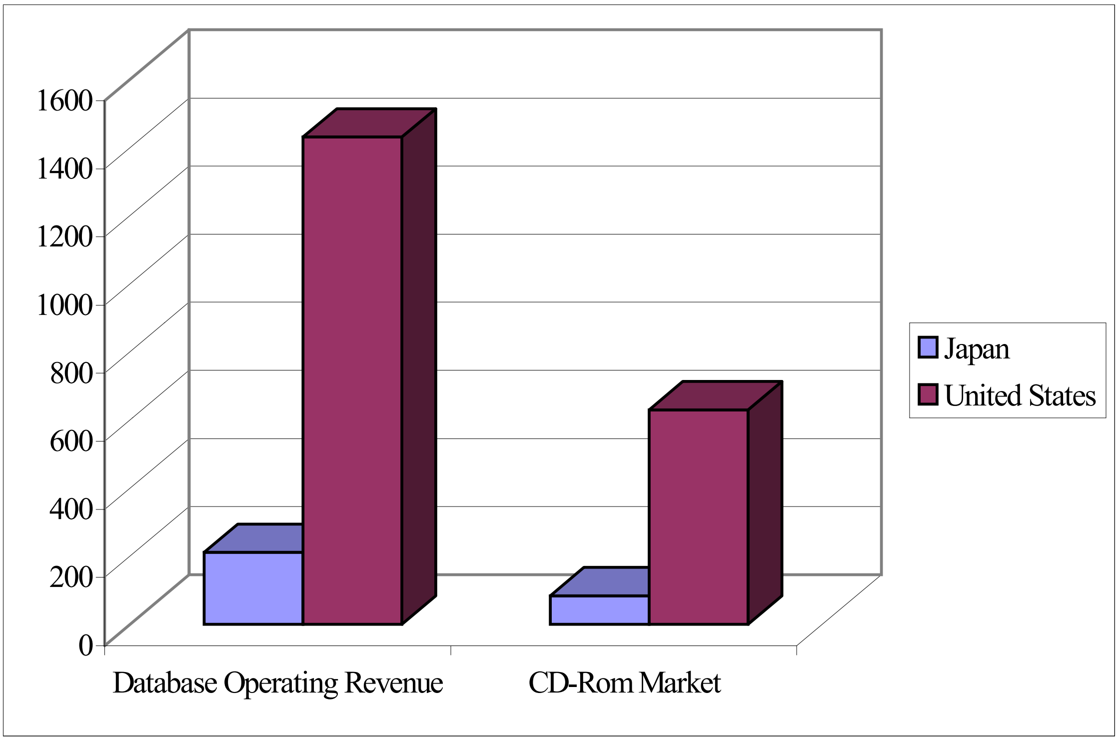
Figure 5.1: Selected Computer-Mediated Communication-Related Statistics, Comparison Japan and United States (in mill.)




Source: Telecommunications Council, 1996 (the data originates from selected 1993-1996 sources).

The MITI Report builds on the conclusions of the Information Industry Committee of the Industrial Structure Council (ISC) Report of June 1993. MITI emphasizes the rising importance of intellectual activities as compared to traditional manufacturing. At the same time, it criticized that the potentials of new information and communication technologies have not been exploited in Japan, especially in the fields of multimedia and networking. To overcome these deficiencies, MITI has proposed the following governmental conduct. First, the government should promote the use of information technology in the public sector, particularly in the areas of research, education, and administration. Second, it should foster an environment that is conducive to the dissemination of information technologies in the private sector. Dissemination could not only be improved by promoting adequate security measures and standardization, but also by modifying institutional frameworks. Third, it should promote the development of basic technologies that can serve as the technical foundation of advanced information systems. Thus, the report proposes both technological and institutional measures. Not surprisingly, MITI claims the responsibility to execute these plans.

Figure 5.2: Selected Computer-Mediated Communication-Related Markets; Comparison Japan and United States, Revenues (in bill. Yen)




Source: Telecommunications Council, 1996 (the data originates from selected 1993 sources).

While the bureaucracies of two top government ministries have offered substantive visions of the future Intellectually-Creative Society, the Prime Minister or members of the Cabinet, in contrast to President Clinton and Vice President Gore in the

United States, have not emphasized this issue. This appears to be consistent with the assessment that the bureaucracy holds a strong position *vis-à-vis* the executive.

## B. Long-Term Aim and Strategy

The Japanese government has recognized the enormous potentials of computer-mediated communication technologies. MPT estimates that new fiber optic infrastructure markets add up to Yen 56 trillion, the expansion of existing markets in video equipment, telecommunications equipment, computers and video software up to another Yen 67 trillion. Related job creation is expected to reach up to 2.43 million. However, the MPT Report also identifies a number of potential transition problems: problems are expected in employment, workstyles, new market and participation barriers, and privacy and consumer protection.

To exploit new markets and to safeguard against transitional problems, MPT's Telecommunications Council has outlined goals and strategies [Telecommunications Council, 1994]. The first principle task is the generation of demand, which is a significant turnaround from the decade-long practiced concentration on the supply- and hardware-side. Past technology policy considered principally the suppliers' perspective. Suppliers, however, did not supply domestic markets but concentrated on export markets. This caused high prices in the domestic markets, thereby undermining domestic demand. The export orientation also caused suppliers to develop and market highest-end hardware, such as supercomputers or large-scale industrial applications. Mass-oriented applications, however, were largely ignored, with the exception of some niche products, especially in the gaming sector. New media and attached services were not extensively introduced. Consequently, new media experts remained few into the 1990s and an installed user base in computer-mediated communication technologies could not develop. Part of the problem was and is the telecommunication tariff system that favored short and geographically-near telephone use but hampered the introduction and use of new services. Due to these reasons, the incentive for enterprises to enter the new media service sector remain low. The Telecommunications Council argues that "[i]t is therefore essential to develop a wide range of measures that concentrate on the inclusion of user interest. Such measures include a new tariff system tailored for the multimedia age, assistance in the initial stages of utilization, protection of information assets, and burden sharing for software, maintenance, hardware and human resources" [ibid.]. An important method to generate demand is the upgrade of the domestic infrastructure and the development of an international infrastructure in cooperation with other countries.

The second goal is the promotion of the development and introduction of applications in the ”society-public”, the ”lifestyle-consumption”, and the ”industry-business” sectors. For each sector, the Telecommunications Council expects a number of benefits. In the society-public sector, the Council foresees benefits of telematic applications that can improve transportation efficiency, individualized education, improved links between medical institutions, contributions to medical home care systems, qualitative improvements and greater efficiency in administrative services, and integrated recycling systems for production, consumption and disposal. In the lifestyle-consumption sector, expected benefits include access to home shopping and home banking, network medical services, quick access to stored and current information at home, and new styles of art and entertainment based on virtual reality. In the industry-business sector, the benefits entail enhanced senior management (quick decision making and fast and accurate access to information from Japanese and international sources), more efficient office work (streamlining in the white collar sector), more productive and creative R&D, effective logistics systems such as systems for controlling the entire distribution process, and a renewal of industrial activities.

To achieve these aims, the first basic task is the creation of country-wide information networks. The Telecommunications Council envisions the following timetable to achieve an information highway by 2010: fiber optic networks are to be established to large urban areas by 2000, to all cities up to a population of 100,000 by 2005, and by 2010, full ISDN installment everywhere so that everybody could theoretically connect. These aims for an ISDN-network do not seem to be overambitious; already in 1992, ISDN circuits exceeded those installed in the United States by 50%.

In almost all other sectors than ISDN-circuits, however, Japan lags behind the United States, not only in the number of personal computers but also in the use of communication and information industries, such as the media, advertisement, and mail exchanges [MPT, 1995, 18]. To promote the introduction of applications, the Telecommunications Council urges to consider the following principles. Central is the creation and maintenance of a ”vigorous cycle”: ”Applications and associated network infrastructure form the core for developing full-scale info-communications infrastructure. Creating demand by developing and ushering in applications will, in turn, promote enhancements in the network infrastructure. Similarly, the betterments made to network infrastructure will accelerate the development and implementation of new applications. To actualize this scenario, it is necessary to put into action a plan to ensure that a vigorous cycle arises" [ibid., Section 5]. In other words, the Council recognizes the importance of increasing returns to adoption. Equally important is the creation of a regulatory environment that promotes creativity and innovation: it is necessary to "review obsolete regulations and practices constraining both the public and private industry, and to create an environment where innovation in both sectors is nurtured and embraced" [ibid.]. Moreover, the government needs to promote the maximum compatibility of terminal equipment (interconnectivity and interoperability). And finally, it needs to further international cooperation. These aims reach deeply into MITI's policy domain.

The MITI Report outlines similar aims and strategies as those adopted by MPT's Telecommunications Council. Neither MPT nor MITI, however, explicitly outline a division of tasks between the two ministries. Recognizable is the emphasis both ministries place on their tasks. As we will further witness in the discussion of policy, while MPT appears to concentrate on the creation of backbone infrastructures, MITI focuses primarily on the development of end applications and content. On the surface, this appears to be a hardware – software differentiation of tasks. Considerable overlaps, however, are visible that point to a preemptive attempt to reserve policy domains within these ministries.

While both MPT's and MITI's identification of issue areas is highly inclusive, the selection of participating actors is not. Principally, the long-term strategy is a matter of bureaucratic action. This top-down strategy neither provides incentives for societal actors to participate in the process of strategy-formulation, nor does it intend to open this process to the wider public. Furthermore, highest governmental levels have not advanced a vision; rather, the strategy on computer-mediated communication technologies remains faceless, without the appeal of charismatic leaders such as Clinton and Gore in the United States.

## C. Policy

In contrast to the catch-up years until the 1970s, the strategy of government-led development in the technological domain proved to be less successful in the 1980s, for reasons that will be further highlight below.[79] To overcome inherent problems of the change of technological paradigms, Japanese governmental leadership will have to reassess its role in the promotion of its envisioned intellectually-creative society. Sheridan Tatsuno proposes that ”[i]n the future the Japanese government will no longer be able to force industry to march to its tune; that heavy-handed approach is too time-consuming and has not worked with fast-moving, high technology companies. Instead, government ministries, such as MITI, the Science and Technology Agency, and the Ministry of Posts and Telecommunications, must anticipate, cultivate, and promote emerging technologies and markets in which Japan has a competitive advantage. Anticipation, not reaction, will be the name of the game, and government's new role will be that of a catalyst, strategist, cultivator, and advisor – a cross between a 'think tank' and a consulting firm” [1986, 35].

In the following sections, we will assess to what extent Japanese governmental leadership can indeed adjust its role in the promotion of new technologies and, especially, their wide application throughout society. Especially important is the question whether it can find a positive balance between technology policy that concentrates on the creation of technologies and the embedding of these technologies in society by means of a flanking regulatory policy.

### 1) Technology Policy

In the 1980s, the Japanese government outlined a general, six-prong technology policy strategy for the 1980s and 1990s: the pursuit of parallel track R&D projects, the Technopolis concept, telecommunications networking, creation and support of venture capital and venture businesses, strategic international alliances and selective import promotion. These strategies are based on a reorientation of governmental action: ”Unlike past practice, these take-lead strategies are not based on large budget increases, nor on the Japanese government's previous method of directing and restructuring industry. Rather, they are designed to take maximum advantage of the major changes occurring within Japanese society and the trend towards private investment" [Tatsuno, 1986, 36]. Thus, the Japanese government has recognized the new conditions in the international economic environment and how the Japanese position within it has changed. Novel constraints consequently require an adjustment of the policy approach.

The top technology policy-making authority is the Council for Science and Technology (CST), chaired by the Prime Minister and consisting of ten members and various specialized subcommittees. It outlines scientific research activities and coordinates different ministries. The Science and Technology Agency (STA) cooperates closely with the Council. STA is responsible for base research, the operation of the Tsukuba Science City, and the production of white papers.[80] In the creation of new computer-mediated communication infrastructures and the "Intellectually-Creative Society", however, neither the CST nor the STA have not been active institutions.[81]

Although MITI has no formal responsibilities in the telecommunications sector, it nevertheless has been, as has already been outlined above, a central actor in the promotion of computer technologies and processing. Furthermore, since the partial deregulation of Nippon Telegraph and Telephone Corporation (NTT) in 1985, MITI has become increasingly active in the field of telecommunications. In the past, MITI and its Agency of Industrial Science and Technology (AIST) have undertaken three types of projects: subsidized projects (50% cost contribution by means of conditional loans that must only be repaid when the product is profitable), large-scale projects, and the promotion of new technologies and industries.

MITI generally promotes R&D when the project is too large or too risky for the private sector to handle, when it is far from commercialization, and when many enterprises express their interest in a particular technological domain. The Policy Legislation Deliberation Council, a meeting of deputy division directors, is the most influential committee within MITI. The Council coordinates the different divisions

---

79 For excellent assessments of Japanese technology policy, see, for example, Okimoto, 1984, 1989.

80 For the conduct of technology policy initiatives, the Science and Technology Agency (STA) transfers funds to the Japan Research and Development Corporation (JRDC), which awards contracts and licensing agreements to private industry to promote the transfer of R&D results from national labs and universities to private industry.

81 This claim must be qualified: there is a general lack of English-language publications on the topic; thus, the role of especially the STA may have been greater than presented here. Nevertheless, both MPT and MITI award very little reference to the role of the STA; as both ministries have been the principle actors in the creation of the envisioned intellectually-creative society, and as both have coordinated only to a limited extent, it seems that STA has not assumed an overarching organization comparable to the initiatives of the Clinton Administration and the European Commission.

within MITI and makes budget and personnel decisions. The division head usually initiates a project: first, s/he undertakes informal discussions with MITI officials, university officials or researchers, representatives from government-funded institutions, and industry representatives. Rolf Evers notes that "usually MITI is successful in persuading the companies which are important for a project to join the cooperation, due to its authority and the generally accepted qualification of its officials. It must be mentioned that this authority is not so much based on outstanding expert knowledge which they could hardly obtain as they usually change their field of work every second year, but on their capabilities to familiarize themselves rapidly with a new domain, to select suitable experts, to organize cooperation, to formulate the objectives jointly achieved, and to classify and evaluate individual results with regard to these objectives" [1987, 45]. Other advisory committees in the project definition and planning phase are the Industrial Structure Council, the Industrial Technology Council, and the Data Processing Promotion Council. For the planning and execution of promotion measures, the MITI's subsidiary Machinery and Information Industries Bureau has three subdivisions responsible for information technologies: the Electronic Policy Division, the Information Systems Development Division, and the Data Processing Promotion Division.

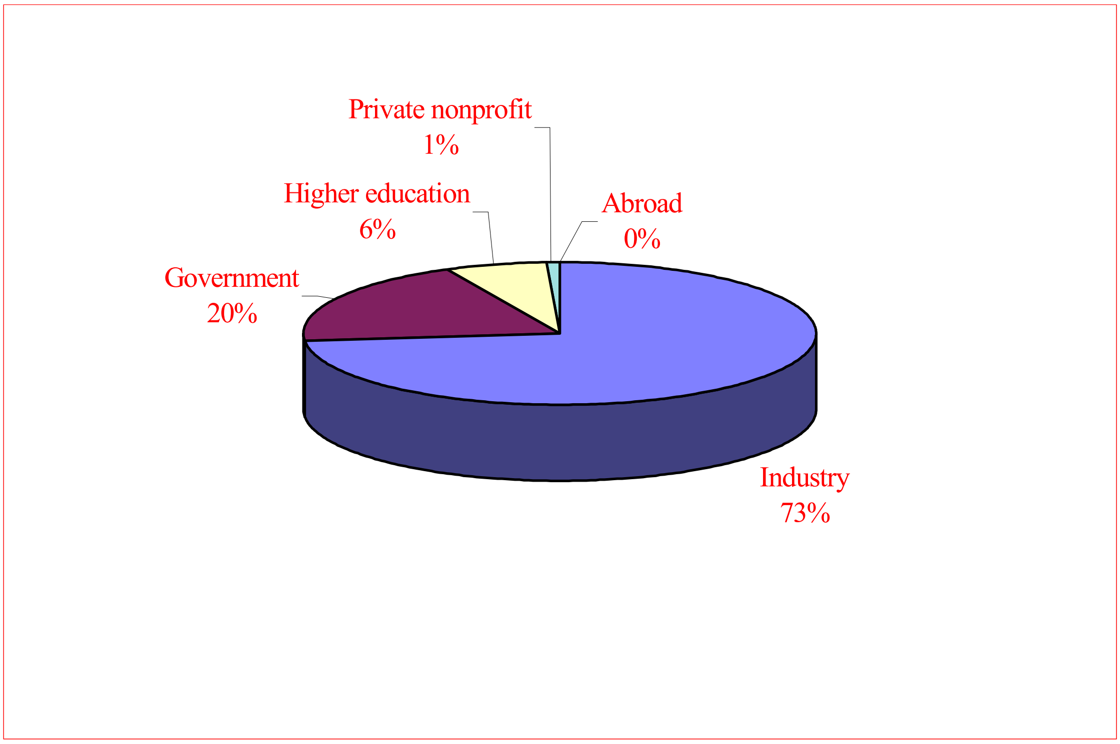
During the 1980s, MITI pursued the following programs relevant to information technologies: fifth generation computers, interoperable databases, the Supercomputer Project, the Optoproject to lay the foundation for a future broadband local fiber optic network, new functional devices such as the "Next Generation Technologies Development Program" (of which three subprograms were related to information technologies), the computerization of handling proprietary information, and the SIGMA Project to counteract the "foreseeable delay of computerization of the Japanese society caused by a lack of programmers" [ibid., 50]. The evaluation of a project takes place annully. Following the completion of a project, MITI owns the resulting patents and non-patentable processes. It then passes these patents or patentable processes on to the semi-governmental Japan Industrial Technology Association (JITA), which in turn grants non-exclusive licenses to private enterprises in return for a fee.

Since the 1980s, MITI's role has changed from acting as financier (which was not as extensive as in other industrial nations; see below) to that of organizer and coordinator. Two factors contributed to this reorientation: budgetary bottlenecks, and the recognition that the development of cutting-edge technology is increasingly difficult to steer from above. Tatsuno argues that ”MITI projects are usually limited to the top companies in a given field, exempting them from the Antimonopoly Law. This oligopolistic approach limits excessive competition and makes the projects more manageable, but MITI has frequently been criticized for excluding small, innovative companies with leading-edge technologies” [1986, 40-41]. To counter such criticisms, MITI has lately been placing a heavier emphasis on R&D subsidies, tax breaks, and the buildup of investment loss reserves for startup enterprises, for example, within the context of the Venture Business Promotion Law.

In an assessment of MITI's promotional efforts in the 1980s, Tatsuno argues that it has made relatively small financial contributions, has mostly taken a consulting role, but has been highly effective when projects are pointed and well defined [ibid.]. Direct subsidies have been relatively low in comparison with other nations; the principle share of Japanese R&D expenditures comes from private enterprises (see Figure 5.3).[82] In relation to other governmental agencies that promote or conduct R&D, MITI's share is relatively small (13% as compared to 47% by the Ministry of Education and 26% by the Science and Technology Agency) [Neuschwander, 1994, 165-157; Anderson and Sigurdson, 1991, 61]. As Figure 5.4 shows, government spends 10% of all R&D funds in own research-related activities; MITI's share of that spending thus amounts to less than 1%.

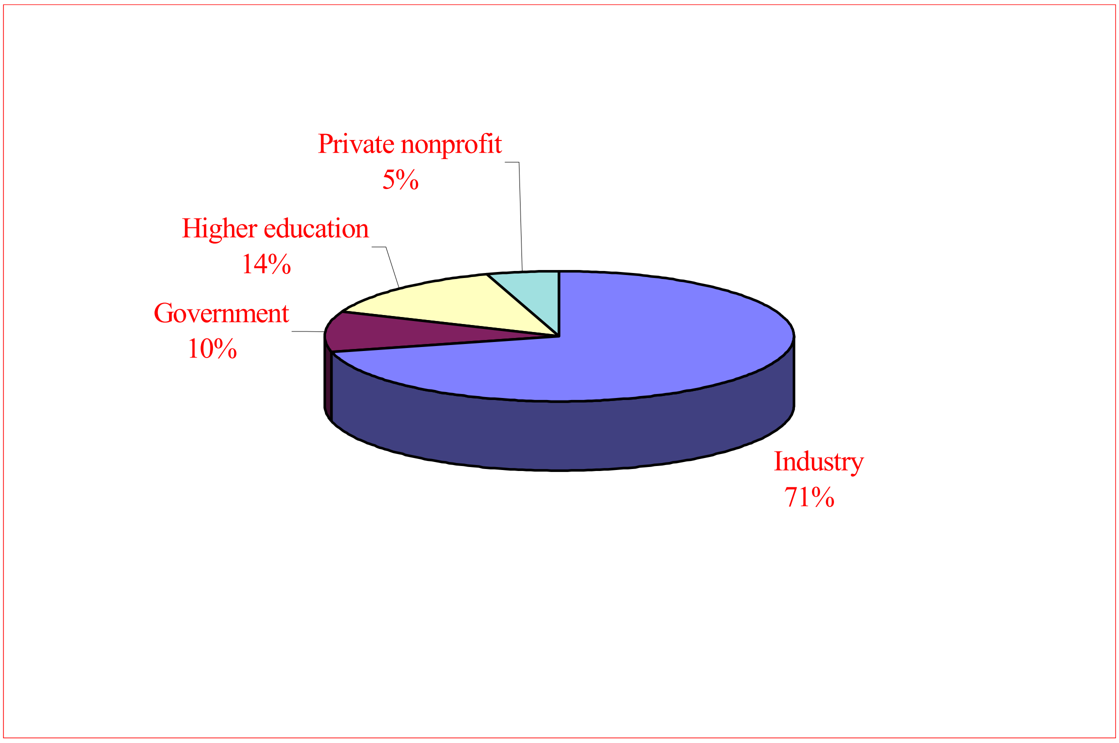
[82] For example, Miles et al. state: ”As is frequently pointed out by European governments who are to loath to increase the degree of government-supported R&D, in Japan the overwhelming majority of funds devoted to IT innovation comes from individual companies and not government. However the nature of the Japanese politico-economic infrastructure, in which there is an interweaving of state, banks and industry, renders such support unnecessary. It is too simplistic to say that in the West governments fund research while in Japan it is the companies. After all much of government funding in the United States or Europe comes from companies as tax revenue. More important than the way in which the funds are raised, perhaps, is the issue where R&D is best *located* (in industry, academia, or government labs); and where R&D *priorities* are best established and evaluation about progress best made” [1988, 237-38].

Figure 5.3: Source of R&D Funds, 1993 (in %)




Source: National Science Foundation, 1996, Table 4-35.

Figure 5.4: Spenders of R&D Funds in Japan, 1993 (in %)



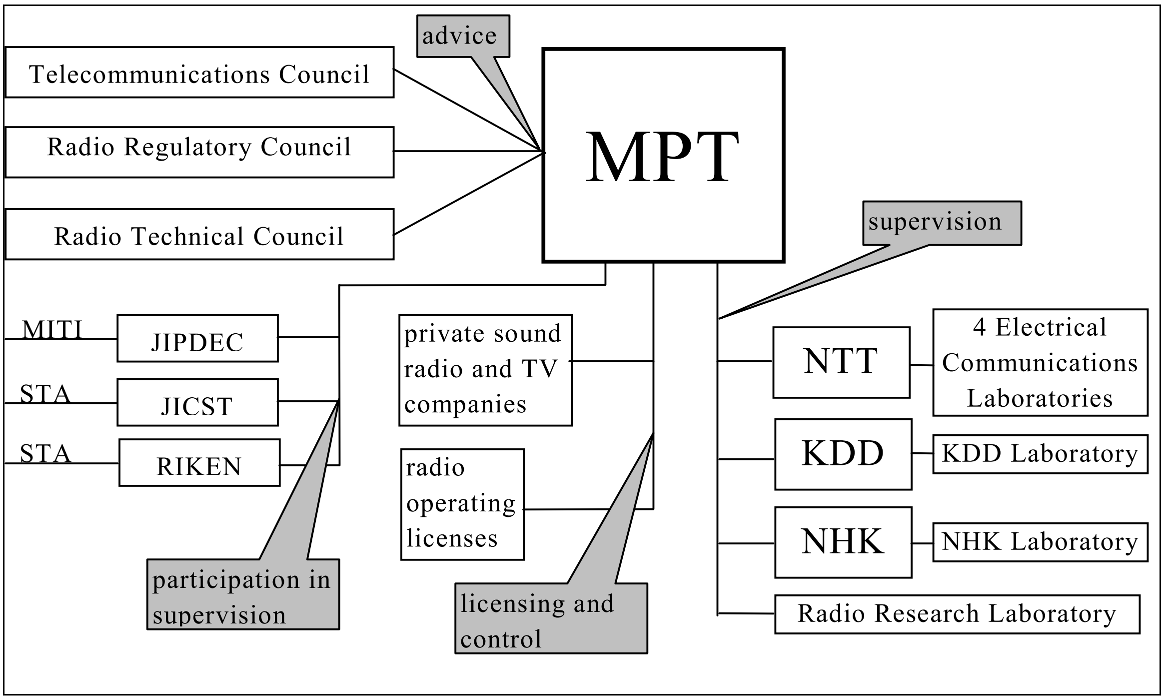

Source: ibid.

MITI has been and remains an important information source for Japanese enterprises: it undertakes comparative studies on trends worldwide, such as studies on the state of the art, trend analyses, the state of technological development, design and planning work, market studies, training programs, and measures for the application of technologies. Evers argues that ”[t]he importance of MITI promotion does not so much lie in the financial means, which will probably be concentrated on an even lower number of projects due to budget cuts and will loose more and more weight in comparison with the increasing expenditures of the private industry, but in the process of producing a common acceptance of objectives among the industrial companies relevant for a certain field of technology, objectives found as a result of long-lasting processes of consultation and harmonization. … That is why MITI projects should be less judged by the direct results but by the developments carried out by the companies without promotion but in close connection with MITI projects. They are much more application-oriented and aim towards shorter periods” [1987, 51]. Positive has been the frequent exchange of researchers and research results, normally a missing feature of Japanese R&D conduct as the enterprises prefer to internalize research and development.

The Information-Technology Promotion Agency (IPA), a subsidiary of MITI, promotes the development and application of computer programs. It supports the information processing industry, often by means of loan guarantees. Evers summarizes that the ”agency awards contracts to develop program packages, takes efforts to market them, in other words, it tries to take the place of the software market not yet sufficiently developed so far” [1987, 48]. In the 1990s, it has cooperated in MITI's and other ministries' efforts in the establishment of multimedia centers that have the purpose to initialize the multimedia market in Japan (see below).

Other prominent actors in information-related technology policy are the Ministry of Education, Science, and Culture (MESC) (university research, but strictly separated from MITI projects), and especially important in the context of this study and as already outlined above, the Ministry of Post and Telecommunication (MPT). The principle tasks of MPT concern telecommunications and broadcasting: the definition and formulation of policy, technology and research policy, the promotion of research and international affairs, and the regulation of entry and exit in the telecommunications and broadcasting markets. The latter function is a considerable source of influence in the creation of the intellectually-creative society. The supervision of operating companies, the domestic and international telecommunications operators Telegraph and Telecommunications (NTT) and Kukusai Denshin Denwa (KDD), and Nippon Hoso Kyokai (NHK), in charge of broadcasting, cable, and satellites), as well as the power to allocate radio frequencies, has placed MPT at the center of policy initiatives. MPT has three advisory councils: the Telecommunications Council, the Radio Regulatory Council, and the Radio Technical Council. Figure 5.8 shows the institutional setup.

Figure 5.5: MPT Structure




Source: Evers, 1987, 53.

Until its privatization in 1985, NTT was a state-owned monopolist similar to other telecommunications monopolies in Western countries. NTT's principle mission is the provision of domestic telecommunications and other services. It is obligated to secure telephone service, advance telecommunications, conduct research and development, and transfer R&D results to industry. Since 1986, other carriers have been approved besides NTT (so called New Common Carriers or NCCs), and the market for service provision has been further deregulated. The telecommunications reform has also provided for a differentiation between 'general' and 'special' service provision, and enabled more value-added services and a free terminal choice. Liberalization and additional competitive pressures are expected to raise NTT competitive efforts, especially its provision of more services and lower tariffs. MPT continues to supervise NTT's operations with the purpose to find a balance between the economic interests of the operator and the economy as a whole. Below, we will explore MPT activities in greater detail.

