InterNyet: why the Soviet Union did not build a nationwide computer network

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This article examines several Soviet initiatives to develop a national computer network as the technological basis for an automated information system for the management of the national economy in the 1960s–1970s. It explores the mechanism by which these proposals were circulated, debated, and revised in the maze of Party and government agencies. The article examines the role of different groups – cybernetics enthusiasts, mathematical economists, computer specialists, government bureaucrats, and liberal economists – in promoting, criticizing, and reshaping the concept of a national computer network. The author focuses on the political dimension of seemingly technical proposals, the relationship between information and power, and the transformative role of users of computer technology.

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In October 1961, just in time for the opening of the Twenty-Second Congress of the Communist Party, the Cybernetics Council of the Soviet Academy of Sciences published a volume appropriately entitled, *Cybernetics in the Service of Communism*. This book outlined the great potential benefits of applying computers and cybernetic models in a wide range of fields, from biology and medicine to production control, transportation, and economics.[1] In particular, the entire Soviet economy was interpreted as 'a complex cybernetic system, which incorporates an enormous number of various interconnected control loops.' Soviet cyberneticians proposed to optimize the functioning of this system by creating a large number of regional computer centers to collect, process, and redistribute economic data for efficient planning and management. Connecting all these centers into a nationwide network would lead to the creation of 'a single automated system of control of the national economy.'[2]

The new Party Program adopted at the Twenty-Second Congress included cybernetics among the sciences that were called to play a crucial role in the construction of the material and technical basis of communism. The new Program vigorously asserted that cybernetics, electronic computers, and control systems 'will be widely applied in production processes in manufacturing, the construction industry and transport, in scientific research, in planning and designing, and in accounting and management.' The popular press began to call computers 'machines of communism.'[3]

The proclamations of Soviet cyberneticians caused considerable alarm in the West. 'If any country were to achieve a completely integrated and controlled economy in which "cybernetic" principles were applied to achieve various goals, the Soviet Union would be ahead of the United States in reaching such a state,' wrote an American reviewer of *Cybernetics in the Service of Communism*. 'Cybernetics,' he warned, 'may be one of the weapons Khrushchev had in mind when he threatened to "bury" the West.'[4] The CIA set up

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a special branch to study the Soviet cybernetics menace.[5] It issued numerous reports, pointing out, among other strategic threats, the Soviet plans to build a 'Unified Information Net.'[6] Based on CIA reports, in October 1962 President Kennedy's top aid wrote in an internal memo that the 'all-out Soviet commitment to cybernetics' would give the Soviets 'a tremendous advantage.' He warned that 'by 1970 the USSR may have a radically new production technology, involving total enterprises or complexes of industries, managed by closed-loop, feedback control employing self-teaching computers.' If the American negligence of cybernetics continues, he concluded, 'we are finished.'[7]

Yet the grandiose plans of Soviet cyberneticians to reach optimal planning and management of the national economy by building a nationwide network of computer centers never came to fruition. Western analysts have commented on the technological obstacles to the development of Soviet computer networks, such as the lack of reliable peripherals and modems, poor quality of telephone lines, and weak software industry.[8] Although these considerations significantly limited the options for Soviet advocates of national computer networks, these factors could hardly have played the decisive role. Other Soviet large-scale technological projects, such as the nuclear weapons and the space program, were able to overcome much more serious technological challenges. This article, by contrast, focuses on the *political* dimension of several Soviet initiatives to develop nationwide computerized information systems for the management of the national economy in the late 1950s–1970s. It explores the origins, government consideration, and gradual transformation of these proposals in a broad socioeconomic and political context. This article attempts to take the history of Soviet computer networks out of the narrowly conceived history of computers and to make it part of Soviet history, in which technology and politics proved closely intertwined.

1.   The rise of 'economic cybernetics'

By the time of Stalin's death in 1953, the Soviet economy 'resembled an exhausted beast.'[9] As a consequence of Stalin's forced collectivization of agriculture, shock industrialization, and devastations of war, the Soviet industry suffered from severe disproportions, shortages, and arbitrary pricing. The central planning system was struggling with the task of assigning production quotas to each and every economic unit and distributing the output according to the continuously revised national plan. Top–down decision-making did not provide incentives for initiative and innovation. The attempts to solve these problems by administrative measures resulted in the proliferation of centralized government agencies and the expansion of bureaucracy, further complicating the situation.

Soon after he consolidated his power as the leader of the Communist Party and chairman of the Council of Ministers, Nikita Khrushchev announced a bold reform aimed at a radical decentralization of economic management. In May 1957, he introduced a system of regional economic councils. The central ministries that had controlled individual branches of agricultural and industrial production across the entire country were abolished, and the new councils assumed responsibility for all types of production within their regions. Instead of reducing bureaucracy and fostering initiative, however, the reform produced total chaos. Supply chains were severely disrupted, because different enterprises within a single supply chain often ended up under the control of different regional councils. To remedy this problem, gradual 'consolidation' of councils began: groups of regional councils united to form larger inter-regional councils; the latter, in turn, grouped under the central economic council of a Soviet republic; and the republican councils were subordinated to the Supreme Economic Council. To coordinate production in various branches of industry across the country, a number of 'state committees' were established in Moscow, taking on many functions of the

former central ministries. As a result, by 1963 'the bureaucratic apparatus for "managing" industry not only had not been reduced, as had been intended by the concept of "decentralization," but had almost tripled.'[10] At the same time, industrial production output steadily declined from 1959 to 1964.[11]

