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Prospects for Computers in the Soviet Economy

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PROSPECTS FOR COMPUTERS IN THE SOVIET ECONOMY

The USSR is far behind the West in the production and use of computers for the general economy, primarily because of its concentration on military and scientific computers. The Soviets only recently recognized the value of computerizing their antiquated and inefficient system of processing economic data, and must now solve a multitude of technological problems before much progress can be made. At present, Soviet computers are not tailored closely enough to the needs of individual consumers, and obsolete equipment is used even after new models are developed. Installation and service must be improved, and qualified personnel trained. Moreover, a host of support equipment, especially important to the solution of economic problems, must be developed and produced. The ultimate goal of many Soviet economists is a completely computerized economy, but great controversy surrounds this proposal. A less ambitious project, the development of a computerized information system, has been planned for the next decade.

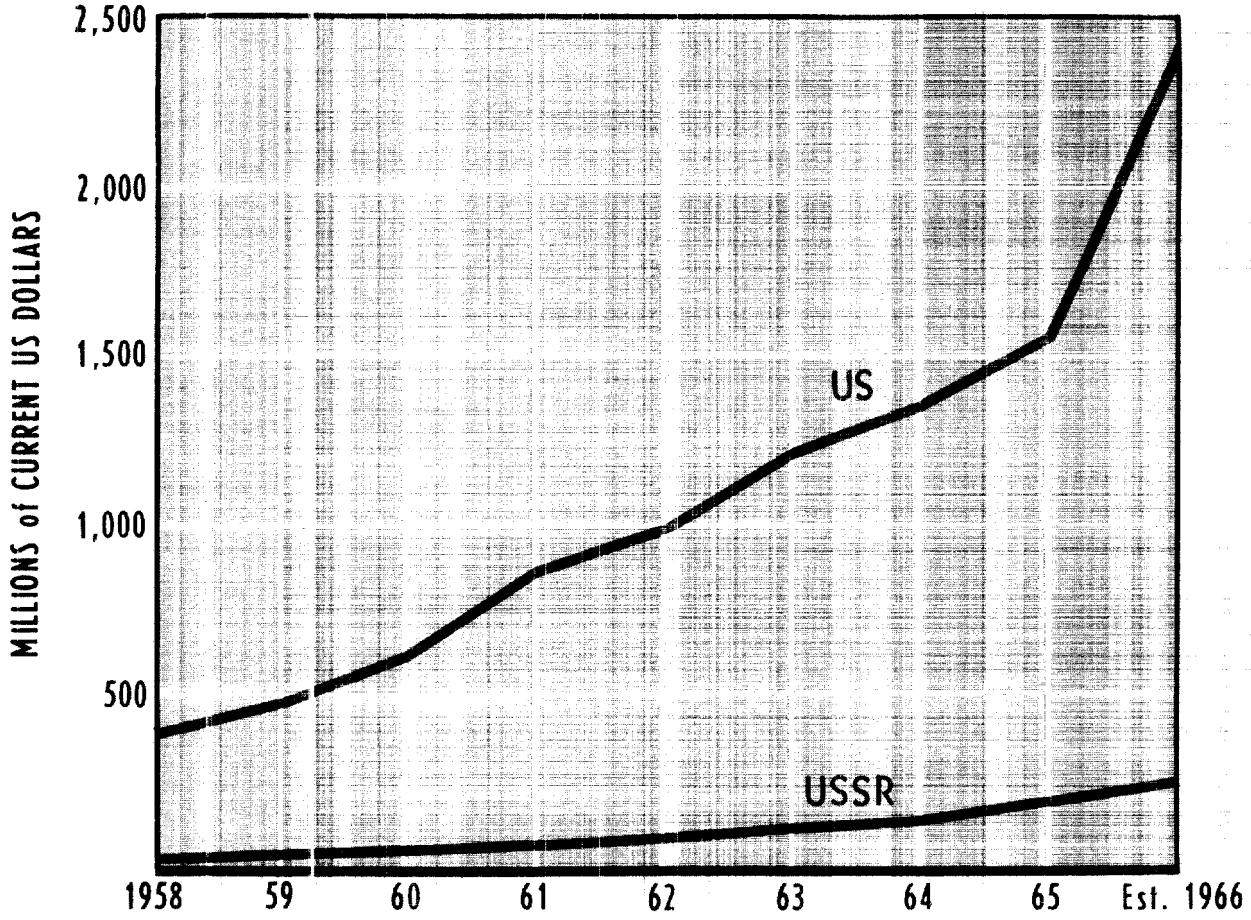
Early Development

Soviet computers used to solve economic problems are technologically behind those in the US by about five years. The USSR is even further behind in computer production. The US installed its first thousand computers about eight years before the USSR did, and it now has about ten times as many in use. The US has automated much of its economic data system with the help of more than 15,000 computers, but the Soviets use fewer than 500.