An interesting feature of ministerial responsibilities in the creation of new computer-mediated communication infrastructures, as already hinted at above, has been institutional rivalry: ”In principle the R&D investment of the [ministries] is co-ordinated by a Science and Technology Council. In practice they vie each other to back the most attention-catching science initiatives – a bureaucratic game many scientists feel they can turn to their advantage” [The Economist, August 11, 1990, 7]. In the 1980s, an intense rivalry developed between the MITI and the MPT over responsibilities in the telecommunications sector. While the latter has been traditionally the principle actor, MITI was able during the 1980s to gain power with the privatization of NTT (as MITI is responsible for the private sector and international trade). The winner of this rivalry has not been declared; as we have seen above, both MITI and MPT have offered visions of the future information infrastructures in Japan, and both continue to be principle actors in their completion. MITI is also in competition with other ministries:[83] with the Ministry of Education over copyright issues of software and general professional qualification requirements and promotion, with the Ministry of Building over the Technopolis Program (see below), and with the Ministry of Transport over intelligent city traffic systems.

In 1985, MPT and MITI established a joint research institution for base research, the Japan Key Technology Center (JKTC).[84] Its principle function has been the provision of special credits to reduce risks and extraordinary burdens of research projects. Furthermore, it has promoted contacts between industry and state research institutions, provided information services, and organized scientist exchanges. Conflicts, however, have developed over the selection of future key technologies [Neuschwander, 1994, 138]. As was mentioned above, structural economic changes have lead to a reorganization of ministerial authorities. MPT and MITI, however, have tended to fiercely guard their policy domains. Ryutaro Hashimoto, former Chief of

---

[83] Citing here only those that are relevant for information and communication industries. See also Neuschwander [1994, 68-69].

[84] The foundation of the Center was financed by the sale of NTT.

MITI and Prime Minister, criticizes these developments: "in the 1980s, MITI has failed to promote enterprises that could have taken the lead in the 1990s. This is our problem. Let us consider the information and telecommunications sectors: instead of promoting new media together, MITI concentrated on information technologies and MPT on telecommunications. While the civil servants apparatuses of both ministries defended their competencies, we fell behind in new technologies" [*Der Spiegel*, No. 45, 1995, 137, own translation]. Furthermore, some charge that the managers of large telecommunications enterprises have displayed a high degree of ignorance about grass-root developments in computer-mediated communication:

> The researchers and research managers I met, men at the highest levels of Japan's telecommunications companies, shared one important characteristic with their counterparts in large American and European telecommunications companies I've visited – they seemed generally unaware of the impending collision or convergence between the social revolutions at the grassroots of [computer-mediated communication] and the high-tech communications infrastructure the big companies were installing in Japan [Rheingold, 1993, 199].

As we will see below, the structural separation between MITI and MPT in similar functional areas seems to highlight the lack of understanding on the convergence of telecommunications and computer technologies. Ministerial competency conflicts may also explain why both MPT and MITI have advanced their own visions of the future computer-mediated communication society.

In the following sections, we explore the technology policy in Japan since the 1980s with an emphasis on the creation of new computer-mediated communication infrastructures.

a. Technology Policy of the 1980s: A Six-Prong Strategy

The pursuit of parallel-track R&D projects constitutes the first of the six-prong technology policy strategy of the 1980s. Parallel-track R&D projects imply joint actions in national labs and corporate R&D centers. The declared emphasis is increasingly base research and research with a long-term planning horizon. A wide range of governmental ministries and agencies are involved in these projects, such as MITI, NTT, STA, MPT, the Ministry of Education, the Ministry of Construction, and others. The research strategy implements the following support mechanisms, consisting of primarily indirect subsidies: R&D tax credits, accelerated depreciation for new R&D

facilities, and low-interest loans by the Japan Development Bank. Parallel-track projects are mostly large-scale and long-term. In their execution, they are competitively based, however, the definitional and planning stage is based on a consensus approach. Proposals circulate in trade associations and MITI councils for a period of up to three years. Following approval, MITI organizes, most often in three phases: in phase one, MITI undertakes project organization and identifies basic R&D tasks. In phase two, MITI labs and private researchers cooperate to outline broad product specifications so that private enterprises have the same starting positions. Enterprises may cooperate, but they do not have to disclose proprietary information when the activities reach beyond basic product specifications. In phase three, following the development of the technologies, MITI files the patents and grants licenses. Enterprises then compete in the marketplace [Tatsuno, 1986, 41].

The second strategy has been the improvement of telecommunications networks. In the 1980s, NTT forwarded a vision of an Information Network System (INS). The program goal has been the digitalization of telephone networks and the integration of new information processing systems such as supercomputers, expert systems, video signal processing, and fifth generation computers: ”the program is designed to link Japan's major cities to the technopolises and other regional cities with a nationwide fiber optics network, backed by direct broadcasting and communications satellites” [ibid., 52]. This is a full-scale R&D and construction program to extend over the period of twenty years, with the expected costs of $125-150 billion (1986 estimate), but also an expected market value of $200-300 billion. A 1986 assessment has been that ”INS has already spawned a rush of companies, both domestic and foreign, competing to provide add-on services in the emerging value-added network (VAN) market. Because of the massive investments involved and the prospects for creating new industries and jobs, INS is widely hailed as the 'bullet train of telecommunications' – Japan's new *Shinkansen* program for the 1980s and 1990s” [ibid., 52-53].

> INS will combine the latest in computer and optical communication technologies to make the transition from verbal communication (words) to audiovisual communication (images), paralleling work on the fifth generation computer. When INS is completed, the Japanese home-of-the-future will be offered a variety of new services, including mini-facsimile machines, videotext and videophones, telemetering and telecontrol for monitoring water and gas utilities, medical information systems, home shopping and banking, computer-aided instruction (CAI) for home study,

> and home security systems. Offices will be equipped with digital sketch phones, teleconferencing, video response systems (VRS), and optical storage systems. Rather than supplanting face-to-face contact, these systems will enable the Japanese to exchange information more quickly and efficiently [ibid., 55].

The principle reasons for the INS initiative had been twofold. The first one is financial: the old communications system had been ”excessively bureaucratic, technologically outdated, and bloated with 330,000 lifetime employees who could not be fired”, leading to fears of unprofitable operations [ibid., 53]. Furthermore, management mistakes and deficitory operations have lead to cash-flow problems. In the case that a new system could be installed (for example, the switch from analog to digital systems), NTT would have a new source of revenue. The second reason was political pressure to eliminate the ”Buy Japan” procurement practice, which was one major cause of trade frictions during the 1980s, especially with the United States. Yasusada Kitahara, then Vice President of NTT, described in 1986 the underlying philosophy of the INS: ”The philosophy of the INS is identical to the basic technological thought underlying the ISDN which is soon to be established by the International Telecommunication Union as an international standard. More specifically, it is aimed at unifying, on the basis of the *bit* concept, the rate systems now varying from service to service. INS will be built by making the best use of the digital and optical fiber technologies, which have recently seen rapid advancement, in order to minimize the distance-dependency charges. This can only be done on the basis of semiconductor technology which brings about higher economic efficiency, functional improvement and higher reliability” [Kitahara, 1987, 41]. As Tatsuno comments, ”the INS program is designed to give Japan the most advanced telecommunications system in the world” [1986, 55].[85] The following technological components were planned for introduction:

- integration of all switched communication services (telephony, data communication, facsimile, individual access to still and moving pictures, video telephony and conferencing, distributed services (for example HDTV);
- fully digital network, broadband services;

---

[85] A rival project to the INS initiative of MPT has been MITI's New Media Community Project. Its objective has been ”to find out the most economic telecommunications infrastructure by applying cable and radio networks of NTT, cable TV networks and telecommunications satellites to new services. The development of suitable computer systems, software development and legislative acts concerning protection of software production and date are the main projects of this project” [Evers, 1987, 78].

- high capacity transmission system by means of fiber optics;
- satellites for supplementary transmission capacity;
- communications processing functions (conversion of format, speed and services, information processing functions);
- tariff structures that are independent of distance and type of service (bps charging) [Evers, 1987, 70-71].

The principle R&D actors regarding underlying infrastructure technologies have been NTT's four research laboratories with a budget that exceeds MITI's: the Electrical Communication Laboratory, Atsugi (semiconductors), Ibaragi (fiber optics), Musashino (digital switching), and Yokosuka (computers). Research programs are also linked to NTT's procurement program. As we will see below in the discussion of policy efforts in the 1990s, initial euphoria has been excessive, and it almost fully evaporated in the 1990s.

The third technology policy strategy of the 1980s has been the creation of so-called ”Technopolises”: 19 Silicon Valley-type agglomerations that have the purpose to facilitate working partnerships between businesses, universities, and local governments. Emphasis has been placed on ”soft” infrastructures, training, new technologies, information services, venture capital, and telecommunications networks. The role of MITI has been the identification of basic project criteria, provision of technical assistance, advice, and tax incentives. Local governments were envisioned as leading actors in the efforts to promote the integration of the Technopolises in the local communities.

The Technopolis strategy derives directly from some negative experiences with Tsukuba Science City that was built near Tokyo during the 1960s. The main problems of Tsukuba have been the following: highly secretive relations, no cross-fertilization of ideas, no scientific exchanges, and no exchanges of researchers. Tatsuno argues that ”Tsukuba is a totally cerebral place, a one-dimensional brain with very little spontaneity or surprise. … In its search for scientific excellence, Tsukuba may become a cold, heartless place where sheer intellect takes precedence over human values, and where excellence becomes synonymous with elitism and intellectual arrogance. Already one senses a certain smugness among Japanese researchers and businessmen who take great pride in Japan's commercial successes. Perhaps their self-confidence is long overdue, but as Japan becomes a technological superpower, the best and the brightest in this 'city of brains' could easily become a hermetically isolated elite without a conscience. It has happened before" [Tatsuno, 1986, 108-109, 110]. Furthermore,

> [s]ome critics say Tsukuba is a 'white elephant' without cultural and historic roots. Others doubt that it will have much influence on improving the creativity of Japanese industry and education. Except at MITI laboratories, private researchers have not been allowed to enter national research laboratories. Japan's national universities have few ties with Tsukuba University or the research laboratories. If the Japanese government's goal is to accelerate the pace of basic research and to diffuse high technology throughout all sectors of society, its closed door policies at Tsukuba are certainly self-defeating. The new science city threatens to fall into the same trap as American military research – very expensive, good at its main mission, but poor at benefiting industry and society with its advanced technologies. Perhaps this situation will change as Tsukuba lures more foreign researchers and becomes more of an open, international science city. But until then, it runs the risk of becoming an expensive laboratory for industrial secrets – or just another 'ivory tower' [ibid., 112].

As a consequence of the negative experiences, the conception of the Technopolises is different. The most prominent difference is the concentration on 'soft' infrastructures: "Unlike Silicon Valley, the Technopolis Concept emphasized a more balanced approach to high technology development. Instead of only focusing on technology, it proposed the creation of totally new cities, complete with research parks, new universities, technology centers, housing, parks, and cultural activities. The goal was to create an environment where people could become creative, well-rounded citizens" [ibid.], a task that is easier to conceive on a drawing board than to implement. Tatsuno argues that to integrate the sterile scientific worlds with a well-balanced social environment requires an imaginative local leadership that can cooperate with industry. Furthermore, the Technopolis concept requires the elimination of the weak university-industry links. Larger enterprises focus principally on research that can be commercialized. Instead of coordinating with universities, they conduct in-house training. This may obstruct the increased governmental emphasis on the conduct of base research of a public good nature. In universities, strong hierarchies persist and impede independent research, especially the research that graduate students undertake. Especially the lack of student funding hinders the early development of creativity in universities. Tatsuno also cites a number of wider societal factors that restrain research in the Technopolises: the lacking supplementary attractive environment and services to keep people in the rural areas or to bring them back from the big cities, land speculation, conflicts with more traditional industries, and the lack of innovative public schools. Thus, a high technology environment does not automatically yield the successful creation of technologies; social factors play an important role.

The strong Yen-appreciation during the 1980s has caused substantial problems for the establishment of the Technopolises. On one hand, smaller enterprises have been forced to reevaluate the future plans as their products become increasingly expensive abroad [Neuschwander, 1994, 137]. On the other hand, the strong Yen has prompted many enterprises to move to cheaper production sites in other East-Asian countries [Anderson and Sigurdson, 1991, 228ff]. Both factors have reduced the incentive to move to a Technopolis site.

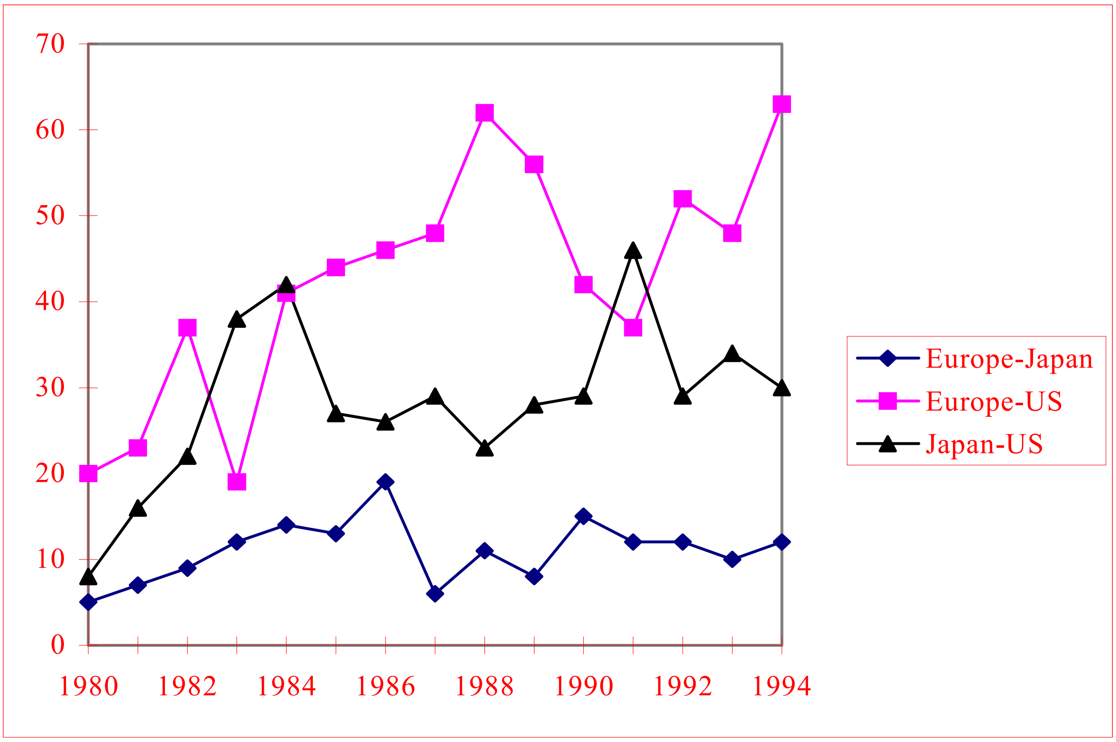
One major criticism of the Japanese research environment has been the lack of venture capital and venture business. The fourth strategy of the 1980s has been to overcome these deficiencies by promoting entrepreneurship and risk taking to enable more homegrown technologies. Nevertheless, the problem persists: over-the-counter markets are underdeveloped and people rather invest overseas. Two laws have had the purpose to increase support for small businesses: the Small Business New Technologies Promotion Law and the Small Business Credit Insurance Law. The former law enables the creation of investment loss reserves and preferential tax treatment for research activities. Local governments select the qualifying businesses. The latter law outlines qualification criteria for credit support. The applying enterprise must conduct research in electronics, mechatronics, new materials, biotechnology, or computer software, have R&D outlays larger than 3% of total sales, must have been founded or must have moved into the high technology field within the last ten years, and must plan to be listed on the over-the-counter stock exchange. However, the greatest obstacle to entrepreneurial conduct and open venture capital markets remains to be societal, and this situation can be expected to be long-term:

> Despite these latest developments, there are many obstacles blocking the development of a thriving venture capital market and venture businesses in Japan. Probably the biggest roadblock is Japan's highly group-oriented society, which discourages individual actions. From childhood, Japanese are taught that ”the nail that sticks out gets hammered down”. If an aspiring entrepreneur wants to jump ship, his parents, family, friends, and colleagues will often work together to discourage him. Indeed, entrepreneurs in Japan are called *datsusara*, meaning ”salerymen who have broken loose”,

> suggesting rebels who cannot work well with other people, rather than groundbreaking pioneers. Japan's famous lifetime employment system reinforces this loyalty to the company by discouraging job-hopping and severely penalizing those who leave. Consequently, startup ventures have an extremely difficult time finding qualified scientists, researchers, and other technical staff. This is compounded by a general reluctance to hire "head hunters" and by the absence of a strong network of lawyers, consultants, venture capitalists, and successful entrepreneurs [Tatsuno, 1986, 62-63].

Furthermore, legal and organizational obstacles exist to entrepreneurship. For example, the trade commission prohibits venture capital firms to place their employees on venture business staff and prohibits ownership of more than 49% of a venture business. Venture businesses also have capital raising problems as banks are reluctant to finance start-up enterprises. Often, the only source of funds is family and friends, which often leads to financing deficits.

Figure 5.6: Interregional Alliances in Information Technologies




Source: National Science Foundation, 1996, Table 4-38.

The continual opening of Japan to the West is slowly changing this obstacle. As we will see below, MITI and other governmental institutions place an increasing emphasis on entrepreneurship and financial markets, especially in software development. Examples of thriving entrepreneurship already exist, for instance, downtown Hiroshima now has a large concentration of software entrepreneurs.

The fifth and sixth technology policy strategies formulated in the 1980s concern the international level. Strategic international alliances have the purpose to improve technology transfer to Japan. Such alliances have worked to Japan's advantage in the past. To gain access to the Japanese market, foreign enterprises were often forced to license their technologies to Japanese enterprises. Effectively, foreign enterprises thereby permitted access to underlying innovations and technical information. Other countries have reacted to this practice, as Tatsuno states: "For over thirty years this one-way flow of technology worked brilliantly, enabling Japan to quickly catch up with the West. But now the technological free ride has come to an end. Many western enterprises are reluctant to license their technologies to Japanese enterprises for fear of the boomerang effect; and under the Reagan Administration, the Pentagon has cracked down on the flow of advanced technologies to Japan. According to Kazuo Miyazawa, director of MITI's Supercomputer Project, this technology boycott is beginning to be felt. 'It is getting harder to follow leading-edge American technology because the Pentagon often requests American scientists to withdraw sensitive papers from international conferences and has closed many American conferences to foreigners altogether. We are concerned about this stifling of scientific exchanges'" [ibid., 43]. As a reaction to these developments, the government and larger corporations now emphasize joint ventures and mutual technology exchanges. However, as Figure 5.6 shows, the number of interregional alliances has not increased since the 1980s, at least not in the field of information technologies (with one exception in 1991 between Japanese and US enterprises). In comparison, the number of European-US alliances have continuously risen since 1991. Intentions and actions diverge in Japan on this point.

The other strategy on the international level has been increasingly controversial, especially in view of the trade deficit with the United States and measures on the part of the latter to reduce it: selective import promotion. In the sector of information and communication technologies this strategy implies infant-industry protection for satellites, telecom equipment, and other technologies. Mature industries, on the other hand, are relatively open, but highly competitive. In the software arena, MITI proposed legislation during the 1980s designed to push American enterprises out of the Japanese market: ”MITI's proposal called for mandatory registration and licensing of new software. Software developers would be required to disclose their programs to a new agency, and third parties could lease and modify these programs. Developers would have limited control over copying, licensing, and distribution of their programs for a period of fifteen years under a revised patent law, but all programs deemed vital to the public welfare (such as medical software) would come under MITI's control” [ibid., 67-68]. This legislation derived from a previous battle over software copyrights in which Japanese courts ruled that software is subject to protection, a standpoint that MITI strongly opposed. The issue of copyrights and the definition of ”fair use” returns in the 1990s, as we will return to below.

To conclude, Japanese technology policy has been changing since the 1980s to react to the changing Japanese position in the world economy, at least rhetorically. As we will see in the next sections, many traditional problems remain. Most prominent in regard to computer-mediated communication are the subtle, but existent, ministerial competency fights between MPT and MITI.

### b. Technology Policy and Computer-Mediated Communication in the 1990s

Until now, we have considered general technology policy and computer-mediated communication-related policy of the 1980s. Let us now turn to technology policy specific to the creation of an Intellectually-Creative Society. We will concentrate on MPT’s and MITI’s efforts.

#### *i) MPT and the Four-Level Approach*

Regardless of MITI's attempts to become the major player in the creation of an Intellectually-Creative Society, MPT remains dominant. The major reason is that Japan currently concentrates on the creation of underlying information infrastructures and less on software, applications, and services. MPT offers the following definition of what it calls an info-communications infrastructure: ”a comprehensive entity that encompasses network infrastructure, terminals, software applications, human resources, public and private info-communications systems, as well as social values and lifestyles related to the information-oriented society” [ibid.]. It entails a focus on user-friendliness, synchronized promotion of the different elements (layers), standardization and social reforms. Box 5.1 shows MPT’s definitional hierarchy.

Hardware continues to be central in MPT's approach, specifically the installation of fiber optic networks and new transmission technologies, such as the high-speed Asynchronous Transfer Mode (ATM), transit system technologies, and subscriber system technologies. In parallel efforts (and in parallel efforts to MITI’s actions), MPT also conducts research in application and terminal technologies. Efforts include research in compression technologies, interfaces such as voice recognition, digital image coding technologies, information storage, information retrieval and synthesis, and multimedia operating systems.

Since the early 1990s, MPT places a stronger emphasis on the private sector. This emphasis is a change from the previous practice to promote the 'third sector' that describes the joint organization of private and public sectors. In this practice, the government directly subsidized joint efforts. The new approach, however, emphasizes new financing systems, including interest-free loans and tax incentives. Private research activities thereby receive considerably more autonomy than before. MPT estimates that the private sector needs to invest an estimated Yen 1 trillion per year, amounting to a total investment of Yen 16 trillion. Private sector measures include greater budgetary allocations for the development of public applications, especially for the promotion of public service applications in medical care, health care, education and welfare services, greater budgetary flexibility to enable a quick reaction to technological changes, the assistance of pilot projects, the provision of interest-free loans and grants to industry, the industrial utilization of public research facilities, and the adoption of advanced technologies to improve information flows. Principle recipients of loans are the telecommunications and cable-TV industries, primarily for infrastructure investments. However, the Telecommunications Council recognizes that ”these resources are too limited and too inflexible to adequately support the proposed fiber optic network improvement” [ibid., Section 6].

Besides the promotion of research activities, MPT has been undertaking supplementary measures. It has claimed responsibility for the construction of 'bottleneck facilities', for example, utility poles, conduits, and common-use tunnels for underground cables. Such measures have had the purpose to reduce installation costs for private operators (some may interpret these actions to be hidden subsidies). Example projects have been the ”Program for Enhancement of Regional and Life-related Info-communications Infrastructure”, the ”Teletopia Project”, and the ”Telecom Town”, all of which assist the creation of underlying infrastructures in selected regions.

Box 5.1: MPT’s Four Level Info-Communications Structure

- Level 1, which comprises physical transmission media, is the basic underlying social infrastructure that enables the social utilization of info-communications capabilities. This level is subject to certain social requirements such as stable supply, fair use, and affordable tariffs.
- Levels 2 and 3, which assume the existence of level 1, are areas where the multimedia and new businesses will be generated. For that reason, they will be required to be highly versatile, innovative, and convenient.
- Level 4, where technologically feasible applications and services will be introduced to play essential roles in society, embraces personal values and an adequate legal framework, as well as an efficient and effective socio-economic system that decisively influences human activities. This is where the shift in perspective from conventional industry to new info-communications industry will take place.

Source: Telecommunications Council, 1994, Section 1.

MPT has also addressed the issue of consumer protection. To enhance the complaint handling system, it has proposed to establish a legal framework for a complaint filing system within administrative authorities. To prevent the abuse of communications systems (such as malicious calls or unwanted telephone solicitations) and to maintain ”public order” on computer networks, it has demanded adequate legislation. To prepare for electronic commerce, it has proposed a legal system to implement an identification and authentication system. The specifics of the consumer protection system, it has not yet outlined.

As Japan is highly susceptible to natural disasters, the issue of emergency measures is a salient one. To prevent interruption of normal operations and traffic congestion and to ensure the priority use of communications systems by public entities during an emergency, MPT has proposed to enhance disaster-resistant networks, to promote R&D on emergency communications technologies, to establish a Central Security and Reliability Center[86] with carrier support, and to enhance wireless emergency communications [ibid.]. In sum, hardware continues to be MPT’s central focus.

[86] This label is tentative.

*ii) MITI and the Intellectually-Creative Society*

In contrast to MPT, MITI focuses on ”soft issues” of the Intellectually-Creative Society: computer security measures, promotion of standardization, continuous systems, protection of intellectual property rights, and facilitation of the reuse of intellectual property. Furthermore, MITI has planned to improve the business environment and to deregulate restrictions on government-business interaction in order to permit particular applications, for example, electronic filing of business and income taxes. To achieve a reform, MITI argues, ”it is necessary that the related ministries and agencies together formulate a nonpartisan integrated political plan regarding the promotion of information systems in Japan, and that a structure be established in which each ministry and agency pushes forward these policies through mutual cooperation in line with this plan” [MITI, 1994, Chapter 2].

The issue of network security is high on MITI’s agenda in its efforts to promote the adoption of computer-mediated communication technologies. MITI has recognized the new potential dangers that computer-mediated communication technologies pose: ”In an advanced information society, malfunctions occurring in an information system including a computer system breakdown would have a social impact incomparably more serious than at present. For this reason, in order to realize such an advanced information society, both the government and the private sector are required to positively tackle security measures and to ensure the security and reliability of information systems. Particularly in an advanced information society, numerous computers are linked to networks. As a result, it is important to take measures against network-related invasions including attacks by hackers and computer viruses. Reflecting concerns that such damage may expand on an international scale through networks, OECD has already formulated information system security guidelines. It is necessary to continue to promote security measures through international cooperation” [ibid.]. To achieve network security and network reliability, MITI has proposed the creation of common security standards and the implementation of counter-virus measures. Furthermore, to deter attacks on the system, it has proposed a redefinition of the Criminal Law Act of 1987 to include computer crimes, for example, the illegal creation or destruction of magnetic records or systems, and computer fraud. Furthermore, it has identified the need to establish verification systems that concern the issues of identification, integrity and non-repudiation. To what extent security response teams play a role is not clear; one can expect an intensification of these efforts in the international context.

MITI's other declared responsibility is the pursuit of standardization of software and systems. The aim is to promote standardization efforts of the private sector and to reduce the level of governmental interference. MITI's principle efforts concern a review of existing standardization systems: "When promoting standardization in the area of information, excessive governmental intervention in the market may hinder technical progress attainable through competition among enterprises. However, in cases where too many specifications exist compared to the differences in functions due to competition for market share, users may suffer from disadvantages and voluntary standardization among vendors may become difficult owing to the lack of mutual operability. In such cases, the government should create a structure for standardization and provide incentives for standardizing activities" [ibid.]. What these incentives could consist of, however, is unclear; the concerns about predatory pricing and other competition policy-related themes developed in Chapter 1 have not been addressed.

While Japan has exhibited great strength in the development of electronics hardware, a major problem has been its deficient software development. MITI states that in Japan "there is a lack of high quality software corresponding to advanced users' needs and of original software" [ibid.]. The reasons for this deficiency include an insufficient awareness of the merits of software, as well as the delay in the introduction of computers generally. These factors have caused an underdeveloped software market and therefore an insufficient allocation of resources for software development. Furthermore, a general insufficiency in creativity and entrepreneurship exists, as expressed in a small number of software venture businesses.