The electronic digital computer arrived at the scene just in time to promise a panacea for the Soviet economic woes. By the late 1950s, the language of cybernetics acquired the aura of objectivity and truth, and computer simulation came to be viewed as a universal method of problem-solving. At that time, a group of prominent economists, mathematicians, and computer specialists raised the possibility of using computers to improve economic management. Under Stalin, mathematical methods in economics had been subjected to ideological critique and lingered on the margins of the discipline. With the onset of Khrushchev's political 'thaw,' previously suppressed ideas were now openly discussed.[12] In December 1957, the Soviet Academy of Sciences suggested in a confidential report to the political leadership that 'the use of computers for statistics and planning must have an absolutely exceptional significance in terms of its efficiency. In most cases, such use would make it possible to increase the speed of decision-making by hundreds of times and to avoid errors that are currently produced by the unwieldy bureaucratic apparatus involved in these activities.'[13] The Academy proposed creating a computer center in every region to aid planning, statistics, engineering, and scientific research.

The Soviet cybernetics movement, rapidly gaining force in the latter half of the 1950s, provided both an intellectual framework and an institutional umbrella for mathematical economics. Soviet cyberneticians pursued a much more ambitious agenda than originally envisioned by Norbert Wiener in his *Cybernetics* or developed later by the Cybernetics Group in the USA.[14] In the Soviet context, the term 'cybernetics' encompassed not only the initial set of feedback control and information theory concepts, but the entire realm of mathematical models and computer simulations of 'control and communication' processes in machines, living organisms, and society. By closely associating cybernetics with computing and capitalizing on the popular image of the computer as an 'objective' truth-teller, Soviet cyberneticians overturned earlier ideological criticism of mathematical methods in various disciplines, and put forward the goal of the 'cybernetization' of the entire science enterprise. In this sense, Soviet cybernetics was not a settled discipline, but rather an ambitious project of introducing mathematical methods and computer models into the life sciences and the social sciences.

A large number of previously marginalized research trends found a niche for themselves under the aegis of the Academy Council on Cybernetics, including mathematical economics, which was refashioned as 'economic cybernetics.'[15] Conceptualizing the Soviet economy in cybernetic terms, economic cyberneticians regarded economic planning as 'a huge feedback system of control (or regulation). If a "signal" is delayed, the system may start to oscillate.'[16] Economic cyberneticians aspired to turn the Soviet economy into a fully controllable and optimally functioning system by managing its information flows.

The Cybernetics Council set up an economics section, regularly published papers on mathematical economics in the annual volumes of *Cybernetics in the Service of Communism*, and sponsored several conferences, bringing mathematicians, computer scientists, and economists together. In 1958, only a handful of Soviet economists were interested in mathematical models of planning and management. In 1960, the first national conference on the use of mathematical methods and computer in economics and planning was held; the following year, over 40 institutions conducted research on mathematical economics.[17] By 1967, the Council on Cybernetics coordinated cybernetic research in some 500 institutions, and half of them were engaged in applying cybernetic methods to economics.[18]

Soviet projects in computerized economic management were to a large extent inspired by parallel developments in military computing. All the early Soviet computers were built for the military. The initiative to apply computers in economics came from the same engineers who designed military systems, and they brought the 'command and control' philosophy of military computing into their economic proposals.

2. Military networks for civilian use?

In the mid 1950s, Soviet military planners became seriously alarmed by the news of the development of the American air-defense system SAGE (Semi-Automatic Ground Environment), a centralized nationwide network of computerized command-and-control centers capable of coordinating a response to a massive air offensive.[19] The Soviets decided to build three systems – an air defense system, a missile defense system, and a space surveillance system – each with its own centralized computer network.

All three networks were developed independently by different organizations. In 1956 the Scientific Research Institute No. 101 (later renamed the Scientific Research Institute of Automatic Equipment) was created specifically to design a national air defense system similar in function to SAGE. In the early 1960s, the Institute developed TETIVA, the first Soviet transistor-based computer, and built a network, which comprised eight computers coupled in pairs for back-up and located in distributed command-and-control centers.[20] In the late 1950s, the Moscow Institute of Precision Mechanics and Computer Technology developed a network for a prototype missile defense system, code named 'System A,' at the Sary-Shagan Proving Ground near Lake Balkhash in Kazakhstan. Two large universal computers, M-40 and M-50, at the command-and-control center were linked with several specialized computers that controlled remote radar installations. System A was successfully tested in March 1961, after which Khrushchev publicly boasted that Soviet anti-missiles could 'hit a fly in outer space.'[21] Work on the space surveillance system began in 1962; its purpose was to track Soviet and foreign spacecraft with high precision needed for possible destruction of spy satellites. It had two remote nodes, in Sary-Shagan and near Irkutsk in Siberia, and a command-and-control center near Moscow. Each node included eight computer-controlled radar stations. The Moscow Institute of Electronic Control Machines developed transistor-based M4-2M computers for its distributed network, which exchanged data across thousands of miles and was fully automated.[22]

The SAGE model of a hierarchical control network inspired not only military, but also civilian projects. At a plenary meeting of the Academy of Sciences in October 1956 director of the Control Machines and Systems Laboratory Isaak Bruk proposed creating a hierarchical network of 'control machines' to collect, transmit, and process economic data and to facilitate decision-making by computer simulation.[23] Two years later his laboratory was transformed into the Institute of Electronic Control Machines, which developed M4-2M computers for the space surveillance system, as well as M-5 computers for processing economic data.[24] In 1961 the Institute was transferred under the control of the State Economic Research Council, and later the State Planning Committee, all the while continuing its work on both defense and economic applications.

