English translation (2026)

Tallinn 1994

Estonian informatics development
plan to the year 2000

“Estonian road to the information society”

Version 1.0



Foreword about this translation 32 years later after the original publication in 1994

> This 1994 document matters not because it predicted every technology that would follow, but because it understood the nature of the challenge with unusual clarity. It recognized early that Estonia's future would not be secured simply by acquiring computers or digitizing isolated administrative tasks. What was required was something much more ambitious - the deliberate building of a modern state in which information infrastructure, public administration, law, education, research, communications, culture, and economic development would be understood as parts of one national project.

Read today, the document feels less like a technical program of its time and more like an early blueprint for the digital state Estonia would later become. Its core insight remains strikingly current. Informatization is not treated as a narrow technical matter or a support function. It is presented as a strategic capability that shapes competitiveness, administrative effectiveness, quality of life, sovereignty, security, and cultural continuity. Even at that early stage, the vision was broad and systemic. It linked public registers, governance, education, healthcare, communications, research, workforce capabilities, legal reform, standards, and public awareness into a coherent national agenda.

One of the most impressive features of the document is its strategic confidence. It did not argue that Estonia should wait until it was wealthier before investing in information society development. It argued the opposite - that building information infrastructure was itself a precondition for economic development, state effectiveness, and integration with Europe. For a newly re-independent country with very limited means (we had trouble paying government salaries for basic services at that time), this was a profound insight. A small state cannot afford duplication, fragmentation, or administrative slowness. In that sense, digital capability was already understood as a force multiplier for the entire nation.

The document is also notable for how clearly it understood the foundations of effective digital government. It emphasizes core registers, legal acts, common standards, interoperable systems, communications networks, and coordinated governance. It envisages a state administrative information system built on shared foundations rather than disconnected digitization by institution. That remains one of the clearest reasons the document still feels so relevant today. Estonia would later become internationally known for precisely these principles: trusted registers, interoperability, legal clarity, secure exchange of data, and a state architecture built on common foundations rather than isolated solutions.

Equally important is the document's insistence that technology alone is not enough. Law, policy, standards, institutions, funding, skills, and leadership are treated as inseparable from technical progress. The text calls for legal and regulatory development in areas such as registers, data protection, electronic documents, communications, procurement, intellectual property, and security. It also stresses standardization, compatibility, certification, and institutional coordination. Many organizations still struggle with these questions today. This document understood them more than thirty years ago.

What gives the text additional depth is its human and cultural dimension. It is not only about systems and administration. It speaks about education, computer literacy, research capability, public access to information, the role of libraries, the preservation of archives and museums, and the place of Estonian language and culture in the emerging information space. It understood that for a small country, digital development is never only about efficiency. It is also about continuity, resilience, memory, identity, and the capacity to remain sovereign and confident in a rapidly changing world.

Of course, some of the technologies named in the document belong unmistakably to another era. But that is beside the point. Technologies change. What endures is the governing logic. The emphasis on shared infrastructure, interoperability, legal foundations, institutional coordination, research, skills, and public purpose remains deeply relevant, even in the age of AI. The vocabulary may be of the 1990s. The statecraft is not.

That is why we chose to translate and republish this document. We did so out of respect for the informatics, engineering, academic, policy, and public-sector communities whose work made Estonia's digital society possible. Too often, digital success is told as if it emerged suddenly from a few later breakthroughs. This document reminds us that the roots run much deeper. Estonia's digital development was prepared through years of scientific work, systems thinking, institution building, policy design, standards work, and education. It was built by people who saw the importance of these foundations long before digital government became widely understood or celebrated.

This translation is therefore more than an archival exercise. It is an act of continuity and gratitude. It reconnects the present with the intellectual and institutional history that made it possible. It honors those who worked with fewer resources, less certainty, and less recognition, yet helped shape the trajectory of a country. Many of the capabilities Estonia is known for today rest on foundations laid by people who came much earlier.

For that, we offer a warm and sincere thank you.

Much of what Estonia has today was made possible by people who came long before us. Remembering them is not only a matter of historical fairness. It is a reminder that the strongest digital societies are not improvised. They are built over time, by communities of conviction, competence, and care.



Andres Raieste
Global Head of Public Sector
Nortal



Urmas Kõlli
CEO
Datel
Member of the Informatics Council in 1994



Doris Põld
CEO
ITL

Executive Summary

The world's advanced countries are moving steadily, and with increasing speed, toward a state characterized by the abundance of computers and other information-technology tools, communications networks and services, and electronically accessible information resources in every sphere of life. The idea of transition to the information society, which for a long time seemed more like a declarative slogan, has become a practical guide for action for states and governments.

Among all fields of high technology, information technology occupies a special place in today's world development. Governments and international organizations are in agreement that information technology, telematics, informatics—whatever this field may be called—is a decisive instrument for economic development and for raising efficiency, preserving and increasing international competitiveness, and securing a place in the global economy. Information technology improves the structures of state administration and makes the management of economic and social life more effective.

The informatization of education, health care, and social assistance serves the satisfaction of citizens' social needs. Service quality improves, responsiveness increases, and contact between the population and government bodies becomes closer—the society becomes more democratic. At the same time, it becomes possible to save state resources in all these fields. To provide more, and yet do so at lower cost—that is the strength of informatization.

The development of information technology, both in breadth and in depth, changes the substance of all areas of life. Through technological means, information resources and services become operationally accessible everywhere. A new way of life begins to emerge, with new forms such as remote work, remote commerce, and home-based education—possibilities that ultimately affect not only the economy but the overall quality of life of the whole people.

Modern information technology and computer networks help strengthen state sovereignty by serving national defense and other security structures. For the Border Guard and the police, these tools help contain crime; for rescue services, they help save lives. From the cultural point of view, informatics serves the same fundamental purpose. Information systems help preserve and disseminate the values of the Estonian language and culture in the world information space, thereby strengthening our cultural identity.

During the past few years, movement toward the information society has received a powerful impulse. In most industrial countries, governments have either developed or are developing corresponding programs, led by officials at the highest level of government and backed by major public resources, not to mention the broad involvement of business and the public. The European Union has also developed a broad program for the development of informatics.

Against this background, it became essential to develop a strategic development plan for Estonia as well. It would be mistaken to assume that the acceleration of informatics development could be left until later—until a time when our economy has already restructured and recovered. If we acted in that way, we would fall hopelessly behind in international economic and social contacts. The priority development of informatics is an

unavoidable precondition for achieving the international competitiveness of our economy and, at the same time, for integrating into the structures of the European Union and other international organizations. We must follow these objectives in developing the information systems of state administration, in shaping information networks, and in legislation and standardization.

In accordance with the tasks assigned to it by the Government, the Estonian Informatics Council has for a considerable time dealt with specific problems of the state's informatics policy. This development plan represents an interim summary of that work—a generalization of the directions of Estonian informatics development in the coming years. It is understandable that a lag that has accumulated over decades cannot be overcome in just a few years. The emphasis of the plan is placed not so much on an end-state as on directions that must be consistent with the policies being implemented in industrialized countries and in the European Union.

The concepts used in the field of informatics and information technology are often applied arbitrarily. For that reason, the first chapter of the plan explains the key concepts and terms. It also provides a brief overview of earlier stages of Estonian informatics development, without knowledge of which it is sometimes difficult to understand the specific features of the current situation. Despite the backwardness of Soviet-era technology, it must be recognized that during that period the main body of specialists grew up and acquired strong training—the very people who are now developing and implementing modern information technology, the computer business, and informatics policy.

Estonia is setting out on the road toward the information society from the current state of informatization of our society, state, and economy, which is summarized in the second chapter. In some areas—notably public administration and banking—significant progress has been made in the last few years, although in places it has suffered from insufficient coordination. Some advances have also been made in legislation and in the state coordination of informatics activity. This is our launch platform.

The third chapter sets out the general core objectives of informatization as they are defined in development strategy documents of the European Union and many countries, and as characterized in the opening sections of this summary. The fourth chapter seeks to describe the state that Estonia can realistically attain by the year 2000 in different fields of economic and social life. Public administration and legislation are treated somewhat more fully, because they have been the focus of greater activity over the past two years. Yet the plan also establishes concrete and attainable objectives for the other fields.

To reach these objectives, active action is needed across all parts of the state, and above all focused and well-considered action by state administration structures in defining and implementing economic policy directions. At the present stage, the coordinating and regulatory role of the state must be regarded as especially important. State informatics policy cannot be limited merely to financing certain directions from the state budget. It must include the preparation of legislation, standardization, and the shaping of informatics governance structures. It is particularly important to create awareness at all levels of the inevitability of the priority status and accelerated development of informatics. Informatics has become so deeply interwoven with every field of life that its needs and possibilities must also be reflected in industrial, investment, science, education, and social policy—in every area where development must not be planned without attention to the state's informatization. It is essential to create the conditions for a free and vigorous market in information and communications services, and to support private enterprise through tax, credit, and customs policy instruments.

International cooperation must deepen, especially with the structures that guide European Union informatics policy and through participation in the programs they design. The coordination of all this activity requires, in line with the practice of many countries, the establishment of a public authority that monitors and directs development processes—an Informatics Agency.

The next stage of our work is to prepare concrete action plans for achieving the objectives described in this development plan. It is expedient to group the work financed from the state budget around five target programs covering public-administration information systems (including the local-government level), state-security information systems, the system of state registers, spatial information systems, and data communications.

The shaping and determined implementation of state informatics policy will make a decisive contribution to shaping Estonia into a state with a developed economy and social life, capable of functioning among the countries of Europe as a competitive economic partner and as an equal participant in public administration, science, environmental protection, social structures, and all other spheres of life. This development plan seeks to describe only the first stage in the process of reaching those goals. Over time, objectives and programs will become clearer and more precise, making it possible to extend the planning horizon ever further.

Foreword

The decision to prepare this development plan was made by the Estonian Informatics Council at the end of 1993. The Council had already dealt with the problems of informatics and information-technology development in Estonia for more than three years. The need had matured to outline an integrated development perspective.

In recent years, a great deal of information has been received about how other countries plan informatics development—programs from Finland, Sweden, Norway, Denmark, Germany, the United States, Japan, Canada, and other countries, as well as OECD and European Union program documents. The Council of the European Union also recently approved the report "European Information Society." All of this helped shape our own picture of the near future.

Preparing an informatics development plan is, by its nature, a statutory task of the Informatics Council. Through the preparation of this plan, the Council seeks to achieve the following objectives:

1. to inform the governing bodies of the Republic of Estonia—the Riigikogu, the Government, the Science Council, and others—about the current state of informatics and its development problems in Estonia;

2. to justify the priority of developing informatics and information infrastructure in the development of the economic and political structure of the Republic of Estonia against the background of contemporary global and European development processes;

3. to lay the foundation for the preparation of concrete national development programs.

