Soviet Scientific and Technical Information System: Its Principles, Development, Accomplishments, and Defects

Ruggero Giliarevskii

Abstract

The Soviet system for scientific and technical information begins with the founding of the Institute of Scientific Information in 1952 at the Soviet Academy of Sciences, now called the All-Russian Institute for Scientific and Technical Information (VINITI). Gradually, VINITI became a center, around which branch information centers developed in industries and in regional capitals that included the central libraries of the Soviet republics and provinces. In 1966 the Supreme Soviet formulated the basic principles for the development of a scientific and technical information system. Many of these fundamental principles never came to fruition, but by the mid-1960s the system counted 2,500 member organs and 11,500 by the mid-1970s.

However, from its very beginning, the system suffered from flaws that increasingly diminished its functional efficiency. The Soviet Union spent ten times less annually on scientific and technical information support activities than the United States, even though the number of specialists working in the field was almost the same. Thus, only about half the Soviet scientific workers had access to a quarter of the world's scientific and technical results—and then only two years after publication. However, since Soviet economics did not stimulate enterprises to master new methods of production, basically the available information was underused. Today, the transition to capitalism requires a totally new system of scientific and technical information. While the previous system encompassed the entire Soviet Union, it now must extend only over Russia.

Introduction

The Soviet Scientific and Technical Information (STI) system (developed in 1952) was destroyed when the U.S.S.R. disintegrated into fifteen independent republics in December 1991. The Soviet Union's national economy was administered by command and constructed on a departmental basis. This method of control was also reflected in the organizational functional structure and practical activity of the STI system.

Transition to market principles of economy began in Russia in the 1990s: Spheres of private property quickly extend; economic methods of management take root; commercialization imperiously meddles in the activity of STI bodies. However, the total transition to information service on a purely market basis would threaten the development of significant spheres of Russia's national economy. The transition requires an essential change in the previous organizational functional structure. A new system is needed, to be created quickly and to make maximum use of structures and staff from the former system.

We must solve this very difficult problem because information and knowledge are essential resources. In this period of transition, scientific development has become a main direction of public manufacture and production. In Russia, with fewer materials and less energy, even more knowledge and skills are required, particularly since the advanced countries of the world have already entered the information era.

Principles

The Soviet STI system was formed in the U.S.S.R. according to the principles stated by V. I. Lenin in 1918–1922, which mainly applied to political speech but also concerned scientific and technical information. These principles embodied the concept of a government monopoly on information activity. In a society entirely

controlled by ideology, these principles have often been used as arguments to substantiate decisions made by the Communist party and government agencies.

During the period of its maximum growth the system was based on the following principles (though not all these principles were formulated explicitly):

- Unified government control of scientific and information activity under the U.S.S.R. State Committee for Science and Technology. The development of a specialized (largely departmental) STI system was delegated to government ministries and departments. Within the republics the STI systems were the responsibility of the councils of ministers, while directors of factories and organizations supervised the work of information departments subordinated to them.
- The structure of the STI system was organized like the national economy. Each management level, from government ministries (departments) to local economy units (enterprises and organizations), corresponded to a certain level in the system. Restructuring in the national economy necessarily caused a reorganization of the system.
- Coverage of all types of documentary sources for all fields of science and national economy. The complete coverage was a proclaimed goal, but in practice there was a wide difference in the degree of coverage in individual industries.
- Specialization of STI agencies based on a rational division of functions. The specialization was twofold: centralized, analytical, and synthetic processing of documents by federal and specialized (and partly territorial) STI agencies and decentralized delivery of information to users, accomplished mainly by interdisciplinary and regional STI agencies and information units at enterprises and organizations.
- Uniform construction of the network and organization of activity of STI agencies and special libraries based on standardized reference information collections (federal, disciplinary, regional, and local).
- Unified classification (indexing) of natural and engineering sciences publications by publishers and editors of special journals and information materials kept by STI services.
- Use of modern technologies (computers, office automation, broadcast, motion pictures, and television) to improve the speed and quality of information services provided to scientists, professionals, and industrial innovators.
- Financing virtually all expenses of information services by government budget. (Some self-sufficiency was required, but in practice it boiled down to shifting funds from one budgeted expenditure item to another.)
- International cooperation in scientific and technical information limited because of the ideological and military-industrial confrontation with economically advanced countries.