Another proposal to create a computer network for economic management came directly from the military. In January 1959, Engineer Colonel Anatolii Kitov, deputy head of the Computation Center No. 1 of the Ministry of Defense, a co-author of the first Soviet article on cybernetics, and the author of the first Soviet book on digital computers, sent his book to Khrushchev and attached a letter, which advocated 'radical change and improvement of methods and means of management by making a transition from the manual and personal

forms of management to automated systems, based on the use of electronic computing machines.' He proposed first to install computers at several large factories and government agencies, then to link them together to form 'large complexes,' or networks, and ultimately to create a 'unified automated management system' for the national economy. Kitov suggested that these measures would lead to a significant reduction in administrative and management staff and even to the elimination of certain government agencies. He realized that potential personnel cuts would cause friction, and suggested that a new powerful agency be created to implement the automation and reorganization of work in all government institutions. The computerization of economic management, he argued, would 'make it possible to use to the full extent the main economic advantages of the socialist system: planned economy and centralized control. The creation of an automated management system would mean a revolutionary leap in the development of our country and would ensure a complete victory of socialism over capitalism.'[25]

The Soviet leadership took Kitov's proposal seriously and appointed a panel led by the chairman of the Cybernetics Council of the Academy of Sciences Engineer Admiral Aksel' Berg, one of Kitov's biggest supporters. In June 1959, the Central Committee held a meeting, which publicly called for widespread mechanization and automation of industrial production and accelerated development of computers. In December, the Party and the government adopted a joint resolution on automation in accounting and engineering. The Soviet leadership took a cautious approach, however. It encouraged new technologies but stopped short of any organizational reform. The resolution ordered the construction of specialized computers for economic analysis, statistics, and planning, but it did not include Kitov's most radical ideas – a nationwide computer network and an automated management system for the entire economy.

Inspired by their partial success, cyberneticians continued their campaign. At a national conference on mathematics and computer technology in Moscow in November 1959, Berg, Kitov, and the deputy head of the Cybernetics Council mathematician Aleksei Lyapunov presented a joint paper, in which they proposed creating a 'unified state-controlled network of information processing centers' under 'centralized control' as a basis for 'a single uniform system of information and computer service, meeting the demands of all institutions and organizations in the processing of economic information and in the execution of computing work.'[26] In September 1960 they published a joint article in the leading Party journal *Communist*. The authors argued that an automated management system for the national economy, based on a unified territorial network of information computation centers, would provide the means for the automatic collection of economic data, planning, distribution of resources, banking, and transportation control. They claimed that it would take only two or three minutes for a computer to complete a task that would take a week for a human worker. Given that nearly a million people were involved in processing material supply documents at various regional economic councils and individual enterprises, the promised savings looked enormous. An introduction of computers would slash supply planning time from three or four months to three days, cut the management by half, and reduce the cost of supply management by a factor of five. The authors claimed that computer installation expenses would be recouped within two years. They promised that computers would greatly improve the efficiency and productivity of economic management, and would provide the basis for a powerful upsurge in the national economy.[27]

In the meantime, Kitov came up with an idea of radically reducing the cost of construction of a nationwide computerized system. He proposed creating a dual-use nationwide network of computer centers for both military and civilian applications. As was typical for the time, Kitov believed that computer capacities outpaced the demand. He reasoned that

military calculations would not entirely fill the capacity of computer centers, and in the spare time these facilities could be used for civilian purposes. Kitov suggested building these centers underground in secret locations and protecting them against a direct bomb hit. These centers would then be connected by hidden communication lines with civilian information-collection stations in big cities, turning the entire network into a dual-use system. Again, he submitted his proposal directly to the Soviet leadership, but it was referred to a Ministry of Defense committee headed by the Marshal Konstantin Rokossovsky and dominated by the military top brass. Kitov's biggest supporter Aksel' Berg had left the government by that time, and despite the backing from a handful of less influential computer enthusiasts among the military, Kitov's proposal was rejected. Kitov's appeal to the Party leadership over the heads of his military superiors and his critique of the current state of affairs with computing at the Ministry of Defense infuriated the committee. He was expelled from the Communist Party, lost his position as deputy director of the Computation Center No. 1, and was discharged from the Army.[28] The proposal was formally rejected on the grounds that the combination of civilian and military functions was inefficient. Perhaps the military feared that they might be held responsible for failures in the civilian economy. Kitov personally believed that the main reason behind the rejection of his proposal was that 'people in power were concerned that, as a result of the introduction of computer technology, many of them could prove redundant.'[29]

Despite the setbacks, cyberneticians continued their public campaign for a nationwide computer network. In 1962, in another article in *Communist*, the leading communications engineer Aleksandr Kharkevich proposed to build a unified nationwide information transmission system on the principles of SAGE. He proposed to digitize all telephone, telegraph, radio, and television communications and to transmit all signals over a unified computer network for 'information transport.' He envisioned a 'central depository of information,' which would be fully automated and would provide instant response to information inquiries from any terminal on the network.[30] Eventually the campaigning paid off: the Soviet leaders embraced the cybernetic vision.