The first version of the development plan is to be submitted to the Science Council for comment, and discussions will also be organized with participation from professional circles and the broader public. International experience has shown that the informatization of a country's economic and social life can succeed only with the active involvement of the highest political leadership of the state. For that reason, after necessary additions and corrections, the plan is intended to be submitted to the Government of the Republic of Estonia for review and approval. It should then be discussed and adopted by the Riigikogu.

After the adoption of the development plan in the higher organs of state, work must begin on the preparation of individual target programs under the coordination of the state informatics authority and under the general oversight of the Informatics Council. Those programs must contain concrete lists of activities, calendars, implementers, and resource requirements, and on that basis the financing of the work from the state budget can continue.

This document consists of the following parts. Chapter 1 explains the key concepts and gives a brief overview of the development of informatics in Estonia to date. Chapter 2 characterizes the current state of informatics. Chapter 3 briefly presents the development objectives of informatics and information infrastructure. Chapter 4 describes more concretely the target condition to be achieved through development work in various fields of economic and social life. Finally, Chapter 5 describes the action program required to achieve the stated objectives. The Annex provides additional material on informatics development programs in other

countries and in the European Union.

The first version of the development plan was prepared during the period January–September 1994. The document's structure and conceptual general principles are the collective work of the members of the Informatics Council. The text of the document was written mainly by Ustus Agur; the shaping of the document also involved contributions, amendments, and comments from members of the Council, especially Ülo Kaevats, Ülo Jaaksoo, Ants Wõrk, Boris Tamm, Jaak Tepandi, Leonhard Tammik, Raivo Kasemaa, Toomas Sõmera, and Arvo Ott.

The present version of the development plan is based on our current knowledge and understanding, as well as on the policy documents of international associations and organizations as they stand today. The extremely rapid development of information technology, and the new opportunities that arise from it, make it necessary for work on the development plan to continue and for a new version of the document to be produced every one to two years.

Introduction 1

This chapter presents definitions and explanations of key concepts related to informatics as they are used in this document. It is followed by a brief historical overview of the development of informatics in Estonia, beginning with the introduction of electronic computers.

1.1. Key Terms

Terms used in the information sphere are often interpreted differently. We therefore begin by presenting the meanings of the main terms as they are used in this document and as they generally coincide with, or are close to, the interpretations that have become widespread in many countries in recent years.

Information technology is the general term for the technological means and procedures of automated information processing. It includes computing equipment, information transmission and storage facilities, and related tools. Information technology is the technological basis of informatics.

In many countries, this term is also used to cover the whole field of application of information-technology tools—in other words, in the same sense in which the term informatics is used in this document.

Information systems are created for the collection, storage, and processing of information within organizational units or structures (state agencies, enterprises, libraries, hospitals, etc.) by means of information-technology tools. The state's information structure is made up primarily of information systems of different levels and scope.

Informatics is the general term for the branches of science and technology and the fields of practical activity that deal with information-technology tools and their use. The term has also been used in narrower senses, and even in two different variants: in one case to denote the collection and dissemination of scientific and technical information by technical means, and in another to denote the theoretical foundations for the application of computers. In this document, the term informatics is used in the broad sense, as reflected in the name of the Estonian Informatics Council itself.

Telematics ("telecommunications + informatics") is a term that began to be used in some European countries, especially France, in the 1980s to denote information-technology applications based on communications networks (data queries, bank transfers, ticket ordering, etc.). The term also appears in some European Union documents. Telematics falls within the contemporary understanding of the concepts information technology and informatics.

Informatization means the reorganization of a given field, or of the life of the whole state, on the basis of the universal application of modern information technology.

The information sector in the economy includes fields of activity involved in the collection, processing, and dissemination of information. In OECD statistics, the workers of the information sector include, in addition to persons directly connected with the application of information technology, all kinds of knowledge workers, including engineers, lawyers, administrators, librarians, and others.

The information sphere is a general concept describing everything that takes place in the collection, processing, and dissemination of information.

The information society is a term denoting a stage in social development in which the course of all social and economic processes is decisively shaped by the availability of information through information-technology tools.

The state information infrastructure includes the resources intended for collecting, disseminating, and using information—communications networks, data collections, and network-based electronic information services.

This "narrow" interpretation is used in more recent conceptual documents of the United States and the European Union. In its "broad" interpretation, the concept includes all organizational structures that help satisfy the information needs of all sectors of the state and society, including libraries, publishers, museums, mass media, and others. Sometimes the production of information-technology tools is also treated as part of information infrastructure.

In contemporary society, information infrastructure is becoming just as indispensable a basis for the functioning of all socio-economic processes as, for example, transport infrastructure. By developing information infrastructure, a major step is taken in the informatization of society and in the transition to the information society.

1.2. Brief Historical Overview

Informatization in Estonia began in the early 1960s, when the first electronic computers were installed. During those decades, several centers of informatics-related research and development emerged—the Institute of Cybernetics (1960), the Special Design Bureau for Computer Engineering EKTA (1976), and the relevant departments of Tallinn Polytechnic Institute (TPI) and Tartu State University (TRÜ). These institutions developed high-level solutions and, in some cases, even solutions approaching world level. However, because of implementation difficulties typical of the state system, those solutions often remained single instances or spread only within the Soviet Union and the "socialist camp."

In the 1970s, the Soviet Union launched a broad campaign to build "automated control systems." By the end of the decade, Estonia had about fifty computing centers employing six thousand people. When the all-Union management structure collapsed in the second half of the 1980s, those systems lost their

purpose, and the computing centers that served them were gradually dismantled, a process accelerated by the broad spread of personal computers.

In the field of information dissemination, an attempt was made during that period to develop scientific and technical information systems. In Estonia, the Estonian Information Institute operated in that direction. Because of the limited availability of information sources, as well as the weakness of the technical base and communications networks, that activity did not produce sufficient results either.

Nevertheless, on the basis of informatics education and scientific work, that period did create a cadre of enterprising computer engineers and programmers on whom today's development of informatics and the related private sector largely rests.

Private entrepreneurship in Estonian informatics began in 1988–1990, when the first computer companies were established—often as joint ventures—dealing with the import of equipment and the design of systems. The number of such firms grew rapidly in subsequent years, and Estonia now has more than two hundred active computer firms. Their total turnover in 1993 is estimated at 300–400 million kroons.

During the Soviet period, the development of informatics in Estonia was determined by all-Union plans and often outdated concepts. The problem of the comprehensive development of informatics was first raised after the beginning of perestroika in Ustus Agur's presentation "On Improving the Information Infrastructure of the Estonian SSR," submitted to the Government Commission on improving the economic system in June 1987. In a 1988 competition on development scenarios for the national economy, an expanded version of that presentation—the scenario "Development of Estonia's Information Infrastructure"—won an award. When the well-known IME program was compiled that same year, information policy was included in it as a separate chapter. A broad group of specialists from informatics, culture, and other fields took part in drafting that chapter. In concentrated form, it contained a fairly concrete strategic orientation, much of which has not become outdated.

In 1990, preparations began for the development of an "Estonian Informatization Concept." A disposition was prepared and discussions took place, but the work remained unfinished.

A major step in organizing Estonian informatics life was the establishment of the Informatics Council by Government decree in August 1990. At the end of the same year, the Informatics Fund began operations. Since its establishment, the Council has met regularly, discussing key issues in informatics development, the use of state budget funds for information-system development work, policy on public-administration information systems, procurement policy for information-technology tools, and related matters. The Informatics Fund has begun publishing information-technology standards, has organized computer fairs since 1992, publishes a computer magazine and informatics literature, and organizes seminars.

The Current State of Estonian Informatics 2

2.1. Public Administration

The informatization of the public-administration sector has progressed with some stability, depending on the initiative and resources of particular institutions. The Informatics Council has sought to focus attention on those directions most important for the functioning of the state apparatus—above all the system of state core registers, the tax system, state statistics, the customs system, and state-security information systems.

The system of state registers was founded on the State Registers Act, adopted in 1990 on the initiative of the Informatics Council and the Statistical Committee. On that basis, 22 registers have been developed, including the enterprise register, building register, property-reform registers, the register of legal acts ESTLEX, and others. In practice, most registers have been concentrated in the state enterprise State Computing Centre, which provides at least a minimally adequate technical base. A working group was created under the State Chancellery's Department of State Information Systems to coordinate work related to state registers.

Until now, the main focus of this activity has been the collection of registration data and the clean-up of the data sources by field; the provision of services based on registry data has therefore not yet reached the required level. The services of the enterprise register, the legal acts register, the vehicle register, and the property-reform registers are already in broad use. The establishment of the real-estate register was delayed by weaknesses in legislation and conflicts among administrative bodies, but the project has now been launched. The development of the population register has also remained obstructed by conceptual disagreements, even though the Informatics Council presented clear proposals on this already three years ago.

Among the state apparatus's central information systems, those of the Customs Board, Tax Board, Labour Market Board, and Ministry of Foreign Affairs are more advanced than most others. The technical base of central institutions is developing rapidly and is, in most cases, at a good level; about 30 percent of central institutions have connected their computers into local networks. More than 160 informatics specialists are employed in central institutions. Many employees of state agencies have received training for working with computers.

In 1992, the defense forces were established and development began on state-security information systems for the Border Guard, police, rescue services, and related structures. A corresponding target program and council were created for this purpose. Working groups operating under the Institute of Cybernetics have prepared a development plan, and individual subsystems are being developed through projects.

In the sphere of local government, the development of information systems has been uneven. Some city governments—especially Tallinn and Tartu—have been relatively active and have built extensive subsystems. In many municipalities, only simpler applications have been introduced and technical equipment has been purchased; in some local governments even that has not been possible due to lack of means.

2.2. Economy

Over the last few years, large quantities of hardware and software have been acquired in the economy, but their application has not been effective everywhere.

The most advanced field is banking, where, because of relatively high pay levels, highly qualified informatics specialists are employed. Several banks have local information systems at a high technical level; an interbank settlement system is in operation; and Estonian banks have joined the international settlement network SWIFT. Leading banks have introduced magnetic bank-card systems, and a nationwide chip-card system is under design. Banks are also connected to international information services such as Telerate and Reuters.

Worth particular mention is the development of electronic document interchange (EDI), one of the fastest-growing directions in information technology internationally. Customs, transport, and banking enterprises have shown some activity in this field. The Estonian EDI Association is active.