The forms, methods, and degree of realization of these principles varied in different phases of the system's development.

First Steps

Until the late 1940s the main sources of scientific and engineering information were publications, obtained by scientists and engineers from publishers or libraries. Gradually, special libraries came to be organized into industry-wide networks.

Although information services were set up at factories and design bureaus and disciplinary information centers in some fields operated independently, their links were sporadic and disorganized. As a result there was large-scale duplication in analytic and synthetic processing of information sources and huge gaps in coverage. The coordinating functions of the State Committee for New Technology and its successor, the State Scientific and Technical Committee, were limited mainly to publishing and disseminating new information in industry. Numerous attempts to publish abstract journals initiated since the 1920s never came to much.

After World War II large files of documentation on military technology, especially rocket and radio engineering systems, were brought to Russia from occupied East Germany. The study of these materials gave powerful impetus to active information work in military industries. The demand for special information in various fields of science and industry intensified when a program to develop nuclear weapons, rocket technology, radar, and technical modernization of all military services was instituted.

This was reflected in a decree of the Council of Ministers, issued on 19 July 1952. The decree founded an Institute of Scientific Information of the U.S.S.R. Academy of Sciences (after December 1955, the All-Union Institute of Scientific and Technical Information, abbreviated VINITI) with the mission to publish an abstract journal providing exhaustive coverage of world scientific and technical literature. In 1956 VINITI began also to publish current-awareness publications

(*Express Information*) with abridged translations of significant articles from foreign periodicals. In 1957 it started the series of monographs *Advances in Science and Technology.* By 1960 the *Soviet Abstract Journal* held the first place in the world through the number of sources covered in its abstracts.

The development of information services at industrial enterprises and scientific research institutes continued. Between 1951 and 1955, 230 information units were created (not counting information services in the defense industry); between 1956 and 1960, this number increased by 1,631. The network of specialized information centers continued to evolve.

The transition to industrial management, according to the regional principle of economic boards, was accompanied by the foundation of regional central scientific and technical bureaus in 1957 and central bureaus of technical information for the industry boards, as well as republic information institutes in the Union republics. A swollen network of regional publishing agencies was inefficient. The Council of Ministers, in its decree of 11 May 1962, required centralization of publishing information materials by specialized central institutes. It required mandatory classification of all publications and materials in natural and engineering sciences according to the universal decimal classification (UDC) by publishers and editors of scientific and engineering journals. The use of the UDC in social sciences was rejected for ideological considerations.

Later decrees issued by the Council of Ministers (14 June 1962, 21 May 1964, and 10 September 1964) created the Central Institute of Patent Information, the All-Union Institute of Technical Information Classification and Coding (VNIIKI), and the All-Union Collection of Standards and Technical Specifications (VIFS). The government introduced coordinated acquisition of foreign literature in natural and engineering sciences purchased for hard currency, and information agencies acquired manuscripts of interest to limited groups of specialists (the manuscripts were received for storage and copies were provided on request). Attempts to circulate unpublished research and development documentation through information channels were continued.

Development

The government decree of 29 November 1966, "On the General National System of Scientific and Technical Information," was a major event in this sphere of activities. It regulated the work of ministries and departments and the governments of Union republics and information agencies of different levels in supplying special information to the national economy. It made the State Committee for Science and Technology responsible for the "management of scientific and technical information in the country." It mandated that all publications in natural and engineering sciences be accompanied by source-supplied abstracts and called for the coordination of the activities in information centers and special libraries based on unified reference and information collections. The All-Union Scientific and Technical Information Center (VNTITsentr) created at this time was required to keep a registry of all unclassified R&D projects, both ongoing and completed; file microphotocopies of progress reports and published abstracts; and provide copies of reports on request.

At the government order the State Committee approved standard organization charts for specialized STI systems, which were to "supply all kinds of information services within their respective subject fields to all enterprises and organizations, as well as individual scientists and experts regardless of their departmental affiliation." It also introduced standard organization charts for interdisciplinary and regional scientific and technical information agencies, calling for creation of information centers based on the information bureaus of industry boards that had been abolished in autonomous republics, provinces, and regions.