3. Communism with a cybernetic face

The vision of the Soviet economy as a cybernetic system appealed to the Party and government leadership. The Soviet leaders readily accepted the idea that economic problems could be solved merely by improving information flows and management techniques, without any radical reform. At a Party Central Committee Plenum in November 1962 Khrushchev called on his Party comrades to borrow widely Western 'rational' managerial techniques. In the conditions of a planned economy, he argued, these techniques would be even easier to implement than under capitalism. Khrushchev came to view not only the economy, but Soviet society in general as a tightly controlled, organized system, regulated in all of its aspects. The cybernetic control of automated assembly lines served for him as a model of how the entire society should function: 'In our time, the time of the atom, electronics, cybernetics, automation, and assembly lines, what is needed is clarity, ideal coordination and organization of all links in the social system both in material production and in spiritual life.'[31]

Ironically, Khrushchev's vision clashed with the liberal social ideals cultivated by cyberneticians. Norbert Wiener believed that a cybernetic social theory would play a liberating role by breaking down rigid vertical hierarchies of control, by removing barriers for free communication, and by encouraging feedback-type interactions among different layers of society.[32] This liberal version of social cybernetics widely resonated with Soviet

intelligentsia's enthusiasm for the political 'thaw' that marked the first years of Khrushchev's rule after the 'winter' of Stalin's regime. In his own vision of a cybernetic society, however, Khrushchev placed more emphasis on control than on communication. He firmly associated communism with social order and efficient organization. Khrushchev viewed the liberal talk about 'freedom' as potentially disruptive and even harmful to this vision of well-ordered communism. In March 1963, he told a group of leading intellectuals: 'Maybe you think that there will be absolute freedom under communism? Those who think so don't understand what is communism. Communism is an orderly, organized society. In that society, production will be organized on the basis of automation, cybernetics, and assembly lines. If a single screw is not working properly, the entire mechanism will ground to a halt.'[33]

In November 1962, the deputy chairman of the Soviet Council of Ministers Aleksei Kosygin called to his office president of the Academy of Sciences Mstislav Keldysh and director of the Institute of Cybernetics in Kiev Viktor Glushkov. Glushkov, who had been familiar with Kitov's ideas, presented a new proposal to build an automated system for economic planning and management on the basis of a nationwide computer network. Kosygin generally supported the idea and soon appointed Glushkov chairman of the Interagency Scientific Council on Computer Technology and Automated Management Systems.

In May 1963 the Party and the government issued a joint resolution, which decreed new drastic measures aimed at accelerating the introduction of computers into the national economy. Numerous central government agencies were ordered to set up their own computer centers and research institutes. Cybernetics turned into a buzzword. Popular press touted computers as a panacea for all problems, and cybernetic concepts were floated everywhere, from philosophy to atheist propaganda. Even Kosygin's son-in-law privately complained that he had to put 'cybernetics' in the title of his book to make it more appealing.[34]

The Kiev Institute of Cybernetics started planning a wide-ranging economic management reform on the basis of computerization. In 1963, Glushkov visited over 100 organizations, studying their management methods and information flows. The draft design of a nationwide computer network included 100–200 large centers in major cities serving as regional nodes, which would be linked to 20,000 smaller centers located in government agencies and large enterprises. The large centers would be connected by dedicated high-bandwidth channels without channel-switching or message-switching. The network would support a distributed data bank, which anyone could access from any terminal on the network after an automatic authorization check.[35]

Glushkov's initial proposal included one particularly controversial provision. He envisioned that the new network would monitor all labor, production, and retail, and he proposed to eliminate paper money from the economy and to rely entirely on electronic payments. Perhaps Glushkov hoped that this idea would appeal personally to Khrushchev. The elimination of paper money evoked the Marxist ideal of money-free communist society, and it seemed to bring the Soviet society closer to the goal of building communism, promulgated by Khrushchev at the Twenty-Second Party Congress in 1961. The Academy president Keldysh, who was much more experienced in top-level bureaucratic maneuvers, advised Glushkov to drop the provision, for it would 'only stir up controversy.' Glushkov cut out this section from the main proposal and submitted it to the Party Central Committee under a separate cover. If ideology were to play any significant role in Soviet top-level decision-making, this was its best chance. Glushkov's proposal to eliminate money, however, never gained support from the Party authorities.

While previous cybernetic proposals had been developed solely by mathematicians and computer specialists, Glushkov wisely cooperated with economists. His Institute of

Cybernetics established close ties with the Central Economic Mathematical Institute of the Academy of Sciences, headed by the academician Nikolai Fedorenko. In 1964 Glushkov and Fedorenko published a joint proposal for a unified system of optimal planning and management on the basis of a three-tier unified nationwide network of computer centers. The proposed network included tens of thousands of local computer centers to collect 'primary information,' 30–50 mid-level computer centers in major cities, and one top-level center controlling the entire network and serving the government.