In industry, information-technology tools have been used mainly in administrative functions. In the technological control of production processes—which globally is one of the most important directions of information-technology application—only a few isolated systems can be identified, including solutions already developed during the Soviet period by the Institute of Cybernetics. In our still-restructuring industrial sector, there are generally still too few modern technological systems in which real-time control could be effectively applied. In design activity, the use of computer systems has expanded somewhat in recent years in machine-building, apparatus manufacturing, and construction.

In transport, computers have so far been used mainly for the organization of financial and accounting operations. By contrast, information-technology tools are still used hardly at all in the operational management of traffic processes.

In energy, too, information-technology tools are still used rather sparingly, even though the existence of system-specific communications channels creates especially favorable opportunities precisely in this field.

In the field of information services, Estonia has achieved results primarily in the design and construction of information systems, where several firms operate successfully. The electronic market for economic and business information remains underdeveloped. Only a few firms and organizations produce or mediate databases, and due to the lack of technically well-equipped service centers—hosts—Estonia does not yet have a local network for online information services. It is, however, possible to connect to the commercial information networks of other countries (for example Telesampo). The Estonian center of

the international information network CIESIN has recently begun operating, and the State Computing Centre maintains the database of Estonian legal acts ESTLEX.

2.3. Health Care and Social Welfare

The informatization of health care and social welfare has lagged behind chiefly because of financing difficulties. Only a few systems are in operation (the labour market information system, some polyclinic systems, the cancer register), although plans exist to develop a health-insurance information system and a system of social registers. In 1994, large quantities of hardware were acquired for social-welfare information systems in the counties.

2.4. Education, Science and Culture

The computing centers of higher-education institutions had already been relatively strong earlier. By now, the technical base of higher education has been renewed, primarily with the support of foreign aid, although still not to a sufficient extent; the content of instruction has also been modernized. Tallinn Technical University is developing an integrated information system that covers both the instructional process and all other aspects of university life.

In recent years, more attention has been given to general education schools, where the creation of computer classrooms had begun already in the 1980s. Over the last few years, computers have been purchased and some standard solutions for their use are available. It is worth emphasizing that nearly fifty general schools have the possibility of accessing the databases of the global information network Internet; in this respect Estonia is ahead of several developed countries. To manage educational life, the Ministry of Culture and Education has created databases.

In science, computers and modern technology are being applied in nearly every field, although to varying degrees and, mainly for financial reasons, at a level clearly below world standards. Research institutions and universities in Estonia have begun to make extensive use of the possibilities offered by modern information networks, especially the Internet. We are badly lagging behind in the creation of publicly accessible information banks containing our scientific results and other information; worth noting are only a few databases at research institutions (including environmental databases) and bibliographic databases in libraries.

In the cultural sphere, progress should be noted in the development of library information systems, especially in the National Library, where the modern KIRI system now being introduced should become a prototype for the informatization of other libraries as well. Some work has also been done on library electronic catalogues and the national bibliography. Information systems for archives and museums are only now emerging, although development of standard solutions has already begun.

Driven by market demand, the informatization of publishing activity has advanced relatively quickly; almost all publishers use computer-based tools and methods for preparing printed materials. Information agencies are using modern communications tools based on information technology to connect with global information banks, but the development of their own larger databases is only at an initial stage. In addition to the legal acts register and the enterprise register, some business-oriented databases are offered, along with library bibliographic databases and a few individual scientific databases (for example those of the Marine Institute, the Institute of Zoology and Botany, and the Information and Technology Centre of the Ministry of the Environment).

2.5. Technological Base

The technological level of Estonia's informatization is satisfactory thanks to a developed network of computer firms that bring a broad range of the latest quality products onto our market. Thanks to this, and to the good quality of the specialist workforce, Estonia has a relatively large number of local area networks, UNIX-based client/server systems, and other modern solutions. Nevertheless, PC-platform devices still predominate, chiefly because of their relative low cost. They are also used in some state information systems where the real need would require more powerful equipment.

Public procurement of information-technology equipment for state institutions is carried out through open competition under rules established on the initiative of the Informatics Council. Computers have been received as non-repayable foreign aid by the Statistical Office, Standards Office, Customs Board, Ministry of Finance, Ministry of Social Affairs, a number of local-government bodies, and universities.

Licensed software is used to an increasing extent in information systems, supplied by many computer firms. The acquisition of standard software licenses for state institutions is facilitated by framework agreements concluded with major firms on favorable terms; their implementation is organized by the Informatics Fund.

One of the technological foundations of informatics—the communications network—was inherited from the Soviet period in a technically backward state, which resulted in poor communication quality. With the support of Finnish and Swedish capital, the rapid modernization of the core networks has begun, thereby creating opportunities for the rapid development of computer communications in the coming years. The mobile communications network is well developed; in terms of mobile-phone density, Estonia occupies a remarkably high position in Europe. Construction continues on fiber-optic and radio-relay lines covering the whole country. The Government has approved the three-year and ten-year plans submitted by AS Eesti Telefon for the modernization, digitalization, and development of Estonia's long-distance communications network. Data-transmission systems for government institutions, customs and border guard structures, and the state administrative structure are planned on the basis of these communications facilities.

Since the beginning of the 1990s, Estonia has also been connected to global information networks via low-capacity communications channels (Finland 128 kbit/s, Sweden 64 kbit/s), used to provide Internet information services to research institutions and for commercial data communications based on the X.25 protocol. Using technical equipment acquired partly with international support, the first stage of Baltbone, the data-transmission backbone connecting the Baltic states, has been built.

The production of information-technology equipment in Estonia is very modest. The Soviet-era electronics industry worked in the interests of all-Union structures and has now largely withered away as an independent industrial branch; there is no significant serial production of original products. Some computer firms assemble computers from components manufactured abroad. Plans have long existed to create a technological base for microelectronics, but this would require major investment. By contrast, software production has been developed more actively.

2.6. Legal and Regulatory Base

The first step in establishing the legal base for informatics was the adoption of the State Registers Act in 1990. The Statistics Act, Communications Act, and a number of other acts have also been adopted. By now, however, they are outdated in some respects and require revision and supplementation. A draft Personal Data Protection Act, developed at the State Computing Centre, and a new version of the State Registers Act are currently under review. The Copyright Act, adopted in 1993, regulates certain questions of software legal protection, but implementing mechanisms are lacking. At the end of 1993, rules for public procurement of information-technology tools were adopted and put into effect; these played an important role in organizing procurement procedures and aligning them with international practice. The regulatory acts governing the operation of the state's core registers are partly outdated, and there are no legal acts at all regulating data security and information secrecy.

Informatics development work relies to a great extent on standards, of which there are an exceptionally large and complex number in the world. Under an agreement concluded in 1992 with the Estonian Standards Office, standardization activity in informatics is organized by the Informatics Fund. On its initiative, the first standard in this field was issued in 1993: "Information Technology Rules in the Environment of Estonian Culture and Language." Further standardization work has been planned together with international organizations and the Estonian Electrotechnical Committee. Estonia is an official member of several key international bodies dealing with informatics standards, including the ISO/IEC Joint Technical Committee JTC 1 on information technology.

2.7. Informatics Research, Development Activity and Training

There are three centers of informatics research in Estonia: the Institute of Cybernetics, Tallinn Technical University, and Tartu University. Basic research in informatics had, at one point, fallen to a minimum because of reduced financing, but has recently been revived by research support from the European Union. Long-term experience in applied research ensures the continuation of work, above all on concrete tasks for Estonian institutions, organizations, and enterprises (for example the development of state-security systems). Several Estonian computer firms are active in software and system development; some of them have grown out of the above-mentioned research centers, and also out of the former EKTA design bureau. Estonian original software for sports research (firm Kinex) attracted attention at the international CeBIT '94 fair. Nevertheless, the volume and intensity of work are entirely insufficient and do not match our potential.

Specialists in informatics with higher education are trained in Tallinn and Tartu universities. Although the technological base at the universities has improved considerably in recent years, it still does not meet international standards. Mid-level specialists are trained by the Tallinn Higher Technical School and the Tallinn School of Economics. Most mid-level specialists come from other sectors of the economy, having acquired additional knowledge through courses or practical work. This is supported by above-average labor demand in the field, as well as by the field's popularity and attractiveness.

As the sphere of use of informatics tools expands rapidly and technology continues to renew itself, the importance of continuing education is increasing. Estonia has developed a fairly extensive network for this purpose. Its most important components are the continuing-education faculty of Tallinn Technical University, the firm BCS Tallinn Computer School, ESKO Training established by the Finnish foundation Viron Säätiö, the Institute of Economic Management, the State Computing Centre, and others. The quality of training in these institutions is good, and their technical base meets training needs.

2.8. Management and Coordination of Development Work

For the substantive coordination of informatics development work, the Estonian Informatics Council was created in August 1990. Under its founding statute, its functions include shaping the organizational and legal foundations of the state's information policy, developing the strategy for informatics development, and forming a unified technical policy in this sphere. Unfortunately, the Council does not have management or control rights, and therefore its decisions are only advisory in character. Under its statute, the Council is chaired by the State Secretary. Thanks to the activity of its current chairman (Ülo Kaevats), the Council's influence in the preparation of legislation and in coordinating the development work of state information systems has increased.

On the recommendation of the Informatics Council, the Department of State Information Systems was established under the State Chancellery in March 1993. It has put coordinating bodies to work, reorganized the planning of informatics expenditures in the state budget, together with the Informatics Fund developed and implemented rules for public procurement of information-technology tools, and organized the certification of computer firms.

In many countries, organizations bringing together enterprises and specialists participate actively in shaping informatics policy. In Estonia, the Electrical Engineers' Association, within which the Informatics Society operates, the Estonian Electrotechnical Committee as the coordinating unit for standardization, the Estonian Software Society, and the Association of Computer Firms have been established. So far, however, their influence on the formation of information policy has been very limited. In 1993, the Estonian EDI Association also began active work, focusing on the narrower field of electronic document exchange.

General Objectives of Informatization 3

This chapter sets out the objectives of informatization as they are formulated in development strategy documents of the European Union, the United States, Japan, and many other countries.

Developed society is now moving irreversibly toward a condition in which the collection, dissemination, and use of information become decisive factors of development. The general application of information technology and the development of information infrastructure increase the efficiency of all socio-economic activity, while simultaneously opening the way for many new types of social and economic undertakings. Information and intellectual activity become decisive production factors and the main source of economic value creation. The main objectives and directions of informatization can be summarized as follows.

1. Raising economic efficiency and competitiveness

This is achieved through the application of information-technology tools in administration and technology. As a result, management becomes more responsive and flexible, the use of labor and other resources is optimized, the innovation process accelerates, and opportunities are created for extensive restructuring in both production and administration.