In 1968 the All-Union Scientific and Technical Research Institute of Interdisciplinary Information (VIMI) was set up to organize interdisciplinary information exchange in the military industry and to transfer scientific and engineering developments from military to civilian sectors of the economy. The Institute of Scientific Information for Social Sciences was also founded at that time. VIMI became responsible for registration of classified and declassified (except for top-secret projects) research work conducted by the defense industry.

These government decrees resulted in a rapid growth of the network of information agencies. The government decree of 19 July 1971 required VNTITsentr to register classified and unclassified research projects conducted in the defense industry (except for the top-secret work). The VINITI Translation Bureau was converted to the All-Union Translation Center. The VINITI Continuing Education Courses became the Institute of Continuing Education for Information Personnel. The Central Statistical Office of the U.S.S.R. was ordered to prepare lists of STI agencies, including special libraries, every five years.

The growth dynamic of the number of Russian and

Table 1. Growth Dynamics of the VINITI *Abstract Journal* from 1953 to 1990

Branches of Science and Technology	Number of Abstracted Publications				
	1953	1960	1970	1980	1990
Automation—radio electronics (1961–)	—	—	64,015	74,360	100,967
Astronomy (1953–)	1,468	12,850	18,015	19,040	29,777
Biology (1954–)	—	119,971	147,699	120,493	255,648
Computer science (1987–)	—	—	—	—	10,158
Geography (1956–)	—	35,781	43,915	45,317	43,474
Geology (1954–)	—	28,342	39,998	38,359	40,546
Geophysics (1957–)	—	16,510	21,547	24,885	24,557
Mining (1960–)	—	16,973	22,911	21,500	24,498
Publishing—polygraphs (1975–)	—	—	—	4,442	4,276
Information science—informatics (1963–)	—	—	4,244	4,762	6,836
Mathematics (1953–)	455	14,640	25,611	35,592	32,220
Machine-building(1956–)	—	135,545	127,374	130,143	144,850
Metallurgy—welding (1956–)	—	30,394	37,096	44,818	47,739
Mechanics (1953–)	1,140	17,065	33,034	34,558	38,077
Management (1970–)	—	—	1,009	3,113	5,775
Environment protection (1975–)	—	—	—	11,749	20,446
Fire protection (1972–)	—	—	—	8,146	6,473
Transportation (1960–)	—	1,388	58,491	69,944	66,543
Physics (1954–)	—	34,450	65,493	83,890	101,544
Chemistry (1953–)	10,042	109,613	237,011	254,166	214,302
Industry economics (1959–)	—	3,168	8,749	10,137	20,593
Electrical power engineering (1955–)	—	83,288	43,708	55,071	66,567
Total	13,105	658,984	1,000,691	1,094,485	1,314,866

foreign publications covered by the *Abstract Journal* of VINITI is illustrated in Table 1. While the growth of world special literature continued unabated, the data show coverage numbers were stalled at a certain level. The loss of the Soviet's leading position in the world in coverage of the literature by its abstract journals meant that Soviet scientists had access to a dwindling portion of the world information flow. It reduced their capacity to trace advances in foreign science and technology and to use new results in their own work.

One important development was the production of prototypes of computerized copying and other equipment by the Electric Modeling Laboratory of VINITI. The first computerized STI systems were put into operation as a result of research conducted at VINITI. The first nationwide automated STI systems were introduced at VINITI and VNTITsentr, and specialized systems were introduced at Electrical Engineering Institute, Instrument Making Institute, Institute of Electronics and Radio Engineering, Institute of Light Industries, and others.

By the mid-1970s a national information network was largely complete. It encompassed all fields of science, industries, and regions and included main types of STI sources. It realized the basic principles outlined above. However, the results were contradictory. Local organizations were buried under an avalanche of standards regulating every aspect of their information activity. All documents concerning the work of the system had to be approved by ministries, departments, and local enterprises and organizations.