Research institutes under the Academy of Sciences began computer development in the USSR, primarily to promote scientific research. Few resources were allocated for the design or production of computers especially adapted to commercial or economic use, and little research was directed toward the development of the auxiliary equipment necessary for data processing. As a result, the USSR now uses less than 15 percent of its computers for economic work. By comparison, the US employs nearly 60 percent of its total inventory in the economy.

Computers are generally designed either for scientific or economic use. Scientific problems typically involve a large number of computations and a relatively small amount of data. Data processing problems, on the other hand, involve a small number of

COMPARISON of US and SOVIET PRODUCTION of COMPUTERS and DATA-PROCESSING EQUIPMENT



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Estimates of production do not include special-purpose military computers in either country.
Rubles have been converted to dollars at the rate of 1 ruble = US $0.75

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simple calculations on a tremendous volume of data, thus requiring computers with large storage capacity but less speed in computation.

Technological Problems

Typically, the Soviets emphasized serious production of a minimum assortment of models rather than the production of computers tailored to the requirements of individual consumers. Moveover, even when a computer has become obsolete and a replacement model more responsive to user needs has been developed, the obsolete model is often used for a long time because plant managers are reluctant to change models--the changeover usually leads to reduced bonus payments for both management and work force. The delay in the appearance of improved models is also partially the result of the bureaucratic separation of the users from the designers and producers of the equipment.

Quick and responsive service by American computer manufacturers has been a major factor in the widespread adoption of computer systems in the US, but the Soviet manufacturer generally neglects his customers. The customer receives brief, inadequate instructions in programming, operating, and maintaining his computer, and the manufacturer takes no responsibility for its maintenance. Spare parts are often unobtainable and the user must employ makeshift expedients to keep his machine in operation. These may change the operating characteristics of the computer enough to prevent sharing of programs among users of the same models. An All-Union Technical Planning and Installation Association was set up last March and it may have alleviated some of these servicing problems.

The USSR is short of qualified computer specialists. Although technical and economic institutes have established an increasing number of computer courses, the supply of programmers, operators, repairmen, and other specialists is far below demand and will remain so for many years.

In general, Soviet computers are incompatible in that one program cannot be used on different computer models. Thus, programs must be re-done for different machines and personnel retrained when transferred to different installations or to new machines. The Soviet "command economy," ironically, has been unable to resolve this problem while US industry achieves tremendous economies through standardization.

Support Equipment and Special Techniques

A dearth of support equipment also has plagued the Soviet computer industry and is a direct consequence of the long delay in recognizing the need for computers in processing economic data. Support equipment typically includes language compilers, program libraries, and input-output equipment.

Special computer languages eliminate the complicated task of transcribing instructions into abstract number codes that the computer can read. The Soviets have done little work with these special languages for general and economic use and have concentrated their limited efforts on scientific languages. They may try to shorten the path of development followed in the US by modifying one of their algebraic languages to meet the requirements of economic data processing, but are unlikely to succeed. To program a large cybernetic system directly into machine language without the use of programming languages would require more trained people than could be made available.

Packaged programs can be prepared when certain computer operations are performed repeatedly and these can then be placed in a central repository for all to use, a common practice in the US. The USSR, however, has made little effort to create such program libraries. A central repository for algorithms and computer programs was established in October 1965, but it is intended mainly for scientific use. Nevertheless, it should provide valuable experience eventually for similar efforts in the economic area.

Efficient input-output equipment is particularly important to the solution of economic problems. Since these problems typically involve a large volume of data, all of which cannot be stored inside the computer unit, the controlling factor in efficiency becomes the speed with which data can be selected and transferred from external storage to the computer unit. The Soviet input-output capability has greatly improved in recent years, but it still lags behind the development of computers.

Input-output operations utilize punch-cards, tapes, and storage units. The USSR often uses punch-cards as a direct input for economic data. The US practice is to transcribe the cards to magnetic tape, a much faster and more efficient system. The Soviets use magnetic drums for external storage; the more efficient disk files, widely used in the US, are just beginning to be developed. Input-output equipment has been improved recently, but it still hinders the expansion and effective use of computer systems.

Accounting and Data Processing

The USSR could reap tremendous economic gains from modernizing its accounting system. At present, about 3 million people are employed in accounting work, most of which is done by abacus and desk calculator with the aid of some punch-card equipment. Soviet academician Glushkov dramatized the inefficiency of this system when he stated that by 1980, using the present techniques, the volume of paperwork will have increased by 3,600 percent and the entire population of the USSR will be needed to compile and analyze economic data. The need for fast, accurate processing of accounting information

will become even more critical as the economy completes the transfer to the new rules for economic reform in industry begun in 1965.