The favorable conditions created by information infrastructure are especially important for small enterprises, which gain access to many information services that until now were affordable only for large organizations, including information on procurement and distribution opportunities. Informatization supports an open and competition-based economic environment. New jobs are created in every sphere of life, and especially in high technology, including information technology. Opportunities open up for the development of high-technology production in remote areas. Part of the information formerly available only to the government becomes accessible to the public, thereby also increasing the competitiveness of the private sector.

Fundamentally new possibilities also arise for organizing state administrative activity, including the formation of the budget, the collection of taxes, and the monitoring and evaluation of budget execution. It becomes possible to put the state's statistics in order. Correct and timely information on the state of the country's resources and their dynamics enables leaders to make objective and optimal decisions. The interconnection of information systems makes it possible to consolidate work functions previously performed by a single employee and significantly raise officials' productivity. A unified information-technology infrastructure facilitates necessary organizational changes in administrative work, including the transfer of functions from one institution to another and the delegation of decision-making authority to lower levels of the management structure.

2. Better satisfaction of social needs

This is likewise achieved through the use of information systems based on modern information-technology tools, thereby increasing the efficiency of work organization in health care, education, social assistance, and other fields. The development of information infrastructure makes it possible to apply modern methods in treatment and diagnosis, distance education, and other areas. Information-technology tools are indispensable for organizing the work of emergency centers. Informatization opens new opportunities for assisting elderly persons and citizens with disabilities and for integrating them into active social life.

3. Improving quality of life

This is achieved by improving the operation of all structures that directly serve the citizens of the state (transport, communications, commerce, financial services, government structures that deal directly with citizens, cultural institutions, and others). The activities of government bodies come closer to the citizen, and public awareness improves, making society more open and democratic. Information-technology tools also help improve the condition of the environment.

Through information infrastructure, all kinds of information services become accessible not only in every enterprise, office, school, hospital, and library, but eventually in every home. Information technology becomes the basis of a new work and lifestyle. Representatives of many professions will be able to work from home. Fundamentally new possibilities arise for acquiring education and continuing education, and for satisfying cultural and entertainment needs.

4. Strengthening state sovereignty and cultural identity

Modern information technology and data networks make it possible to build an effective state-security system without significantly increasing material or human resources, which for a small state is the only feasible path. The development of information systems strengthens the state border and improves international cooperation in combating crime. In education, science, and culture, information systems make it possible to preserve and make accessible to all residents the achievements of national culture, past and present. Computer technology helps overcome language barriers and allows local minority groups to partake in our national values. Universal information-exchange channels thereby also help reduce ethnic tensions and integrate minority groups into the state's political and cultural life.

Databanks, information networks, and electronic publications extend the reach of our cultural assets abroad, help raise the prestige of the state and of national culture, and also yield economic gains through the marketing of cultural information and the expansion of tourism. The expansion of cultural exchange through electronic information channels is essential for bringing us closer to the international cultural space, while at the same time helping preserve our cultural identity in the face of the advance of international mass culture. National-language information banks and channels help secure the position and future of the Estonian language.

These directions are all closely interconnected. Better satisfaction of social needs and improvement of quality of life affect social activity and labor productivity, thereby increasing the competitiveness of the national economy. Rising economic efficiency, in turn, creates the conditions for financing social assistance, health care, and the functioning of other social systems, increases employment, and opens new paths for people's professional training. Building information systems for the Border Guard, police, and rescue services helps strengthen citizens' sense of security, and operational information can in some cases save lives. Particularly noteworthy are the opportunities created by the development of information infrastructure for revitalizing economic and cultural life in remote regions and improving the socio-economic climate there. In this respect, information systems play a role analogous to the development of road networks, but in the long term an even more important one.

In sum, informatization will raise the social welfare of the state and the people and create the preconditions for Estonia's integration into the world economy, including the European Union.

Directions of State Informatization

4

This chapter describes the concrete objectives to be achieved in the various fields of the state's economic and social life over the next five to six years.

4.1. Public Administration

The upper level of state administration consists of the central apparatus—ministries, boards, inspectorates, and other institutions. In all central institutions, information systems meeting modern requirements are to be built and, through the government communications system, combined into a unified and integrated state administrative information system.

The state's core registers are the following: the population register, building register, real-estate registers, enterprise register, register of legal acts, and classifier register. These core registers serve as the information base of state administration. They are state registers into which continually updated and verified information is collected on the state's core resources—citizens, organizations, assets, and the like—and which are used by many bodies of public administration. For each register, a state institution is designated as the responsible authority, and a register keeper—an institution or enterprise that performs data storage, service, and maintenance work. All core registers are accessible through communications networks.

The population register contains information on the state's citizens and permanent residents. Local governments and local state institutions exchange data with county registers, which in turn exchange data with the central state register. The administration and maintenance of this register are subject to especially strict confidentiality requirements, based on the Personal Data Protection Act.

The building register contains information on buildings and other structures. It too is maintained in the county governments, and the data are consolidated into a central register. The building register also receives data from the construction register, which contains information on structures under construction.

The real-estate registers form, within the real-estate information system, a complex comprising the land register and the land-title register. At county level, these registers are formed under the relevant branches of the central administrative bodies, from where the data are transmitted to the central registers.

The enterprise register contains information on enterprises, institutions, and organizations registered in the Republic of Estonia. This register is

also maintained by county governments, on the basis of whose data the central register is formed. Updates to entries also use data received from the information systems of the Tax Board, other institutions, and county governments. Depending on the commercial legislation under development, the enterprise register's legal functions may be assumed by the register of legal persons and the commercial register for entrepreneurs.

The ESTLEX register of legal acts contains the updated full texts of the legal acts of the Republic of Estonia in Estonian and complete information on the validity and amendments of those acts. The register is to become accessible both in Estonia and abroad via publicly accessible information networks.

The classifier register consolidates data on all classifiers used in the state administrative information system, on which the functioning of all state information systems and state registers depends.

In the near future, particular importance will attach to central registers serving property reform (the register of former owners and property, the register of people's capital bonds, and the register of privatization securities), which, as the reform progresses, will gradually transfer their functions to other registers and institutions.

The maintenance of the state's central registers is concentrated primarily in the State Computing Centre, where this work takes place in a specially developed environment ensuring data protection and the availability of integrated services at acceptable cost.

In addition to the above-mentioned core registers, numerous state registers of narrower scope are maintained in public institutions, such as the road register, vehicle register, register of heritage protection objects, and others. In all of these, compatibility with the core registers is ensured, as is access by other administrative bodies through the government communications system and, selectively, through publicly accessible information systems, with due regard to data-protection requirements.

All state core registers, and likewise the state registers maintained in institutions, serve users under a prescribed procedure that regulates which institutions and persons have the right to receive registry data, the payment for registry services, and the rules governing the use of received data. Only a defined group of institutions and defined services are provided free of charge. Depending on the scope of chargeable services, the core registers are financed from the state budget.

The state's central information systems operate on the basis of the core registers and cover the central integrated functions of public administration, operating on the basis of classification standards.

The state budget information system makes it possible to monitor the preparation of the draft state budget and its execution. The system receives information on the use of budget funds from the accounting systems of budget-funded institutions. The information systems of the Tax Board, Customs Board, and others are linked with the budget system, making it possible to monitor budget revenues. The system also enables the modeling and forecasting of

budget processes.

The information system of the Tax Board is being developed in the direction of continuous collection, via other state information systems, of the data needed for completing income-tax declarations. Preparations will begin for the submission of tax declarations in electronic form.

The real-estate information system is based on the core registers (land register, building register, land-title register), which operate at county-government level and on the basis of which the corresponding central registers are formed.

The customs information system will be developed in close linkage with border protection and other state-security information systems, since customs points and border-guard posts are mostly co-located and some of their functions overlap (for example the detection of illegal border crossings).

The environmental monitoring information system will make it possible to monitor continuously, throughout the territory of the state, the condition of soil, water, and air, and to produce summaries and forecasts. The information stored in this system must be made accessible in particular to the relevant central and local administrative bodies and to the public.

The information systems of county governments will develop as the continuation, at county level, of the functional directions of the state's central information systems. Informatics centers operate in the counties. Their task is, on the one hand, the maintenance of the core registers and, on the other, the coverage of the other data-processing needs of county governments and of county representatives of central agencies. For county information systems, mandatory compatibility conditions are to be developed, and standard solutions are to be proposed for structure and software. On the basis of these solutions, the development and operation of county information systems may also be entrusted to private enterprise.

Local-government information systems represent the lower tier of the governance structure. These systems are to be developed in local-government units according to local management needs, and also in line with the requirements that the state level of administration places on data capture. For this purpose, recommended standard solutions and software products will be developed. In larger cities, individual projects will be implemented where substantial independent development work has already been done (for example Tallinn, Tartu, Viljandi).

All administrative systems rely to a significant degree on the concept of spatial information systems (geoinformation systems, GIS), which makes it possible to link administrative objects to their location. The basis of spatial information is the digital map of the Republic of Estonia, to which different user layers are added as needed. The use of spatial information is based on uniform national standards regulating information representation and methods of use. Spatial information is especially important for real-estate registers, but it is also used in other administrative functions and together with other registers (for example the road register). The information of the digital map and the local maps based upon it is available through the communications system of government institutions to all administrative structures, as well as to national-defense structures,

rescue services, state agencies organizing transport and tourism, and private enterprises.

The government institutions' computer network links all institutions of the central state apparatus, county governments, and core registers. Its functions include electronic mail for the transmission of current information and news, transmission of registry data (queries and responses), data entry, data updating, and control. The connection of local-government information systems with county governments and state core-register centers is organized mainly through publicly accessible communications networks. In the document exchange of state institutions and state enterprises, electronic EDI technology is used increasingly widely. The design of computer communications, training, and the coordination of project implementation take place in a central client organization representing the interests of all state institutions.

Departmental information systems are developed on the basis of the needs of specific agencies, using project-based individual solutions, but they are subordinated to the general requirements of the state administrative information system and to common standards and classifiers as regards data representation and exchange procedures.

All state procurement—that is, procurement financed from the state budget—is organized through competitive tendering. Information on offers is collected in separate data banks.

In order to make generally useful information stored in the state's data banks available to the public—including information on the labor market, tax and social assistance arrangements, education, the availability of medical assistance, statistics, and other information—public information points operate in larger cities and county centers under government institutions. From there, any citizen can use communications networks to submit queries to certain parts of state data banks.

In designing and developing state administrative information systems, their future linkage with international networks and systems is kept in view, including those of the European Union within the framework of the IDA administrative information network program. For individual systems—customs, social insurance (SOSENET), public procurement, transport information (INCA), police, and environmental monitoring (ENVIRONET)—linkage to international networks is to begin as early as 1996–1998.