The norm-setting documents regulated collection, analytic and synthetic processing, storage, and dissemination of information: There were world science and engineering literature, patent documentation, technical-normative documentation, translations of scientific and technical literature and documents, ongoing and completed R&D projects, doctoral dissertations, patent certificates for products and industrial processes, know-how, industrial products (industrial catalogs), exhibits at national industrial fairs, computer software, educational motion pictures and newsreels, and results of scientific and engineering conferences, congresses, meetings, symposia, and seminars. However, none of these initiatives was brought to fruition, except for coordinating the purchase of foreign literature. Maintaining a registry of performance indicators of information work, based on

annual reports of STI services, simply increased the amount of red tape.

Expansion of computerized information processing became the main phase of further STI system development. A network of computerized information centers was created, with remote access to databases produced by national, specialized, and regional information services to accelerate delivery of data to scientists, engineers, and managers. Principles to create integrated information systems were formulated. They called for one-time input (description, indexing, and abstracting) of source documents, conversion of the results to a computer form, multi-aspect data processing, and subsequent multiple use to meet various information needs. Selective dissemination of data, publication of various secondary services, and retrospective document and data searches (including photofactographic retrieval) were included.

The first stage of the state automated STI system included the participation of forty-seven STI agencies: eight national, thirteen specialized, and twenty-six regional organizations. As a result automated services were developed and databases formed for selective dissemination of information and retrospective search, as well as production of secondary publications. VINITI became the main source of databases in the country. In 1989 it published 241 databases in science and engineering, including 42 bibliographic databases with no abstracts (325,000 documents per year), 196 databases with abstracts (957,000 documents annually), and 3 databases for organic compounds and reactions, chemical structures, and biotechnology.

In 1990 retrospective databases published by VINITI covered 10 million documents. The patents database had coverage of 12.5 million documents; regional institutes had coverage of 500,000; and most industrial centers processed 50,000 to 100,000 documents each. However, because of a shortage of high-capacity magnetic disks, VINITI could provide direct access to just 0.1 percent of its cumulative file. Remote access to databases never developed because of the low throughput capacity of communication links in the country.

Copying documents on request remained a "bottleneck" in the work of information centers in the first version of the system. The need for copying equipment at information institutes and centers was at a staggering 70 to 80 percent, resulting in delays of up to four to five months and undermining the value of bibliographic and abstracting information, even if the initial records were found quickly in the database.

In September 1981 the State Committee issued a new edition of its "Standard Procedures for Automated System Development," which in subsequent years was supplemented by numerous additional documents. By mid-1985 there were fifty-five such regulatory circulars in effect. As a result the committee lost its ability to enforce these standards on numerous automated systems. The procedures for coordination gradually became irrelevant.

An interdisciplinary automated STI system evolved separately from the first stage of the state system. Its function was to integrate automated services of the defense industries with the services at VIMI through dedicated communication links into a star-shaped network. The channels were then linked by VIMI with several major research centers and design bureaus in the defense industry. VIMI thus became a powerful information service center. Its equipment and software (in 1992, up to six ES-1066 computers with external memory up to twenty gigabytes) allowed it to simultaneously process up to three hundred requests and service a network of three thousand to five thousand subscribers. This information center satisfied ten to fifteen million requests per year, comparable to the performance of the biggest information centers of the world.

However, the hope of creating an effective system to transfer new developments from the defense industry into the civilian sector was never fulfilled. In fact, the military industry adopted more new ideas from the civilian sector than vice versa, simply because the financial, material, and technical conditions and the infrastructure of defense industry made it better equipped to introduce innovations.

Numerous attempts by the State Committee (in 1978, 1984, and 1987) to draw up a new general government decree mapping out the development of the system failed because the committee lacked new ideas. It could no longer manage the information system according to the old policies. In 1988 it abolished the old practice of annual official approval of the list of information publications (titles of journals, their sizes, and the subject scope of abstracting and analytic reviews).

International Efforts

On 27 February 1969 the governments of Bulgaria, Hungary, the German Democratic Republic, Mongolia, Poland, Romania, U.S.S.R., and Czechoslovakia signed an agreement to create an International Center of Scientific and Technical Information (ICSTI) in Moscow. In 1973 Cuba and in 1979 Vietnam joined this project. ICSTI was treated as an independent international

organization, but in actual fact it was a branch of Comecon. In the 1970s it issued handbooks describing the information services of its member countries and listing their publications, as well as presenting a series of reviews of information work in these countries.