MITI has been cooperating with other ministries to boost the value of human resources, such as a general improvement of information literacy in schools. The special emphasis has rested with the developers of new applications and software who can improve the design and management of new systems. The creation of new multimedia software and databases has been a central component of MITI's strategy. MITI has argued that the government needs to provide the initial impetus for the creation of software: "For the creation and editing of multimedia software, studio and editing equipment with advanced functions are sometimes required and the construction of such equipment by the private sector itself is often difficult in circumstances where the market for multimedia software has not been fully established” [ibid.]. MITI has identified the need to foster creative and skillful personnel, and to cultivate general information literacy. The means to achieve more software production could be ”the promotion of various measures including the creation of 'inter-media factory cities' as the core for production and dispatch of information and 'information parks' in local communities were proposed by the New Visual Industry Discussion Group (presided over by the director of the Industrial Policy Bureau of the MITI) in March 1994 to enhance the capacity to supply multimedia software” [ibid.].

MITI has also addressed the improvement of the environment for the development of end applications:

> In order for an advanced information society to be created, not only hardware including communications infrastructures and computers but also a variety of high-grade contents (information resources such as databases) and applications meeting the needs of various people are an important requirement. However, Japan has a problem in that up to now, contents and applications have not been adequately supplied as commodities in comparison with hardware. As a result, the preparation of an environment where contents and applications may be provided to the market to a sufficient degree is an essential future political task for realizing an advanced information society [ibid.].

MITI proposed the following measures to be enacted in 1994 and beyond to promote the human resources side of multimedia production. The first measure was the establishment of Multimedia Centers in Marukamachi and the Nagano Prefecture. These centers, financed by the Information-Technology Promotion Agency (IPA), are intended to produce multimedia software and foster personnel in this sector: ”[i]mage-related enterprises will work together to produce and test advanced multimedia software including virtual reality software, and will endeavor to upgrade the skills of multimedia producers”. Furthermore, ”[o]pportunities to produce multimedia software will be offered to multimedia producers consisting of students, young members of society, etc., to improve their skills”. The second measure is the construction of databases of multimedia materials. MITI proposed that ”[m]ultimedia software databases will be prepared in order to allow image and sound information serving as materials for multimedia software production to be freely searched and retrieved, as well as storing produced software and making it available to others”. The third measure is the establishment and support of Regional Multimedia Centers which will be controlled by the regional governments will be in charge of these centers. The centers’ purpose is the training of managing staff and the provision of technical guidance. This action resembles the European Union’s MIDAS project.

MITI's principle support instruments concentrate on the market framework. Especially, the ”basic market conditions should be established clarifying contractual relationships for the development of software and pricing policies should be formulated in which the merits of software products are rationally evaluated” [ibid.]. Specifically, one area is the clarification of the ”main items to be included in software development contracts”. The ”Software Life Cycle Process – Japan Frame '94” has been initiated to serve as a common framework for system development business; it has promoted standards for the classification of system development processes, and defined job descriptions. Other measures include the introduction of a comprehensive bid evaluation system for governmental procurement, new training systems for information technology engineers, and the introduction of new curricula in schools and universities. MITI supplements these efforts with the implementation of tax measures, for example, a ”general-purpose program development reserve fund system” for subsidizing software development and maintenance costs.

The creation of databases is another critical factor in which Japan is lagging behind the developments in the United States: sales reach only one-sixth of those in the United States and two-thirds of databases sold in Japan are foreign-produced [ibid.]. Furthermore, the number of database distributors and builders is insufficient. The MITI Report cites the following reason for this underdevelopment: neither public nor private actors have open information policies; those who create databases thus lack access to information for databases. Since no databases exist, user groups also do not exist; demand for databases is consequently low. To overcome these deficiencies, MITI is promoting the compilation of ”socially useful data” following the fiscal year of 1994, including private and public information resources that have not yet been tapped into. Access will also be improved; access over networks and with easier interfaces. MITI supplements these measures with financial support schemes, such as a tax incentive for a database reserve fund system and a low-interest financing system.

To conclude, both MPT and MITI have undertaken specific policy initiatives to promote the creation of an ”Intellectually-Creative Society”. While MITI concentrates on end applications, MPT promotes the development of a communications infrastructure and intermediate applications. Little evidence exists that the efforts of these two ministries are coordinated.

c. Computer-Mediated Communication Technologies and the Public Sector

While MPT has predominantly addressed the hardware side of computer-mediated communication, the telecommunications infrastructure, and its regulatory framework, MITI has emphasized the development of end applications and software for various sectors. MITI has identified the public sector to be a reverse salient. In the installation and use of computer-mediated communication technologies, the public sector lags considerably behind the private one. Rather, MITI argues, the public sector should perform the function of an important supplier of content and services, as well as of methods and systems, aims that in MITI's conception can only be changed with the application of active technology policy measures. MITI has outlined an action program for the following public sectors: education, research, health and welfare, administrative systems, and electronic libraries. To fulfill the action program, MITI has proposed a cooperation between the National Diet Library, the Management and Coordination Agency, the Science and Technology Agency, the Ministry of Education, the Ministry of Health and Welfare, and other ministries and agencies. MPT, however, is not mentioned in MITI's plans.

*i) Education*

In recent years, criticism of the education system has been on the rise among the Japanese public. Some complain about the lack of creativity and independence of students.[87] For example, Akio Hosono, President of IO Data Device, says that the "biggest problem we face is that we can't find graduates who can think for themselves" [quoted in Friedland, 1994, 50]. Societal factors such as the consensus orientation, the striving for social harmony and the suppression of the pursuit of individual desires are inhibiting the creative development of new technologies, especially in the software domain. During the catch-up phase, these societal factors were one of the main pillars of the Japanese success story, however, Japan has entered a new technological era that demands novel strategies. The new strategic environment increasingly requires creativeness, and "unless young Japanese are better trained at the university level, they won't be able to function effectively in an industrial structure that values ideas and service as much as diligence" [Friedland, ibid.].

MITI views the proliferation of computer-mediated communication technologies as a chance to overcome these deficits: "By taking maximum advantage of the advanced functions of computer software and networks, such learning activities as identifying and analyzing subjects to study and expressing the results may become more advanced and active, and the capabilities of learners including their creative, intellectual, and expressive powers may be dramatically enhanced" [MITI, 1994, Chapter 2]. However, while the 1990 five-year plan of the Ministries of Education and the Ministry of Home Affairs promoted the introduction of computers in schools, the number of students per computer averaged only 38.6 in 1992 (USA: 19.2 in 1991) [ibid.[88]]. In 1992, only 2,500 educational software titles existed in Japan; in the United States 15,000. Teachers with computing capabilities amount to 11.3%. In sum, "Japan lags behind in the preparation of an environment suitable for carrying out education using computers, and the fruits of information technology development are not being sufficiently utilized in the education field" [ibid.]. Another problem is that while computers were introduced into schools according to the five-year-plan, "connections outside schools utilizing the computer network have only been executed for experimental purposes in a very limited number of schools" [ibid.]. Important, according to MITI, however, is the improvement of access to worldwide information and the use of remote education.

In its report, MITI foresaw the following measures for the fiscal year 1994 within the framework of the "Educational Software Development and Utilization Center" of the Information-Technology Promotion Agency (IPA). The emphasis has been on the development of software:

- Advanced computer software to allow interactive study.
- Computer software with user interfaces that can be easily used in educational facilities.

---

[87] For discussions of the Japanese education policy, see Schoppa (1991); Rohlen (1983); White (1987); Duke (1986); Horio (1988); Beauchamp (Ed.) (1991); and Shields (Ed.) (1989).

[88] Japan: Ministry of Education, USA: Dun & Bradstreet.

- Computer software which enables more advanced intellectual activities through so-called groupware, supporting collaborative study and decision-making and various types of simulation.
- Computer software to handle and analyze diverse types of information [ibid.].

MITI and the Ministries of Education and Home Affairs are also undertaking joint measures to introduce computers in schools by 1999 on a leasing and rental basis, in cooperation with the Japan Development Bank. An additional measure is the assignment of information technology engineers to train teachers. MITI and the Ministry of Education are also promoting the development of easy interfaces for databank searches and retrieval.

Effectively, MITI's plans are tautological: computer-mediated communication infrastructures and software applications are to expand creativity, and more creativity adds to the development of more applications. MITI apparently neglects existing applications and platforms, for example, American software that has already been widely adopted in Japan. Whether this is a strategy of reinventing the wheel is not clear; however, one could alternatively pursue the strategy to build on existing technological solutions. The Internet, for example, is almost never explicitly incorporated in the plans. In sum, whether the political class can promote creativity in the context of proprietary efforts is questionable.

*ii) Research and Research Networks*

In the facilitation of research, MITI's efforts have concentrated on the improvement of computing capabilities, the promotion of collaboration efforts, the sharing of information and the use of satellites for information collection. MITI argues that the United States are far advanced in the application of supercomputers for research purposes, and that in Japan "the number of organizations in which supercomputers had been introduced was very limited at that time; for example, only eight universities (10 machines) among the country's 98 national universities. Thus, it has been fairly difficult to challenge innovative scientific technologies by freely using advanced software" [ibid.]. In fiscal year 1993, appropriations for 11 more supercomputers were made, in fiscal year 1994 for an additional 10 supercomputers. Additionally, the MITI Real World Computing Program has the purpose to develop a new generation of computers and software.

Japan appears to lag behind the United States, not only in the use of supercomputers, but also in networking in the megabit class. Networks between research institutes are not interlinked, they are vertically divided between different ministries, they are slow in the speed of transmission, and local area networks (LANs) exist only in five of the 98 universities (1994). To overcome these deficits, MITI has set up the research network discussion group (coordinated by the Scientific Technology Conference Policy Planning Committee). Furthermore, STA and MITI have initiated a cooperative effort between different ministries to institute an ”Inter-Ministerial Research Information Network” and a ”Science Information Network” with the purpose of connecting research institutes, ministries, agencies and other countries, and to promote dissemination of scientific information. However, the greatest sums have been distributed for high-prestige research efforts, such as satellite technologies and undersea cable projects. These technologies may have a high value for future competitiveness in an important future industry, however, to what extent such activities promote grass-roots research is not clear.

*iii) Medical and Welfare Services*

In the provision of medical services, Japan has as yet only experimented with computer-mediated communication technologies. The reason is primarily a regulatory one: the Medical Service Law and other regulations require that medical image information, for example, computerized axial tomography, be preserved in original form. Only when the security of such information can be assured, it can be stored and exchanged electronically. MITI argues that in the future ”it will be necessary to execute model operations, to ensure compatibility and the standardization of transmission methods so as to allow the exchange of information between different information systems” [1994]. Since fiscal year 1994, MITI and the Ministry of Health and Welfare have coordinated their actions. For example, they have been undertaking model operations in the area of exchange of medical data via satellite transmission (since 1993) and exclusive lines (since 1994). Furthermore, they have been testing remote health care and therapy support systems as well as implementing medical databases.

In the provision of welfare services, MITI complains that ”[i]n Japan, only limited efforts to promote computerization of welfare services are done and no advanced nursing system has yet been realized on a practical level. Moreover, the issue of helping aged and physically handicapped people to participate in society using information systems is only being tackled for experimental purposes by some self-governing bodies" [ibid.]. To overcome these problems, it has proposed the "Mellow Society Plan": to promote the "active participation of aged people in society and the utilization of their accumulated experience and knowledge" [ibid.]. Activities include:

- Surveys and research on information apparatus which may be easily operated even by aged people who are unfamiliar with such equipment.
- Surveys and research aimed at establishing model information systems in local communities, including such systems to help the aged participate in local communities through serving as volunteers and handing down traditional culture to young people.
- Operation of a personal computer network named "Mellow Net" designed for the aged.
- Dissemination and education by means of sponsoring symposiums and awarding commendations to enterprises for the development of information apparatus designed for the aged [ibid.].

MITI furthermore supports research on advanced telecommuting nursing equipment systems. As the aging population is rising in numbers, one can expect a greater utilization of online medical services in the medium-term to raise their attractiveness. User friendliness and trust in these systems are crucial.

*iv) Administrative Systems and Libraries*

Computer-mediated communication technologies in administrative systems have not extensively proliferated in Japan. Public access to governmental information has been limited: "In Japan, although there are some cases in which certain governmental agencies furnish public relations data, etc. via personal computer communications, only a limited portion of the vast volume of administrative information released to the public is obtainable through various types of network. Moreover, the preparation of databases by administrative agencies is not sufficient and at the present time, only [few] administrative information databases are being provided to networks" [ibid.]. MITI outlines three principle components in which computer-mediated communication technologies could be of use: access to public administrative information, efficient and advanced administration, and paperless and automated administrative services. MPT argues as well that administrative systems could become a means to increase the installed user base and thereby increase the incentive to develop new and better systems: ”To ensure greater efficiency in administrative procedures and to enhance administrative services, information-based applications should be designed to improve certification procedures and government public relations services. This should result in a shift to on-line processing of administrative services and to paperless documentary exchange between different organizations. A database comprising administrative information should be accessible and contain a directory service coordinating all government ministries and agencies” [Telecommunications Council, 1994, Section 5]. Common initiatives, however, have not been implemented.

To overcome the existing deficits, MITI has proposed a 5-year ”plan to promote administrative computerization” within the 1994 administrative reform (supervised by the Management and Coordination Agency, supplemented by MITI efforts). Furthermore, in fiscal year 1994, MITI initiated cooperative ventures with other related ministries to establish a ”New Industry Creation Database Center” within the Information-Technology Promotion Agency (IPA). The aim is to promote the collection and dissemination of public data over networks, such as governmental statistics and bibliographic data (for example, White Papers, standards publications, industrial council publications, and other governmental publications).[89]

However, Japan has not only lagged behind in the dissemination of governmental data, but also in its limited use of computer-mediated communication in administration. Since fiscal year 1994, MITI has pursued an improvement of local area networks and systems within ministries so that all ministries and government employees have access and are interlinked. Furthermore, it has planned to increasingly implement paperless administration.

Libraries are important institutions regarding the flow of information. The National Center for Science Information Systems connects more than 300 libraries, however, access over public networks, has not yet been implemented. In fiscal year 1994, MITI initiated the ”pilot electronic library system operations”, in cooperation with the National Diet Library, the Ministry of Education, Science and Culture, the Ministry of Home Affairs, and STA. The plans have included:

---

[89] Much of the information in this chapter originates on official governmental servers.

- Determination of a common format for information on the bibliography and location of public libraries on a national level.
- By compiling information on bibliographies and locations in a database based on this format and connecting libraries with each other, a pilot operation will be undertaken to create an environment where data can be integrally retrieved regarding in which library desired information can be found [ibid.].

Furthermore, the construction of an electronic library system (including storage and retrieval systems) has been a major aim.

In sum, in Japan, the most concise technology policy measures have been initiated in the hardware domain as well as in specific islands of the software side. Supplementary technology policy measures, which could be called the ”soft” measures, have been conceived in principle, however, the largely top-down approach promises little success. Although the pledge has been made to assist smaller and highly innovative enterprises, financing constraints and a low degree of independence and flexibility are likely to obstruct significant process in the medium-term. Only the large-scale hardware and infrastructure developments promise success. Much of these developments, however, have an export focus and are unlikely to permeate Japanese society.

In the United States, as we have seen in Chapter 3, regulatory policy has played a major part in the development of the ”Information Superhighway”. The Clinton Administration has promoted a wide societal debate over the future regulatory framework. Whether Japan undertakes a similar approach or whether it is closer to the European approach of top-down determination of the regulatory structure without a wide societal debate, is the subject of the next section.

2) Regulatory Policy

While significant elements of technology policy have been well-defined, the revision of the regulatory structure to integrate the demands of new technologies has been slow. The Telecommunications Council has pledged to ”review regulations and business practices in the fields of education, medical and health care and commerce, in assessing both network enhancement and utilization. It is also paramount to promptly examine the establishing of new rules for governing electronic funds transfer using the network and information assets protection through the network" [Telecommunications Council, 1994, Section 5]. Concrete actions have not been undertaken, despite that a number of study groups have been implemented. We will now review the progress on regulatory issues such as competition policy and interconnection, universal service, and intellectual property rights. These issues are still in the phase of problem recognition. On other issues such as cryptography, privacy, and decent conduct on networks, very little discussion exists in Japan.

a. The "Second Info-Communications Reform": Providers and Competition

In 1985, Japan undertook its first major telecommunications reform. The government privatized NTT, and permitted the entry of alternative telecom carriers into the market. This liberalization opened the way for more competition, lower telephone rates, more services, and explosive growth in the mobile communications market. The compounded annual growth rate of the market between 1985 and January 1994 was 7.3%, of capital investment 7.1%, and of employment 4.5% [Telecommunications Council, 1996; own calculations]. In market niches, the reform was highly successful. Mobile telephony had the phenomenal compounded annual growth rate of almost 100% while the basic rate fell by factor four and the rate for long-distance calls by more than factor 2 [ibid.]. The great expansion of alternative telecommunications carriers, from solely NTT and KDD to several thousand following the reform, can be found mostly in this niche.

With the proliferation of new communications systems and processes, however, the First Info-Communications Reform proves to be increasingly inadequate. Eiichi Tanaka, Senior Advisor of the Telecommunications Policy Division of MPT, argues that rates are still excessive and are higher than in other countries as 99% of all intra-prefectural calls remain subject to the NTT monopoly. Furthermore, less services exist than in other countries, and the cross-entry between domestic/international and long-distance/local service provision remains inadequate. Lacking content production, deficient research in service models, and general informatization gaps parallel competitive deficiencies in Japan [Tanaka, 1996, 4].

One major problem has been the regulatory and administrative system that is oriented towards voice communications, as Professor Kotaro Suzumura, member of the Information Technology and Communications Policy Forum of Japan, explains: "Japan is still unable to extricate its regulatory system and administration for the information and communications sector from the concepts and system of the 1985 telecom reform, designed for a time when the primary technology was voice communication using the telephone. Therefore, the limitations restricting the scope and the speed for applying new technology to approaches to the current system and administration are rapidly becoming acute" [1995]. The technological revolution, however, has been in the form of the convergence of the telephone and the computer. Regulatory constraints, for example, the prohibition of modems during the 1980s, have limited the proliferation of computer-mediated communication in Japan as a mass phenomena as has happened in other countries:

> The increasingly widespread reach and popularity of the Internet has subjected Japan's telecommunications service structure to a barrage of new pressures and demands. Though Japan's public-service frameworks may not have kept pace with the advances shown by the technologies the Internet has come to symbolize, to consumers that has little to do with the main issue. Indeed, the real problem clearly has to do with the encumbrances posed by a service architecture and rate structure that historically has always trailed far behind evolving trends in the use of phone-oriented communications media: trends, incidentally, that have gone hand-in-hand with advances in the technological arena. The Internet itself came into being and thrived on the notion of transferring every imaginable form of computer data across multiple network links. … Given the maze of regulations still strangling activity in these fields, it seems rather easy to predict that coming trends in Internet usage will ultimately help to demolish the traditional regulatory framework [Yoshimura, 1995].

For the time being, however, a number of problems persist. Some commentators have criticized the continual pursuit of "managed competition", the inadequate rate structures and the general regulatory structure. Regarding "managed competition", Suzumura criticizes the discretionary regulatory administration by the MPT [1995]. Despite privatization, MPT has limited competition by restricting market entry and exit, and by setting fees and services. This management is the compensation for NTT's continuing universal service provision.

Another critique concerns the present structure of the "message areas". Message areas are geographical divisions to distinguish fee areas. The problem with the present system is that access to computer networks is unequal because less access points exist than message areas. This implies that many have to pay "a several-fold increase in the cost" of access because they have to dial up to a message area outside their own [ibid.].

Rather, Yoshimura suggests, rates should be based on actual distance but without such sharp rate increases for calls exceeding the distance of 15 kilometers [1995]. Similar arguments apply to leased lines and ISDN.

Moreover, excessive bureaucracy persists, Suzumura criticizes: "Private community efforts to accommodate the need for network services will be extremely limited as long as apartment managers, for instance, have to be licensed as telecommunications carriers. Efforts to build and run networks on large university campuses in recent years are an example of what is realistically possible through the operation of community networks. The institutional barriers posed by regulatory red tape therefore count as the only serious problem now remaining" [1995.]. As we will see below, the application process for new services is often not transparent and obstructs market entry.

The Telecommunications Council has been authorized to review the existing regulatory structures. Suzumura describes the role of the Council as follows: "The work done by the Telecommunications Council to reexamine the operational configuration of NTT is a golden opportunity for the Japanese political and economic system to recover the ground lost during its delay in coming to grips with systemic reform, and to seek a new systemic and policy framework in the public sector. We would like to see the use of fair procedures to create a radical design for a new systemic framework for Japan's information and communications industry, employing in a forward-looking manner the competitive and regulatory experiences since telecom reform" [ibid.].

The centerpiece of the Second Info-Communications Reform is the breakup of NTT as outlined in the Telecommunications Council Report [Tanaka, 1996; Telecommunications Council, 1996]. The underlying perspective behind the report is that the changes in industrial and social structures are inseparable components. As the technological innovation advances, telecommunications, and broadcasting technologies converge, economic changes and competitive pressures in the world economy accelerate, the policy-making domain has to preempt developments by letting the economic benefits trickle down to the general public and not only to the large corporations. The envisioned reform rests on three principle pillars of governmental action: deregulation, a new interconnection policy, and the implementation of NTT's restructuring.

The deregulation initiative entails the deregulation of the telecommunications sector, the deregulation of the utilization of public land to enable the establishment of physical infrastructures, and the deregulation of computer-mediated communication application fields, such as education and medicine (for example, the regulations concerning the reimbursement of medical online services which has not yet been permitted). These measures have the purpose to improve competition in regional markets and international competitiveness generally. Interconnection policy entails the establishment of interconnection rules and conditions, and the strengthening and specialization of expert and working groups in the Council with the mandate to institute, monitor, and decide upon interconnection rules. The restructuring of NTT is to be completed by fiscal year 1998; this requires swift governmental action on a restructuring plan and legislative initiatives. Let us examine these three pillars of the Second Info-Communications Reform in greater detail.

*i) Deregulation*

The existing regulatory structure divides telecommunication services along regional dimensions, the international, the domestic, and the local. It also differentiates between services and their regulation. Principally, telephone providers in one of these area-based divisions cannot offer services in other areas (for example, the provision of long-distance service by a local operator, or vice versa). Other regulatory obstacles include the separation of the telecommunications and cable-TV business, the restriction of foreign investments, and the closed processes in the existing fee approval system. These obstacles obstruct the market entry of competitors. The Second Info-Communications Reform aims at eliminating or reducing these obstacles. Concerning the divisions of geographical and service areas, ”the Telecommunications Council report strongly emphasizes the fact that in Japan as well, it is necessary to enhance cross-entry into different business areas”, such as cross-entry in local- and long-distance services, as well as in telecommunications and cable-TV [Tanaka, 1996, 2]. Box 5.2 summarizes MPT’s deregulation plans.

Box 5.2: Telecommunication Deregulation Plans in Japan

1. Market entry regulations

a) Elimination of the clause on excess facilities as one of the criteria for permission to enter into the Type I telecommunications business
   - -Premise: Establishment of new frameworks for provision of privileges concerning public utilities

2. Tariff regulations

a) Regional services (after restructuring of NTT)
   - -NTT: Introduction of authorization methods such as the "yard-stick" system
   - -Others: Shift to an advance notification system

b) Long-distance services
   - -After the restructuring of NTT –> Shift to an advance notification system
   - -Introduction of an incentive regulation for dominant carriers instead of present authorization system

c) International services
   - -Expansion of destinations by carriers other than KDD –> Shift to an advance notification system
   - -Introduction of an incentive regulation for dominant carriers instead of present authorization system

d) Mobile telecommunications shift to an advance notification system

3. Leased circuits

a) Allowing interconnection of private leased circuits with public switched networks at both ends by the end of 1996 domestically, by the end of 1997 internationally (complete liberalization)

4. Restrictions on foreign investment

a) Based on the results of WTO negotiations, the possibility of relaxing restrictions on foreign ownership in the future will be considered.

b) Long-distance NTT: It will receive the same treatment as other Type I carriers.

c) Regional NTT: Restrictions on foreign ownership will be relaxed according to the progress made in market competition.

d) KDD: Relaxation of restrictions on foreign investment in KDD will be considered, taking into account viewpoints for assuring national security and citizens' safety, when studying the abolition of the KDD Law.

Source: Telecommunications Council, 1996.

A major problem of the present regulatory structure, as argued above, is difficult market entry. The regulations are not transparent and decision processes are often closed to new entrants. Tsuruhiko Nanbu argues that the Telecommunication Business Law made an "unrealistic assumption" in that it "furnished the regulatory agency with the ability to define the competitive market before competition actually began" [1995]. Thus, the actual viability of a firm is not tested in the market, and the decision on its probable viability is made prior to market entry. Or in other words, the Law ”does not allow for the entry of companies who would start a business without knowing whether they can survive” [ibid.]. Thus, a governmental regulatory institution preempts a market test. The issue of market entry is also important with respect to foreign enterprises. The proposed deregulation initiative plans to relax restrictions on foreign ownership, however, to what extent restrictions will be reduced is not yet clear. To the issue of vertical integration and mergers and acquisitions, the Telecommunications Council has not explicitly provided comments. The future of competition policy in the telecommunications domain is therefore not clear.

Another barrier to the market entry of providers and service providers is the present fee structure. Suzumura argues that MPT and its policy of fee approvals is ”responsible for the maintenance of the sharp fee differential between NTT and the [New Common Carriers] (NCCs). Even if the excessive protection and fostering of the NCCs was worthwhile in the context of industrial policy, it weakened the incentive of businesses to compete using new service as a strategy, and it rendered competition in the telecommunications market conservative” [1995]. Therefore, this system also reduces the incentives to offer the new services that are the principle feature of an Intellectually-Creative Society. Suzumura suggests that ”the prior regulation by the MPT in a new framework should be limited to securing the transparency and openness of the rules of competition to avoid hindering with an unclear regulatory administration the evolutionary development of the telecom industry through dynamic competition. The unfortunate experience of unclear and discretionary prior regulation may further intensify the instability surrounding an unstable telecommunications business. This current opportunity must be taken to adjust and eliminate regulations” [ibid.].

Considerable debate surrounds the status of the future regulatory institution. While the Telecommunications Council argues to maintain regulatory capabilities within MPT [Tanaka, 1996], other commentators plead for the establishment of an independent third-party agency [for example, Kokuryo, 1995]. The selection of council members is a decisive factor regarding the independence of the regulatory institution. MPT currently appoints committee members, and it usually appoints only those who do not oppose the MPT line. Thus, as Suzumura states, ”[f]rom the start, the possibility is extremely limited that members critical of the policy stance of the agency with jurisdiction will be selected. This alone creates a tendency for preliminary screening by the agency with jurisdiction over the views expressed during the deliberation process" [ibid.]. Enterprises that want to enter the market are not likely to have their own constituency within the Council as they lack market and lobby powers. Consequently, their chances for a fair consideration are smaller than those of large corporations that have great lobbying power. Furthermore, the deliberation process is closed. It is a normal procedure to first outline an in-house report and to publicize only an anonymous version that displays unanimity. In other words, the individual opinions of council members and outside specialists are not publicized, and therefore, they are not subject to public scrutiny. In sum, the strategy has been to minimize the potential for disagreements by only selecting "compatible" (to MPT opinion) members to the committee, to minimize disagreement by closing the deliberation process and to present an agreement that is seemingly unanimous. Those that remain outside of this process have little chance to protest and, what has troubled many commentators, often cannot even comprehend the decisions.

To overcome such problems, Suzumura proposes that the Telecommunications Council must emphasize openness, transparency, and procedural fairness in its deliberations. One method to achieve these elements is to establish an independent and neutral body. This new agency would arbitrate between the different players:

> Over the long-term, it would be desirable if an independent, neutral body were to adopt a decision-making mechanism for management and operation to ensure the openness, transparency, and procedural fairness of the decision-making process throughout the system when public determinations of this sort are to be reached. There are many problems that remain before the actual systemization of this proposal is achieved, however. They include the specific design of what we refer to as "an independent, neutral body to adopt a decision-making mechanism for management and operation", and devising approaches for the accurate, prompt, and comprehensive exchange of the knowledge, experience, and information required for the decisions between this public decision-making mechanism and the agency with actual jurisdiction [Suzumura, 1995].