Glushkov and Fedorenko proposed a great simplification to the cumbersome procedure of collecting primary economic information. Existing procedures prescribed the collection of the same information from individual enterprises through four parallel, relatively independent channels: the planning system, the material–technical supply system, the statistical system, and the financial system. Glushkov and Fedorenko suggested instead to collect all economic data only once, store it in data centers, and make it available to all relevant agencies. Glushkov and Fedorenko promised that the proposed unified system of optimal planning and management would provide support for 'optimal decision-making on a national scale' by processing 'the entire body of primary economic information as a whole.'[36]

Glushkov aspired to create a comprehensive system that would define, regulate, and control the complete operations of the management apparatus of the Soviet economy. In effect, he intended to re-engineer the entire Soviet bureaucracy: 'to develop a detailed design of the work day and the work week for every bureaucrat, to create detailed lists of their duties, to determine clearly the order of document processing, the chain of responsibility, the timetable, and so on.'[37] This far-reaching proposal faced formidable opposition.

4.   The controversy over computers in planning

Glushkov's proposal faced opposition on two sides. Industrial managers and government bureaucrats opposed the computerization of economic planning and management because it exposed their inefficiency, reduced their power and control of information, and ultimately threatened to make them redundant. On the other hand, liberal economic reformers viewed Glushkov's proposal as a conservative attempt to further centralize the control of the economy and to suppress the autonomy of small economic units. A controversy erupted.

Liberal economists saw the solution of Soviet economic problems in introducing market elements into the economy. They proposed radical decentralization of economic planning and management and the introduction of market incentives. In their eyes, Glushkov's project merely conserved obsolete forms of centralized economic management. Glushkov argued that his proposal would not centralize all decision-making, but only top-level strategic planning. He believed that it would be possible to design a system that would provide quasi-market incentives for individual enterprises through computer modeling. He argued that this would work even more efficiently than actual market.[38]

Both Soviet and Western critics viewed Glushkov's proposal as 'computopia.' They questioned the possibility of constructing reliable mathematical models of the entire economy, as well as the validity of data supplied for such models.[39] Liberal economists argued that in the existing system central planning organs and individual enterprises could arbitrarily manipulate various economic data and criteria, and therefore computers could produce only 'distorted results, though with great speed.'[40]

Critics further claimed that Glushkov's project would divert resources urgently needed for economic reform. The construction of the pyramids of Egypt, wrote one economist, was 'one of the reasons why that fertile ancient country turned into a desert. If one vigorously implements a meaningless economic decision, this ruins the economy. According to the

blueprint of a unified state network of computer centers, these centers would spread over this country like those pyramids, designed by talented mathematicians and able engineers with the participation of unqualified economists.'[41] Glushkov admitted that his project would cost 20 billion rubles over 15 years. He acknowledged that this project would be more complex and more difficult to implement than the space program and the atomic bomb project combined. Yet he insisted that at the end of this 15-year period his plan would bring into the budget 100 billion rubles.[42]

The biggest problem with Glushkov's plan was that it would work only if introduced in full. Without a radical management reform on the top, local optimization lost its meaning. One factory manager offered a frank explanation: 'I cannot reallocate portions of the salary fund; it comes with a state order. This fund is greater for the production of narrow pipes. If you reassign the orders, this would upset the stability of this fund. To accept your proposal, the entire management system would have to be reformed.'[43] Economic cyberneticians admitted that it was impossible to achieve local optimization without reforming economic mechanisms on the national scale.[44]

In June 1964 Glushkov submitted his formal proposal to the government, but political events soon upset his plans. In October Khrushchev was ousted from power and replaced by Leonid Brezhnev as the Party leader and by Aleksei Kosygin as Prime Minister. In November the presidium of the Council of Ministers discussed Glushkov's proposal. It faced stern opposition from the same government agencies that were supposed to participate in its implementation. The idea of automated economic management threatened to upset the existing hierarchy of power in the economic sphere: information-collecting through a network of computer centers would challenge the role of the Central Statistical Administration, while automated planning would undermine the monopoly of the State Planning Committee (Gosplan) on top-level economic decisions.

Instead of directly opposing Glushkov's reform, central government agencies began to slow down and emasculate the project. First, officials at the Central Statistical Administration raised objections to the idea of direct access to the proposed central data bank. The Council of Ministers turned Glushkov's proposal over to them for 'finalizing.' This agency already possessed a nationwide network of statistics-collecting stations, and it quietly transformed Glushkov's concept of a national network of computer centers into a simple extension of its own network. This idea, however, did not suit Gosplan: since the computer network lost its planning function, all the resources seemed to be directed to a rival government agency. The Council of Ministers duly turned the project over to Gosplan for another 'touch-up.' As the two powerful agencies battled, trying to accommodate Glushkov's project to their own ends, another major reorganization shook the Soviet economy.