The next stage was the gradual formation of an International System of Scientific and Technical Information, which included seven international specialized systems that processed different types of documents and twenty-two international specialized STI systems. Effective interaction of information services of the member countries was facilitated by the center's standardization efforts. As a result several Comecon standards and "Normative Technical Suggestions of ICSTI" were produced. Some work developed standard information technologies to be submitted to national information centers, providing information services to the Comecon administration and its coordinating bodies. This center was, in fact, a component of Comecon administration similar to the function of Soviet industrial centers as units in the management of the national economy. The center's results were determined largely by the preferential treatment it received, such as higher salaries of employees, funds for freelance experts, and a better equipment base. It was a showcase demonstrating the advantages of socialist division of labor. However, some of its activities were truly effective and retained their value for the future.

Remote access to foreign databases through dedicated communication links, specifically with the shared-use computing information center of the Academy of Sciences, was a new stage in the STI system development. The National Center of Automated Information Exchange, created for this purpose at the All-Union Institute of Applied Automated Systems, was linked with computer networks in other countries through remote communication nodes in Austria and Finland. The practical use of the computer network by U.S.S.R. information agencies, however, was hindered by numerous bureaucratic procedures required for network access.

The dissolution of the U.S.S.R. and the formation of the Commonwealth of Independent States meant the disbanding of the State Committee on Science and Technology. Its control of the information systems was ended. Instead, Russia formed the Administration of Scientific and Technical Information and a Committee for Patents and Trademarks. Before 1988 the Association for the Management of Scientific and Technical Information and Knowledge Dissemination controlled a network of interdisciplinary regional information centers in Russia. It was converted in 1988 to the Special Information Association of the Russian Government Planning Committee. Later it became the Russian Association of Information Resources for Scientific and Technological Development (Rosinformresurs), subordinated to the government of the Russian Federation (according to the government decrees of 28 August 1992 and 6 January 1993). The association operates as an integrated information and technological complex responsible for the maintenance and use of regional information resources in Russia.

Accomplishments and Shortfalls

The main accomplishment of the State STI system at the time of economic reform in Russia was the completion of a four-level network of information services, specializing in different types of documents, acquisition of document collections, database generation, and supply of services to various user groups. Bureaucratic barriers were not a flaw of the system itself but rather the inevitable consequence of the command economy and science management. By the same token it was inevitable that the system structure largely replicated the organization of economic management in the U.S.S.R.

National STI Agencies

National agencies were created at different times by government departments participating in the formulation of the national scientific and technological policies. Allocation of funds for the activities, equipment, and the like increased or decreased depending on the importance assigned by the government to various aspects of technological policy. But there was no general underlying rationale behind these changes.

For instance, the hope that basic science would have a key role in the global rivalry between socialist and capitalist systems led, in 1952, to the formation of VINITI with the mandate to provide an exhaustive coverage of the world literature. The commitment to widespread dissemination of advanced know-how to improve productivity was behind the creation of the giant Exhibition of National Economic Achievements in 1959. To intensify the activity of inventors in industry and research, the Patent Information Center was set up in 1962. The attempt to raise Russian technology "to the best world levels" by means of standardization gave rise to the VNIIKI and VIFS institutes. The decision to organize VIMI in 1968 was prompted by the effort to achieve military and technological superiority over the West. Likewise, the plan to switch economic management to

the regional level was behind the formation of centers at industry boards and republic information institutes in Union republics in 1957. Each time, when it was discovered that the next "key link" failed to produce immediate dramatic results, the government switched its attention to a new panacea.

As a result the specialization of national STI agencies directing the descending information flow was based on different principles—partly on subjects and partly on types of document. The national STI agencies still remained the main sources and channels of information delivery to scientists and to other professionals. They had just 10 percent of the information industry workforce and were responsible for production of 74 percent of all publications (including 83 percent of abstracts). They satisfied 8 percent of requests for supply of scientific and engineering documents and their copies.