The development and cooperation of all state administrative information structures are to be monitored by the central informatics authority—the Informatics Agency—which coordinates development projects, ensures system compatibility and compliance with standards, and monitors the efficiency of budget expenditures.

4.2. Economy

In industry, in addition to administrative information systems, increasing use is to be made of tools for the real-time control of technological processes, as well as computer-based design and engineering systems, often directly linked to systems controlling the production process (CAD/CAM technology). The establishment of these systems is complex and requires major investments in hardware and software; a corresponding market for firms providing such services will therefore develop.

In transport, all major agencies—private firms as well as state enterprises—will develop integrated information systems covering service provision (including ticket reservation), planning and monitoring the movement of vehicles, and other functions, and linked to corresponding international information systems. In air transport, major investments will be required to ensure flight safety; the air-traffic monitoring system will be developed in close linkage with state-security systems. Rail and air transport will develop autonomous computer-communications networks. In road transport, mobile communications tools will be widely used for tracking cargo vehicle movements. Port information systems will be connected to corresponding international systems.

In energy, information systems will be applied to the management of energy systems, including the generation and distribution of both electric and heat capacity, the regulation of energy-flow parameters, and producer–consumer settlements. A large part of these information systems will have to operate in real time.

Communications have a special role in the state's informatization, because data-transmission systems form the technological basis of information infrastructure. During the initial period, development proceeds mainly on the basis of AS Eesti Telefon's network digitalization program and trunk-network development plan. A publicly accessible data communications network is to be developed. The development of new integrated digital service networks is to be encouraged. On the basis of public digital networks, the computer network of government institutions is also to be built, along with specialized departmental and private networks for transport, banking, and other sectors, and information systems serving science and education. The development of private firms offering communications services will continue, relying above all on Eesti Telefon's backbone networks. During the period under review, Estonia is also to begin connecting to pan-European broadband networks (B-ISDN, ATM).

Public communications systems will develop in the direction of expanded value-added services. Electronic mail services are to become available throughout Estonia. A 24-hour one-way data-distribution system will be developed on the basis of television channels. The mobile telephone network will expand and will also enable data communications services. While most of Estonia is currently covered by the NMT-450 system, the development of the GSM mobile telephone system—now operating in Tallinn—is of particular importance from the point of view of integration into European systems. According to the development plans of AS Eesti Mobiiltelefon, the GSM network will expand over the entire country within the next couple of years. In the development of cable television networks, attention will also be paid to the possibility of using them not only for television

program transmission but also for other communications and information services.

In commerce, the use of data communications will spread through all parts of the commercial process. International trade document exchange will move to the EDIFACT electronic document interchange technology, which also covers related customs, transport, and banking procedures. Domestically, EDI technology will be applied increasingly broadly in wholesale trade, industry, transport, and other supply systems, especially in industrial enterprises moving toward JIT (just-in-time) supply management. Thanks to the development of communications systems, electronic services will also become accessible and usable for small enterprises. Making electronic information services available to the population, together with the expansion of banking services, will allow the start of electronic retail trade—ordering and paying for goods from home through communications channels—which is especially valuable for people living in more distant regions.

In banking, a domestic interbank settlement system covering all banks will take shape, based on a specialized data-communications network and linked to banks' local networks. Within banks, communications systems connecting branches located across Estonia are to be developed using existing digital backbone networks.

All banks carrying out international settlements are connected to the international banking data network SWIFT. For customer service, bank machines (ATMs) are to be used widely, providing not only cash withdrawal but many other banking services as well. Banking services through communications channels (home banking services) are to become available to all enterprises and private persons. A nationwide chip-card system will become multifunctional, allowing cards to be used in many fields, from health care and social welfare to car parking.

4.3. Health Care and Social Welfare

In the field of the Ministry of Social Affairs, interconnected information systems are to emerge, linked to all state health-care and social-assistance institutions, the relevant units of county and local governments, and treatment and care institutions.

The social insurance information system covers the administration of state pensions and benefits. Other arrangements of social assistance are covered by the social information system. The health insurance information system covers the financing of medical services throughout the country and is linked to the information systems of hospitals, polyclinics, and the pharmacy network.

All hospitals, polyclinics, and other treatment institutions are to have local information systems. In addition to the information systems of hospitals and other institutions, a state medical informatics center is to operate, providing diagnostic services, methodological support, and information assistance through communications channels. Medical information systems are to have a direct connection with the rescue service.

In the administrative area of the Labour Market Board, a dedicated information system is to be developed covering information on job vacancies and labor supply.

All of the above-mentioned information systems are to rely on the population register.

4.4. Education and Science

Within the education and science system, an administrative information system of the Ministry of Culture and Education operates and is linked to the relevant units of county governments and local governments. In universities and other larger educational institutions, administrative information systems with developed functions are to be maintained; these cover the organization of the teaching process, the development and administration of curricula, and the publication of teaching materials. The Academy of Sciences and research institutions also have their own administrative information systems.

Relatively independently of these administrative systems, systems and networks operate whose task is the dissemination of research and educational information. The information needs of research institutions—both public and private—and of universities engaged in research are to be met primarily by international information networks and systems, especially the Internet, the use of whose resources is coordinated by the organization EENet under the Ministry of Culture and Education. All research institutions, and also educational institutions, are guaranteed access to these information systems through the public data-communications network or through specialized networks established by research institutions on the basis of leased channels.

To cover the data-processing needs of universities and research institutions, they maintain computing centers and local networks. At the same time, these centers operate as hosts, storing broader scientific databases, including those of international interest, and making them accessible through the Internet and other information networks. Depending on the development of international communications channels, the information systems of universities and research institutions will begin connecting to the joint networks of European research institutions.

The development of the state information infrastructure opens extensive opportunities for expanding alternative forms of education. Continuing education is developing intensively, especially on the basis of computer-based training classes operating within educational institutions or as separate institutions. In these classes, not only computer instruction takes place, but also instruction in various other subjects and skills, using modern computer-assisted teaching methods. These classes are connected to information networks, through which it is possible to access general-purpose information banks as well as obtain specialized learning materials from the databases of the Education Informatics Centre and other continuing-education centers. The development of public data communications will also allow the broad application of home-based learning, where the learner uses a home computer to access the instructional databases of the Education Informatics Centre or other hosts.

4.5. Culture

Cultural institutions—libraries, museums, publishers, art institutions, and others—meet the cultural needs of the population, while at the same time fulfilling the function of the social memory of the state and nation. Each institution has its own internal information system, whose specific functions depend on the type of institution. The information systems of institutions of the same type are linked into nationwide systems.

The national library information system covers the National Library, research libraries (including the Library of the Academy of Sciences, Medical Library, libraries of Tallinn Technical University and Tartu University, and others), and the larger public libraries. The center of the system is located in the National Library and is connected to the other larger libraries. On the basis of a distributed division of labor, the system makes it possible to create central bibliographic catalogues in database form and make them usable from all libraries. The functions of the system also include accounting and the maintenance of the national bibliography.

Libraries are to develop from book repositories into universal information centers containing information collections on various media, including CD-ROMs. Libraries will provide all citizens access both to their own holdings and to databases, and will provide network information services on both a paid basis and, within limits, free of charge.

Museum and archive information systems will largely use standard solutions. Museums and archives will form databases on the basis of their collections; the most important of these will be transferred to hosts providing information services and will thereby become accessible through information networks.

Libraries, archives, and museums contain information accumulated over many decades, and in some cases centuries, on traditional paper media. Their digitalization and transfer to modern media, especially laser discs, is indispensable both for better use of those values and for their preservation for future generations. Over time, the most valuable part of the preserved holdings—such as older periodicals, older Estonian literature, the most important archival documents, and visual representations of selected exhibits from art, history, and archaeology museums—will also be transferred to modern media.

The application of information technology in publishing activity and media channels will continue on the basis of private initiative. Cooperation with the information networks of international agencies and publishing systems will deepen, enabling the operational exchange of materials and their broad accessibility. The publication of databases on CD-ROM will begin.

To meet the information needs of the whole population, as well as of enterprises and organizations, a public electronic information market will emerge, covering data centers—hosts—accessible through public communications channels. Providers on this public information market will include:

- information centers of state institutions, through which government documents and certain parts of the material of state registers, statistics, and administrative databases are made available;

- information centers of libraries and of educational and research institutions;
- service centers operating in information networks, such as the host of the data consortium CIESIN, in which extensive information concerning Estonia is concentrated; the same hosts will also provide access to business information;
- international information networks, such as the Internet, as well as the public information networks of neighboring countries.

Among public information-dissemination channels, teletext television will continue to be expanded.

4.6. State Security

Within the state infrastructure there are systems that must ensure the viability of state structures in emergency situations (war, natural disasters, and the like), and that are located both within the defense forces and in the administrative area of the Ministry of the Interior (police, Border Guard, rescue services). The information systems of these institutions are linked to the systems of other state institutions, but for the direct performance of security functions they have their own means and complexes—special-purpose radio communications, databanks containing special-purpose information, a unified radar field, encryption services, and so forth. In the development and operation of security systems, requirements relating to safety, data protection, secrecy, and related matters are to be followed.

For the needs of border protection and customs, and of a rescue service covering the entire territory of the state, a communications system based on the network resources of the information infrastructure is to be created.

Requirements for State Informatics Policy

5

This chapter describes the concrete steps that should be taken at the national level to implement the state informatics development plan through draft laws, regulations, and other acts governing economic and social life.

5.1. Overall Strategy and Priorities

In Estonia's present situation, the priority general objectives of informatics development are, in order of importance:

- increasing the state's economic potential;
- increasing the efficiency of the administrative apparatus;
- providing the population with administrative, economic, scientific, cultural, and everyday information.

The concrete national tasks in the development of informatics systems are as follows:

- development of the state's core registers and strategic information systems;
- development of data communications networks and services;
- standardization activity;
- certification of products and assurance of their quality;
- creation of favorable conditions for private enterprise in information technology;
- promotion of informatics education and the shaping of personnel policy;
- support for basic and applied research in informatics;
- integration into European informatics structures.

The main instruments for implementing the informatics development strategy are:

- shaping the informatics budgets of the state and local governments;
- drafting and enacting laws and lower-level legal acts;
- drafting standards and other normative documents, and enacting acts that regulate their enforcement;
- developing the national governance and coordination structure for informatics.

At all levels, private capital must be encouraged to participate in the development of information systems and components of information infrastructure. At the same time, in current conditions—when economic structures based on private enterprise are only beginning to form—the comparatively weightier role of the state in shaping information infrastructure is unavoidable. At the same time, the task of the state is to create an environment favorable to the application of information technology in the private sector. The instruments for this are, above

all, tax, credit, and customs policy, as well as legal acts guaranteeing the security and standardization of information exchange and use, and the existence of state support structures. A market in information services based on free competition must develop.