The demand for a independent third-party agency has arisen especially in regard to the issue of interconnectivity. As deregulation proceeds, and as it will be pushed into a second phase in the second half of the 1990s, the improvement of competitive conditions has been increasingly requested by market participants, especially by new entrants. The next section reviews this issue.

*ii) Interconnection*

Deregulation in the telecommunications sector potentially enables the proliferation of participating enterprises and the services they offer. A major question that legislation needs to solve is under what conditions the participating enterprises gain access to the existing and newly created networks. The question is the following: how can the government ensure that those who provide the transmission hardware will allow access by alternative content providers, even if these providers compete with the products that the owners of the transmission hardware offer themselves?

Critics of the present interconnection mechanism argue that the regulatory arrangements have been ambivalent and not transparent. Article 38.1 of the Telecommunications Business Law outlines current mechanisms and procedures. Under these arrangements, MPT is the principle authorizing institution for interconnectivity agreements. First, the relevant businesses negotiate an agreement among themselves. When they cannot agree on the content of the agreement, they can involve MPT as a mediating actor. In that case, MPT issues an authority order. If participants of the process are dissatisfied with this order, they can appeal the decision within three months. However, MPT continues to be the final decision-maker; a factor which critics argue is a conflict of interest because MPT has both intermediary arbitration and regulatory functions [Suzumura and Tanaka, 1995]. Whether this factor is indeed a major disadvantage is not clear; in other countries, similar supervisory mechanisms exist. Troubling, however, is the low degree of transparency as the decision-making processes are not publicized. Suzumura and Tanaka[90] therefore argue that ”it would be difficult for potential business enterprises to scrutinize past cases resembling their own at a later date, to objectively and rationally trace the process for determining the methods and conditions for connectivity and the grounds for the decision, or to make reasonable business plans. That makes it almost impossible to assess the profitability of a new service. This would very likely result in eliminating the incentive for potential business enterprises to enter the market and develop new services”.[91] Furthermore, a potential conflict of interest arises as MPT does not only

---

[90] Tatsuo Tanaka, not to be confused with Eiichi Tanaka of MPT.

[91] In a footnote, Suzumura and Tanaka offer the following comparison to highlight the issue: ”To understand that the lack of transparency and the difficulty of anticipating future conditions for regulatory administration reduces the motivation of business enterprises for development and competition, try imagining what conditions would be like if the development of every new vehicle in the automobile

issue regulations, but it regulates on a day-to-day basis. Suzumura and Tanaka call this *dango*, or collusion. They argue that this regulatory condition obstructs competition by excluding users and their demands.

One reason why interconnectivity negotiations require an independent arbitrator is the existence of unequal enterprise power and negotiation strength (see the relevant sections in Chapter 1). Differences in size, experience, and the "structural asymmetry between comprehensive network service providers and businesses providing selected services only" [ibid.] may amount to effective barriers to entry, especially for smaller enterprises. Suzumura and Tanaka cite an example of obstruction: "There were a series of obstructions last year in the connectivity negotiations with NTT regarding frame relay services and VPN [virtual private network] services by the NCCs. In the latter case, the Minister of Posts and Telecommunications had to go so far as issue a connectivity order. This suggests that direct negotiations between business enterprises with differences in network size and business experience do not necessarily proceed smoothly or quickly" [ibid.]. Suzumura and Tanaka explain that "existing business enterprises will always have the incentive to strategically establish connectivity methods and connections that would leverage negotiating strength and weaken the position of potential competitors. In extreme cases, the enormous comprehensive service providers would demand prohibitively high connectivity fees from businesses that cannot offer complete telecommunications services without interconnectivity. This makes it theoretically possible for these giants to prevent others from actually participating in their business" [ibid.]. In other words, large enterprises may abuse their market power by using strategic conduct, perhaps not only in questions of access, but also in their pricing strategies (for example, predatory pricing; see Chapter 1). Although MPT has interfered in the name of smaller providers, the larger players still can use their power.

As an alternative to the present regulatory system, Suzumura and Tanaka first propose to establish an independent third-party intermediary agency. Second, legislation should guarantee transparency and openness in interconnectivity negotiations in open hearings, coupled with access to these negotiations by service providers, potential service providers, and users, with subsequent publication so that decisions are

---

industry required MITI authorization, and that the conditions for authorization were shrouded in the fog of an arbitrary administrative regime. If for some reason authorization were not granted, all the costs retraceable. They argue that ”establishing transparency and openness can be expected to exert a rigorous self-discipline on the intermediary agency through the historical judgement of past results” [ibid.]. Third, the intermediary agency requires the necessary legally-guaranteed authority over the administration of telecommunications to promote its effectiveness, especially in its ability to gather information within MPT on the daily operations. Fourth, and most important, they argue, is the clear differentiation of functions between the administrative bodies.

The independent agency's principle function would be to arbitrate between the different players involved. Suzumura and Tanaka identify the functional tasks of telecommunications regulations, the present regulatory status, and the proposed future responsibilities (see Table 5.1). The new agency would have the following arbitration tasks:

- to accurately monitor connectivity negotiations among the business enterprises;
- to place deadlocked negotiations back on track;
- to block the use of monopolistic power that intends to halt real competition through superior negotiating ability; and
- to create a fair competitive environment in the information and communications industry [ibid.].

They argue, however, that the decision-makers government need to take a cautious approach not to create excessive administrative management of competition that may discourage technological development. The structural design of this agency must clearly distinguish the intermediary function in negotiations from the subsequent regulatory function. For example, the information that the agency collects should not be abused for regulatory use. Similarly, concerns over the implications of subsequent regulatory administration should not impact the mediation process and its content. In sum, the proposals aim at a separation regulation and regulatory administration.

---

required for the development of a new automobile would have been wasted. It is clear that this mechanism has an extremely inhibiting effect on the motivation for development” [ibid.].

Table 5.1: Proposed Interconnection Regulatory Agencies and Tasks

| ***Functional Task*** | ***Executing Institution*** | |
|---|---|---|
| | Today | Future |
| Creation of basic rules for the systemic framework of the industry | Legislative action on the Telecommunications Business Law; MPT (Telecommunications Council) | same |
| Creation of specific measures for applying the basic rules | MPT | New independent agency |
| The day-to-day enforcement of telecommunications policy and administration | MPT | MPT |
| Day-by-day oversight of the compliance with these basic rules | MPT | MPT |
| The resolution of disputes among the business enterprises | MPT | New independent agency |

Source: ibid.

A second concern is the constitution of the agency, or more specifically, its membership. Suzumura and Tanaka propose a full-time membership in this agency. These members should be neither affiliated with involved enterprises nor with any related regulatory agencies as that may create conflicts of interest. Members leaving the committee should also be barred from taking up employment in involved enterprises or agencies (they propose a five-year period). The creation of an independent agency requires the following legislative actions: a revision of the current Telecommunications Business Law, the assembly of suitable personnel with experience and knowledge, staff for the research, collection and analysis of the information required for resolving disputes, and budgetary measures to carry out the intermediary function [ibid.].

The final report of the Telecommunications Council, however, does not divide regulatory and intermediary functions. Rather, MPT argues for the maintenance of full responsibility for both. Suzumura and Tanaka conclude that this shows that ”the Telecommunications Council is an organization for defending the MPT's interests” [ibid.]. In short, the problems that have been identified by various commentators can be expected to persist in the short- and medium term.

Jiro Kokuryo has made another proposition that may uncomplicate the issue of interconnection: the principle of ”unbundling” as a means to open the networks to all [1995]. Unbundling implies the complete separation of services and hardware provision. In this case, hardware providers could not restrict access to their system, and they would be forced to charge its own content providers the same as they charge competing content and service providers. Kokuryo argues that such a regulation would open the market for new services and thereby raise the incentives of newcomers: ”Unbundling would enable new market participants to combine their own functions with those rented from other companies without having to independently develop and prepare every element of a large network from the start of operation” [ibid.]. New content providers could specialize in certain products. Non-Japanese service providers could enter the Japanese market without great problems and intensify competition within Japan. Kokuryo proposes that unbundling could significantly contribute to Japanese international competitiveness:

> The capability to offer industry and individual users the world's most advanced telecom services at all times – including fee schedules – is extremely important for maintaining Japan's competitiveness on the verge of the 21st century. A comparison between one country that is only able to

> receive frustratingly expensive services limited to those of just some of the providers, and another country that can receive at any time the best services from around the world without special arrangements, makes clear which country has the competitive advantage [ibid.].

The Telecommunications Council has not yet decided on these issues. It has publicized propositions, established the Special Committee to Promote Interconnection, and held a series of discussion meetings on the issue. The objective is the promotion of fair and effective competition. The principle conflict of interest, however, persists: MPT outlines itself what future tasks it will have. Independent parliamentary committees, as they exist in other OECD-countries, have played no role in the process. On the other hand, some propositions on the future regulatory authorities and the separation of functions seem excessively interventionist, promoting extensive bureaucratic supervision. Especially the proposition to bar employment in certain authorities and to obstruct specific enterprise activities seems problematic. The supervision of competition may end in institutionalized intervention.

*iii) NTT Restructuring*

The third pillar of the Second Info-Communications Reform is the restructuration of NTT. Eiichi Tanaka, Senior Advisor of the Telecommunications Policy Division of MPT, argues that the restructuring of NTT will enable more efficient and competitive services in the telecommunications sector, create an inherent dynamism in computer-mediated communication-related industries, and promote cross-entry and competition. Box 5.3 summarizes the expected effects of NTT restructuring.The restructuring scheme foresees the breakup of NTT into Long-Distance NTT and West and East NTT (see Figure 5.7). Long-Distance NTT will be liberalized and able to enter both the international market (presently controlled by KDD, which will later also be privatized) and the regional markets. Furthermore, it could enter the cable-TV and content markets. The regional operators West and East NTT would not be restricted to their own regions, but could cross-enter each other's markets, including telephone, cable-TV and content markets. With an intensification of competition, both West and East NTT could then also enter the long-distance and international market within their own service areas. Tanaka argues that "the rationale here is to prevent unfair conditions under which a bottleneck monopoly could be developed that would inhibit competition" [ibid., 9]. In the meantime, the regional NTTs remain subject to the conditions of current NTT law.

Box 5.3: Expected Effects of NTT-Restructuring

1. Lowered rates, diversified services

a) Lowering overall communications rates for restructuring info-communications industry on the basis of low-cost structure
b) All info-communications service rates depend on rate of regional networks as interconnection rates.
c) Realizing services meeting users' needs

2. Preparation of conditions for fair and effective competition

a) Unified business operations of long-distance and regional communications sectors as a background

3. Smoothing interconnection

a) Securing smooth interconnection is indispensable for realizing improved competition and new services at early stage
b) Unified business operations of long-distance and regional communications sectors as a background

4. Strengthening international competitiveness

a) 0verseas business deployment and aggressive strategic global alliances
b) Dynamic domestic competition among multiple carriers of over a certain size can lead to improvement in international competitiveness.

5. Enhancing R&D capabilities

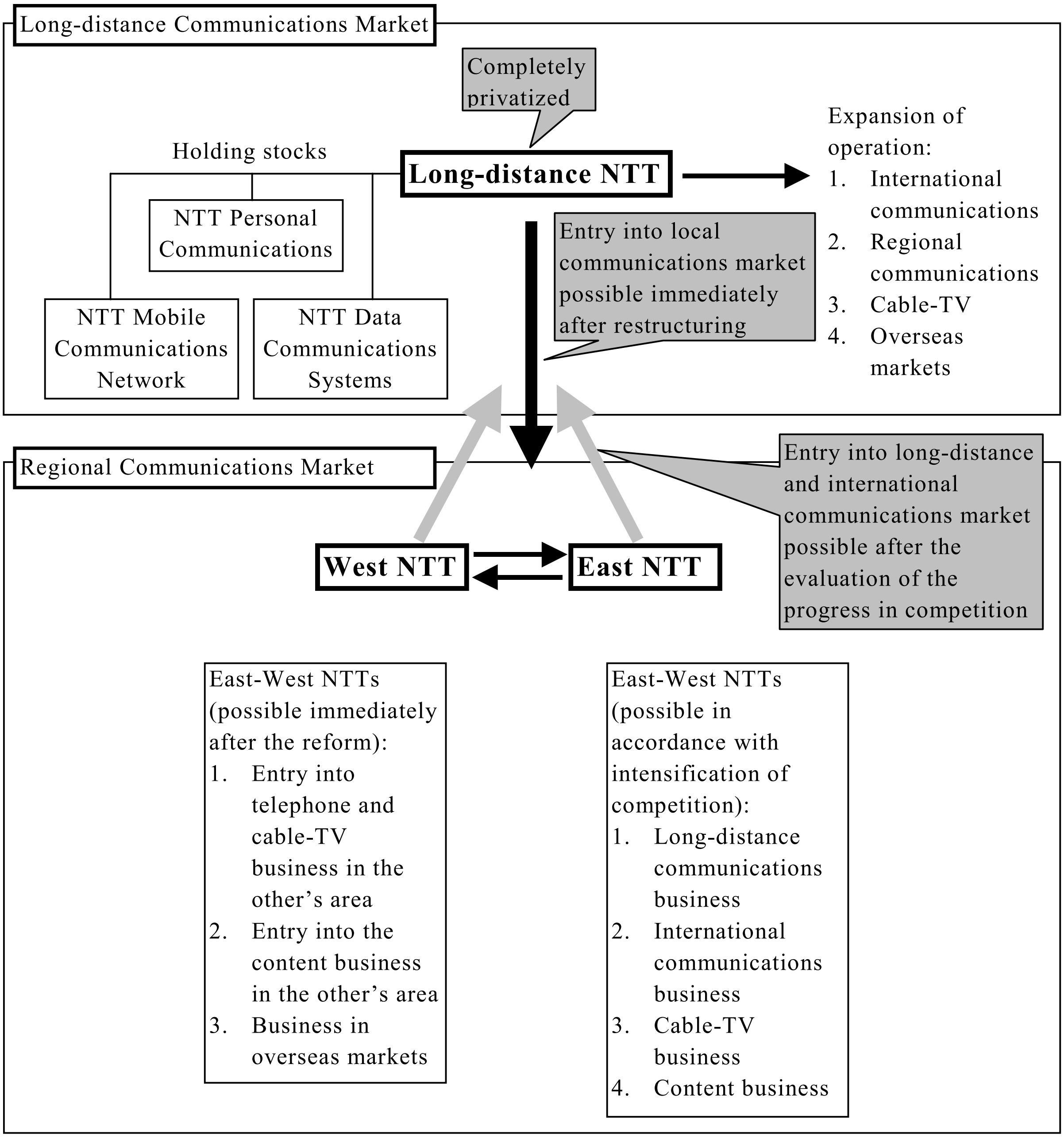
a) Dynamics in competition by multiple players needed
b) Enhancement of R&D capabilities is expected for meeting environmental changes such as development in multimedia and globalization

6. Contributing to establishment of info-communications infrastructure

a) NTT should play an important role in providing balanced domestic communications services at an early stage, while competing with other service providers such as cable TV operators.

Source: Telecommunications Council, 1996.

Figure 5.7: NTT-Restructuring Scheme




Source: Telecommunications Council, 1996.

MPT plans the following measures for deregulation: changes of market entry regulations, tariff regulations, and regulations on leased circuits, and the reduction of restrictions on foreign investment.

Critics argue that the present restructuring scheme would recreate the conditions in the United States that now have been removed with the passage of the

Telecommunications Act of 1996. For example, Tsuruhiko Nanbu, member of the Information Technology and Communications Policy Forum of Japan, argues:

> This is the greatest weakness of the plan to spin off NTT's long distance division. Creating such a condition will structurally exclude the long distance company from the telecommunications format of the near future – open-ended, non-hierarchical systems. There are concerns that the long distance telephone company service would degenerate into the previous method of transmitting in bulk the traffic generated locally. Of course, this would be the same for the regional telephone companies confined to intra-city service, depriving them of an effective method for competing with computer networks. Eventually, the spinoffs and breakup of NTT would be tantamount to purposely repeating the experience of facing the aftereffects of the AT&T breakup that currently confront the U.S. [Nanbu, 1995].

He also argues that a breakup along regional lines would reduce the incentive of international carriers to form alliances when they can only reach a limited number of customers.

In a statement of December 6, 1996, MPT persists with its breakup plans and with the functional differentiation of the three future NTTs. Whether it can indeed promote the envisioned competitive environment, remains to be seen. Especially the functional differentiation may necessitate further management of competition. If competitors could indeed enter both short- and long-distance markets, while the regional NTTs cannot, then it seems likely that the latter will request protection, and if protection measures are indeed instituted, then the deregulation package may be inconsequential.

To conclude, MPT's principle tasks are the creation of computer-mediated communication infrastructures and the redefinition of the regulatory structure in the telecommunications market. While the plans for a new computer-mediated communication infrastructure have been in the process of implementation since the middle of the 1980s, the big question of the creation of competition has not been resolved. The First Info-Communications Reform of 1985 has only been partially successful: ”managed competition” persists and the demands of new computer-mediated communication technologies have not been integrated. A remaining challenge is the development and provision of content. MITI has pursued the strategy to promote content development with public sector initiatives.

b. Universal Service

As in other regulatory issues, the future definition of the universal service principle is still in its infancy. In the present telecommunications system, the provision of universal and equal access is achieved by the principle of cross-subsidization. Cross-subsidization implies lower telephone rates for local service than economically-justified, and higher rates for long-distance service. In the future, however, the establishment of a competitive environment requires economically-calculated rates and not socially-calculated rates, even if that requires a transitional period of higher rates. Higher and economically-justified local rates will induce local service providers to extend their services and provide an incentive for new providers to enter the market.[92] Consequently, as Masahiro Okuno and Takehiko Aoyagi, members of the Information Technology and Communications Policy Forum of Japan, argue, the universal service concept must be redesigned by means of ”sufficient information concerning mechanisms for determining who benefits, who shares the burden, and how must be made available through a transparent and democratic procedure, and the information should be reviewed periodically. Finally, this type of universal service should involve protection for competition between providers, services, technologies, and regions, and should distribute as fairly as possible among these entities all associated costs” [1995].

Okuno and Aoyagi define ”universal service” as ”information and telecommunications services ensured to all citizens – regardless of region and user circumstance – through standard cost-burden sharing” [ibid.]. Universal service neither implies identical rates nor uniform services for all. Rather, ”it should be understood that good service is defined as a policy which is to realize the social fairness of the telecommunications industry, and that it also functions as a structure which attracts the advantage of competition while avoiding the problems of social distribution that result by introducing competition” [ibid.]. Thus, the new universal service concept must both accommodate basic access by all and the consequences of deregulation that may cause higher prices in the short-term. This, however, is difficult because it is a distribution versus an efficiency problem. A solution could be the creation of a system that concentrates on those segments of the population that need subsidization. The new

---

[92] This should reduce rates in the long-run, however, in the short- and medium-term, higher rates may reduce the attractiveness of online services. For example, in the United States, free local calls have contributed to the wide use of online services.

system must also be flexible in what services it offers, i.e., provide extended services to those that want them. The achievement of such a system, they argue, requires a national consensus on the future concept.

Okuno and Aoyagi base their reasoning on the changing trends in network externalities during the development of a novel technological system: in the beginning phases of large technological systems, it is advantagous to charge low fees to achieve a large installed user base. Furthermore, from a social standpoint, the poor and the handicapped have the right to participate in a social life. The problem that develops when the telecommunications structure is deregulated is that carriers prefer to concentrate on more profitable customers ("cream skimming") and avoid offering the governmentally-administrated local service. Real competition in the local areas cannot develop in such a case.

As an alternative to the regulation of fees to achieve universal service, Okuno and Aoyagi propose a fee system that is based on the cost principle. Such a system implies higher fees for local service, an estimated rise of 16%. Nevertheless, the problem of access remains: access by those that cannot afford cost-based fees, and access by those that live in rural and depopulated areas, as well as on islands (as economies of scale are higher and costs lower in areas with a high-density population).

To overcome this problem, Okuno and Aoyagi propose two basic principles of universal access from which any subsequent action should derive:

1. Consensus among the public: "The type and content of services which are covered under universal service should be decided upon as a result of a consensus formed among the public through fully informed, transparent and democratic discussions on the costs and benefits. The specifics of universal service should then be subject to a continual review" [ibid.].
2. Neutrality: "Universal service should be positioned in a neutral position in the market place. The conditions for competition among different corporations, different services, different technologies and different regions should be maintained as fairly as possible, and all corporations, services, technologies and regions should, to the extent possible, equally share the burden of universal service" [ibid.]. No individual company, including NTT, should carry the burden of cross-subsidization alone but only to the extent of their market share.

To administrate such a system, Okuno and Aoyagi suggest the establishment of a ”program principal”: ”Program principal of universal service [..] is an organization which has the authority and responsibility to operate the system, secure financial resources (or alternatively receive financial resources from the government), select and determine beneficiaries, and distribute the capital” [ibid.]. This program principal could subsidize the difference that providers demand and what users can pay.

What financing system is preferable in the future is not yet clear. Either the system can be based on direct or indirect subsidization, or on a voucher system. Direct subsidies are paid out directly without any restrictions on the use. Indirect subsidies, conversely, are use-restricted: for example, they apply only for the use of a telephone (for example, lower phone rates or access charges). Possible beneficiaries could be low income households and the handicapped. The biggest problem, however, is the great administrative burden in the identification and selection of the needy.

The other method to guarantee universal service is the voucher system based on the benchmark method. The process is as follows:

1. The principal body drafts a ”benchmark rate table” for the entire country that serves as the basic rate. The providers can then make a decision on how much they prefer to charge in a particular region.
2. The principal body distributes vouchers to the needy. The latter then have a choice which company they prefer.
3. When the company's rates are higher than the benchmark rate, the voucher covers a fixed ratio of the difference. The principal body refunds this difference to the provider.

The system characteristics would be the following: vouchers are only issued when the market rate is higher than the benchmark rate. The reimbursement to the user is equal to the benchmark rate. In this case, when one provider is cheaper than another, the user has an incentive to select the cheapest provider for a certain service or to select one with a better service at the same price. Okuno and Aoyagi call the voucher system a ”pseudo-competition mechanism” because providers have the incentive to offer better services at lower costs despite the existence of a governmentally-administrated fee system. The introduction of two types of services that are open for choice could supplement the universal service provision: one with a high basic rate with unlimited calling privilege (for those who can afford it), and one with a low basic rate with a high charge for calls over a basic limit (for the needy to make emergency calls, also called lifeline). The voucher system can be financed as follows:

1. Individual consumer tax and corporation tax on telecommunications services.
2. A value-added tax on telecommunications services (or a portion of the revenue from consumer taxes on the telecommunications services).
3. Corporate donations.
4. Other income (such as sales from NTT stock) [ibid.].

Not only fees are important when considering the aspect of universal service, but also access charges. In Japan, charges are solely based on traffic sensitive cost for the use of long distance corporations that use regional circuits. This system is thus independent of universal service elements. In contrast, in the United States, the long-distance corporations do not only contribute to the cost of regional circuits, but also pay into financial service systems (for example, universal service foundations and assistance for the lifeline)[93]. One way to overcome the lack of universal service attributes could be the establishment of a Universal Service Fund as has been proposed in the United States.

Despite these propositions, until early 1997, no concise legislative action has been undertaken to clarify the future universal service concept.

b. Systems Review

Systems review concerns the procedural redefinition of the interaction between government institutions and societal actors. Both the Telecommunication Working Group and the Administration Reform Task Force are involved in the process of systems review. Specific examples of review include a redefinition of tax filing laws, medical filing laws, application processes and contract laws. Current tax laws require the storage of accounting materials in physical form for seven years. This law excludes the possibility to undertake the tax filing process by means of electronic transmission. Some argue that this regulation, which intends to prevent the alteration of data, excessively burdens enterprises and individuals. Some aspects of medical treatment are subject to similar restrictions. For example, prescriptions, medical charts and diagnostics cannot be transmitted electronically. Without the redefinition of regulations, the networking of hospitals for coordinating treatment is without practical benefits. Remote health services could not develop, especially as a fee reimbursement system has not been set up. Paperless applications to governmental or public offices have also not been widely implemented. Exceptions are applications to the Patent Office (since December 1990). This example has been highly successful; 95% of all applications are now paperless. Similar efforts have been undertaken within the Nippon Automated Cargo Clearance System concerning the procedures on imports and exports. The status of e-commerce and online sales has also not been finalized. The Installment Sales Law necessitates that a contract must be in written form. Despite this lack of clarity on online transactions and processes, the mere recognition of these problems is a considerable step towards the Intellectually-Creative Society. Nevertheless, whether these problems will be overcome in the short- and medium term is not yet clear.

c. Intellectual Property Rights

Similar to the regulatory issues above, action on intellectual property rights has been limited to the establishment of councils and work groups. The declared aim is to establish a regulatory framework to protect personal information: "protecting individual privacy, confirming information authenticity, preventing information misuse, and preventing information theft" [Telecommunications Council, 1994, Section 5]. The Ministry of Education is conducting a study and has established the Copyright Council that cooperates with related organizations of rightholders and producers as well as with MITI. MITI comments that it "will endeavor in its turn to encourage open discussions by a broad range of interested people, and to reflect these in the discussions of the Copyright Council" [MITI, 1994]. The issue of the duplication of software is presently protected under Copyright Law, however, the new technologies pose problems. MITI proposes to strictly enforce the law and raise awareness, for example, by encouraging management procedures that prevent illegal duplication within enterprises.

Since the issue of intellectual property rights and copyrights is a matter of international discussion, for example within the context of the World Intellectual Property Rights Organization (WIPO), Japan appears to not actively pursue an

---

[93] 45% of long distance and 25% on regional corporations' expenditures are on access charges in the United States.

individual policy. Whether Japan can influence these international discussion is not clear; however, without a national discussion, the development of an own policy standpoint in the context of international negotiations is probably difficult.

## Conclusion

Japan is one of the foremost technological leaders in the world. The great successes since the 1960s have been based on superior hardware developments and improvements, novel (mass) production techniques, and an aggressive export orientation. The Japanese-style market economy with its egalitarian tendencies has clearly been a success factor in the catch-up years following World War II. High growth and low unemployment rates, supplemented by a high degree of unanimity and consensus on the aims and processes of the political system, have enabled Japan to become one of the most successful economic actors of this century. Recent signs of economic and political distress, however, point to a slow but forceful downward trend that may have its source in the changing technological paradigm, a paradigmatic change that calls for more individuality and flexibility, and even for dissension. These factors have not been deeply engrained in the Japanese political system. In the development of novel technologies, in another word, inventions, especially in software, content, and applications, Japan has failed massively to exploit market potentials. Even the attempts to buy into creative industries overseas, foremost in the Hollywood industry, have been unsuccessful.

One prominent obstacle to adjustment has been the strong elitist tradition. In questions relevant to the country's technological development, the bureaucracy has defined the country's preference as leading industry has focused predominantly on export markets and high technologies. Political action plans on issues with technical complexities are mostly decided in the ministries before the public, or even parliament, has the opportunity to evaluate them. Semi-public hearings, most often only with industry representatives, are held at lower levels of the bureaucracy.[94] Even the executive's role has been negligible as basic knowledge on the implications of the new technological paradigm has been limited. Although the technology policy approach in

[94] See the Summary of the Minutes of Meetings of the Telecommunications Council's Special Subcommittee on the Status of NTT, accessible via http://www.mpt.go.jp/Council/Council-home.html.