Turf wars among government agencies were responsible for the lack of centralized publishing of information on world literature. During the early years of its existence VINITI abstract journals were superior to their foreign counterparts, but limited resources (especially scarce hard currency funds) by the latter half of the 1970s stabilized coverage at 1.3 million, and the journals increasingly lagged behind their foreign competitors. The coverage of the world literature in the abstract journals published by federal centers responding for medical, agriculture, and construction information never exceeded 20 percent of the world information flow, providing only fragmentary information to subscribers with no clear selection criteria. These three information centers (VINITI, VIFS, VIMI) largely duplicated the VINITI effort by processing the same periodicals. The abstracts supplied by the Institute for Social Information were also selective because of ideological considerations. Expert assessments of documentary information sources received by the state system in 1987 revealed these inadequacies; while patent documentation was covered to an extent close to 100 percent, just 50 percent of scientific and technical publications were processed. For normative and technical documentation the number was 10 percent, with just 8 percent of information on new industry products available. Some 1,500 important foreign periodicals were not received in Russia at all. Conference proceedings, R&D reports, and dissertations were received sporadically. No information agency was responsible for systematically collecting and processing these documents.

All national STI agencies were concentrated in Moscow, where over a thousand general, special, and technical libraries (not counting the libraries in the defense industry) were located, with multiple duplication of book and journal collections. However, this did not guarantee scientists access to even domestic books or periodicals. A large part of library collections were taken out of circulation because of lack of space, and some materials were simply scrapped. Moreover, the central national library (the Lenin Library) made a negligible contribution to the network: It functioned merely as the information agency on problems of culture and arts. Despite these shortcomings the centralized processing of the main types of documents by national STI agencies enabled them to eliminate duplication in the purchasing and analytic-synthetic (meaningful) processing of the literature (especially foreign publications). This reduced the expenses of specialized and regional information systems involved in the formation of collections and provided access to centralized document files to participant organizations.

Another achievement of the national information agencies was formulation of procedures for analytic and synthetic processing of large flows of documents and computerized generation of a wide spectrum of information products and services. Preservation of the former national STI agencies at the federal level and promotion of their activity with elimination of unjustified duplication of effort remains a key challenge facing scientific and technological policy in Russia. Another important objective is connecting national information centers to communication networks (including the defense network, as has been done in the United States) to enable them to realize the full potential in providing access to information for scientists and other professionals.

Central Specialized STI Agencies

The disciplinary principle in the designing of the state system was officially established by the edict of the Council of Ministers on 29 November 1966 and resulted in rapid growth of the number of information centers in industry centers.

Employing some 11 percent of the personnel of the state system, the industrial centers produced some 20 percent of information publications, including 69 percent of reviews and 100 percent of industry catalogs. Their reference information collections amounted to just 2 percent of the total size of the holdings of the system and largely duplicated materials at VINITI, the Republic Scientific and Technical Library (for scientific and engineering literature), the Patent Library (for patent documentation), and so forth. But they were responsible for

just 2 percent of document delivery on request. These central industrial centers provided methodological guidance to information units at enterprises and organizations and helped developed a network of information services. They monitored compliance with national and industry-wide norms and methodologies and identified and promoted new methods of information work. The growth in the number of people employed by these centers was an indirect result of regular personnel reductions at ministries and administrative agencies. While the functions of the ministries and agencies remained unchanged, the staffs were reduced, with some of these individuals simply transferred to the staffs of institutes and design bureaus, including information centers.

The basic concept—each system was to provide all kinds of information service to users in their subjects "regardless of their affiliation"—was never put into effect, mainly because industrial information centers were part of the industrial management system. In reality they not only provided preferential treatment to organizations in their industry but also consistently represented the views of their superiors in the annual reports on the main domestic and foreign achievements in science, engineering, and industry. They wanted to put their industry in a better light and sometimes went so far as to distort the actual state of affairs.

The standard charters of STI agencies called for creating in industries "central scientific research institutes for information and technical economic studies." However, while the standard charters called for technical economic studies "based on information materials (publications and other documentary sources accumulated in specialized information collections)," the ministries and other administrative bodies were primarily interested in estimates of the technical and economic indicators of the activity of enterprises in the industry. The effort of such institutes was increasingly concerned with these tasks, and they became more and more dependent on planning and economic departments of ministries.

Initially, the industrial centers were fully financed from the government budget, but in recent years all kinds of imitation self-sufficiency principles were introduced because enterprises and organizations rather than the individual users paid for the information services. Even after the switch to self-sufficiency was completed for scientific research organizations of the industrial ministries, seventy-eight centers covered 60 percent of their expenses from budgets of their ministries and administrative departments.