Following the example of countries with developed informatics structures, opportunities should also be sought for outsourcing the information-processing work of state institutions to private firms. At the same time, it is necessary to ensure growth in the competence of users—that is, the state institutions themselves—so that the possibilities of information technology can be fully exploited.

In every country, the state is one of the largest consumers of information-technology sector products (20–30 percent of purchases of computing and communications equipment). As a result, the development policy of state information systems has a strong influence on the development directions and pace of the informatics sector as a whole and on informatics entrepreneurship. At the same time, state structures must set an example to the private sector in the application of information technology.

5.2. Shaping the Informatics Component of the State Budget

The development of information infrastructure is carried out in the interests of the whole state and society, and in all developed countries investments for that purpose are made from the budgets of the state and local governments. In developed countries where the information-technology and communications base has already largely been created, 3–4 percent of the state budget is allocated to the information-technology development of both state institutions and public-law structures. In Estonia, the share of informatics expenditure in the 1993 state budget was 0.8 percent, which is entirely inadequate (Lithuania's corresponding share was 1.5 percent). It is essential to increase the share of informatics expenditure in the state budget gradually in the coming years to 2.5–3 percent. The corresponding control figure (as a percentage of the total state budget) should be approved annually at the level of the Riigikogu.

The principles for forming the informatics component of the state budget were shaped during the preparation of the 1994 draft budget. Under those principles, each ministry, board, and county government has a separate budget line for informatics expenditures covering the acquisition of information-technology tools for the relevant state institution and design costs (but not current operating costs, which are treated as administrative expenses). The state budget also finances local-government activity in the data capture of state core registers and the maintenance of subordinate registers.

In addition, the Informatics Fund finances, as separate target programs, cross-departmental work streams and functional areas: development and operation of the state's core registers, development and operation of strategic information systems (the state budget system and the state-security information system), development of data communications networks and spatial information systems,

standardization activity, and the like. The Informatics Fund also finances development work of a research-oriented nature, training of professional specialists, and subsidizes publishing activity.

The planning system described above has proved expedient and should be retained during the period under review.

Development work financed from the state budget in priority directions should be grouped into five national programs:

- data communications program;
- state-security information systems program;
- state administrative information systems program;
- state registers program;
- spatial information systems (GIS) program.

In order to use state financial resources more efficiently, the public procurement rules for information-technology tools must be applied consistently, gradually extending them also to the design and development work of information systems and their components, while aligning procurement procedures with the corresponding documents of the European Union.

5.3. Legislation and Standardization

The legal acts required for the informatization of the state can be divided into two groups.

A. Acts directly dealing with the information sphere

- State Registers Act: the existing law requires substantial modernization and is currently under review. It will also regulate questions relating to the right to use data and to charging for their use.

- General Data Protection Act: regulates the use and publication of information concerning public-law persons.

- Personal Data Protection Act: must guarantee the confidentiality (privacy) of personal data and is necessary for regulating the use of personal databases held in state registers—especially the population register—as well as in agencies and all other organizations.

- Act defining the status of electronic documents: must establish the conditions under which data stored on media such as floppy disks or in database form are legally equivalent to paper documents. Such an act is indispensable because the use of electronic documents is expanding, especially in connection with EDI technology and banking services performed via communications channels.

- Communications Act: defines the basis for the construction, development, and management of communications systems. The currently valid law requires supplementary normative documents.

In addition to laws, lower-level acts are needed for shaping and operating informatics objects—for example, statutes for state registers and acts regulating procedures for data collection, which can be developed on the basis of legislation. Communications also require improvement, including the national mechanism for coordination and regulation of data communications.

B. Legal acts in various fields that affect informatics issues

- Acts relating to the protection of intellectual property define, among other issues, the legal bases for the use of computer software and databases. The Copyright Act adopted in 1993 addresses these issues and is in line with corresponding European Union and international provisions. However, the law requires extension and supplementation concerning the copyright of databases and new electronic information carriers. Implementing acts must be created for enforcing intellectual-property protections, including measures against software piracy.

- Enterprise law must regularize the flow of information connected with the registration and re-registration of enterprises and with the termination of their activity.

- Criminal-law acts must make it possible to address cases falling within the sphere of computer crime, the danger of which is constantly growing. These issues are insufficiently treated in the legislation of other countries as well; in Estonia, corresponding provisions are entirely absent.

- Civil-law acts must cover the legal aspects of transactions connected with documents on non-traditional media.

- The National Library Act, other library laws, the Archives Act, and related legislation must adequately reflect, in addition to traditional library and archive objects, problems connected with modern information media.

- Laws in the fields of enterprise, taxation, customs, and others must establish tax concessions, credit concessions, and other special conditions for informatics and information-technology enterprises that would secure the priority development of this sector.

- Acts governing public procurement must begin to take account of the electronic procedures applied or planned in the European Union's common procurement regime.

- The laws on accounting and auditing must take into account the technological specificity of modern accounting systems based on information technology.

In the preparation of these and many other legal acts, the involvement of informatics specialists in working groups—or at least as experts—is obligatory. When draft acts are coordinated, provision should be made for approval by the Informatics Council and/or the national central informatics body, and for professional analysis and due consideration of their comments.

It is also essential to provide additional training in informatics issues for certain jurists, and to qualify a certain number of law students in this direction, with a

view to their later employment in the Ministry of Justice and in the state's central informatics body.

Standardization activity in the field of informatics must ensure above all the following:

- compatibility of databases with regard to information representation;
- communications compatibility of information systems, that is, common data-exchange protocols and procedures;
- user-friendliness of systems and tools (ergonomic requirements and the like).

In building a system of standards, the unchanging basis must be the standards of international bodies such as ISO, IEC, ITU, CEN/CENELEC, ETSI, and others. Some of these can be adopted unchanged and without translation as Estonian standards; others require adaptation in view of language and cultural characteristics and the technological level.

The national organization of standardization activity in information technology must fall within the competence of the state's central informatics body. Substantive work should be led by the relevant specialist commission of the Estonian Electrotechnical Committee, in close cooperation with the Informatics Council. Informatics institutions are represented in the Estonian Standards Council. In communications matters, the Ministry of Roads and Communications performs the national coordination function. In the future, as the non-state management structure for standardization common in developed countries takes shape, social and business structures in the field of informatics (the Association of Computer Firms, the Software Society, the Informatics Society, sectoral business associations in industry, banking, transport, and others, and major enterprises) must assume a more weighty role.

In forming the long-term standardization program, the highest priority must be given to standards that ensure system compatibility and are based on the concept of open systems. To ensure the unity of state administrative information systems, it is necessary to develop a set of standards—a functional profile. In order to meet the requirements of state security systems, core registers, banking, and others in safeguarding information security, encryption standards and other acts regulating the security of data storage and transmission must be developed and enacted by law.

The standardization process must also cover the needs of the information-technology industry. In addition to standards dealing with technological tools, quality standards (the ISO 9000 system) must be regarded as important. It is necessary to organize the certification of both produced and procured information-technology tools.

In public procurement of information-technology tools, guidance should, as far as possible, be taken from the corresponding materials of the European Union (including the EPHOS system).

5.4. Links with Industrial and Innovation Policy

The shaping of the state's industrial and innovation policy should become one of the most important tasks of the Ministry of Economy. Within that framework, the general priority of high-technology industry must be established, with information technology at its core. That priority must be reflected in national tax, customs, investment, and other incentives.

Until a broader political document exists, the basic principles of informatics technology policy should be developed in a separate document. That document should fix the following principles:

- the priority of information technology in the investment process;
- the forms of support and promotion for information-technology entrepreneurship and for the corresponding organizational structures (such as the Association of Computer Firms and others);
- reliance, in developing state information systems, on the systemic principles adopted in the European Union and international organizations (the concept of open systems);
- the implementation principles of the GIS spatial information system as one of the foundations of central national information structures;
- the general principles and directions of development of data communications systems.

The more precise formulation of informatics technology policy and the coordination of its implementation must take place under the leadership of the state's central informatics body and the Informatics Council. Particular attention must be paid to the production of Estonian-language software.

5.5. Links with Science and Social Policy

In implementing the state's science policy, stronger support must be ensured for both basic and applied research in informatics. More active integration into international programs (Copernicus, Eureka, and others) is necessary. In setting priorities, it must be kept in view that strengthening informatics systems is indispensable for increasing the effectiveness of all other branches of science, including basic research, national scholarship, environmental research, and others.

For applied research in information technology, a strong technological base must be developed. Since in the coming years it is inconceivable that this could be done solely through private-sector investment, strong financial support from the state budget is needed to establish corresponding competence centers at Tallinn Technical University, Tartu University, and the Institute of Cybernetics. Financing of initiative-driven research should be increased from state-budget funds through the Informatics Fund. At the same time, the share of information-technology firms in financing this work should also increase. It should be considered expedient to create a corresponding development fund under the

Association of Computer Firms or another organization, from which subsidies and loans could be granted for such research.

Education policy must create opportunities to diversify and expand the training of specialties in the direction of informatics at Tallinn Technical University and Tartu University. Priority development of the relevant specialties, institutes, and laboratory base should be treated as a priority task of university leadership and of the Ministry of Culture and Education.

In the general education system, it is necessary to ensure that a minimum computing base exists in every school without exception. That base will enable:

- the implementation of computer instruction as an essential component of general education;
- the application of computers in the teaching process of other subjects;
- integration into international information networks.

In developing the information-technology base of general schools, this must be done at the contemporary technological level. Systems acquired in the early years of computerization that are technically and conceptually obsolete must be fully replaced in the coming years. In planning resources, it must be taken into account that even the equipment being acquired now will require replacement or substantial modernization within no more than four to five years. In the systems of continuing education and retraining, specialized computer-training centers must be created.

Within the institutions of the Ministry of Culture and Education, the development and dissemination of educational software must be organized. For this purpose, an Education Informatics Centre will be created, which will also function as a databank of educational software, enabling schools and other educational institutions to receive learning materials through data networks.

A system for conferring the engineering profession is currently being planned through specialist associations and the newly created Chamber of Architects and Engineers. Within that framework, the qualification issues of information-technology hardware engineers and designers must also be resolved. The question of conferring professional status on programmers trained in non-engineering applied mathematics or economics programs must also be addressed.

In health care, a clear concept must be developed for linking the information systems of medical institutions into a unified network and for forming central databases. A state Medical Informatics Centre must be established. Its tasks should include developing standard solutions for information systems, providing assistance in their implementation, and providing diagnostic services, methodological support, and information assistance through communications channels.