Japan has always promoted an early integration of relevant actors in important technology policy questions, these actors have predominantly come from the supply-side. The emphasis on the supply-side, in combination with the internationally controversial export promotion and discriminatory trade barriers, has worked well in the previous technological paradigm. Global markets demanded technologies, Japan supplied. Innovativeness was important, but not necessarily inventiveness. An internal mass-market for inventive computer-mediated communication applications has not developed, with the exception of a few niches. The end-user, in Chapter 1 argued to have an important role in a rising technological paradigm, has neither been involved in the creation of science cities or other super-projects, nor has the user-side been able to develop a bottom-up dynamic which is comparable to that in the United States or the European Union. High domestic prices for telecommunications and low-end hardware, as well as the development focus on highest-end hardware, such as supercomputers or large-scale industrial applications, have stifled domestic demand for innovations; prices have remained higher than in other countries. High-end hardware, especially in satellite technologies, robotics, and telecommunications networks with the focus on ISDN and fiber optics, have been world class; the know-how for such technologies is not limited. In previous chapters, however, it has been argued that creativeness often originates outside the existing system, and precisely the lack of this non-technological factor has become a foremost reverse salient in Japan's technological development.

The bureaucratic leaders in Japan have recognized the need for inventiveness and creativity but have responded with an elitist, bureaucratic initiative. The government wants to promote the demand-side, long neglected in Japan, and creativity, in a top-down initiative. While the coordination activities in the European Union in the context of the Information Society have the principal purpose of reducing the barriers-to-entry because of market fragmentation along national lines, the Japanese bureaucracy has planned to promote creativity by installing multimedia centers in the regions and computers in school. The important question arises: can creativity be assigned from above or is the enhancement of creativity a wider societal process that depends on the size of the installed user base, not only in schools and enterprises, but also in private life? To install computers may seem a necessary response to the technical demands of computer-mediated communication, but creativity cannot be promoted if general school policies and educational content are not altered accordingly. The announcement of a venture capital market may be what bureaucrats and experts deem necessary for promoting entrepreneurs, however, the existing elitist tradition mistrusts such individualism. Giant corporations and real estate agencies receive capital for risky activities, but the small, highly creative inventors are distrusted. Thus, the future impact of the bureaucratic initiatives is unknown; in the short- and medium-term, their success is not likely, especially as Japan lacks a multicultural setup and remains, in comparison to the United States and the European Union, relatively closed to external influences.[95]

The second cause for the failure to design an integrated and societal technology policy with a considerable bottom-up dynamic has been ministerial competency struggles. Policy content is often subsumed to considerations of power. Both MPT and MITI have offered a vision of the future, and both have undertaken major initiatives to create an ”Intellectually-Creative Society”. They pursue seemingly complementary efforts. MPT has concentrated on the implementation of the hardware infrastructure, telecommunications deregulation, and the status of NTT, and MITI has emphasized the development of content and end applications, as well as soft issues, such as computer security measures, the promotion of standardization, and the definition of the protection of intellectual property rights. Both have outlined the problem of a lacking installed user base, promoted the development of infrastructure and applications, criticized old regulations for obstructing the proliferation of computer-mediated communication, and suggested measures to overcome these problems. There is little evidence, however, which suggests that this is a coordinated effort. Ministries in Japan ”collect” power. MPT has guarded its supervisory role in telecommunications, and MITI has attempted to gain power over NTT and other market participants following the deregulation of the telecommunications sector. Both ministries may act within the confines of their perception of societal interests. They have not made efforts, however, to include wider societal segments in policy formulation and action. Whether this approach will be successful in the transition to a new technological paradigm is questionable.

In the 1980s, the Japanese government advanced a strong vision, with elements consisting of the Information Network System and the Technolopolis concept, flanked by the pursuit of parallel track R&D projects, the creation and support of venture capital and venture businesses, the pursuit of strategic international alliances, and selective

---

[95] This point disregards Western pop culture, which is particularly popular among Japanese youth.

import promotion. Thus, we can attest to successful “collective projection”, the recognition that an integrated societal strategy is the proper strategy during a paradigmatic transition. The bureaucracy’s role in general, and MITI’s role in particular, in financing technological development has been reduced while strengthening its coordination and organization functions. Especially its function as a provider of information to Japanese enterprises was strengthened, consisting of comparative studies on trends and market conditions worldwide. “Synchronous preadaptation”, the linkage of different actors that embody various evaluation mechanisms, however, was not successful. Despite Japanese policy having always awarded particular importance to early actor inclusion in deliberation processes, the actor selection was nevertheless limited as other relevant interest groups were not easily identifiable – the latter have lacked a forum to advance their positions. The close interaction between the bureaucracy and the private sector has benefited large corporations and punished newcomers and smaller enterprises, especially as bureaucrats have frequently been employed by corporations to strengthen the latter’s influence. Closely connected is the failure to achieve “functional equivalent”. Japanese decision-makers have recognized that they must react to the constraints of the new technological paradigm and have altered some of the administrative systems, rules, and laws. Action, however, is limited. The bureaucratic, elitist response has not foreseen a reduction of its own role in determining the technological future. The calls for independent regulatory authorities and a differentiation of regulatory and oversight functions have been ignored. The pledge to examine past practices for compatibility with demands of computer-mediated communication has not implied that the demand-side will receive a greater voice in defining new practices. To excessively concentrate on infrastructure measures such as high-cost fiber optic networks and large-scale projects such as the creation of sterile science cities, however, is risky if it ignores the user-side and principle bottom-up dynamics that spill over from abroad. In sum, bureaucratic decision-making prevails, parliament lacks initiative, and external influences on decision-making remain indecipherable.

Japanese regulatory policy that integrates the demands and implications of computer-mediated communication technologies exists only on paper. Perhaps, no real necessity has yet existed to formulate regulatory policies that protect the society from the probable side-effects of computer-mediated communication. The penetration and use of computer-mediated communication technologies has been low. This has obstructed the enabling elements as a critical mass has not developed. The failure of designing long-term regulatory policies creates uncertainty on how this new technological paradigm will be politically treated in the future. The deregulation of NTT, a new interconnection policy, and NTT's restructuring remain on the drawing board. The separation of the telecommunications and cable-TV business, the restriction of foreign investments, and the closed processes in the existing fee approval system continue to obstruct the market entry of competitors. In hearings, conducted by MPT and not by parliament, enterprise leaders have repeatedly demanded the implementation of deregulatory policies in the telecommunications and content sectors, without observable success.[96]

Other regulatory issues have not even reached the final proposal status. The issue of cryptography has not been a topic of governmental deliberations, perhaps for two reasons. First, national security issues do not have the same salience in Japan as in the United States. Second, the issue of privacy protection is also not a prominent one. It will be seen in the future whether considerations over criminal activities or terrorism will result in the regulation of cryptography or whether the imperative of secure online conduct in business or commercial transactions will promote the free circulation of cryptography products. Very little discussion exists in Japan on issues such as universal service, intellectual property rights, copyrights, systems for reviewing the interaction between government institutions and societal actors, and decent conduct on networks. Some of the regulatory issues are likely to be resolved in the context of global initiatives, which will take time.

All in all, the prospects for the successful management of the transition between technological paradigms are less good than those in the United States and the European Union. While the political leadership role is well developed, it is possibly overdeveloped, thereby significantly stifling the bottom-up dynamics. It is questionable whether this is a long-term disadvantage; Japan’s industries have proven in the past that they are able to adapt, improve, and market technologies with a high degree of perfection. In the present configuration, however, Japan is unlikely to significantly

[96] See fn. 94.

*shape* the emerging technological paradigm. Rather, it is probable that it will *react* to developments from abroad.

# Conclusion

During the past two decades, a new and highly complex technological and economic paradigm has been emerging throughout the Western world, in which technological inventions, economic incentives, political motives, and social constraints reciprocate to shape novel ways of interaction. The underlying technologies are both cause and effect: they change economic, political, social, and private interactions, while scientists, entrepreneurs, political actors shape the technological development path. The ultimate success of a technology, however, depends on bottom-up processes on the user-side as these decide over the final product success. The transition between technological paradigms is thus an interactive and recursive process.

Carlotta Perez and Christopher Freeman argue that a paradigmatic change is identifiable by significant productivity increases, fundamental changes of cost structures, an unlimited supply of basic inputs, a technological all-pervasiveness, and significant qualitative leaps. Other signs are significant institutional, organizational, and societal changes (see Chapter 1). What is the balance sheet of the system of computer-mediated communication in terms of these criteria?

The industrial age is subsiding in the "developed" world, to be witnessed by the decline of heavy industries, the outsourcing of low value and mass production goods to emerging markets, and the concentration on the innovation and production of high value and high technology goods and services. For the past two or three decades, phrases like "post-industrial society" or "knowledge economy" have been circulating. The microprocessor revolution, with its breakthrough in the early 1970s, has had a strong impact on economic interchanges as more data can be stored and processed, both in the context of industrial applications and the circulation of information relevant to economic production and services. This factor alone, however, has not been the sole source of a paradigmatic change. Rather, the combination of computing power, the emergence of a large user base, and the economic sector's recognition of the new paradigm's importance and potential, have been the predominant sources of a paradigmatic transition. The cost of information has been decreasing significantly, and information has simultaneously become an enormously important input factor for productive and organizational processes. The utilization of information has slowly been supplanting the predominance of industrial production processes in the creation of economic value. The Internet has enabled the flow of information beyond levels ever known before, while the costs for underlying hardware and transmission have been falling continuously. Computer-mediated communication has become all-pervasive. The integration of traditional forms of media, such as newspapers, radio, and television, with computer-mediated communication technologies, is not complete, but advancing at a fast pace. Industries, financial institutions, health care providers, transportation systems, and increasingly, governing institutions, have been connected to national and international networks. Computer-mediated communication has not only become cheaper, but it has significantly altered the cost structures of other inputs by improving international logistics, remote production processes, and customer support and services.

Moreover, the emerging paradigm has influenced institutional, organizational, and societal structures. Novel regulatory demands have prompted the development of new institutions in the economy and politics. Research institutes and regulatory authorities, at international, national, and local levels, have been established to evaluate the implications of computer-mediated communication. Computer-mediated communication has also modified organizational processes in enterprises and in the governing systems of countries. Societal changes are perceptible in altered employment structures and levels. The decline of traditional economic sectors have undermined employment structures and social security systems; industrial robots have threatened the job of blue-collar workers, online banking the job of the bank clerk, e-mail the job of the postal employee, and telemetrics the job of the technical supervisor and engineer. New occupations are being “invented”, especially in the service sector: knowledge managers, information brokers, web designers, and so on. Management consulting, perhaps the growth industry of the 1990s, has benefited from these developments; many enterprises are overwhelmed by the organizational demands of the new paradigm, a gap that highly mobile and global consulting firms can close. Many of the new occupations assume highly educated and flexible employees; they are therefore not capable of fully offsetting the job losses in traditional industries. Computer-mediated communication also causes a geographic expansion of activities, and it can strengthen or undermine local forms of interaction.

These processes have a clear impact on resources available for decision-makers and political institutions. Tax revenues from declining industries fall while the revenues of more successful industries rise, albeit with considerable time lags. Depending on what political levels gain or lose revenues, a paradigmatic technological change alters the power base of decision-makers as administrative abilities shift, either leading to an overlap of ministerial competencies or to the reformation of bureaucratic responsibilities, within and between ministries. The competition for scarce resources intensifies: declining industries require substantial funding for managing the economic transition, either for reeducation programs, lump-sum payments to those who lose their jobs, or general welfare and infrastructure programs. Rising industries, on the other hand, require support when no critical mass of users has formed to ensure the success of promising technologies or infrastructures which are the prerequisite for the proliferation of technologies throughout society.

A paradigmatic change is thus not only the source for success stories and the technological development of society, but it also causes considerable crisis as new forms of interaction undermine traditional types as well as the resource base which is necessary for political action. In sum, although it is difficult to pinpoint the initiation of the new paradigm and to evaluate its progress, a new paradigm is appearing, recognizable by its impact on economic, political, social, and organizational structures and processes. In the following, we will evaluate, based on the conclusions of the previous chapters, how political decision-making can influence the technological development of society.

Technology policy has the principle purpose to promote technological development. The state can use active instruments, with which it directly intervenes in the research and development process of enterprises, or passive instruments, with which it changes the business and competitive environment, and induces users to adopt technologies. Decision-making has been defined as the "authoritative allocation of values in society". During a paradigmatic change, however, it is not clear, who allocates the principle values. The technological development of society is not unilinear, neither technologically, nor economically, nor socio-politically. The transition between technological paradigms is a process of action and constraint, and continuously undergoing crisis and discontinuity, in unpredicted ways. The number of relevant variables is enormous as is the variety of options. Decision-makers cannot incorporate all variables and options in their personal evaluatory framework. They are thus confronted with an incomplete picture of the world, a world which is both highly embedded in "grown" institutional structures and in a highly transitive environment. While the actors and variables which decision-makers have to consider are multiple in a "stable" development path, their reorganization during a paradigmatic change confronts decision-makers with added evaluatory and interpretative difficulties. They cannot identify the principle sources of changes, whether they originate in technological, economic, political, social, or cultural developments. This lack of clarity impacts decision-making capabilities: uncertainty emerges over who should be the principle decision-makers, for example, on which political level decisions should be made and who should be the principle executives and administrators. Let us now examine how the different theoretic decision-making models "perform" during a paradigmatic change.

According to the rational actor model, decision-makers attempt to achieve maximal utility by surveying the policy alternatives and subsequently deciding on an optimal action path. This is difficult as decision-makers are influenced by their personal preferences, by the preferences of their constituencies, by the preferences that derive out of the organizational and bureaucratic rules, and by broader societal and cultural factors. During a paradigmatic change, however, these various preferences are not obvious as the environment itself changes significantly. Even the concept of "bounded rationality", a concept to overcome the limits of rational decision-making theory, gives us little guidance. The concept of bounded rationality describes decision-makers as acting rationally on the basis of *available* information, which they break up into logical components and sequentially examine until an alternative emerges which meets minimum standards of acceptability [Simon, 1955, 1957, 1958; Coplin, 1971]. During leaps in the technological development of society, the acceleration of available information creates a high degree of uncertainty. This may lead to stagnation and inaction as decision-makers are unable to process incoming information. It can also lead to the rejection of novel information as decision-makers may prefer to act on personal experiences and intuition [Steinbruner, 1974]. During a paradigmatic transition, however, intuitive decision-making is ineffective as the environment is changing, and not just isolated variables. Traditional cause-and-effect schemes are ineffective.

In this study, we have clearly differentiated between technology and regulatory policy. As we have seen in the empirical chapters, technology policy has been comparatively uncontroversial. Several factors contribute to this. First, technological development is less rooted in ideological or cultural beliefs; scientific facts and economic incentives on the microlevel promote a system which develops internal dynamics. Second, scientific facts and subsequent technological innovations are more easily recognized and adopted by decision-makers as scientific knowledge and its application proliferates faster throughout society than the knowledge about the wider societal consequences of a whole technological system, and as scientific inventions and innovations and political interests often overlap (for example, the quest for domestic welfare or international competitiveness, both of which are contributed to by technological developments). As Haas states:

> [C]hange in human aspirations and human institutions over long periods is caused mostly by the way knowledge about nature and about society is married to political interests and objectives. I am not merely asserting that changes in scientific understanding trigger technological innovations, which are then seized upon by political actors, though this much is certainly true. I am also asserting that as scientific knowledge becomes common knowledge and as technological innovation is linked to institutional tinkering, the very mode of scientific inquiry infects the way political actors think. Science, in short, influences the way politics is done. Science becomes a component of politics because the scientific way of grasping reality is used to define the interests that political actors articulate and defend. The doings of actors can then be described by observers as an exercise of defining and realizing interests informed by changing scientific knowledge about man and nature [1990, 11].

In this context, interest groups play an important role. Especially during the 1980s, technology policy was a subset to industrial policy considerations. In the United States, industrial policy was linked to defense considerations; often regions with less favorable economic conditions received defense contracts ("pork barreling", which describes the negotiations between members of Congress over the distribution of lucrative defense contracts, has been an accepted though controversial practice in American politics). As the contractors were often the only larger employers in certain regions, they had strong lobby powers. The linkage between military concerns and technology policy in the United States was especially strong in the context of the Strategic Defense Initiative (SDI). Technology policy was linked to strategic defense concerns; the development of technologies underlying SDI originated predominantly in enterprises closely linked to the Department of Defense and certain important members of Congress. Not only the declining threat posed by the Soviet Union, budgetary concerns, and a wide-spread disbelief of the project's feasibility, but also the recognition of the power of emerging computer-mediated communication technologies on highest political levels contributed to a reassessment of the Department of Defense's strategy. Many new and small enterprises now receive funding, enterprises which have previously been excluded from the benefits of military-industrial policy and which have had different research foci. Correspondingly, the defense contractors' powers have diminished. Thus, the rise of civilian technology in the United States, and the relative decline of defense-oriented industrial policy considerations, resulted in shifts of lobby powers.[97]

Although it lacked the strong linkage between industrial policy and defense,[98] the strategy of the supranational level in the European Union was to support large enterprises which were thought to be capable of advancing R&D intensive technological development. Industrial lobbies were strong and successful; whole armies of lobbyists resided in Brussels. Towards the end of the 1980s, industrial policy collided with regional and cohesion objectives as it benefited primarily large corporations in the economically stronger member states. Following the accession of Greece (1981), Spain, and Portugal (both 1986), this conflict became increasingly apparent. It came to be a political imperative that the benefits must be decentralized, both regionally and in terms of the number of beneficiaries. Furthermore, the necessity to improve the infrastructures of less wealthy member states promoted the shift in technology policy. Thus, the necessity to spread the benefits of centralized efforts and to create enabling infrastructures promoted the emergence of a new, as the Commission called it, horizontal approach to technology policy. The horizontal technology policy was not conceived as a subset to industrial policy concerns and the underlying assumption of its strategic importance in the technological competition between the European Union on one side, and the United States and Japan on the other side. Decision-makers in the Commission recognized that technologies were not an end in themselves, but an important enabler for subsequent technological developments. In other words, the unilinear presumption that political support inevitably leads to technological success on international markets which in turn leads to economic welfare was rejected.

For example, industrial policy and strategic concerns were an important factor in the High Definition Television (HDTV) project. The European Union promoted this project, which was based on analog technologies, despite digital technologies being on

---

[97] One event is worth mentioning in this context. At the beginning of the Second Gulf War, the United States froze the sale of Intel's i486 microprocessor as it was feared that in the event of a longer war, shortages might hamper the United States' military efforts. Thus, it was not steel production or similar industrial products which had a preeminent importance, but a product of the new technological paradigm.

the rise. Long after it was apparent that the underlying analog technologies were superfluous, decision-makers withdrew their support.[99] Subsequently, the multimedia support strategy shifted to the implementation of decentralized multimedia centers to enable the creation of new products and to attract new enterprises. Furthermore, the emphasis shifted towards trans-European communication and transportation infrastructures. Simultaneously, industrial lobbies witnessed a reduction of their lobby powers, in this case, those which concentrated on analog technologies, including some of the leading electronics companies in Europe.

Although MITI and other governmental ministries have had a smaller share in the funding of research and development than the ministries and other public institutions in the member states of the European Union, Japan's strategy has long been the support of enabling technologies. Nevertheless, Japan's strategy to promote enabling technologies has not always been successful. In particular, the science cities, which were envisioned to promote scientific advances, have been criticized for their sterility. They were not the result of organic processes, but of a top-down and elitist strategy to create creativity and risk-taking by decree. Supplementary efforts, such as a reform of the education system or the change of administrative requirements for the foundation of new enterprises were not undertaken.

The failures have prompted decision-makers to alter their strategy towards a greater emphasis of infrastructures. The ISDN communication network is now well developed, and the plans for future computer-mediated communication infrastructures are ambitious and enjoy a high degree of credibility. The unitary nature of Japan's state contributes to effective coordination efforts in this context. The alteration of the strategy, however, has also opened a new source of ministerial conflict: promoted by technological advances, the intermeshing of underlying economic activities has lead to shifting ministerial competencies, a fact which some ministers have not welcomed.

In all cases, changes in technology policy strategies have not appeared abruptly. The preferences of decision-makers are rooted in a particular development path within a technological paradigm. Decision-makers cannot afford to discontinue contracts or to

---

[98] This concerns only the supranational level. In the member states, industrial policy and defense considerations were often linked.

[99] These are examples of cases where enterprises only undertake projects when they are subsidized. Without subsidization, these projects may not have been pursued at all as the underlying technologies were recognizably inadequate.

ignore unemployment and regional decline. Thus, they are confronted by both sides which a paradigmatic change entails: on one hand, they have to define alternatives for declining industries, often entailing expensive transitional support such as reeducation or relocation initiatives. On the other hand, they have to commit resources for enabling infrastructures. Both measures are expensive and fall into a period of declining tax revenues.

For example, in the European Union, the subsidization of former industrial policy favorites, such as shipbuilding, the coal and steel industry, and agriculture have drawn investment resources away from investment opportunities in future industries; subsidies have accounted for almost two-thirds of the European Union's budget. Furthermore, the decentralized decision-making setup – both the supranational and national political levels have overlapping policy responsibilities – limits decision-makers' abilities to alter processes which have taken decades to design and which are based on fragile compromises. These factors complicate decision-making, as regional, structural, and technology policies entail contradictory implications in terms of the classic distribution, allocation, and stability aims of the state. Similar has been the case in the United States, where the defense sector has swallowed considerable resources without corresponding tangible societal benefits.[100]

In Japan, the situation has been different. While the state spent relatively less on technological development, the main performers of R&D, the large corporations, have had a strong export orientation. Thus, the benefits to Japanese society have more indirect. Export successes and high employment levels have seemingly reduced domestic economic pressures. Recent economic upheavals in East Asia, however, have altered the situation, but it is too early to evaluate their consequences for decision-making in the context of technology policy.

Technology policy is not only the active support of the research and development process, but also the use of flaking supplementary measures. Decision-making in this context, however, is comparatively difficult: while infrastructure measures are subject to collective action problems and to significant costs and delays, other supplementary technology policies such as education or health policies are

[100] The benefits were mostly intangible, foremost a perceived increase of national security. While some technologies created for the defense sector have benefited the civilian domain, it is not clear whether these resources would have been more effective if they would have been spent in the civilian context.

difficult to define and implement. This especially has been the case in the United States, where ambitious policy initiatives by the Clinton Administration have failed, both in the health and education sectors. To take the case of education policy, only the United States' immigration policy and the attractiveness of American universities for foreign students, especially on the graduate level, have prevented shortages of skilled labor. In the European Union, supplementary technology policies are even more difficult to implement as many issues have not become subject to community policies and remain under the authority of the member states. The harmonization of education policy has progressed only in terms of the (limited) mutual recognition of university and professional degrees, but further harmonization has not been an item of high salience on the agenda. This similarly applies to other supplementary issues. Japan, being a unitary state, should have fewer problems in the reformation of these issue areas, but has nevertheless been unable to consistently implement supplementary measures. Reforms have been piecemeal, and the desire to achieve greater creativity has not been supplemented by a reform of the education system. In sum, in cases where cause-and-effect schemes are less apparent and direct, the ability of decision-makers to make supplementary reforms is reduced. When resources are spent for scientific breakthroughs or innovations, successes and failures are comparatively easy to identify. In contrast, when they are spent for supplementary measures, the effects are more indirect. Decision-makers have less information on the prospects, and they may hesitate to implement necessary measures.

Thus, during the transition of technological paradigms, not only the immediate environment for inventions and innovations is important, but also wider societal factors, or more specifically, the user side. Regulatory policy entails a higher complexity during the transition of technological paradigms than the management of technology policy. Accordingly, it has been regulatory policy which has received considerable political and public attention, although comparatively more so in the United States than in the European Union and Japan.

An argument of this study has been that open political processes can assist in overcoming the informational problems relevant to regulatory policy. In the domain of regulatory policy, it is not the markets which decide over the success of political initiatives, but processes which are far less visible and graspable for decision-makers. Several factors are important: the entry of new players in decision-making processes, the role of interest groups, the formation of novel actor coalitions, and the effect of these factors on organizational and bureaucratic processes.

According to John Law and Michel Callon , the entry of new actors does not only alter the relationships between the actors, but also implicates the reshuffling of the underlying aims and processes (in their language, the entry redefines the “obligatory point of passage”, see Chapter 1). These processes undermine the decision-makers’ ability to use available information as accepted cause-and-effect schemes become increasingly invalid. Problem-solving capacities can be improved when the available information is based on a wider selection of underlying interests. Although the costs of analysis may be higher when processes are more decentralized, in the medium-term, the analysis covers more eventualities than when based on a limited informational variety (chance events are less likely to have a significant impact). Closed processes, in contrast, can cause untimely actions as important information is excluded from the information gathering process.

In the United States, various new players have been involved in Congressional hearings, among others, from industry and civil rights groups. These participants have different preferences than established groups, both in the selection of the topics which they consider as salient, as well as in the geographic extent which decision-making processes implicate. Opponents of the restriction of the export of cryptography products have had other concerns than the group of actors that had previously been associated with issues relevant to the export of cryptography products, the Department of Defense and other agencies linked to national security issues. In the European Union, entering actors have had a greater supranational orientation than some of the established, and often nationally-oriented, players. New, transnational groups, comprising European and American actors from industry and other groups, have been able to engage public groups and the media in greater coverage of such issues. Thereby, they have forced decision-makers to consider the demands of computer-mediated communication.

In Japan, on the other hand, newly entering actors are rather rare. The relatively closed legislative processes have undermined the incorporation of newly emerging factors into the decision-making process. Consider, for example, the deregulation plans in Japan on NTT. Some have argued that the plans enact the conditions that the telecommunication reform of 1982 in the United States eliminated and that the envisioned plans are a move backwards. This is especially problematic as decision-makers failed to recognize the great desire of the Japanese for communication, as can be witnessed by the phenomenal success of mobile communications.

Newly entering actors and groups often have preferences *unknown* to the principle decision-makers. In the United States, at an early stage, the desire proliferated to use the new medium of the Internet for unrestricted and private communication purposes. This desire accounted for the rise of the university-close Bitnet, which was used for scientific and non-scientific exchanges as well as for private chats. A similar case happened in France (Minitel) and Great Britain (multi-user dungeons), and then later in other member states in the European Union. The restriction of the use of modems on public telephone networks until the late 1980s in many countries, including most member states of the European Union as well as in Japan, clashed with the desire to exploit the possibilities of an advanced communication system. This is a classic example of how regulatory structures, which have been designed for another technological paradigm, can promote the creation of tightly-knit groups: most groups associated with computer-mediated communication rose during that period, with the principle opponent being the state-controlled telecommunication networks and their regulations.

Alternative interests, however, are an often unrecognized but important potential source of information for decision-makers. Early users of novel technologies have a decisive influence on subsequent technological development as they concentrate know-how and creativity. The early opening of political processes to alternative groups, however, is not a strength of decision-makers as such groups do not have economic power and influence, and as decision-makers fail to foresee their importance for future technological developments. Accordingly, early computer-mediated communication user groups were frequently perceived as freaks and criminals; until today, the word "hacker" is associated with subversive and criminal activities. These hackers, however, have been some of the most important drivers of technological developments, often more so than the research labs of giant multinational corporations.

Thus, a significant void may develop during a paradigmatic technological change in which the relative decline of interest groups associated with declining industries appears without an offsetting rise of new interest groups. The success of new interest groups depends on two factors. First, a medium has to exist so that information can be raised, collected, processed, and applied. In the United States, the Bulletin Board System initially assumed that function, superceded by the Usenet and the Internet. The invention of these mediums is comparable to the invention of the printing press and the subsequent innovations of the newspaper, radio, and television during the passing technological paradigms. Each of these innovations increased the radius of information collection and processing. The particular dynamics of these systems, each not being the "state of the art" or the highest-tech of their eras, rested on the proliferation of information to a greater audience, both in numbers and in geographic extent, and each time larger than the particular social, economic, and political superstructures. These were *mass* media instruments and more powerful in the proliferation of ideas and creativeness than *personal* media instruments, such as postal mail, the telegraph, or the telephone. With the advent of the Internet, exchanges of people with similar opinions and aims has become possible, independent of time and space, and independent of predefined groups or nations. Many of these newly created communities became to be the political spearheads of the new technological paradigm, combining dense technological know-how and a highly critical view on market developments and political initiatives. The delay until these groups have established and gained significance in decision-making processes, however, is significant. In all examined countries, a void existed in which the collection of information was severely hampered, and continues to be so in Japan, and in the European Union to a lessor extent.