In 1965 the Khrushchev-era decentralized system of regional economic management was dismantled, and a centralized managerial structure of industrial branch ministries was restored. In 1966 the Party and the government issued another decree authorizing a large-scale program of introducing computerized management information systems into the economy. The decree was a typical bureaucratic compromise between the camps of the planners and the statisticians: the Central Statistical Administration was placed in charge of the development of a national network of computer centers, while various ministries were authorized to set up their own computer centers and to develop management information systems at the enterprises under their control. The Central Statistical Administration advocated the construction of a network of regional computer centers, but Gosplan insisted on organizing the network according to its own departmental structure, which corresponded to groups of industries. While the dispute continued, no action on the network plan was taken.[45] The construction of management information systems at individual enterprises and

central agencies proceeded on an *ad hoc* basis: during 1966–1970, 414 such systems were built without any coordination or connecting network.[46]

In the meantime, the military moved on to a new generation of distributed command-and-control systems with more sophisticated networking capabilities. The Institute of Precision Mechanics and Computer Technology developed a network of eight 5E92B computers for a missile defense complex, code named 'System A-35,' which was built to protect Moscow from a missile attack.[47] The Institute of Computer Complexes, which split off from the Institute of Electronic Control Machines, built another network for an early warning system, which included two nodes near Riga and Murmansk and a command-and-control center near Moscow.[48] The Scientific Research Institute of Automatic Equipment designed yet another network to support an automated control system for the Strategic Missile Forces. This network had a nationwide coverage and transmitted coded messages over low-quality communication channels and used an open systems approach and datagram switching.[49]

Because of pervasive secrecy, the Soviet economy could not take advantage of any technological innovations in the defense industry. Even if secrecy restrictions were lifted, it would have been very difficult to adapt military technologies for civilian use. Dealing with unreliable components, defense industry engineers tried to simplify computer design. Instead of building complex universal computers, they developed a large variety of small specialized computers with hardwired algorithms. Every type of weaponry was controlled by its own type of computer; over 300 hundred different types of specialized computers were developed in total in the Soviet defense industry.[50] Their highly specific designs were of no use in a civilian context. The Soviet military–industrial complex functioned as an information 'black hole': everything was coming in, but nothing was coming out.

5.   Virtual socialism: information is power

A new impetus to the idea of a nationwide computer network came in the late 1960s, when the Soviet leadership learned about the development of the ARPANET in the USA. Glushkov came up with a new proposal, even more ambitious than the previous one. He proposed to unite management information systems of all levels – from individual enterprises through branch-based ministry systems and regional nodes up to the top government level – to create the Statewide Automated Management System for Collection and Processing of Information for the Accounting, Planning, and Management of the National Economy (in Russian, abbreviation, OGAS) (Figure 1). Glushkov argued that the larger was an object controlled by an automated management system, the greater would be its economic effect.[51] Unless the processing of economic information was automated, he warned, by the mid 1980s nearly the entire adult population of the Soviet Union would be engaged in planning, accounting, and management.[52]

To make his idea more palatable to various government agencies, Glushkov cleverly asserted that OGAS would not control the economy itself, but only the information flows in the economy. Glushkov insisted that OGAS would not undermine the existing system, in which individual ministries already controlled their sectors of the economy and accumulated information in their own computer centers. OGAS would only make the system function more efficiently. 'In order to organize information flows on the national scale,' he argued, 'one needs to centralize interagency management of all information banks and computer centers, not the management of the economy.'[53] OGAS was thus depicted not as an economic super-agency but merely as a management system for information processing and software development. One of the functions of OGAS, for example, would be redistribution

Figure 1. Viktor Glushkov speaking about management information systems. Reproduced by permission from Glushkov family papers.

of computing tasks among different computer centers with the help of special 'information dispatch stations' in order to even out the load across the network.

Glushkov aspired to make OGAS a truly universal information bank accumulating all conceivable information from the lowest level up to the top. He went as far as suggesting that OGAS would include not only factual data, but also innovative proposals and ideas from individuals: 'Since the object of control is not only equipment but also personnel, one must include all the information about new technical, technological, economic, and organizational ideas and projects that workers at a given enterprise have.'[54]

Some liberal intellectuals began to see in Glushkov's proposal the specter of an omnipresent surveillance system; others dismissed it as a technological utopia. Economists argued that solution was not in processing large amounts of information, but in reducing the amount of information necessary for decision-making: 'Excess information is not only useless, but it is harmful.'[55] Management experts asserted that management information systems had 'simply reinforced outmoded methods of accounting and keeping statistics in American corporations' and insisted that a management reform must be implemented first, and computerization should come second.[56]

Glushkov, on the other hand, viewed computerization as a vehicle of reform. He believed that his task was 'not only scientific and technical, but also political.'[57] He was convinced that a reform might come only from the very top, and put his efforts into convincing the Soviet leadership to support OGAS. As a result, the draft resolution of the Twenty Fourth Party Congress, published in 1971, authorized the full-scale OGAS project, but this decision was soon retracted. The Soviet leadership also realized that the OGAS project had direct political implications, which threatened to upset the established balance of power. Shortly before the Congress the Politburo decided to scale down the OGAS plan. They now called only for wider introduction of individual management information system, but the creation of an automated management system for the entire economy was put off. The plans for the construction of a national network of computer centers survived, though only on paper. Lacking a clear economic purpose, the costly construction of a nationwide network could hardly be implemented.

Ministry officials realized that there were many ways to skin the cybernetic cat without necessarily losing their grip on power. Each ministry built its own computer centers and developed management information systems for their internal needs. In 1971–75, the number of such systems grew almost sevenfold, but they often used incompatible hardware and software and did not form any cross-agency network.