In cultural policy and policy concepts, a consistent direction must be taken toward developing libraries into broad-profile information centers. This also requires increased state support for the development of the corresponding technological base. Through the relevant working bodies, the Ministry of Culture and Education must more decisively direct the technical policy of the library

network in the development of information systems.

A conversion center should be established at the National Library, where Estonia's cultural heritage will begin to be transferred systematically to modern media, above all CD-ROMs.

The creation of central bibliographic databanks in all cultural fields (museum and archive collections, filmography, and others) must continue. For this purpose, technological centers must be created in the relevant central institutions.

For the development of a public information market, the state must support general-purpose databanks (including the CIESIN information center). The organization arranging the connection to the Internet, EENet, must have its own information center; a network of county support centers must be developed. The state television teletext system must be modernized.

To expand the international dissemination of cultural information, it is necessary to intensify the building of databases and to create links with corresponding international information networks and organizations, joining joint projects in this field where possible (architectural and archaeological monuments, museum assets).

One direction of cultural policy must be the deepening of society's general computer literacy. In addition to computer education provided in schools and continuing education, the dissemination, through mass media and other information channels, of information about the possibilities of applying modern information technology in all areas of life and about its importance for the development of society's economic and social life must be encouraged.

One component of the state's culture is language and language culture. To develop these and to restrain the dangerous Americanization of language, means and opportunities must be found to advance terminological work in informatics, including the creation of corresponding databanks and the publication of dictionaries.

5.6. Informatics Governance Structures

To implement the informatics development plan, a national coordination mechanism is needed that, with regard to state structures, also carries executive functions. On the basis of the State Chancellery's Department of State Information Systems, a central body with the status of a state agency—the Informatics Agency—is to be created. If a central authority is created to coordinate issues covering the entire sphere of state administration (state statistics, classifiers, management of state assets, personnel issues of civil servants, and so forth—for example a Ministry of Administration), the Informatics Agency should belong to its administrative area.

The following key tasks must belong to the field of activity of the Informatics Agency:

- further development of state informatics policy and coordination of its

implementation;
- shaping the informatics component of draft state budgets;
- coordination of informatics activity in state institutions (interdepartmental target programs, cooperation with county governments and local governments, organization of relevant working groups, etc.);
- compilation and analysis of statistics on the technical and human resources of information technology;
- management of public procurement arrangements for information-technology tools;
- planning of a unified security policy for state information systems and monitoring its implementation;
- organization and coordination of the preparation of legislation and standards;
- organization and coordination of international cooperation in informatics;
- identification of human-resource needs in information technology, and direction and coordination of training;
- planning and coordination of informatics outreach and public-awareness activity.

The strategic direction of the Informatics Agency's work must remain the responsibility of the Informatics Council. The financial and economic operations connected with the Agency's activity are to be handled by the Informatics Fund operating within its administrative area.

For the qualified management of informatics development work, each ministry should designate its Secretary General or one of its Deputy Secretaries General as the person responsible for such work, and should create a separate subunit to organize development and operational work.

One aspect of managing informatics development is supporting and cooperating with civil-society type organizations (such as the Software Society, the Informatics Society, the Estonian EDI Association, and others), as well as associations of entrepreneurs (such as the Association of Computer Firms and others).

5.7. International Cooperation

In the development of the state's informatics, international cooperation is of primary importance. First of all, cooperative links must be created and developed with the structures of the European Union (Directorates-General III and XIII of the European Commission and the bodies within their area of work). Cooperation must be expressed both in continuous information exchange and in direct participation in the drafting and implementation of strategic development programs (PHARE, ESPRIT, ESATT, Tempus, and others).

Participation must be sought in new European Union programs related to the implementation of the European Information Society agenda (the transport infrastructure programs INCA and Via Baltica, the environmental information network ENVIRONET, and others).

In a small country, it is inconceivable to develop all components of state administrative information systems independently. Every opportunity should

be used to adopt solutions from other countries with the help of international assistance (an example is the state budget information system being implemented with Icelandic assistance). But this must occur within a unified development strategy, ensuring compatibility and security of components and taking into account the general principles accepted in the European Union.

Participation in the work of international bodies must be developed and expanded in a number of directions:

- standardization (ISO/IEC, especially JTC1, CEN/CENELEC, ITU, ETSI, X/Open, and others);
- public-administration information systems (ICA);
- electronic document transmission technology (UN/ECE WP4, and others);
- product certification;
- information networks (the Internet's governing bodies, CIESIN, and others).

Established links with neighboring countries' informatics bodies, especially those of Finland and Sweden, must be preserved (the Finnish Data Transmission Association, the Swedish state agency Statskontoret, and others).

Cooperation among the Baltic states in the field of informatics must be brought out of its present low point, and a common policy should be developed at the level of the states' central informatics bodies. A joint English-language information bulletin should begin to be published; information exchange should be organized concerning draft legal acts and draft standards; standardization programs should be coordinated; and joint conferences should be held.

To promote international cooperation, Estonian information concerning informatics (legal acts, decisions, information on organizations and enterprises and on events, offers concerning development and procurement projects, and current information) should be made available in international information networks.

5.8. Informatics Outreach and Public Awareness

The development of informatics structures and the creation of information infrastructure are tasks that affect all socio-economic structures and all strata of society. Their implementation therefore requires broad public support. Public opinion must be shaped purposefully by informing the public about programs, their objectives and results, and their impact on the economic and social life of society. In this way, the population will be prepared for the emergence of new services and their acceptance will be accelerated.

Informatics outreach is also important for shaping the informatics market, because the creation of interest and demand stimulates the development of new services and the flow of capital into information-technology firms. Informatics outreach and education are especially important for the broad spread of modern information technology in the sphere of small enterprise, where entrepreneurs often lack the necessary competence.

The leadership and coordination of informatics outreach should be concentrated in the Informatics Agency, where the corresponding action plan should be developed. The Informatics Fund should continue publishing the magazine Arvutimaailm; a similar journal devoted to communications should also begin publication. Popular literature on informatics should be published, although this will require state subsidies.

A strong instrument for shaping public opinion is the computer fair, the organization of which should continue under the Informatics Fund. Until an Estonian Museum of Technology has been created, a computer museum should be planned jointly with computer firms, with an exhibition oriented especially toward educating young people. Together with computer firms, a traveling exhibition should also be financed to introduce the tools and objectives of modern information technology in more remote rural areas.

Informatics outreach must cover all layers of society, including those who make political decisions concerning the development of the state. The circle of demonstration events organized on the initiative of the Informatics Agency must also include the Riigikogu, government institutions, and local-government institutions, for whom explanatory materials with the appropriate orientation should be developed and widely distributed.

To give a stimulating impulse to the informatization process in society, it would be expedient to declare 1996 or 1997, under the aegis of the Government, as an "Information Technology Year" or "Informatization Year." To organize the year's events, a government commission should be formed and an extensive program of events should be developed within the Informatics Agency (seminars, exhibitions, lectures, radio and television programs, street campaigns, mass publications, and so forth), covering all economic and social structures and levels and aimed especially at young people, entrepreneurs, civil servants, and professionals in many fields. Civil-society and professional organizations should be involved in the development and implementation of the program, including informatics and computer societies, the Engineers' Association, the House of Scientists, the Students' Scientific Society, and educational institutions.

Concluding Remarks

The development of informatics in Estonia is essential for achieving the state's economic and social objectives. Just as transport infrastructure formed the basis for the rise of industrial society, the transition to the information society requires the creation and development of an effective information infrastructure.

This development plan is the first attempt to define development objectives and the steps needed to achieve them in a concrete and systematic way. The plan must be reviewed periodically and new versions must be prepared.

The steps defined in the development plan constitute a minimum program. Without them, it will not be possible seriously to raise the competitiveness of Estonia's economy, the efficiency of the state apparatus, or the social welfare of the population. These steps are also indispensable for more effective integration of Estonia into international economic and cultural life and for its forthcoming integration into the European Union.

President John Kennedy liked to tell the following anecdote. A French general ordered a gardener to plant a tree in the garden. "This tree grows slowly," said the gardener, "it will become large only after a hundred years." "Then we must not lose time," replied the general. "Go and plant the tree at once."

Annex

Brief Overview of Informatics Development Policy in Selected Countries and in the European Union

In advanced industrial countries, the large-scale application of information technology and the development of information infrastructure have already been under way for decades. In those countries, there is a functioning computer market, there are communications networks of large scale and capacity that provide various computer services, information systems are used in all fields of life, and 3–4 percent of the total state budget is typically allocated to the development and operation of public-administration information systems.

> Despite all this, radical steps are now being taken to accelerate further development. The slogan of transition to the information society has become a practical guide to action, and national programs are being prepared for its implementation and assigned very high priority.

In the United States, the National Information Infrastructure Act was adopted in 1993. Its predecessor was the 1991 High Performance Computing Program, which focused above all on developing the information-technology base of research institutions. The new law launches a broad federal program whose planning and implementation are organized both by government structures guiding research activity and by the Department of Commerce; overall management is in the hands of the Information Infrastructure Task Force led by the Secretary of Commerce. The objective is to develop to the maximum the communications and information-processing structures of the United States. One of the most prominent components of the program is the concept of "information highways" or "superhighways", meaning a system of ultra-high-capacity communications networks. The law and the program are especially associated with Vice President Al Gore, who had already for years been an initiator of efforts in this direction.

The U.S. program covers both communications infrastructure and the applications of networks and information technology, with particular attention to such areas as libraries, education, electronic commerce, environmental monitoring, health care, and public administration. One of the program's most important expected results is considered to be substantial cost savings in public administration and in the health-care system. It emphasizes the opportunities offered by the new tools for raising industrial competitiveness and for the free development of the individual. Implementation of the program is expected to remain mainly in the hands of the private sector and market forces; for coordination with the private sector, the NIIS Advisory Council was created, comprising leading industrial executives. The role of government is seen in financing pilot projects (hundreds of millions of dollars have been allocated for this purpose), encouraging private enterprise, promoting standardization, ensuring information security, and protecting intellectual property.

In Canada, development work is led by the Ministry of Industry, where in 1994 the plan "The Canadian Information Highway" was prepared. A special body, the Information Highway Advisory Council, was created to coordinate the development of the concrete program. The plan places its main emphasis on the development of communications infrastructure

and on the social and cultural aspects of information-technology applications. It stresses the importance of information technology for increasing international competitiveness and creating new jobs. It highlights the role of information technology in presenting the achievements of national culture to the world and in strengthening national identity. It also emphasizes the need to give priority to the development of the industry producing information-technology tools.