By the mid-1980s the activities of these centers and other STI agencies were controlled by such a large number of instructions, manuals, procedures, standards, and other norm-setting documents that it became impractical to monitor compliance. The authorities lost their ability to regulate the development of specialized STI systems. In the course of their evolution many centers became offshoots of the bureaucratic apparatus of ministries, rather than scientific research organizations. The uniformity in the structure and functioning of these networks was largely an illusion.

On the other hand, many of these centers accumulated experience in analyzing documentary sources and compiling reviews of the development of their respective industries in Russia and other countries. Several centers created automatic information services with rapid and purpose-oriented operations. The methodological guidance accumulated by them (mainly concerned with managing information services of subordinate organizations) was of value only as long as command economy methods were still in place.

Republic STI Institutes

The first Republic Scientific and Technical Information Institute (RINTI) was formed in 1954. Other such institutes were created in the 1960s when industry management was organized according to the regional principle.

While initially RINTIs were subordinated to republic industry boards and later, by the late l960s, research coordination committees, they were under the control of planning committees of Union republics and became elements of national economy management in their territories. Their major function was to provide information services to government officials and executives, especially supplying analytic materials (reviews and reference data) to support economic and social management. Publishing secondary documents in the national languages of the republics was another important function.

Also suffering from turf rivalry, RINTI's main objective was to support regional interests in the struggle with central agencies. The privileged position of these institutes in the system is indicated by the fact that they constituted 7 percent of expenditures, while employing just 2.6 percent of workers.

Interdisciplinary Regional STI Centers

Since 1957 central technical information bureaus were set up at industry boards during the period when industry was controlled according to a regional principle.

When the national economic management was reorganized and converted to the specialization principle (in 1965), the government initially decided to close down

not only the industry boards but also their information bureaus. After further study this decision was reconsidered: In the Ukraine and Kazakhstan thirteen bureaus were specialized by industry, while in Russia twenty-four bureaus were used as interdisciplinary information centers.

In the past few years the network of regional centers (as well as the network of former All-Union STI agencies) has demonstrated that it can function effectively even during an economic crisis. This vitality is explained by several factors. The large size of the former U.S.S.R. (and today's Russia) required (and still requires) collections of special information accessible to this immense territory, including holdings of patents, standards, and catalogs, duplicating the central holdings kept in Moscow. The rapid pace of industrial innovation in these areas confirms the importance of support services in the Far East and eastern and western Siberia provided by regional patent collections. The proximity of these centers to enterprises and organizations enabled them not only to supply new data and documents, but also to create their own information collections and organize exchange of data among the republics of the former U.S.S.R. and various regions of Russia.

Regional literature and document holdings (formed in the republics of the former U.S.S.R. and regions of Russia) are in demand: Specialists received more than 50 percent of all documents and copies from the collections of central agencies through these services (including libraries). Through selective dissemination of information, republic information institutes and other regional agencies provided their subscribers some 60 percent of new data they received from central organs.

Despite these positive accomplishments there have been some significant shortcomings. An inferior technological base and the lack of skilled personnel have had a negative effect on information quality and speed of service. Important problems remain with the network organization and its evolution as a component of the informational infrastructure necessary for technological progress.

The Rosinformresurs Association, which according to the Russian government decrees (28 August 1992 and 6 January 1993) comprises sixty-nine regional centers, is currently forming local information collections for Russian regions to develop this federal network into an integrated resource. This national network provides access to information sources in various parts of Russia, leaving the local governments responsible for development or for other regional information centers focused on local needs.

STI Agencies of Enterprises and Organizations

Government decrees and orders, the standard charters of information agencies, and other norm-setting documents described information departments and bureaus as structural units that perform the following functions:

- Supply specially prepared information to support decision making in the management of research, development, and industry.
- Supply information to professional users for research and development work, process engineering, and industrial operations.
- Monitor information use by departments of an enterprise and provide information on new technological developments and advanced industrial experience to higher-level information agencies.