The second factor is the underlying credibility of interest groups. New participants demand an auditorium for their demands and standpoints. If emerging interest groups are highly fragmented, which is likely to be the case in the early stages of a paradigmatic change, their credibility is low. Furthermore, specific interest groups may concentrate excessively on their particular isolated interests. For example, cases where competition law has stepped in to prevent abusive behavior of the most powerful may lead to a situation where competition is improved, but only to a limited extent: a monopoly may be broken, only to lead to an oligopoly (consider, for example, the battles of the 1990s between Microsoft, Netscape, Intel, Oracle, and other big players). As economic interests remain at the forefront, the danger exists that decision-makers are captured by such interests, thereby leading to a stifling of technological development as alternative interests are disregarded.

During a paradigmatic technological change, however, such a development is not automatic. As economic and socio-political factors, nationally and globally, intermesh, they promote the formation of interest group alliances. "Grand motive coalitions", as outlined in Chapter 1, can strengthen the influence and credibility of emerging associations, even if the strategy in the achievement of aims, or even the aims themselves, diverge.

Consider the example of cryptography policy in the United States. In its organizational logic, cryptography has been part of the defense domain, being subject to considerable export restrictions. Until the late 1980s, only in a small selection of economic sectors, far removed from the normal consumer markets such as international finance and banking, and high-level R&D, it has been a factor. Since the beginning of the 1990s, in contrast, cryptography has been intrinsically linked to privacy, free speech, secure business transactions, and personal authentication. The rise of computing power, a technological development, in combination with a societal system that embraces personal autonomy, has produced a decision-making process with new participants, taking the issue out of the defense domain into a wider societal context. Coalition building has been pragmatic. For example, those who have supported strong cryptography systems to protect individual autonomy and privacy have allied with the business community, despite the former having opposed a commercial role of the Internet. Both groups opposed the governmental control of cryptography, although for different reasons.

The government, especially the FBI and the defense community with the NSA as the spearhead, attempted to maintain control over this issue. During the Cold War (the end of which was a chance event with great implications for technology policy), the control of cryptography was a primate of national security policy. Its end also eliminated the reason for the control of cryptography, even if the defense and law enforcement community attempted to replace the Soviet threat by the alleged threats of international terrorism. This attempt, however, could not overturn the momentum gained by the strong motive coalition of civil rights and business groups. Three factors contributed. The first factor was the limited controllability of cryptography, especially in the technical sense. Many of the Clipper Chip's opponents did not believe in the proclaimed principle of voluntary use, and the law enforcement agencies openly opposed Clinton's proclamations. Thus, as no technical limits existed to the use of strong cryptography products, their restriction automatically implied the necessity to criminalize and penalize users who do not conform to governmental guidelines. This aroused considerable opposition. Second, civil rights groups opposed Clipper because they feared that the protection of individual privacy would be undermined. Third, internationally active enterprises argued that the Administration's plans did not enable enterprises to use top-level cryptography products which could protect from international industrial espionage. Furthermore, business interests recognized considerable economic potentials in cryptography products and feared the loss of lucrative market opportunities. All three groups, software developers, civil rights groups, and the business community, thus had the same aims, the rejection of the Clipper initiative, although for different reasons. Nevertheless, a motive coalition developed, which to date successfully opposed the Clinton Administration's plans.

The conflicts over cryptography policy are far from resolved in the United States; the executive continues to attempt the control of its spread and application, although primarily in the international context. Conflicts, however, can highlight that some initiatives are futile as the technological development of society is an ongoing process which demands continuous political flexibility. The processes surrounding the Clinton Administration's Clipper initiative demonstrate this; the Administration had to repeatedly withdraw or alter its plans.[101]

---

[101] Whether Clinton and Gore were themselves strong proponents of the Clipper initiative is uncertain. To the contrary, the opening of processes to a wider public may have been desired. Consider the "multiple advocacy model" as developed by Alexander George [1972]. A multiple advocacy model describes "a mixed system [which combines] elements of centralized management with certain features of pluralistic participatory models to harness diversity of views and interests for the sake of enhancing rational policy-making": "One of the dangers of bureaucratic politics against which the Executive wishes to guard is the possibility that organizational subunits might restrict competition with each other and work out compromises among themselves before the policy issues are aired at the highest level, so that the final decision is likely to be based on the preferred option that results from the internal bargaining process. Under these conditions, of course, policy options that might be viable but are unpopular with the bureaucracy are rendered unavailable as a result of unfavorable presentation or inadequate information" [Dougherty and Pfaltzgraff, 1990, 472]. The provision of a substantive vision and its active pursuit by the highest political levels can prevent excessive bureaucratic control. The Clinton Administration was able to manage the conflicts and bargaining between the departments involved over the issues of export controls of critical technologies and protection of individual privacy and autonomy (Departments of Defense, State, Commerce, and Justice). Furthermore, it thereby prevented a bureaucratic approach towards these issues. During a paradigmatic transition, the argument of this study has been, the inclusion of groups external to the immediate decision-making process is vital to promote the proliferation of essential information to the decision-makers. This enables the executive to not only manage bureaucratic decision-making, but also to raise the subsequent public acceptance of decisions when important groups are drawn into the process. George himself, however, warned of an excessive centralization of executive leadership. This point deserves further research.

Another example of the force of motive coalitions in the United States is the issue of the appropriate conduct online networks. In the United States, free speech activists and the business community allied to oppose those who advocated severe and intrusive mechanisms to prevent indecent conduct on online networks, especially those who advocated the Communication Decency Act. Without such a motive coalition, the Act may have passed Congress, especially as the Act contained language difficult to object to (rejecting the Act could have been interpreted to imply the consent with the criminal activities that the Act aimed at). The motive coalition, again with actors which have different aims but similar concerns, was able to raise the credibility of arguments against the Act.

Thus, motive coalitions have both greater chances to access the decisive political levels and to cover a greater variety of underlying interests. The success of the opposition groups in the United States, however, was not limited to the specific issue. It also contributed to a greater subsequent acceptance of these groups in legislative activities. Representatives of these groups now frequently participate in legislative activities and their voice is a welcomed information source for decision-makers, some of which have become allies of these groups. Furthermore, motive coalitions feed back into the relative powers of different bureaucratic organizations. The delinkage of cryptography and national security, and the linkage of cryptography to export concerns, for example, has strengthened the role of the Department of Commerce *vis-à-vis* the Department of Defense in this domain.

In the European Union and Japan, such developments have not emerged to the extent they have in the United States. This is perhaps the most notable difference between the three regions. In the European Union, coalition building has been more difficult, especially as politicians, interest groups, and industry representatives in the member states have diverging interests on individual issues and geographical scope (for example, diverging privacy laws, different conceptions of the freedom of speech or morality). These factors have also the effect that newly emerging interest groups have had less access to the decisive decision-making levels as motive coalitions have not emerged as they have in the United States; accordingly, new and alternative voices have less political influence than in the United States. In Japan, coalition building has had a completely different role as coalitions have often been institutionalized; despite that sometimes conflictual and competitive relationships exist, they predominantly have been fought out behind closed doors.[102]

The influence of interest groups does not only depend on whether they are considered by decision-makers or not, but also on what political level the access points exist. The question is whether the participation of newly emerging interest groups is restricted to the collection of information, or whether they also have a more direct and ongoing input into decision-making processes. In this context, a notable difference exists between the different regions. In the United States, novel groups have not only been active in the raising and evaluation of information, but civil rights groups, business associations, and others have been directly involved in legislative processes, specifically in Congressional hearings. In contrast, in the European Union, the Commission has heard novel groups, but has not involved them in the decisive decision-making processes. The European Parliament is not comparable to the Congress in the United States; its legislative abilities are severely constrained by the Commission's predefined legislative rights, and it can only confirm or reject the Commission's plans. Thus, the difference is the following: in the United States, these groups have had direct access to decision-makers, whereas in the European Union, access was limited to the definition phase of legislation. In the United States, these groups have had the opportunity to comment on legislation after it has been written, as well as to provide input during the informational stage. In the European Union, and especially in Japan, these groups have had an opportunity to comment on legislation only on lower levels in the bureaucracy.

The availability of information, however, may not be sufficient as this information has to be processed. Under what conditions can decision-makers and institutions as a whole adapt and learn is a question which Ernst B. Haas has posed in the context of international organizations. Haas defines adaptation as being the "ability to change one's behavior so as to meet challenges in the form of new demands without having to revaluate one's entire program and the reasoning on which that program depends for its legitimacy. This, of course, assumes that the challenges come slowly and can be dealt with in a piecemeal fashion. Adaptation is incremental adjustment, muddling through. It relies largely on technical rationality. Because ultimate ends are

[102] In all three examined regions, there seem to be few ideologically dominated discussions. Party politics does not seem to be a deciding issue during a paradigmatic technological change, although it is an issue which has to be researched further.

not questioned, the change in behavior takes the form of a search for more adequate means to meet the new demands" [Haas, 1990, 34]. True learning goes further: learning occurs in "situations in which an organization is induced to question the basic beliefs underlying the selection of ends. True revaluation is attempted when beliefs of cause and effect are examined. Revaluation involves the recognition of connections among factors thought to constitute causes of whatever problem is to be solved, connections that had previously gone unrecognized. Revaluation implies shifting one's cognitive horizon towards beliefs about causes that are different from previous beliefs. Revaluation is made possible by the existence of bodies of knowledge not previously available. Learning involves the penetration of political objectives and programs by new knowledge understandings of connections" [Haas, 1990, 36]. The achievement of "consensual knowledge" is the final stage of a learning process:

> By consensual knowledge I mean generally accepted understandings about cause-and-effect linkages about any set of phenomena considered important by society, provided only that the finality of the accepted chain of causation is subject to continuous testing and examination through adversary procedures. Cause-effect chains are derived from information, scientific and nonscientific, available about a given subject and considered authoritative by the interested parties – though the authoritativeness is always temporary. Consensual knowledge is socially constructed and therefore inseparable from the vagaries of human communication. It is not true or perfect or complete knowledge [Haas, 1990, 21].

Let us briefly evaluate whether examples exist in which decision-makers have learned or only adapted in the context of computer-mediated communication and its underlying technologies. In the United States, the chance event of the end of the Cold War reduced the need for SDI. Many SDI technologies, however, never became successful marketable products as developments often lagged behind those in the free market. Consider today's strategy of the Department of Defense: virtual combat, information warfare, and the networking of soldiers on the battlefield are the buzzwords, far removed from that which had been conceived in the 1980s. Here we can attest that the defense community has *learned*, i.e., to reject former cause-and-effect schemes, and to incorporate the implications of computer-mediated communication technologies into their strategy, although the time lag was significant. Furthermore, and more fundamentally, the opening of the ARPANET to the scientific community, and later to the general public, demonstrates a learning process. Where the defense community seems not to have learned remains the issue of cryptography; this is clearly an issue which touches on fundamental military interests.

In the European Union, a learning effect also emerged in the early 1990s. Following the failures of many projects in the 1980s, with the HDTV project in the forefront, the Commission has integrated the implications of computer-mediated communication into its strategy. Its technology policy approach has been more modern than those in the member states, as shown by the quality and comprehensiveness of its networking and telematics projects. The shift of emphasis in the support of enterprises, a reduction of large enterprises towards a greater equality of support, has had significant benefits.

Only in Japan, the learning process has been more limited; adaptation remains in the forefront. A first cause may be that the governmental authorities, specifically MITI, have played a smaller role in technological developments than governmental in the military-industrial complex of the United States, specifically the Department of Defense and other national security-oriented agencies, and the accumulated R&D outlays throughout the member states and the Commission in the European Union. In Japan, large enterprises with an export orientation were the principle initiators of technological developments. A second cause, however, is also important: the questioning of accepted cause-and-effect schemes is far more difficult in Japan than in other OECD-countries. Political processes, especially those pertaining to more technical issues such as technology policy, are relatively closed, a point to which we will return below. Adaptation in this context is effective. In the context of regulatory policy, this strategy, however, has been ineffective and a significant obstacle to swift and comprehensive action. Thus, existing organizational structure can become the principle obstacle to change, most openly witnessed in Japan where the organizational system has been dominant and unchanged, both in the selection of the participants and of the topics under discussion. Closed processes limit the available information base which is available for decision-makers, especially if the organization itself is the principle supplier of information (in Japan's case the bureaucracy and semi-governmental institutions).

A follow-up question is whether learning is also transformed into decisive action, namely the reform of political institutions and decision-making processes? A first indicator concerns organizational and bureaucratic changes to accommodate the demands of the emerging technological paradigm. In the United States, decisive steps have been undertaken in the reorganization of organizational and bureaucratic responsibilities, especially those of the Department of Commerce to upgrade its role in non-defense technology policy as well as in regulatory issues. In the European Union, these processes are also underway, although driven more by general political activities to achieve a political union than by the impetus of a changing technological paradigm. In Japan, such processes are less obvious. MITI and MPT witness a redefinition of their powers. Whether such informal reorganization is an explicit policy to adjust to the demands of the emerging technological paradigm, however, cannot be confirmed.

In sum, a paradigmatic technological change has implications for the ability of decision-makers to pursue a coherent and well-planned political action plan, both in terms of the available resources and of the available information. As incoming information accelerates and the combination of factors adds to the great complexities, decision-makers have uncertainties on how to embed new technologies and technological processes in society and how to promote the acceptance, usability, and integration of these technological systems in societal practices.

Let us now evaluate to what extent decision-makers in the United States, the European Union, and Japan have performed in terms of the criteria which have been called a "substantive vision" in Chapter 1. All three regions have advanced an overarching vision of a future society; thus we can attest a high degree of collective projection (see Table C.1). The visions that have been advanced have covered various areas related to both technology and regulatory policy. As we have argued above, the provision of a vision, however, is not sufficient.

In terms of the second evaluatory factor, synchronous preadaptation, the decision-makers of the different regions have performed differently. In the United States, actors with different underlying interests have come together to form powerful motive coalitions. These motive coalitions have resulted in the upgrading of the standing of each group as they have been consulted by decision-makers from Congress and the bureaucracy. The consultations were undertaken both in the phase of the definition of legislation as well as in the phase of comment and Congressional deliberations. In the European Union, and especially in Japan, both the formation of actor coalitions, and especially their role in the legislative processes, has been more limited. The bureaucracies have maintained a strong influence over the definition of legislation, while in deliberation processes, the influence of novel interest groups has been limited. Especially in Japan, processes remained closed and interest group representatives came predominantly from entrenched industry groups. One explanation may be that the bulk of political activity concentrated on the more technical aspects, especially on the creation of infrastructures, and less on regulatory policy concerns. In the European Union, processes were more open, but restricted to brief consultations from interest group representatives; hearings such as in the United States, and especially, their coverage in the media, were limited. Nevertheless, the efforts undertaken in the regulatory policy domain are more advanced and comprehensive than those in Japan.

Table C.1: Intensity of Substantive Visions in the United States, the European Union, and Japan

| | Collective Projection | Synchronous Preadaptation | Functional Equivalent |
|---|---|---|---|
| **United States** | high | high to medium | low to medium |
| **European Union** | high | medium | low |
| **Japan** | high | low | none |

Functional equivalent, the substitute for rules and decision-making principles that do not yet exist, has been generally low or non-existent. Decision-making processes have not been altered to incorporate the possibilities of the new technological paradigm, and legislative processes have been undertaken within fixed paths. Novel participatory models have been applied in the United States, for example, the online access to Congressional decision-makers, which has a different quality than traditional mail. These models, however, have had the format of pilot projects. No mechanisms have yet been designed to institutionalize such participation. The question of new electoral mechanisms, such as online elections, has been addressed, but existing cryptography technologies, which could ensure the authentication of voters, have not been applied, and their implementation in electoral rules has not been undertaken. In the European Union, such processes may develop as soon as the status of supranational organs has been elevated, especially the European Parliament, however, in the present context, no actions are underway. The same applies to Japan.

To conclude, the management of a paradigmatic technological change is a significant challenge for decision-makers. Incoming information accelerates, but the variety of information and the interconnection between different technological, economic, socio-political, and cultural factors is enormous. While in the domain of technology policy, decision-makers can draw on experiences of past actions – technology policy is rather technical, and these technical issues are less controversial – regulatory policy is highly complex. In the latter, not only the interaction between the active creators of new technologies – the enterprises, universities, and other research organizations – is relevant, but also the user side and even those groups which are not directly affected by the developments. Accordingly, the difficulties in the management of the paradigmatic transition has been less in technology policy than in regulatory policy. In the domain of technology policy, the creation of infrastructures has been especially successful, however, the accompanying regulatory policies such as on the provision of universal service, intellectual property, or the protection of privacy have been lagging behind significantly.

Furthermore, the visions advanced by top decision-makers have not always been fulfilled; in many cases, adaptation has been at the forefront, not learning. In the United States, despite claims to reduce military procurement, it has been shifted from traditional large scale weapons producers to smaller enterprises. Supplementary technology policy measures, such as health or education policy, have failed. The control of abusive monopolies or oligopolies has not been achieved, the threat of a society of haves and have-nots has not been eliminated, and the regional consequences of the new paradigm have not been estimated. In this context, certain infrastructure measures lag behind the developments in the European Union and Japan. On the other hand, the conflictual approach in American decision-making has contributed to the rise of new and accepted interest groups. The medium of the Internet has played a strong role. In this context, the United States differentiate themselves from the European Union and Japan.

Despite the ambitious aim to achieve a Single Market, the Commission has not yet been able to drive the paradigmatic change. Its substantive vision and action plans are well designed, with the aim to achieve a viable balance between the promotion of technological developments, infrastructure measures, and regulatory policy. It appears to be the member states which have been a principle obstacle to the management of the transition. The Commission has a superior oversight over supranational developments, and the bureaucracy is able and well-informed. The Commission's strongest weapon has been the mandate to promote and achieve the Single Market as this achievement pertains also to regulatory instruments. As only a few supranationally-oriented interest groups have formed, and as nationally-oriented interest groups have lacked access to supranational decision-making processes, the Commission's bureaucracy has had a relatively free hand in the definition of regulatory policies.

While the United States and the European Union have not only adapted their policy strategies, in Japan, decision-makers have not fundamentally revised decision-making principles and processes; learning has not been a feature. Japan's strengths concentrate in large-scale technologies, for example, in satellite technologies. In the domain of regulatory policy, however, action has been limited. Novel interest groups have not emerged, and decision-making processes have remained relatively closed. Whether this will hamper subsequent developments is not clear; adaptation, in combination with the integration of internationally adopted principles (which will still have to emerge) may suffice. In the long-run, however, the Japanese share in shaping the emerging technological paradigm will be negligible.

The presently emerging technological paradigm is far from being stable; the development paths may take multiple directions. Crisis and discontinuity will continue well into the next century, with an uncertain final outcome. Some of the topics covered in this study will disappear, while new ones emerge. In this sense, this study can only be a first step in the evaluation of decision-making during a paradigmatic technological transition; much work remains, both for decision-makers and researchers and analysts.

# Bibliography

Abe, Hitoshi, Muneyuki Shindo, and Sadabumi Kawato (1994), The Government and Politics of Japan (Tokyo: University of Tokyo).

ADMedia (1995), "The Future of Media and Advertising. Executive Summary" (November), http://www2.echo.lu/impact/imo/final_ex.html.

Aichholzer, Georg, and Gerd Schienstock (Eds.) (1994), Technology Policy. Towards an Integration of Social and Ecological Concerns (Berlin: Walter de Gruyter).

Allinson, Gary D., and Yasunori Sone (Eds.) (1993), Political Dynamics in Contemporary Japan (Ithaca: Cornell University Press).

Allison, Graham T. (1971), The Essence of Decision: Explaining the Cuban Missile Crisis (Boston: Little, Brown).

American Economic Association (1968), Readings in the Theory of International Trade (Homewood, IL: Richard Irwin Inc).

Anderson, Alun M., and Jon Sigurdson (1991), Science and Technology in Japan, 2nd ed. (Harlow: Longman).

Anderson, Esben Sloth, and Bengt-Åke Lundvall (1988), "Small National Systems of Innovation", in Freeman and Lundvall.

Anderson, S. J. (1993), "Japan. The End of One-Party-Dominance, in *Current History* 92, 578, 406-412.

Ando, Hiroshi, and Robert C. Angel (1994), "Japan's New 'Reform' Government: An Interim Assessment, in *Asian Affairs* 21, I, 14-38.

Arrow, Kenneth (1962), "Economic Welfare and the Allocation of Resources for Invention", in *National Bureau of Economic Research (NBER)*, 609-625.

Arthur, W. Brian (1983), "Competing Technologies and Lock-In by Historical Small Events: the Dynamics of Allocation under Increasing Returns", International Institute for Applied Analysis Paper WP-83-92, Laxenburg, Austria (Stanford: Center for Economic Policy Research Paper 43).

Arthur, W. Brian (1989), "Competing Technologies, Increasing Returns, and Lock-In by Historical Events", in *The Economic Journal* 99 (March), 116-131.

Audretsch, David B. (1989), The Market and the State. Government Policy Towards Business in Europe, Japan, and the United States (New York: New York University Press).

Audretsch, David B. (1993), "Industrial Policy and International Competitiveness", in Nicolaides, 67-106.

Badham, Richard (1994), "From Socio-Economic to Socially Oriented Innovation Policy", in Aichholzer and Schienstock, 25-66.

Baerwald, Hans H. (1986), Party Politics in Japan (Boston: Allen & Unwin).

Bagger, Thomas (1993), "Strategische Technologien",internationale Wirtschaftskonkurrenz und staatliche Interventionen. Eine Analyse der Entwicklungen und Widersprüche am Beispiel der Halbleiterindustrie (Baden-Baden: Nomos Verlagsgesellschaft).

Bamford, James (1983), The Puzzle Palace (New York: Penguin Books).

Bangemann, Martin (1993), "Gibt es eine marktwirtschaftliche Industriepolitik?", in *Ifo-Schnelldienst* 46, No. 17-18, 26-29.

Baybrooke, David, and Charles E. Lindblom (1963), A Strategy of Decision (New York: The Free Press).

Beauchamp, Edward (Ed.) (1991), Windows on Japanese Education (New York: Greenwood Press).

Bell, Daniel (1973), The Coming of a Post-Industrial Society. A Venture in Social Forecasting (New York: Basic Books).

Belt, Henk van den, and Arie Rip (1987), "The Nelson-Winter-Dosi Model and Synthetic Dye Industry", in Bijker, et al. (Eds.), 135-158.

Bentley, Arthur F. (1908), The Process of Government (Chicago: University of Chicago Press).

Bernstein, Gail Lee, and Haruhiro Fukui (Eds.) (1988), Japan and the World (London: Macmillan).

Bertelsmann Stiftung (1988), Strategien und Optionen für die Zukunft Europas – Ziele und Konturen eines Projektes (Gütersloh: Bertelsmann).

Bijker, Wiebe E., Thomas P. Hughes, and Trevor J.Pinch (Eds.) (1987), The Social Construction of Technological Systems. New Directions in the Sociology and History of Technology (Cambridge, MA: MIT Press).

Bijker, Wiebe, and John Law (Eds.) (1992), Shaping Technology / Building Society. Studies in Sociotechnical Change (Cambridge, MA: MIT Press).

BMWi (1995), Die Informationsgesellschaft: Fakten, Analysen, Trends (Bonn: Bundesministerium for Wirtschaft), http://www.bmwi-info2000.de/gip/fakten/zeitbild.

Bocker, Peter (1988), ISDN. The Integrated Services Digital Network. Concepts, Methods, Systems (Berlin: Springer Verlag).

Bockholt, Andrea, Sandra Kohl, Horst Dieter Schlosser, and Susanne Schmid (1993), ISDN – Eine Technik auf dem Weg zur Allgegenwart. Sprachlich repräsentierte Leitbilder einer neuen Informations- und Kommunikationstechnik (Frankfurt/Main: Verlag G.A.F.B.).

Börzel, Tanja A. (1997), ”Zur (Ir-)Relevanz der ‘Postmoderne’ für die Integrationsforschung. Eine Replik auf Thomas Diez’ Beitrag ‘Postmoderne und europäische Integration’”, in *Zeitschrift für Internationale Beziehungen* 4, 1, 125-137.

Boxsel, Joey van (1994), “Constructive Technology Assessment: A New Approach for Technology Assessment Developed in the Netherlands and its Significance for Technology Policy”, in Aichholzer and Schienstock (Eds.) 181-204.

Braun, Ernest (1994), “Promote or Regulate: The Dilemma of Innovation Policy”, in Aichholzer and Schienstock (Eds.), 95-124.

Brennan, Geoffrey, and James M. Buchanan, (1980), The Power to Tax: Analytical Foundations of a Fiscal Constitution (Cambridge, MA: Cambridge University Press).

Breton, Albert (1970), ”Public Goods and the Stability of Federalism”, in *Kyklos* 23, 882-902.

Buchanan, James M. (1950), ”Federalism and Fiscal Equity”, in *American Economic Review* 40, 583-599.

Buigues, Pierre, and André Sapir (1993), ”Community Industrial Policies”, in Nicolaides (Ed.), 21-37.

Business Software Alliance (1994), ”Unrealistic U.S. Government Export Controls Limit the Ability of American Companies To Meet the Demand for Encryption”, http://www.eff.org/pub/Privacy/ota_priv_sec.report.

Calder, Kent (1989), ”Elites in an Equalizing Role. Ex-Bureaucrats as Coordinators and Intermediaries in the Japanese Government-Business Relationship”, in *Comparative Politics* 21, 4, 379-403.

Cameron, David (1992), ”The 1992 Initiative: Causes and Consequences”, in Sbragia (Ed.), 23-74.

Cameron, David (Ed.) (1981), Regionalism and Supranationalism (Montreal: The Institute for Research on Public Policy).

Campbell, John C. (1989), ”Democracy and Bureaucracy in Japan”, in Ishida and Krauss”, 113-137.

Camps, Miriam (1966), European Unification in the Sixties: From the Veto to the Crisis (New York: McGraw-Hill).

Caves, Richard E., Jeffrey A. Frankel, and Ronald W. Jones (1990), World Trade and Payments. An Introdcution. 5th Edition (Glenview, IL: Scott, Foresman/Little, Brown Higher Education).

Chandler, Alfred D., Jr. (1977), The Visible Hand: The Managerial Revolution in American Business (Cambridge, MA: Belknap Press).

Clinton, Bill (1992), ”Technology: The Engine of Economic Growth. A National Technology Policy for America” (from the Clinton campaign, September 18).

Cochrane, Peter (1995), ”The Information Wave”, in Emmott (Ed.), 17-33.

Cockfield, Lord (1994), The European Union. Creating the Single Market (London: Wiley Chancery Law).

Commission (1988), Green Paper on Copyright and the Challenge of Technology – Problems in Copyright Calling for Immediate Action, COM(88)72 final (June 17).

Commission (1991), Follow-up to the Green Paper – Working Programme of the Commission in the Field of Copyright and Neighbouring Rights, COM(90)584 final (January 17).

Commission (1993), White Paper on Growth, Competitiveness, and Employment. The Challenges and Ways Forward into the 21st Century, COM(93)700 final (December 5).

Commission (1994a), Europe and the Global Information Society. Recommendations to the European Council, http://www.ispo.cec.be/infosoc/backg/bangeman.html.

Commission (1994b), Action Plan: Europe's Way to the Information Society, COM(94)347 final (July 19).

Commission (1994c), Green Paper on the Strategy Options to Strengthen the European Programme Industry in the Context of the Audiovisual Policy of the European Union, COM(94)96 final (April 6).

Commission (1994d), "Replies from Interested Parties on Copyright and Neighbouring Rights in the Information Society", ISBN 92-827-0204-9.

Commission (1995a), Methodology for the Implementation of Information Society Applications, COM(95)224 (May 31).

Commission (1995b), Green Paper on the Liberalization of Telecommunications Infrastructure and Cable Television Networks, COM(94)682 final (January 25).

Commission (1995c), The Consultation on the Green Paper on the Liberalization of Telecommunications Infrastructure and Cable Television Networks, COM(95)158 (May 3).

Commission (1995d), Green Paper Copyright and Related Rights in the Information Society, COM(95)382 final (July 19).