In Japan, a government-level information-infrastructure development program, "Program for Advanced Information Infrastructure," was prepared in the spring of 1994. It emphasizes Japan's lag behind the United States in this sector and sets out concrete steps for reducing that lag. Development work is headed by the Ministry of International Trade and Industry (MITI). The tasks in the public sector—that is, the sector financed by the state—are treated extensively. Great emphasis is placed on education: it is envisaged that a center for educational software will be established and that schools will be equipped with computers on a mass scale; concrete tasks are assigned to the Ministry of Education, Science and Culture. The Ministry of Health and Social Welfare is to prepare plans for broader application of information technology in hospitals. Concrete tasks are also assigned to other state institutions, including the Science and Technology Agency. The applications of informatics in homes and the possibilities of multimedia are treated at greater length. The treatment of the development of communications networks and services is especially thorough.

At the meeting of the Council of the European Union in Corfu on 25 June 1994, the report "European Information Society" was approved. It was prepared by the High Level Group on European Information Society led by Martin Bangemann, Director of Directorate-General III of the European Commission. The report emphasizes the importance of developing information technology for employment and industrial competitiveness, as well as for improving social welfare and quality of life. One of its main theses is the need to fully liberalize communications systems—that is, to eliminate all monopolies in both networks and services. It states that the leading role must belong to private enterprise and the market. In discussing communications structures, the report highlights the growing importance of EDI and the Internet. It sets the task of launching ten pilot programs, to be financed in part from European Union funds. These cover, among other things, the application of electronic tools in home-based work and home-based learning, university science, road and air traffic management, the organization of life for elderly persons and citizens with disabilities, and public administration.

Long before the Bangemann Report, the European Union had already launched several programs in the same direction, including the "European Nervous System" program under the Third Framework Programme, also referred to as the telematics program, because it covers the development of communications systems and their application for linking administrative and research structures. The program addressed such fields as health care, education, transport, libraries, language technology, and administrative organization. In its continuation under the Fourth Framework Programme, pilot programs are being developed, for example for data exchange between public-administration structures of different states (IDA), for environmental monitoring (ENVIRONET), and in the field of social welfare (SOSENET).

In Europe, the Nordic countries have been among the leading states in the application of information technology. In Finland, the Ministry of Finance began in 1993 to prepare Finland's information-technology strategy to the year 2010 (program TIKAS). The strategy is being compiled as contract work by the Information Technology Development Centre TIEKE. The steering group includes senior government officials and representatives of

computing centers and banks. The authors of the strategy proceed from the analysis of the state of information technology and communications in Finland carried out by the OECD in 1992. Among the development goals, they emphasize revitalizing the economy and especially increasing export opportunities, as well as employment growth, increased efficiency of the public sector, and the balanced development of society and the individual. The key concept is a "network-based economy" (*verkoustalous*, *networked economy*), since the focus of development lies on communications networks linking all structures and functions. The strategy was to be completed in the autumn of 1994, with ministries, the Council of State, specialist associations, and the general public involved through questionnaires and seminars.

In Norway, a program titled "National Information Technology Infrastructure" had already been prepared in 1990. Its implementation involved the Ministry of Labour, the Postal Directorate, the Tax Authority, the Customs Authority, the Statistical Bureau, and other state institutions; the project was led by the agency Statskonsult. The main emphasis was placed on communications systems and on the development of electronic document interchange (EDI technology) in the public administration system and between the public and private sectors. An important place was given to standard development, including the open-systems profile NOSIP.

In Denmark, the Government's "EDP Policy Committee" was formed in 1992 to define the tasks for developing information technology in government institutions up to the year 2000. The program is led by the Ministry of Finance. It requires each ministry to prepare a concrete strategy. Particular emphasis is placed on the possibilities for decentralizing management created by information-technology tools. It also addresses the problems of public procurement of technological tools and of system security.

In Sweden, a government Information Technology Commission was established in March 1994, chaired by the Prime Minister and including six ministers, leaders from industry and education, and representatives of state institutions. In August, the Commission's report "Information Technology: Wings to Human Ability" was completed, defining near-term tasks in the fields of communications development, education and science, public administration, health care, and information-technology research. Its main objectives are to raise international competitiveness and improve quality of life. Communications networks and services, and the development of legislation, are treated as key issues. The report also notes the role of information technology in securing the position of the Swedish language and culture, in developing life in more remote parts of the country, and in integrating immigrants into society. A major part in financing the program is to be played by the foundation "Foundation for the Development of Knowledge and Competence." The Government commission continues its work, and a conference was planned for autumn 1994.

Source note in original: *"Bit". 1994. T. 313. 400.*



1. SISSEJUHATUS

Käesolevas peatükis esitatakse informaatikaga seotud põhimõistete määratlused ja selgitused nii nagu neid kasutatakse käesolevas dokumendis. Järgneb lühike ajalooline ülevaade informaatika arengust Eestis alates elektronarvutite rakendamise algusest.

1.1. Põhimõisted

Infosfääri termineid tõlgendatakse tihtipeale erinevalt. Esitame kõigepealt põhiterminite sellise tähenduse, nagu seda edaspidi käesolevas dokumendis kasutatakse ning mis ühtib või on lähedane enamikus maades viimasel ajal levinud tõlgendusega.

Infotehnoloogia on informatsiooni automaattöötluse tehnoloogiliste vahendite ja menetluste üldnimetus. Ta hõlmab arvutitehnikat, informatsiooni edastus- ja säilitusvahendeid jpm. Infotehnoloogia on informaatika tehnoloogiline alus.

Paljudes maades kasutatakse seda terminit hõlmamaks ka kogu infotehnoloogiavahendite rakendusvaldkonda, niisiis samas tähenduses nagu «informaatika» käesolevas dokumendis.

Infosüsteemid luuakse organisatsiooniliste üksuste või struktuuride (riigiasutus, ettevõte, raamatukogu, haigla jne) teabe kogumiseks, säilitamiseks ja töötlemiseks infotehnoloogiavahendite varal. **Riigi infostruktuur** moodustub valdavalt eri taseme ja ulatusega infosüsteemidest.

Informaatika on üldnimetus infotehnoloogiavahendeid ja nende kasutamist käsitlevaile teadus- ja tehnikaaladele ning praktilise tegevuse valdkondadele.

Seda terminit on kasutatud ka kitsamas tähenduses ning koguni kahes eri variandis: kord tähistades sellega teadus- ja tehnikateabe kogumist ja levitamist tehniliste vahendite abil, teinekord aga arvutite rakendamise teoreetilisi aluseid. Käesolevas dokumendis kasutatakse terminit «informaatika» laias tähenduses, nagu see peegeldub ka Eesti Informaatikanõukogu nimes.

Telemaatika («telekommunikatsioon + informaatika») on termin, mida 80datel aastatel hakati mõnedes Euroopa maades, eriti Prantsusmaal, kasutama tähistamaks sidevõrkudel põhinevaid infotehnoloogia rakendusi (andmepäringud, pangaülekanded, piletitellimine jms). Termin esineb ka mõnedes Euroopa Liidu dokumentides. Telemaatika mahub mõistete «infotehnoloogia» ja «informaatika» tänapäevase tõlgenduse raamidesse.

Informatiseerimine on teatud valdkonna või kogu riigi elu ümberkorraldamine moodsa infotehnoloogia üleüldise rakendamise alusel.

Infosektor majanduses hõlmab tegevusalasid informatsiooni kogumisel, töötlemisel ja levitamisel. OECD statistikas loetakse infosektori töötajateks lisaks vahetult infotehnoloogia rakendamisega seotud isikutele igasugused

vaimse töö tegijad, sh insenerid, advokaadid, haldustöötajad, raamatukogutöötajad jne.

Infosfäär on üldmõiste, millega kirjeldatakse kõike informatsiooni kogumise, töötluse ja levi alal toimuvat.

Infoühiskond on termin, millega tähistatakse ühiskonna arengu etappi, kus kõigi sotsiaalsete ja majanduslike protsesside kulgu otsustavalt määrab informatsiooni kättesaadavus infotehnoloogia vahendite varal.

Riigi **informatsiooniline infrastruktuur** hõlmab informatsiooni kogumiseks, levitamiseks ja kasutamiseks määratud ressursse — sidevõrke, andmekogumeid ja võrkudel põhinevaid elektroonseid infoteenuseid.

Sellist «kitsast» tõlgendust kasutatakse USA ja Euroopa Liidu uuemates kontseptuaalsetes dokumentides. «Laias» tõlgenduses hõlmab see mõiste kõiki organisatsioonilisi struktuure, mis aitavad rahuldada riigi ja ühiskonna kõigi sektorite teabevajadusi, sh raamatukogud, kirjastused, muuseumid, massimeedia jne. Mõnikord vaadeldakse informatsioonilise infrastruktuuri osana ka infotehnoloogiavahendite tootmist.

Nüüdisühiskonnas on informatsiooniline infrastruktuur kujunemas kõigi sotsiaalmajanduslike protsesside toimimise vältimatuks aluseks samal määral nagu seda on näiteks teine infrastruktuur — transport. Informatsioonilist infrastruktuuri välja arendades astutakse oluline samm ühiskonna informatiseerimisel ning siirdumisel infoühiskonda.

1.2. Lühike ajalooline ülevaade

Eesti informatiseerimine algas 1960date aastate algul, kui seati üles esimesed elektronarvutid. Neil aastakümnetel kujunes mitu informaatika–alase teadus- ja arendustöö keskust — Küberneetika Instituut (1960), Arvutustehnika Erikonstrueerimisbüroo EKTA (1976), TPI ja TRÜ vastava profiiliga kateedrid (TPI informatsioonitehnika kateeder — hilisema nimega elektronarvutite kateeder — ja majandusinfotöötluse kateeder 1966, TRÜ majanduskübernetika kateeder 1971). Nendes töötati välja kõrgetasemelisi ja üksikjuhtudel maailmatasemele küündivaid lahendusi, mis aga riiklikule süsteemile iseloomulike evitusraskuste tõttu jäid üksikeksemplarideks või levisid ainult N. Liidus ja «sotsialismileeris».

1970datel aastatel arendati N. Liidus ulatuslikku «automatiseeritud juhtimissüsteemide» rajamise kampaaniat. Kümnendi lõpul tegutses Eestis poolsada arvutuskeskust kuue tuhande töötajaga. Kui üleliiduline juhtimisstruktuur 1980date aastate teisel poolel kokku varises, kaotasid need süsteemid mõtte ning neid teenindavad arvutuskeskused likvideeriti järk-järgult, millele aitas kaasa personaalarvutite laialdane sissetung.

Teabelevis püüti tol perioodil arendada teadus- ja tehnikainfosüsteeme. Eestis tegutses selles suunas Eesti Informatsiooni Instituut. Teabeallikate nappuse, samuti tehnilise baasi ja sidevõrkude nõrkuse tõttu ei ar dnud ka see tegevus piisavaid tulemusi.

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