By constructing specialized management information systems, Soviet industrial branch ministries laid a technical foundation for strengthening centralized control over their subordinate enterprises. Now the ministries did not have to share information/power with any rival agency. On the contrary, each ministry could use computer technology to strengthen its control over sensitive information. 'The Ministry of Metallurgy decides what to produce, and the Ministry of Supplies decides how to distribute it. Neither will yield its powers to anyone,' explained one official.[58] 'Having different ministries is like having different governments,' observed another.[59]

Similar stories repeated every five years, as new economic plans were drafted for approval at Party Congresses. The Twenty-Fifth Congress in 1976 and the Twenty-Sixth in 1981 duly approved new reincarnations of the OGAS project. Every time the efforts to build a network of computer centers stopped at the ministry level and did not reach the national scale.

When computerized management systems are compatible, they can serve to unite different enterprises, but if they are incompatible, they will divide just as effectively. By accelerating the development of branch-based incompatible systems, the ministries effectively blocked the idea of a national computer network.[60] In the 1970s several branch networks were independently developed for civil aviation, weather prediction, banking, and academic research.[61] Most of them collapsed along with the Soviet Union. New Internet-type networks emerged only in the 1990s, and they were created not by the government, but by commercial enterprises.

6.   Conclusion: from a network to a patchwork

In the 1960s, as in the Soviet Union, computer technologies became 'policy instruments' in the USA and the UK.[62] The British government failed to fund an early proposal for a packet-switching network, since at that time it chose to support technological projects with clear commercial value, and computer networks did not seem to fit this profile. The priorities of the US government, however, were dictated by the Cold War, and it funded, through the Department of Defense and other agencies, a wide range of computer initiatives, including the first packet-switching network, the ARPANET. Unlike the Soviet and British authorities, however, the US government facilitated the transfer of new technologies from the military sector into civilian economy by making them freely available and by providing incentives for further development. In the USA, the government supported new *technologies*; new *uses* were stimulated by private companies, which took advantage of the reinvention of the computer first as a business machine, and later as a communication device.[63]

Soviet leaders also envisioned a national computer network as a 'policy instrument.' The idea of creating such a network emerged as part of far-reaching proposals to reform the economy by building a nationwide automated management system. The fate of the computer network proved inextricably linked to the fortunes of these larger proposals, which had profound political and social ramifications. The cybernetic vision of automated management as a vehicle of economic reform drew on technocratic aspirations of Soviet cyberneticians. They believed that a technological solution – the combination of the correct mathematical model, an efficient algorithm, and a powerful computer network – would

bring about a socioeconomic change, both empowering individual enterprises and providing optimal planning on the national scale.

Soviet cyberneticians envisioned an organic, self-regulating system, but paradoxically they insisted on building it by decree from above. They argued against gradual growth from below, because individual parts would not function efficiently without a comprehensive nationwide system, and a piecemeal approach would only conserve existing practices. However, a nationwide management system, any individual part of which was not viable, could not be viable itself.

On a smaller scale, this vision was implemented in Allende's Chile, where the British cybernetician Stafford Beer designed Cybersyn, a national system of automated economic management. Cybersyn was supposed to provide maximum autonomy to individual enterprises within the overall planning system. As with OGAS, however, the actual implementation of Cybersyn effectively subverted its initial goal. The new technology 'served to entrench further many of the management practices that had disempowered workers prior to Allende's presidency, rather than to bring about revolutionary change.'[64]

Recent scholarship on the 'co-construction' of users and technology emphasizes the role of users in defining, modifying, redesigning, and resisting new technologies, and also explores the effects of technology on the definition and transformation of the user.[65] In the debates over the Soviet national computer network, various agencies debated whether to make computer networks a tool of centralization or decentralization, a venue for circulation of information or a safe depository for it, a vehicle of reform or part of the existing management system. The position of the user was also contested. Cyberneticians hoped to establish a new central agency to oversee information management in all other government bodies, but individual ministries succeeded in appropriating the role of primary users of management information systems. These users reinterpreted and reshaped information systems technology as it emerged. They transformed the original concept of a national network into a patchwork of ministry-subordinated data banks. Users also redefined the ARPANET: the network failed its initial purpose as a resource sharing tool but became a huge success as a venue of communication, when email service emerged as a 'smash hit.'[66] For the ARPA-NET, the newly found rationale encouraged further growth of the network. By contrast, in the Soviet case the striving for management information control facilitated the fracturing of the network into unconnected islands. Cyberneticians aspired to reform the Soviet government with a technological tool whose uses the government itself defined. This resulted, quite naturally, in a transformation of the tool itself – from a vehicle of reform into a pillar of the *status quo*.

Notes

1. As presented in the 1948 classic (Wiener, *Cybernetics*), cybernetics combined notions of control engineering and information theory to assert a universal mechanism of self-organization and purposeful behavior in self-regulating machines, living organisms, and society. The cybernetic outlook draws on a wide assortment of machine analogies: neurophysiological and economic processes are compared to the feedback-controlled servomechanism, human communication is interpreted as transfer of information over noisy channels, and the nervous system is compared to the computer.
2. Kitov, 'Kibernetika i upravlenie,' 207, 216.
3. For a general history of Soviet cybernetics in the 1950s–1970s, see Gerovitch, *From Newspeak to Cyberspeak*.
4. Malcolm, 'Review,' 1012.
5. Conway and Siegelman, *Dark Hero*, 391.
6. Ibid., 318.