In their true form these departments and bureaus could be found only at larger information institutes, design bureaus, and factories. Even then they often combined functions of several services: information, patenting of inventions, technical (design) documentation, and standardization. The number of information departments and bureaus grew rapidly after the edict of the U.S.S.R. Council of Ministers on 29 November 1966. As of 1 January 1990 an average information service at an enterprise had 9.3 employees.

This number hides the actual range, which can run as large as a hundred or more employees at large research institutes and design bureaus in the defense industry to as few as a single full-time information officer at a medium-sized enterprise. Just slightly above 10 percent of 46,000 industrial enterprises had information departments of their own. These departments met 78 percent of requests for primary documents from their own holdings. Many have worked out effective methods for supplying information to users, including local automated services built around databases received from federal, specialized, or regional centers. The market reform requires true independence on the part of industrial enterprises and other organizations. Regulation of information work at the local level is counterproductive, even if within government agencies. At the moment local managers should be able to decide whether to retain, disband, or reorganize their information services.

State Information System as a General Concept

Numerous official documents, with no clearly defined legal status, regulated the specialization of information services (processing, accumulating, and delivering of information extracted from documents) in the country and circulation of the documents themselves. The basic

principles of the state STI system were correct; the scope of science and technology and industries and regions that it was supposed to cover made the system unprecedented in world history.

However, the mechanism directing the flows of scientific and technical information had serious flaws. Based either on strict sanctions of the command economy or the interests of user enterprises and individuals, neither mechanism was at work in this system. Each mechanism required additional expenditures, but the outlays on scientific and technical information for the past fifteen to twenty years remained at the annual level of 500 to 600 million rubles.

The U.S.S.R. and the United States had a comparable number of people employed in scientific information, but the Soviet Union spent less on this activity by an order of magnitude. As a result just half of scientists had access to one-quarter of the world flow of scientific and technical literature, with the delay of one-and-a-half to two years, while in the United States 90 percent of all publications became accessible virtually immediately after being issued.

Billions invested in automated systems were not used effectively because the command economy, based on arbitrary decisions, essentially did not need, and in fact was hostile to, objective information. Mistrust of automated systems by the national government was evident in the development of the first stage. A full realization of its potential was also prevented by the shortage of high-capacity magnetic media and fast communication channels and frequent malfunctions in the equipment.

Lack of interest in technical innovation and slow introduction of new engineering concepts results from a general shortage of resources and centralized distribution of funds. The dire state of the industry in 1986, which manufactured just 29 percent of its mass-produced engineering items that met world standards, with 14 percent for the machine tools, and 17 percent for instruments, could not be blamed on a shortage of engineering information.

The main causes of this situation were fourfold: 1) systematic underestimation of the importance of basic science as a foundation of technological progress; 2) bureaucratic barriers between scientific institutions subordinated to the narrow interests of their respective financing agencies; 3) monopoly in technology, engineering, and production of equipment with the specifications defined by the manufacturer rather than the customer; and 4) manufacturers' disincentive to embark on intensified research and development ventures. The latter is indirectly evidenced by the fact that 53 percent of invention applications were rejected by experts for lack of novelty (the comparable figure for the United States is 36 percent). The industrial and technological infrastructures in civilian sectors of the economy were backward, and even the best engineering concepts, when realized, turned out to be shoddy products.

Finally, the intensive militarization of the economy held back Russian science and technology, which continued to lag behind world standards. The potential capabilities of the system in its previous form were not used fully; scientists and other professionals (and sometimes even information workers) were often unaware of these capabilities.

The Future

The development of a national information system for the Russian Federation should proceed from a careful effort to preserve existing information resources and a thorough analysis of the capabilities of the units inherited from the U.S.S.R. system and the needs for information service, primarily in socially important nonprofit spheres. Concepts based on the complete commercialization of STI agencies, treating information as no more than a marketable commodity, are shortsighted.

The new national information system of Russia should be developed in the context of the general improvement of science communications, which include processes of representation, transmission, and production of scientific information in society. These processes form the mechanism of the existence and evolution of science. This implies that restructuring will also affect the channels of scientific and technical information not included in the scientific and technological information system, such as publishing books and journals and use of mass media (radio and television). The improvements of all these forms of information transmission should be fully taken into account as they are affected especially by automated services.

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