Commission (1996a), Green Paper Living and Working in the Information Society: People First, COM(96)389 final (July 22), http://www.ispo.cec.be/infosoc/legreg/docs/peopl1st.html

Commission (1996b), INFO2000. Stimulating the Development and Use of Multimedia Information Content, http://www2.echo.lu/info2000/en/infowwwc.html.

Commission (1996c), The INFO2000 Programme. 4-Year Work Programme 1996-1999, ftp://www.echo.lu/pub/info2000/infowkpw.zip.

Commission (1996d), Regulatory Transparency in the Internal Market for Information Society Services, Communication to the Council, the Parliament and the Economic and Social Committee.

Commission (1996e), Learning in the Information Society. Action Plan for a European Education Initiative (1996-98), http://www.ispo.cec.be/files/learn.doc.

Commission (1996f), Building the European Information Society for Us All, High Level Group of Experts, http://www.ispo.cec.be/files/hlegfin.rtf.

Commission (1996g), Green Paper on the Protection of Minors and Human Dignity in Audiovisual and Information Services, http://www.ispo.cec.be/infosoc/legreg/docs/protect.html.

Constant, Edward W. II (1987), "The Social Locus of Technological Practice: Community, System, or Organization", in Bijker, et al (Eds.), 223-242.

Copland, William D. (1971), Introduction to International Politics: A Theoretical Overview (Chicago: Markham).

Corden, W. Max (1960), "The Geometric Representation of Policies to Attain Internal and External Balance", *Review of Economic Studies* 28, 1-22.

Cornes, Richard, and Sandler, Todd (1986), The Theory of Externalities, Public Goods, and Club Goods (Cambridge, MA: Cambridge University Press).

Council (1991), ”The Legal Protection of Computer Programs”, OJ L 122/42, Council Directive 91/250/EEC (May 14).

Council (1992), ”Certain Rights Related to Copyright in the Field of Intellectual Property”, OJ L 346/61, Council Directive 92/100/EEC (November 19).

Council (1993a), ”The Co-ordination of Certain Rules”, OJ L 248/15, Council Directive 93/83/EEC (September 27).

Council (1993b), ”Terms of Protection Directive”, OJ L 290/9, Council Directive 93/98/EEC (November 24).

Council (1993c), ”Database Directive”, OJ C 308/1, Council Directive (November 15).

Council (1995), The European Union Today and Tomorrow. Adapting the European Union for the Benefit of its Peoples and Preparing it for the Future. A General Outline for a Draft Revision of the Treaties – Dublin II, Conference of the Representatives of the Governments of the Member States (Brussels: Conf 2500/96, December 5).

Council (1996), 1996 Intergovernmental Conference (IGC ’96). Reflection Group Report and other References for Documentary Purposes, General Secretariat of the Council of the European Union (Brussels, December 1995).

Council (1997), Draft Treaty of Amsterdam, Conference of the Representatives of the Governments of the Member States (Brussels: Conf/4001/97, June 19).

Council on Competitiveness (1991), Gaining New Ground: Technology Priorities for America's Future (Washington, DC: Council on Competitiveness).

Curtis, Gerald L. (1988), The Japanese Way of Politics (New York: Columbia University).

Curzon Price, Victoria (1981), Industrial Policies in the European Community (London: Basingstroke).

Cyberspace Law Institute (1995), ”Copyright Law on the Internet: The Special Problem of Caching and Copyright Protection”, Draft September 1, 1995, http://www.cli.org/Caching.htm.

Dalum, Bent (1994), “National Systems of Innovation and Technology Policy: The Case of Denmark”, in Aichholzer and Schienstock (Eds.), 303-322.

Dasgupta, Partha, and Joseph E. Stiglitz (1980), ”Industrial Structure and the Nature of Innovative Activity”, in *The Economic Journal* 90, 266-293.

David, P. A., and J. A. Bunn (1988), ”The Economics of Gateway Technologies and Network Evolution: Lessons from Electricity Supply History”, in *Information Economics and Policy* 3, 165-202.

De Vree, Johan K. (1972), Political Integration: The Formation of Theory and its Problems (The Hague: Mouton).

Dierkes, Meinolf (1988), ”Organisationskultur und Leitbilder als Einflußfaktoren der Technikgenese – Thesen zur Strukturierung eines Forschungsfeldes”, in *Mitteilungen* 3, Verbund sozialwissenschaftliche Technikforschung, 49-62.

Dierkes, Meinolf, Ute Hoffmann, and Lutz Marz (1992), Leitbild und Technik: Zur Entstehung und Steuerung technischer Innovationen (Berlin: Ed. Sigma).

Diez, Thomas (1996), ”Postmoderne und europäische Integration. Die Dominanz des Staatsmodells, die Verantwortung gegenüber dem Anderen und die Konstruktion eines alternativen Horizonts”, in *Zeitschrift für Internationale Beziehungen* 3, 2, 255-81.

Dimock, Marshall (1958), A Philosophy of Administration (New York: Harper & Row).

Dosi, Giovanni (1982), ”Technological Paradigms and Technological Trajectories”, in *Research Policy* 11, 147-162.

Dosi, Giovanni, and Luigi Orsenigo (1988), ”Coordination and Transformation: An Overview of Structures, Behaviors and Change in Evolutionary Environments”, in Dosi, et al. (Eds.), 13-37.

Dosi, Giovanni, Christopher Freeman, Richard Nelson, Gerald Silverberg, and Luc Soete (Eds.) (1988), Technical Change and Economic Theory (London: Pinter Publishers).

Dosi, Giovanni, Keith Pavitt, and Luc Soete (1990), The Economics of Technical Change and International Trade (New York: New York University Press).

Dougherty, James E., and Pfaltzgraff, Robert L., Jr. (1990), Contending Theories of International Relations. A Comprehensive Survey, 3rd Ed. (New York: Harper & Row).

Duke, Benjamin (1986), The Japanese School. Lessons for Industrial America (New York: Praeger).

Easton, David (1953), The Political System (New York: Knopf).

Ebeling, Adolf (1996), "Abgeschreddert. Das Elend mit dem Computerschrott", in *c't. Magazin für Computertechnik* 4 (April), 124.

EFFector Online, http://www.eff.org/pub/EFF/Newsletters/EFFector.

Elliot, Brian (Ed.) (1988), Technology and Social Process (Edinburgh: Edinburgh University Press).

Emmott, Stephen J. (Ed.) (1995), Information Superhighways. Multimedia Users and Futures (London: Academic Press).

Europäisches Parliament (1996), Weissbuch zur Regierungskonferenz 1996 – Band II. Aufzeichnung über die Positionen der Mitgliedsstaaten der Europäischen Union im Hinblick auf die Regierungskonferenz 1996, Arbeitsgruppe Regierungskonferenz (Luxembourg).

European Parliament (1993), "Resolution on the Commission's Review of the Situation in the Telecommunications Services Sector", Resolution A3-0113/93 (April 20), http://www.ispo.cec.be/infosoc/legreg/docs/a3011393.html.

European Parliament (1997), Europa 2000: Die Europäische Union der Fünfzehn (Cologne: Omnia Verlag).

Evers, Rolf (1987), Information Technology in Japan. State of the Art, Future Developments, and Government Promotion, GMD-Studien No. 125 (Sankt Augustin: GMD).

Farrell, Joseph, and Garth Saloner (1986), "Installed Base and Compatibility: Innovation, Product Preanouncements, and Predation", in *The American Economic Review* 76 (December), 940-955.

Federal Communications Commission (1996), FCC Implementation Schedule for the Telecommunications Act of 1996, Pub. L. No. 104-104, 110 Stat. 56, Enacted February 8, 1996, http://www.fcc.gov/Reports/implsched.htm.

Federal Communications Commission/Federal-State Joint Board (1996), Recommended Decision on Universal Service, CC Docket No. 96-45, Washington, D.C.

Feld, Werner (1966), "National Economic Interest Groups and Policy Formation in the EEC", in *Political Science Quarterly* 81 (September), 392-411.

Ferguson, Tom (1982), "Private Locks, Public Keys and State Secrets: New Problems in Guarding Information with Cryptography", Harvard University Center for Information Policy Research, Program on Information Resources Policy (April).

Fey, Jürgen (1996a), "Die Rückkehr des Bill. Microsofts Internet/Intranet-Strategie", in *c't. Magazin für Computertechnik* 8 (August), 26.

Fey, Jürgen (1996b), "Es kann nur einen geben. Microsoft kontra Netscape: Wer kontrolliert den Browser-Markt?", in *c't. Magazin für Computertechnik* 10 (October), 96-100.

Foljanty-Jost, Gesine (1996), "Die politische Wende von 1993 oder: Japan auf dem Weg zur 'normalen' Demokratie", in Foljanty-Jost (Ed.), 167- 183.

Foljanty-Jost, Gesine (Ed.) (1996), Japan im Umbruch – auf dem Weg zum 'normalen Staat'? (München: iudicium Verlag).

Foucoult, Michel (1977), Discipline and Punish: The Birth of the Prison (New York: Pantheon).

Franzmeyer, Fritz, Ulrich Everling, Christian Joerges, and Rudolf Hrbek (1991), Die Entwicklung der EG zur Politischen Union und zur Wirtschafts-und Währungsunion unter der Sonde der Wissenschaft, Schriftenreihe des Arbeitskreises Europäische Integration e.V. (Baden-Baden: Nomos Verlagsgesellschaft).

Freeman, Christopher (1988a), ”Introduction, Part I”, in Dosi, et al. (Eds.), 1-8.

Freeman, Christopher (1988b), ”Preface, Part II”, in Dosi, et al. (Eds.), 9-12.

Freeman, Christopher (1990), ”Technical Innovation in the World Chemical Industry and Changes of Techno-economic Paradigm”, in Freeman and Soete (Eds.), 74-91.

Freeman, Christopher (1991), ”The Nature of Innovation and the Evolution of the Productive System”, in OECD, 303-314.

Freeman, Christopher, and Bengt-Åke Lundvall (1988) (Eds.), Small Countries Facing the Technological Revolution (London: Pinter Publishers).

Freeman, Christopher, and Carlotta Perez (1988), ”Structural Crisis of Adjustment, Business Cycles and Investment Behavior, in Dosi, et al. (Eds.), 38-66.

Freeman, Christopher, John Clark, and Luc Soete (1982), Unemployment and Technical Innovation. A Study of Long Waves and Economic Development (London: Pinter Publishers).

Freytag, Andreas (1995), Die strategische Handels- und Industriepolitik der EG (Köln: Institut für Wirtschaftspolitik).

Friedland, Jonathan (1994), ”Disconnected”, *Far Eastern Economic Revie*w 157 (June 30), 46-49.

Friedman, J., and W. Alonso (Eds.) (1975), Regional Policy: Readings in Theory and Applications (Cambridge, MA: Cambridge University Press).

Friedman, Milton (1953), ”The Case for Flexible Exchange Rates”, in Friedman.

Friedman, Milton (1953), Essays in Positive Economics (Chicago: University of Chicago Press).

Friedrich, C. J. (1969), Europe: An Emergent Nation? (New York: Harper and Row).

Galbraith, John Kenneth (1971), The New Industrial State (Boston: Houghton Mifflin).

Garrett, Geoffrey (1992), ”International Cooperation and Institutional Choice: the European Community's Internal Market”, in *International Organizations* 46, 2 (Spring), 533-560.

Garrett, Geoffrey (1992), ”International Cooperation and Institutional Choice: the European Community's Internal Market”, in *International Organizations* 46, 2 (Spring), 533-560.

Garrett, Geoffrey, and George Tsebelis (1996), ”An Institutional Critique of Intergovernmentalism”, in *International Organization* 50, 2 (Spring), 269-99.

Gasman, Lawrence (1994), Broadband Networking (New York: Van Nostrand Reinhold).

General Accounting Office (1982), Federal Information Systems Remain Highly Vulnerable to Fraudulent, Wasteful, Abusive, and Illegal Practices (Washington, DC: U.S. Government Printing Office).

General Accounting Office (1993), ”Communications Privacy: Federal Policy and Actions”, GAO/OSI-94-2 (November) (Washington, DC: U.S. Government Printing Office).

George, Alexander L. (1972), “The Case for Multiple Advocacy in Making Foreign Policy”, in *American Political Science Review* 66 (September), 751-785.

Gilfillan, S. (1963 [1934]), The Sociology of Invention (Cambridge, MA: MIT Press).

Gore, Al (1996), ”Statement of the Vice President” (October 1), http://www.eff.org/pub/Privacy/Key_escrow/Clipper_III/961001_wh_clipper3.statement.

Gore, Albert (1993), ”Remarks by Vice President Al Gore at National Press Club” (December 21), http://www.eff.org/papers/gore.speech.html.

Gore, Albert (1994), ”Remarks Prepared for Delivery by Vice President Al Gore”, Royce Hall, UCLA Los Angeles, California (January 11), http://www2.whitehouse.gov/WH/EOP/OVP/other/superhig.html.

Grande, Edgar, and Jürgen Häusler (1994), Industrieforschung und Forschungspolitik. Staatliche Steuerungspotentiale in der Informationstechnik (Frankfurt: Campus Verlag).

Grant, Charles (1994), Inside the House that Jaques Built (London: Nicholas Brealey Publ.).

Green, K. (1985), Research Funding in Australia: A View from the North (Canberra: Department of Science).

Grewlich, Klaus W. (1992), Europa im globalen Technologiewettlauf: Der Weltmarkt wird zum Binnenmarkt (Gütersloh: Bertelsmann Stiftung).

Groeben, Hans van der (1987a), Die Europäische Gemeinschaft und die Herausforderungen unserer Zeit (Baden-Baden: Nomos).

Groeben, Hans van der (1987b), Legitimationsprobleme der Europäischen Gemeinschaft (Baden-Baden: Nomos).

Groeben, Hans van der, and Möller, Hans (Eds.) (1980), Die Europäische Union als Prozeß (Baden-Baden: Nomos).

Groom, A. J. R., and Taylor, Paul (Eds.) (1978), International Organization : a Conceptual Approach (London: F. Pinter).

Grosman, Gene M., and Elhanan Helpman (1990), "The 'New' Growth Theory: Trade, Innovation, and Growth", in *The American Economic Review* 80, 86-91.

Grosman, Gene M., and Elhanan Helpman (1991), "Growth and Welfare in a Small Open Economy", in Helpman and Razin (Eds.), 141-163.

Grote, Andreas (1995), "Ermittlungen. Stoffdatenbank der TU München konkretisiert die Ökobilanz des PC", in *c't. Magazin für Computertechnik* 8 (August), 108.

Grote, Andreas (1996), "Grüne Rechnung. Das Produkt Computer in der Ökobilanz", in *c't. Magazin für Computertechnik* 12 (December), 92.

Grote, Andreas (1996), "Punktgenau. Schweizer Studie präzisiert die Ökobilanz des PC", in *c't. Magazin für Computertechnik* 10 (October), 102-104.

Haas, Ernst B. (1957), Regional Integration and National Policy (New York: Carnegie Endowment for International Peace).

Haas, Ernst B. (1958), The Uniting of Europe; Political, Social, and Economic Forces, 1950-1957 (Stanford: Stanford University Press).

Haas, Ernst B. (1959), The Future of West European Political and Economic Unity (Santa Barbara: Technical Military Planning Operation, General Electric Company).

Haas, Ernst B. (1961), "International Integration: The European and the Universal Process", in *International Organization* 15, 3 (Summer), 366-379.

Haas, Ernst B. (1963), Limits and Problems of European Integration (The Hague: M. Nijhoff).

Haas, Ernst B. (1964), Beyond the Nation-State: Functionalism and International Organization (Stanford: Stanford University Press).

Haas, Ernst B. (1969), Future Worlds and Present International Organizations: Some Dilemmas (Berkeley: Institute of International Studies, University of California).

Haas, Ernst B. (1970a), "The Study of Regional Integration: Reflections on the Joy and Anguish of Pretheorizing", in *International Organization*, 1970, 24, 4 (Autumn), 607-646.

Haas, Ernst B. (1970b), The Web of Interdependence; the United States and International Organizations (Englewood Cliffs, NJ: Prentice-Hall).

Haas, Ernst B. (1975), The Obsolescence of Regional Integration Theory (Berkeley: Institute of International Studies, University of California).

Haas, Ernst B. (1976), "Turbulent Fields and the Theory of Regional Integration", in *International Organization* 30, 2 (Spring), 173-211.

Haas, Ernst B. (1990), When Knowledge is Power: Three Models of Change in International Organizations (Berkeley: University of California Press).

Haas, Ernst B., and Schmitter, Pillippe C. (1964), "Economics and Differential Patterns of Political Integration: Projections about Unity in Latin America", in *International Organization* 18, 4 (August), 705-737.

Haas, Ernst B., and Whiting, Allen S. (1956), Dynamics of International Relations (New York: McGraw-Hill).

Hannequart, Achille (1992), Economic and Social Cohesion in Europe. A New Objective for Integration (London: Routledge).

Hansen, Roger D. (1969), "Regional Integration: Reflections on a Decade of Theoretical Efforts", in *World Politics* (January), 242-271.

Harari, Ehud (1974), "Japanese Politics of Advice in Comparative Perspective", in *Public Policy* 12, 4 (Fall), 542-546.

Harari, Ehud (1988), "The Institutionalization of Policy Consultation in Japan. Public Advisory Bodies", in Bernstein and Fukui (Eds.), 144-157.

Harasim, Linda (Ed.) (1993), Global Networks: Computers and International Communication (Cambridge, MA: MIT Press).

Harnischfeger, Monika, Daniel H. Hüdig, and Peter Zoche (1996), "Netzwerkbildung zur Entwicklung des Multimedia-Potentials in Baden-Württemberg", Report to the Academy for Technology Assessment in Baden-Württemberg (AfTA) (Karlsruhe: Fraunhofer ISI).

Hayek, Friedrich A. von (1975), "The Prestense of Knowledge", in *Swedish Journal of Economics* 77, 433-442.

Heimer, Thomas (1993), Zur Ökonomik der Entstehung der Technologien. Eine theoretische und empirische Erörterung am Beispiel des "Intelligent Home" (Marburg: Metropolis Verlag).

Helpman, Elhanan, and Assaf Razin (Eds.) (1991), International Trade Policy (Cambridge, MA: MIT Press).

Helpman, Elhanan, and Paul R. Krugman (1985), Market Structure and Foreign Trade: Increasing Returns, Imperfect Competition and the International Economy (Brighton: Wheatsheaf).

Hibbs, Douglas A. Jr. (1987), The American Political Economy. Macroeconomics and Electoral Politics (Cambridge, MA: Harvard University Press).

Hippel, E. von (1976), "The Dominant Role of Users in the Scientific Instrument Innovation Process", in *Research Policy* 15 (3), 212-239.

Hoffman, Lance (1994), "SPA Study of Foreign Availability of Cryptography," *SPA News*, March.

Hoffmann, Stanley (1989), "The European Community and 1992", in *Foreign Affairs* (Fall), 27-47.

Hollander, S. (1965), The Sources of Increased Efficiency: A Study of Du Pont Rayon Plants (Cambridge, Mass.: MIT Press).

Hollerman, Leon (1988), Japan, Disincorporated: the Economic Liberalization Process (Stanford: Hoover Press Publication No. 363).

Horio, Teruhisa (1988), Educational Thought and Ideology in Modern Japan. State Authority and Intellectual Freedom, edited and translated by Steven Platzer, (Tokyo: University of Tokyo Press).

House (1980), The Government's Classification of Private Ideas, Committee on Government Operations, H. Rept. No. 96-1540 (December 22) (Washington, DC: U.S. Government Printing Office).

House (1987a), Computer Security Act of 1987, Hearings on H.R. 145, Subcommittee on Legislation and National Security of the House Committee on Government Operations (February 26) (Washington, DC: U.S. Government Printing Office).

House (1987b), Computer Security Act of 1987 – Report to Accompany H.R. 145, Committee on Government Operations, H. Rept. No. 100-153, Part II (June 11) (Washington, DC: U.S. Government Printing Office).

House (1989a), Military and Civilian Control of Computer Security Issues, Subcommittee on Legislation and National Security, Committee on Government Operations (May 4) (Washington, DC: U.S. Government Printing Office).

House (1989b), The U.S. Supercomputing Industry, Hearings, Subcommittee on Science, Research, and Technology (June 20) (Washington, DC: U.S. Government Printing Office).

House (1989c), High Performance Computing, Hearings, House Subcommittee on Science, Research, and Technology (October 3) (Washington, DC: U.S. Government Printing Office).

House (1990), Hearings on H.R. 3131: National High-Performance Computing Technology Act, Subcommittee on Science, Research, and Technology (March 14) (Washington, DC: U.S. Government Printing Office).

House (1994a), Hearing on Internet Security, Subcommittee on Science Committee on Science, Space, and Technology (March 22) (Washington, DC: U.S. Government Printing Office).

House (1994b), Hearings [key escrow], Subcommittee on Technology, Environment, and Aviation, Committee on Science, Space and Technology (May 3) (Washington, DC: U.S. Government Printing Office).

Hrebenar, Ronald. J. (1992), The Japanese Party System. From One-Party Rule to Coalition Government, 2nd Ed. (Boulder, CO: Westview).

Huelshoff, Michael (1994), "Domestic Politics and Dynamic Issue Linkage: A Reformulation of Integration Theory", in *International Studies Quarterly* 38, 255-279.

Hughes, Barry B., and Schwarz, John E. (1972), "Dimensions of Political Integration and the Experience of the European Community", in *International Studies Quarterly* (September), 263-294.

Hughes, Thomas P (1988), "The Seamless Web: Technology, Science, et cetera, et cetera", in Elliot (Ed.), 9-19.

Hughes, Thomas P. (1983), Networks of Power: Electrification in Western Society, 1880-1930 (Baltimore, MD: John Hopkins University Press).

Hughes, Thomas P. (1987), "The Evolution of Large Technological Systems", in Bijker, Hughes, and Pinch (Eds.), 51-82.

Hummel, Marlies (1993), "Industriepolitik – kontrovers", in *Ifo-Schnelldienst* 46, 17-18, 3-6.

Inglehart, Ronald (1967), "An End to European Integration?", in *American Political Science Review* 61,1.

Inglehart, Ronald (1970), "Public Opinion and Regional Integration", in *International Organization* 24, 4 (Autumn), 764-795.

Ingram, James C. (1969), "Comment: The Currency Area Problems", in Mundell and Swoboda (Eds.).

Inoguchi, Takashi (1991), "The Nature and Functioning of Japanese Politics", in *Government and Opposition* 26, 2, 167-184.

Inoguchi, Takashi (1993), "Japanese Politics in Transition. A Theoretical Review", in *Government and Opposition* 28, 4, 443-455.

Ishida, Takeshi, and Ellis S. Krauss (1989), Democracy in Japan (Pittsburgh: University of Pittsburgh Press).

Ishikawa, Masumi (1994), "An SDPJ Collapse from Within", in *Japan Ouarterly* 41, 2, 141-145.

Jacobson, Gary C., and Samuel Kernell (1983 [1981]), Strategy and Choice in Congressional Elections. 2nd Ed. (New Haven: Yale University Press).

Japan Economic Research Institute (JERI) (1995), The Future Course of the Japanese-style Market Economy, http://ifrm.glocom.ac.jp/jeri/t01/sum/introduction.html.

Jaszi, Peter (1995), "Taking the White Paper Seriously", *Network Planning Paper Number 30*, Library of Congress Network Advisory Committee.

Jaszi, Peter (1996), "Some Public Interest Considerations Relating to H.R. 3531 Database Investment and Intellectual Property Antipiracy Act of 1996", http://arl.cni.org/info/frn/copy/peter.html.

Johnson, Chalmers (1982), MITI and the Japanese Miracle (Stanford: Stanford University Press).

Johnson, Chalmers (1982), MITI and the Japanese Miracle. The Growth of Industrial Policy, 1925-1975 (Stanford: Stanford University Press).

Johnson, Chalmers (1984), "The Idea of Industrial Policy", in Johnson (Ed.).

Johnson, Chalmers (1988), "The Japanese Political Economy: A Crisis in Theory", *Ethics and International Affairs* 2, 79-97.

Johnson, Chalmers (1989), "Wer regiert Japan? Ein Essay über die staatliche Bürokratie", in Menzel, 2nd Part, 222-255.

Johnson, Chalmers (Ed.) (1984), The Industrial Policy Debate (San Francisco: Institute for Contemporary Studies).

Junne, Gerd (1992), "Konfrontation zwischen Europa und Japan?", in Grewlich, 287-298.

Kahn, David (1967), The Codebreakers: The Story of Secret Writing (New York: MacMillan).

Kenen, Peter B. (1969), "The Theory of Optimum Currency Areas: An Eclectic View", in Mundell and Swoboda, 41-60.

Keohane, Robert O., and Hoffmann, Stanley (Eds.) (1991), The New European Community: Decisionmaking and Institutional Change (Boulder, CO: Westview).

Kevenhörster, Paul (1993), Politik und Gesellschaft in Japan (Mannheim: B. I.-Taschenbuchverlag).

Kishimoto, Koichi (1988[1982]), Politics in Modern Japan – Development and Organization (Tokyo: Japan Echo Inc.).

Kitahara, Yasusada (1987), "Telecommunications in an Advanced Information Society: A Japanese Perspective", in Orishimo, et al. (Eds.), 39-46.

Klodt, Henning (1992), "Gerät Europa in eine technologische Abhängigkeit?", in Grewlich, 299-312.

Klodt, Henning, and Jürgen Stehn (et al.) (1992), Die Strukturpolitik der EG (Tübingen: J. C. B. Mohr (Paul Siebeck)).

Kohno, Masura (1992), "Rational Foundations for the Organization of the LDP", in *World Politics* 44, 3, 369-397.

Kokuryo, Jiro (1995), "Toward A Policy for Reforming and Opening Japanese Telecommunications", The Information Technology and Communications Policy Forum of Japan Policy Proposal # 4, http://ifrm.glocom.ac.jp/ipf/pr2/statement4.html.

Kondratiev, N. D. (1935), "The Long Waves in Economic Life", in *Review of Economic Statistics* 17 (November), 105-115.

KPMG (1996), "Report for the European Commission. Public Policy Issues Arising from Telecommunications and Audiovisual Convergence" (September), http://www.ispo.cec.be/infosoc/promo/pubs/kpmg/kpmg.zip.

Kreikebaum, Hartmut (Ed.) (1991), Integrierter Umweltschutz: eine Herausforderung an das Innovationsmanagement, 2nd Ed. (Wiesbaden: Gabler).

Krieger, C. (1985), Regionales Wirtschaftswachstum und sektoraler Strukturwandel in der Europischen Gemeinschaft. Kiel Studies 194, Institut für Weltwirtschaft (Tübingen: J.C.B. Mohr).

Kristensen, Peer H., and Jörn Levinsen (1978), The Small Country Squeeze (Roskilde, Denmark: Institute of Economics, Politics and Administration, Roskilde University Centre).

Krugman, Paul R. (1987), "Strategic Sectors and International Competition", in Stern (Ed.), 207-232.

Krugman, Paul R. (Ed.) (1986), Strategic Trade Policy and the New International Economics (Cambridge, MA: Cambridge University Press).

Krugman, Paul, and Maurice Obstfeld (1991), International Economics: Theory and Policy (New York: Harper Collins).

Kubicek, Herbert (Ed.) (1993), Daten- und Verbraucherschutz bei Telekommunikationsdienstleistungen in der EG (Baden-Baden: Nomos).

Kubicek, Herbert, and Arno Rolf (1985), Mikropolis – Mit Computernetzen in die ”Informationsgesellschaft” (Hamburg: VSA-Verlag).

Kumon (undated), ”A Japanese Perspective on the Significance of the Information Revolution”, Center for Global Communications, http://www.glocom.ac.jp/Publications/Kumon/GII2.html.

Landau, Susan (1988), ”Zero Knowledge and the Department of Defense”, in *Notices of the American Mathematical Society* 35, 1 (January), 5-12.

Latniak, Erich, and Georg (1991), Socially Oriented Technology Policy in Germany – Experiences of a North Rhine-Westphalien Program (Hagen: Polis Working Papers of the Fernuniversität Hagen).