7. Arthur Schlesinger, Jr., to Robert Kennedy, 20 October 1962; Schlesinger Personal Papers, John F. Kennedy Library, Boston, Mass., box WH-7, 'Cybernetics.'

8. Goodman, 'Computing,' 545.

9. Judy, 'Soviet Economy,' 642.

10. Medvedev and Medvedev, *Khrushchev*, 107.

11. Judy, 'Soviet Economy,' 643.

12. For an historical overview of Soviet developments in mathematical economics, see Ellman, *Planning Problems*, 1–17.

13. Nesmeianov and Topchiev to the Presidium of the Central Committee, 14 December 1957; Russian State Archive of Contemporary History, Moscow, f.5, op. 35, d. 70, l. 119.

14. On the history of cybernetics in the USA, see Heims, *Constructing a Social Science*.

15. On Soviet 'economic cybernetics,' see Gerovitch, *From Newspeak to Cyberspeak*, 264–84, and literature cited therein.

16. Bruk, 'Perspektivy primeneniia,' 147.

17. Beissinger, *Scientific Management*, 165.

18. Berg, 'Ekonomicheskaia kibernetika,' 148.

19. On the history of SAGE, see Edwards, *Closed World*, chap. 3.

20. Malinovsky, *Pioneers of Soviet Computing*, chaps. 3 and 4.

21. Ibid., chap. 4; Pervov, *Sistemy*, 40–43; Trogemann *et al.*, *Computing in Russia*, 215–20.

22. Malinovsky, *Pioneers of Soviet Computing*, chap. 4; Pervov, *Sistemy*, 142–48.

23. Bruk, 'Perspektivy primeneniia,' 147.

24. Malinovsky, *Pioneers of Soviet Computing*, chap. 3.3.

25. Kitov to Khrushchev, 7 January 1959; Kitov papers, Moscow Polytechnic Museum.

26. Berg *et al.*, 'Possibility of Automation,' 130–31.

27. Berg *et al.*, 'Radioelektroniku – na sluzhbu.'

28. Malinovsky, *Pioneers of Soviet Computing*, chap. 2.2.

29. Kitov, 'Chelovek,' 45.

30. Kharkevich, 'Informatsiia i tekhnika.'

31. Minutes of the meeting of Party and government leaders with intelligentsia, 8 March 1963; Russian State Archive of Socio-Political History, Moscow, f. 17, op. 165, d. 164, l. 196.

32. Wiener, *Human Use*.

33. Minutes of the meeting of Party and government leaders with intelligentsia, 8 March 1963; Russian State Archive of Socio-Political History, Moscow, f. 17, op. 165, d. 163, l. 89. On the role of routine social control and mutual surveillance under Khrushchev, see Kharkhordin, *The Collective and the Individual*.

34. Keeny, Jr, 'Search for Soviet Cybernetics,' 85.

35. Malinovsky, *Pioneers of Soviet Computing*, chap. 2.

36. Glushkov and Fedorenko, 'Problemy vnedreniia,' 87–88. See also Judy, 'Information, Control.'

37. Kapitonova and Letichevskii, *Paradigmy i idei*, 191–92.

38. Ibid., 374.

39. Neuberger, 'Libermanism,' 142.

40. Evsei Liberman, quoted in Cave, *Computers*, 46.

41. Popov, *Problemy teorii*, 160.

42. Malinovsky, *Pioneers of Soviet Computing*, chap. 2.

43. Quoted in Zalgaller, 'Vospominaniia,' 451.

44. See 'Ekonomisty i matematiki za "Kruglym stolom."'

45. See Bartol, 'Soviet Computer Centres.'

46. Conyngham, 'Technology,' 430.

47. Pervov, *Sistemy*, 183–84.

48. Ibid., 239–46.

49. Filinov and Zakharov, 'Igor' Aleksandrovich Mizin'; Malinovsky, *Pioneers of Soviet Computing*, chap. 4.

50. Trogemann *et al.*, *Computing in Russia*, 212–13.

51. Maksimovich, *Besedy s akademikom*, 66.

52. Ibid., 56.

53. Kapitonova and Letichevskii, *Paradigmy i idei*, 189.

54. Glushkov, *Kibernetika*, 92.

55. Birman, 'Dissent,' 14.

56. Mil'ner, 'Lessons,' 9.

57. Malinovskii, *Istoriia vychislitel'noi tekhniki*, 162.

58. Quoted in Zalgaller, 'Vospominaniia,' 451.
59. Golovachev, 'Hercules,' 72.
60. On the automation of planning and management in the Brezhnev period, see Beissinger, *Scientific Management*; Conyngham, 'Technology,' and Cave, *Computers*.
61. Goodman, 'Computing'; Trogemann *et al*., *Computing in Russia*, 168–76.
62. Abbate, *Inventing the Internet*, 40.
63. Ibid., chap. 1; Mowery and Simcoe, 'Is the Internet'; National Research Council, *Funding a Revolution*; and Norberg and O'Neill, *Transforming Computer Technology*.
64. Medina, 'Designing Freedom,' 602.
65. Oudshoorn and Pinch, *How Users Matter*.
66. Abbate, *Inventing the Internet*, 104–11.

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