Law, John, and Michel Callon (1992), ”The Life and Death of an Aircraft: A Network Analysis of Technical Change”, in Bijker and Law (Eds.), 21-52.

Layton, E. T. (1972), ”Conditions of Technological Development”, in Spiegel-Rössing and Solla Price (Eds.), 197-222.

Leahy, Patrick (1996), ”Statement of Senator Leahy on the Administration’s New Encryption Scheme” (October 1), http://www.eff.org/pub/Privacy/Key_escrow/Clipper_III/961001_leahy_clipper3.statement.

Lindberg, Leon N. (1970), ”Political Integration as a Multidimensional Phenomena Requiring Multivariate Measurement”, in *International Organization* 24, 4 (Autumn), 649-731.

Lindberg, Leon N., and Scheingold, Stuart A. (1970), Europe's Would-Be Polity. Patterns of Change in the European Community (Englewood Cliffs, NJ: Prentice-Hall).

Lindberg, Leon N., and Scheingold, Stuart A. (Eds.) (1971), Regional Integration. Theory and Research (Cambridge, MA: Harvard University Press).

Lipsey, Richard, and Kelvin Lancaster (1956), ”The general theory of the second best”, in *Review of Economic Studies* 24, 1 (October), 11-32.

Lowi, Theodore J. (1979 [1969]), The End of Liberalism. The Second Republic of the United States, 2nd Ed. (New York: W. W. Norton & Company).

Lucas, Robert E. (1988), ”On the Mechanics of Economic Development”, in *Journal of Monetary Economics* 22, 3-42.

Lundvall, Bengt-Åke (1983), Technology, Competitiveness and Small Countries (Aalborg: Aalborg University Press).

Lundvall, Bengt-Åke (1985), Product Innovation and User-Producer Interaction (Aalborg: Aalborg University Press).

Lundvall, Bengt-Åke (1986), Technological Revolutions and the International Division of Labour. Paper presented at the Workshop on Innovation and Regional Development (Venice: University of Architecture).

Machlup, Fritz (1962), The Production and Distribution of Knowledge in the United States (Princeton: Princeton University Press).

MacKenzie, Donald, and Judy Wajcman (Eds.) (1985), The Social Shaping of Technology. How the Refrigeratur got its Hum (Philadelphia: Open University Press).

March, J. G., and H. A. Simon (1958), Organizations (New York: Wiley).

Margolis, Julius (1970), The Analysis of Public Output (New York: Columbia University Press).

Markoff, John (1991), ”U.S. Said to Play Favorites in Promoting Nationwide Computer Network”, in *The New York Times* (December 18).

McClure, Charles R., Ann P. Bishop, Philip Doty, and Howard Rosenbaum (1991), The National Research and Education Network (NREN): Research and Policy Perspectives (Norwood, NJ: Ablex Publ.).

McCormack, Gavan, and Yoshio Sugimoto (Eds.) (1986), Democracy in Contemporary Japan (Armonk, NY: Sharpe).

McKinnon, R. (1963), "Optimum Currency Areas", in *American Economic Review* 53 (September), 717-725.

Meade, James (1952), The Theory of International Economic Policy. Volume I: The Balance of Payments (Oxford: Oxford University Press).

Menzel, Ulrich (Ed.) (1989), Im Schatten des Siegers. Japan (Frankfurt: Suhrkamp).

Messmer, Ellen (1993), "Encryption Restriction Policy Hurts Users, Vendors", in *Network World* (August 23), 34-43.

Meyer-Stamer, Jörg (1995), Industriepolitik in der Europäischen Union: Alte Dilemma und neue Optionen (Bonn: Friedrich Ebert Stiftung, Reihe Eurokolleg 33).

Miles, Ian, Howard Rush, Kevin Turner, and John Bessant (1988), Information Horizons. The Long-Term Social Implications of New Information Technologies (Aldershot: Edward Elger).

Mishan, Edward J. (1962), "Second thoughts on second best", in *Oxford Economic Papers* 14 (October), 205-217.

MITI (1994), "Program for Advanced Information Infrastructure", http://www.intergov.gc.ca/docs/world/japan_it.html; see also http://www.miti.go.jp/index-e.html.

Moravcsik, Andrew (1991), "Negotiating the Single European Act: National Interests and Conventional Statecraft in the European Community", *International Organization* 45, 1 (Winter), pp. 19-56.

Mosco, V., and J. Wasko (1988), The Political Economy of Information (Madison: The University of Wisconsin Press).

MPT (1995), White Paper 1995. Communications in Japan (Tokyo: General Planning and Policy Division), http://www.mpt.go.jp/index-e.html.

Mundell, Robert A. (1961), "A Theory of Optimum Currency Areas", in *American Economic Review* 51 (September), 657-665.

Mundell, Robert A. (1968), International Economics (New York: Macmillan).

Mundell, Robert A., and A. K. Swoboda (Eds.) (1969), Monetary Problems of the International Economy (Chicago: University of Chicago Press).

Musgrave, Richard A. (1959), The Theory of Public Finance (New York: McGraw-Hill).

Myrdal, Gunnar (1957), Rich Lands and Poor (New York: Harper).

Myrdal, Gunnar (1959), Ökonomische Theorie und unterentwickelte Regionen (Stuttgart: Gustav Fischer).

Nanbu, Tsuruhiko (1995), "Policy Proposal for Local Telephone Markets", The Information Technology and Communications Policy Forum of Japan Proposal #2, http://ifrm.glocom.ac.jp/ipf/pr1/statement2.html.

National Information Infrastructure Task Force (1993), The National Information Infrastructure: Agenda for Action (September 15) (Washington, DC: U.S. Department of Commerce).

National Institute of Standards and Technology (1995), Delivering Results: A Progress Report from the National Institute of Standards and Technology (Gaithersburg, MD: U.S. Department of Commerce, Technology Administration).

National Science Foundation (1996), Science & Engineering Indicators – 1996, http://www.nsf.gov/sbe/srs/seind96/startse.htm.

Nelson, Richard R., and Sidney G. Winter (1977), "In Search of a Useful Theory of Innovation", in *Research Policy 6,* 1, 36-76.

Nelson, Richard R., and Sidney G. Winter (1982), An Evolutionary Theory of Economic Change (Cambridge, MA: Belknap Press).

Nerb, Gernot (1992), "Der Standort Westdeutschland im Urteil der Unternehmen", in *ifo-Schnelldienst* 8, 6-10.

Nester, William R. (1990), The Foundations of Japanese Power: Continuities, Changes, Challenges (New York: Sharpe).

Neuschwander, Thomas (1994), Mythos MITI. Industriepolitik in Japan (Frankfurt/Main: Peter Lang).

Nicolaides, Phedon (Ed.) (1993), Industrial Policy in the European Community: A Necessary Response to Economic Integration? (Dordrecht: Martinus Nijhoff Publishers).

Nijkamp, Peter (1989), "The United States of Europe: Glorious Victories or Great Defeats?", 29th Congress of the Regional Science Association, Cambridge, August 29 - September 1, Manuscript 1-15.

Noble, David (1986), "Die Entwicklung numerisch gesteuerter Werkzeugmaschinen", in Noble (Ed.), 98-136.

Noble, David (Ed.) (1986), Maschinenstürmer oder die komplizierten Beziehungen der Menschen zu den Maschinen (Berlin: unknown publ.).

Nora, Simon, and Alan Minc (1978), L'informatisation de la société (Paris: Editions du Seuil).

Nye, Joseph S. (1965), "Patterns and Catalysts in Regional Integration", in *International Organization* 19, 4 (Autumn), 870-884.

Nye, Joseph S. (1968a), "Comparative Regional Integration: Concept and Measurement", in *International Organization* 22, 4 (Autumn), 855-880.

Nye, Joseph S. (1968b), International Regionalism (Boston: Little, Brown).

Nye, Joseph S. (1970), "Comparing Common Markets: A Revised Neo-Functionalist Model", in *International Organization* 24, 4 (Autumn), 796-835.

Nye, Joseph S. (1971), Peace in Parts. Integration and Conflict in Regional Organization (Boston: Little, Brown).

Oates, Wallace E. (1972), Fiscal Federalism (New York: Brace Jovanovich).

OECD (1980), The Measurement of Scientific and Technical Activities: Proposed Standard Practice for Surveys of Research and Experimental Development ('Frascati Manual') (Paris).

OECD (1991), Technology and Productivity. The Challenge for Economic Policy (Paris).

Office of Management and Budget (1993), "Management of Federal Information Resources, Circular A-130 – Revised", sec. 8-a(9) (June 25).

Office of Science and Technology Policy (1987), A Research and Development Strategy for High Performance Computing.

Office of Technology Assessment (1987), Defending Secrets, Sharing Data: New Locks and Keys for Electronic Information, OTA-CIT-310 (October) (Washington, DC: U.S. Government Printing Office).

Office of Technology Assessment (1989), High Performance Computing and Networking for Science – Background Paper, OTA-BP-CIT-59 (September) (Washington, DC: U.S. Government Printing Office).

Office of Technology Assessment (1992), Finding a Balance: Computer Software, Intellectual Property and the Challenge of Technological Change, OTA-TCT-527 (May) (Washington, DC: U.S. Government Printing Office).

Office of Technology Assessment (1993), Protecting Privacy in Computerized Medical Information, OTA-TCT-576 (September) (Washington, DC: U.S. Government Printing Office).

Office of Technology Assessment (1994), Information Security and Privacy in Network Environments (September) (Washington, DC: U.S. Government Printing Office).

Ogburn, William F., and Meyer F. Nimkoff (1964), A Handbook of Sociology (London: Routledge & Kegan Paul).

Okimoto, Daniel (1989), Between MITI and the Market: Japanese Industrial Policy for High Technology (Stanford: Stanford University Press).

Okimoto, Daniel (Ed.) (1984), Competitive Edge: The Semiconductor Industry in the U. S. and Japan (Stanford: Stanford University Press).

Okuno, Masahiro, and Takehiko Aoyagi (1995), "Establishing Conditions for Promoting Competition Creating a New Universal Service", The Information Technology and Communications Policy Forum of Japan Policy Proposal # 8, http://ifrm.glocom.ac.jp/ipf/pr3/statement8.html.

Olson, Mancur (1971 [1965]), The Logic of Collective Action (Cambridge, MA: Harvard University Press).

Olson, Mancur (1982), The Rise and Decline of Nations. Economic Growth, Stagflation and Social Rigidities (New Haven: Yale University Press).

Olson, Mancur, Jr. (1969), "The Principle of 'Fiscal Equivalence': The Division of Responsibilities among Different Levels of Government", in *The American Economic Review* 59, 479-487.

Orishimo, Isao, Geoffrey J. D. Hewings, and Peter Nijkamp (Eds.), (1987), Information Technology: Social and Spatial Perspectives (Berlin: Springer).

Orvik, Nils, and Pentland, Charles (Eds.) (1983), The European Community at the Crossroads: the First Twenty-Five Years (Kingston, Ontario: Centre for International Relations, Queen's University).

Park, Yung H. (1972), "The Governmental Advisory System in Japan", in *Journal of Comparative Administration* 3 (February), 437-61.

Park, Yung H. (1986), Bureaucrats and Ministers in Contemporary Japanese Government (Berkeley: University of California Press).

Pauly, Mark V. (1970), "Optimality, 'Public Goods', and Local Governments: A General Theoretical Analysis", in *Journal of Political Economy* 78, 572-585.

Pavitt, Keith (1984), "Sectoral Patterns of Technical Change: Towards a Taxonomy and a Theory", in *Research Policy* 13, 6, 343-373.

Pelkmans, Jacques (1987), "The New Approach to Technical Harmonization and Standardization", in *Journal of Common Market Studies* XXV, 3 (March), 249-269.

Pempel, T. J. (1974) , "The Bureaucratization of Policymaking in Postwar Japan", in *American Journal of Political Science* 18, 4 (November), 656-63.

Pempel, T. J. (1989), "Prerequisites for Democracy: Political and Social Institutions", in Takeshi and Krauss, 17-37.

Pempel, T. J. (1992), "Japanese Democracy and Political Culture. A Comparative Perspective", in *PS: Political Science and Politics* 25, I, 5- 13.

Pempel, T. J. (l992), "Bureaucracy in Japan", in *PS: Political Science and Politics* 25, 1, 19-24.

Perez, Carlotta (1983), "Structural Change and Assimilation of New Technologies in the Economic and Social Systems", in *Futures* (October), 357-375.

Perroux, Francois (1964), "La firme motrice dans la région et la région motrice", in *L'économie du Xxème siècle*, 193-241.

Pinch, Trevor J., and Wiebe E. Bijker (1984), "The Social Construction of Facts and Artefacts: or How the Sociology of Science and the Sociology of Technology Might Benefit Each Other", in *Social Studies of Science* 14, 399-441.

Pinder, John (1968), "Positive and Negative Integration. Some Problems of Economic Union in the EEC", in *The World Today* 24, 3 (March), 88-110.

Pinder, John (1991), European Community. The Building of a Union. Updated Following the Maastricht Treaty (Oxford: Oxford University Press).

Pohl, Manfred (1989), "Hintergründe einer 'Einparteien-Demokratie': Die Anatomie der japanischen Regierungspartei", in Pohl and Mayer, 2nd Part, 275-304.

Pohl, Manfred (1994), "Die politischen Parteien", Pohl and Mayer, 80-102

Pohl, Manfred, and Hans Jürgen Mayer (Eds.) (1994), Länderbericht Japan (Bonn: Bundeszentrale für politische Bildung).

Porter, Michael E. (1990), The Competitive Advantage of Nations (New York: The Free Press).

Prabhakar, Arati (1994), Speech at the IEEE Symposium on the NII, Washington, DC (June 26), http://www.nist.gov/speeches/jun94/ieee.html.

Public Cryptography Study Group (1981), American Council on Education, "Report of the Public Cryptography Study Group" and "The Case Against Restraints on Nongovernmental Research in Cryptography: A Minority Report by Prof. George I. Davida", *Academe* 67 (December), 372-382.

Rammert, Werner (1989), "Technisierung und Medien in Sozialsystemen. Annäherung an eine soziologische Theorie der Technik", in Weingart (Ed.), 128-173.

Relyea, Harold (1994), Silencing Science: National Security Controls and Scientific Communication (Norwood, NJ: Ablex)

Rheingold, Howard (1993), The Virtual Community. Homesteading on the Electronic Frontier (Reading, Mass.: Addison-Wesley).

Riker, William T. (1962), The Theory of Political Coalitions (New Haven: Yale University Press).

Ripley, Randall B. Ripley, and Elliot E. Slotnick (1989), Readings in American Government and Politics (New York: McGraw-Hill Book Company).

Robins, Kevin, and Frank Webster (1988), "Cyberetic Capitalism: Information, Technology, Everyday Life", in Mosco and Wasko.

Rohlen, Thomas (1983), Japan's High Schools (Berkeley: University of California Press).

Romer, Paul M. (1986), "Increasing Returns and Long-Run Growth", in *Journal of Political Economy* 94, 1002-1037.

Rosenberg, Nathan (1971), The Economics of Technological Change (Harmondsworth: Penguin Books).

Roßnagel, Alexander (1990), "Das Recht auf (tele-)kommunikative Selbstbestimmung", in *Kritische Justiz* 3, 267-89.

Rothenberg, Jerome (1970), "Local Decentralization and the Theory of Optimal Government", in Margolis (Ed.), 31-64.

Rothwell, Roy, and Walter Zegveld (1985), Reindustrialization and Technology (Armonk, NY: M. E. Sharpe, Inc.)

Russett, Bruce M. (1963), "The Calculus of Deterrence", *Journal of Conflict Resolution* 7, (June 1963).

Sandholtz, Wayne (1993), "Choosing Union: Monetary Politics and Maastricht", in *International Organization* 47, 1 (Winter), 1-39.

Sandholtz, Wayne, and John Zysman (1989), "1992: Recasting the European Bargain", *World Politics* 42 (October), 95-128.

Sandler, Todd (1992), Collective Action: Theory and Applications (Ann Arbor, MI: The University of Michigan Press).

Sandler, Todd (Ed.) (1980), The Theory and Structures of International Political Economy (Boulder, CO: Westview Press).

Sandler, Todd, William Loehr, and Jon T. Cauley (1978), The Political Economy of Public Goods and International Cooperation (Denver: Graduate School of International Studies).

Sbragia, Alberta M. (Ed.), Europolitics. Institutions and Policymaking in the "New" European Community (Washington, DC: The Brookings Institution)

Schaede, Ulrike (1995), "The `Old Boy' Network and Government Business Relationships in Japan", in *Journal of Japanese Studies* 21, 2 (Summer), 293-317.

Scheingold, Stuart A. (1970), "Domestic and International Consequences of Regional Integration", in *International Organization* 24, 4 (Autumn), 978-1102.

Schienstock, Gerd (1994), "Technology Policy in the Process of Change: Changing Paradigms in Research and Technology Policy?", in Aichholzer and Schienstock (Eds.), 1-23.

Schmitter, Philippe C. (1970), "A Revised Theory of Regional Integration", in *International Organization* 24, 4, 836-868.

Schmookler, Jacob (1962 [1971]), "Economic Sources of Inventive Activity", republ. in Rosenberg.

Schmookler, Jacob (1966), Invention and Economic Growth (Cambridge: publ. unknown).

Schoppa, Leonard (1991), Education Reform in Japan. A Case of Immobilist Politics (London: Routledge).

Schumpeter, Joseph A. (1942), Capitalism, Socialism and Democracy (New York: Harper).

Schwartz Cowan, Ruth (1987), "The Consumption Junction: A Proposal for Research Strategies in the Sociology of Technology", in Bijker, et al. (Eds.), 261-280.

Schwartz, Frank (1993), "Of Fairy Cloaks and Familiar Talks. The Politics of Consultation", in Allinson and Sone (Eds.).

Scott, Allan J. (1995), "From Silicon Valley to Hollywood: Functional Attributes, Location, and Prospects of the Multimedia Industry in California", unpubl. manuscript.

Scott, Allen J. (1996), "Regional Motors of the Global Economy", in *Futures* 28, 5, 391-411.

Senate (1994), Hearings, Subcommittee on Technology and the Law, Committee on the Judiciary (May 3) (Washington, DC: U.S. Government Printing Office).

Senate (1995), Hearings, Subcommittee on Commerce, Justice, State, The Judiciary, and Related Agencies Committee on Appropriations (April 6) (Washington, DC: U.S. Government Printing Office).

Shields, James J. Jr. (Ed.) (1989), Japanese Schooling. Patterns of Socialization, Equality, and Political Control (University Park, PA: Pennsylvania State University Press).

Shiota, Ushio (1994), "Der Weg der Sozialisten in den Ruin", in *Japan Echo* 21, 3, 18-21.

Siebert, Horst (1989), The Single European Market – A Schumpeterian Event? (Kiel: Institut für Weltwirtschaft).

Siebert, Horst (1990), "The Harmonization Issue in Europe: Prior Agreement or a Competitive Process", in Siebert (Ed.), 53-75.

Siebert, Horst (Ed.) (1990), The Completion of the Internal Market (Tübingen: J. C. B. Mohr (Paul Siebeck)).

Siebert, Horst (Ed.) (1992 ), Die Strukturpolitik der EG (Tübingen: J. C. B. Mohr (Paul Siebeck)).

Siebert, Horst, and Michael J. Koop (1990), "Institutional Competition. A Concept for Europe?", in *Aussenwirtschaft* 45, 4, 439-462.

Siebert, Horst, and Michael J. Koop (1993), "Institutional Competition Versus Centralization: Quo Vadis Europe?", *Kiel Working Paper* 548 (January) (Kiel: Institute of World Economics).

Simon, Herbert A. (1955), "A Behavioral Model of Rational Choice", *Quarterly Journal of Economics* 69 (February), 99-118.

Simon, Herbert A. (1957), "A Behavioral Model of Rational Choice", in Simon (Ed.), 241-260.

Simon, Herbert A. (Ed.) (1957), Models of Man: Social and Rational (New York: Wiley).

Simon, Herbert A. (1958), Administration Behavior (New York: Macmillan).

Simon, Herbert A. (ed.) (1957), Models of Man: Social and Rational (New York: Wiley).

Singer, J. David (1963), "Inter-Nation Influence: A Formal Model", *American Political Science Review* 62 (June).

Smith, Hedrick (1988), The Power Game. How Washington Works (New York: Ballentines).

Snyder, Richard C., H. W. Bruck, and Burton Sapin (Eds.) (1963), Foreign Policy Decision-Making (New York: The Free Press).

Software Publishers Association (1994), *SPA News* (March).

Soldera, Marco (1995), Öko-Computer: Vergleich eines Öko-PC mit einem herkömmlichen PC anhand von Lebenszyklenanalysen LCA (Gebenstorf, Switzerland: self-published).

Solow, Robert M. (1956), "Contribution to the Theory of Economic Growth", in *Quarterly Journal of Economics* 70, 65-94.

Soma, John T., and Elizabeth J. Bedient (1989), "Computer Security and the Protection of Sensitive but Not Classified Data: The Computer Security Act of 1987" *30 Air Force Law Review* 135.

Späth, Lothar (1996), "Kann die Informationsgesellschaft zu einer humanen Gesellschaft führen?" Presentation on the International Conference on the Emerging Information Society (Soft Society) in Berlin (November 2).

Spencer, Barbara J., and James A. Brander (1983), "International R&D Rivalry and Industrial Strategy", in *The Review of Economic Studies* 50, 707-722.

Spiegel-Rössing, I., and D. de Solla Price (Eds.) (1972), Science, Technology and Society: A Cross-Disziplinary Perspective (London: Sage).

Starbatty, Joachim (1994), "Europäische Industriepolitik und die Folgen – Zur Immanenz industriepolitischer Dynamik", in Vitzthum (Ed.), 153-176.

Starbatty, Joachim, and Uwe Vetterlein (1990), Die Technologiepolitik der Europäischen Gemeinschaft. Entstehung, Praxis, und ordnungspolitische Konformität (Baden-Baden: Nomos Verlagsgesellschaft).

Steinbruner, John D. (1974), The Cybernetic Theory of Decision: New Dimensions of Political Analysis (Princeton: Princeton University Press).

Stern, R. M. (1987), U. S. Trade Policies in a Changing World Economy (Cambridge, MA: MIT Press).

Stockwin, J. A. A. (1989), "Political Parties and Political Opposition", in Ishida and Krauss , 89-111.

Stockwin, J. A. A. (1992), "Japan's Socialist Party, Resurgence after Long Decline", in Hrebenar (Ed.), 81-115.

Strümpel, Burkhard, and Stefan Langolius (1991), "Leitbilder des integrierten Umweltschutzes zwischen Handlungsprogram und Leerformel", in Kreikebaum, 73-85.

Suzumura, Kotaroh (1995), "Seeking Systemic Reform of the Information and Communications Industry", The Information Technology and Communications Policy Forum of Japan Policy Proposal # 1, http://ifrm.glocom.ac.jp/ipf/pr1/statement1.html.

Suzumura, Kotaroh, and Tatsuo Tanaka (1995), "Seeking the Establishment of a Competitive Environment in the Information and Communications Industry", The Information Technology and Communications Policy Forum of Japan Policy Proposal # 7, http://ifrm.glocom.ac.jp/ipf/pr3/statement7.html.

Swan, Trevor (1955), "Longer-Run Problems of the Balance-of-Payments", reprinted by the American Economic Association (AEA) (1968), 455-64.

Tanaka, Eiichi (1996), "The Status of Nippon Telegraph and Telephone Corp. (NTT)", Foreign Press Center (March).

Tatsuno, Sheridan (1986), The Technopolis Strategy. Japan, High Technology, and the Control of the Twenty-First Century (New York: Prentice Hall Press).

Telecommunications Council (1994), "Reforms toward the Intellectually-Creative Society of the 21st Century – Program for the Establishment of High-Performance Info-Communications Infrastructure" (July), http://www.mpt.go.jp/policyreports/kenhtml/115.html.

Telecommunications Council (1996), "The Status of NTT. Toward the Creation of Dynamism in the Info-Communications Industry" (February), http://www.mpt.go.jp/Council/Council-home.html.

Teusch, Ullrich (1993), Freiheit und Sachzwang. Untersuchungen zum Verhältnis von Technik, Gesellschaft und Politik (Baden-Baden: Nomos)

Tiebout, Charles M. (1956), "A Pure Theory of Local Expenditures", in *Journal of Political Economy* 64, 416-424.

Tinbergen, Jan (1952), On the Theory of Economic Policy (Amsterdam: North-Holland Publishing Co.).

Tinbergen, Jan (1954), International Economic Integration (Amsterdam: Elsevier).

Tomita, N., A. Nakamura, and R. J. Hrebenar (1992), "The Liberal-Democratic Party: The Ruling Party of Japan", in Hrebenar (Ed.), 237-284.

Townsend, J. (1976), Innovation in Coal-Mining Machinery – the Anderton Shearer-Loader, SPRU Occasional Paper No. 3, University of Sussex.

Truman, David B. (1951), The Governmental Process (Chicago: University of Chicago Press).

Tulder, Rob van, and Gerd Junne (1988), European Multinationals in Core Technologies (Chichester: John Wiley & Sons).

Tullock, Gordon (1969), "Federalism: Problems of Scale", in *Public Choice* 6, 19-29.

Tyson, Laura, and John Zysman (1983), "American Industry in International Competition", in Zysman and Tyson (Eds.).

Vetterlein, Uwe (1991), Entwurf einer systematischen Erfolgskontrolle für die Technologiepolitik der Europäischen Gemeinschaften (Baden-Baden: Nomos Verlagsgesellschaft).

Vincenti, Walter G. (1995), "The Technical Shaping of Technology: Real-World Constraints and Technical Logic in Edison's Electrical Lighting System", in *Social Studies of Science* 25, 553-74.

Vitzthum, Wolfgang Graf (1994), Europäische und Internationale Wirtschaftsordnung aus der Sicht der Bundesrepublik Deutschland (Baden-Baden: Nomos).

Wallerstein, Immanuel (1974), "The Rise and Future Demise of the World Capitalist System: Concepts for Comparative Analysis", in *Comparative Studies in Society and History* 16, 4, 387-415.

Walsh, Vivien (1987), "Technology, Competitiveness and the Special Problems of Small Countries", in *STI Review* 2 (September), 81-133.

Ward, Robert E., and Sakamoto Yoshikazu (Eds.) (1987), Democratizing Japan. The Allied Occupation (Honolulu: University of Hawaii).

Weidenfeld , Werner (1988), "Die Zukunft Europas – Strategien und Optionen", in Bertelsmann Stiftung, 9-19.

Weidenfeld, Werner, and Jürgen Turek (1993), Technopoly – Europa im globalen Wettbewerb Strategien und Optionen für Europa (Gütersloh: Verlag Bertelsmann Stiftung).

Weidenfeld, Werner, and Wessels, Wolfgang (Eds.) (1980ff), Jahrbuch der Europäischen Integration (Bonn: Institut für Europäische Politik).

Weingart, Peter (Ed.) (1989), Technik als sozialer Prozeß (Frankfurt/Main: Suhrkamp).

Weinstock, Ulrich (et. al.) (1973), Neun für Europa. Die EWG als Motor europäischer Integration (Düsseldorf: Eugen Diederichs Verlag).

White, Merry (1987), The Japanese Educational Challenge (New York: The Free Press).

Williamson, J. G. (1975), "Regional Inequality and the Process of National Development: A Description of the Patters", in Friedman and Alonso, 158-200.

Willis, F. Roy (1968), France, Germany and the New Europe, 1945-1967, rev. ed. (London: Oxford University Press).

Woll, Peter, and Sidney E. Zimmerman (1989), American Government. The Core (New York: Randam House).

Yoshimura, Shin (1995), "Three Recommendations To Establish a Service Structure Suited to Evolving Styles of Communications in the Marketplace", The Information Technology and

Communications Policy Forum of Japan Policy Proposal # 6, http://ifrm.glocom.ac.jp/ipf/pr2/statement6.html.

Zysman, John, and Laura Tyson (Eds.) (1983), American Industry in International Competition: Government Policies and Corporate Practices (Cambridge, MA: MIT Press).