A government decree of November 1964 provided a better atmosphere for the introduction of computer techniques by ordering the centralization of accounting functions within each enterprise. Some experiments were conducted by the regional economic councils several years ago in centralizing the accounting work of a number of separate firms. The Central Statistical Administration (CSA) originally planned to build 630 machine-calculating stations to handle the centralized accounting work of groups of enterprises by the end of 1965, but progress on these stations has not been reported recently.

Statistical Collection and Compilation

The Central Statistical Administration, consisting of 800 statistical centers and 2,400 smaller bureaus, is the basic statistical collection and processing center for the Soviet Government. The CSA records the fulfillment of state plans, computes national income accounts, conducts censuses, reports on economic subjects, and publishes statistical bulletins and handbooks. In addition, the CSA is required to supply statistics to Gosplan (State Planning Committee) and many other agencies. However, some other organizations--the Ministry of Finance, Gosbank (State Bank), and the individual production ministries--also collect and compile statistics, sometimes duplicating and confusing the CSA's work.

This unwieldy system, largely hand-operated, possesses an enormous potential for computerization. Experimental computer systems have already been installed in Moscow and Latvia. Last March, the USSR announced plans for a nationwide computer network to be started during the current five-year plan (1966-70). This network, which is to collect and process economic information for the whole country, will not be completed for many years, well after 1970.

Planning at Enterprise and Branch Level

During the last few years the USSR has developed various methods for applying computers to the decision-making process at enterprise and branch level. Mathematical methods, especially linear programming,* have been used to solve a wide range of problems in agriculture, industry, transportation, and construction.

*A method for calculating the best plan for achieving stated objectives--such as maximum profit or output--in cases where resources are limited.

The Soviets have used linear programming in agriculture to help determine crop distribution and rotation, livestock production, and allocation of labor and materials. Industrial computer techniques are also being developed, mainly in the fields of metallurgy, chemistry, and electric power generation. However, the returns from practical applications have been small since the generally low level of Soviet plant technology makes the installation of automatic control equipment unprofitable.

Computerized control of transportation in the USSR is still in the pioneering stage. A nationwide electronic computer system for rail transport is planned, and the first stage in this system--a computer center for the Moscow Railroad Administration--has been built. A number of problems remain to be solved, however, if computers are to be used profitably by the transport industry. For example, transmission of data by telegraph is too slow and experiments with new data transmission equipment are proceeding unsatisfactorily. Also, the whole concept of using linear programming in the transport industry, as opposed to nonlinear types of programming, has been questioned.

The USSR began using mathematical methods and computers in the construction industry in 1963. In one technique, developed in the US and called the Critical Path Method (CPM), a project is broken down into all the separate tasks involved and the time required to complete each is calculated. The tasks on the "critical path"--those which would delay the project if not completed on time--are supervised more closely. The success of the first 18 Soviet projects converted to CPM techniques in 1964 led to an expansion to almost 300 projects in 1965. For 1966, 365 new projects, accounting for 12 percent of the total volume of industrial construction were scheduled. The Soviets are studying methods to implement CPM on a larger scale, and plan to build a computer network for the construction industry during 1966-70.

Macro-Planning: Over-all Economic Control

Economic planning in the USSR is a highly complex, imprecise, unwieldy, and time-consuming process. Gosplan, the primary agency charged with the planning responsibility, computes a detailed national balance sheet for about 1,000 major products and a less precise plan for about 16,000 additional ones. The planning process is a year-round operation and is done almost completely in quantitative terms--prices play only a minimal role. Working from the statistics collected by the CSA, Gosplan negotiates "material balances" with the production ministries culminating in the distribution of output and supply plans to the enterprises. As the economy of the USSR has grown in size and complexity, the material balance method has become an extremely inefficient way to determine the product mix.

It would be difficult to use computers in the present planning process. They would have to be fed exact instructions for plan formulation and the present system is too imprecise for this to be done. Although a study of ways to computerize the system might force managers to adopt more precise procedures, Gosplan has not yet taken any major steps toward putting even routine tasks on computers and such work is still only in the experimental stage. Linear programming methods and input-output analysis have been used experimentally in national planning with some success, but Gosplan officials have reported that this type of work is being "poorly introduced into the practice of planning."

The ultimate goal, or dream, of many Soviet economists is an all-inclusive cybernetic system, consisting of a complicated mathematical model and a large network of computers to control every important aspect of the economy. The system would receive data from all levels of the economy, synthesize it, and devise a number of alternative plans. The regime would choose one plan that would then be disseminated, monitored, and corrected by the system.

Controversy has long surrounded this idea. Probably the most fundamental dispute concerns the amount of central control that this type of cybernetic system would generate. The recent economic reforms, although decreasing the amount of control held by the central government agencies, have retained the principle of central planning. Soviet economists who fear that decentralization will creep into the planning process cling to the proposal of a large cybernetic system as a means of effectively retaining central control. They argue that economic plans can best be made from the top, especially if a computer network rapidly processes masses of data and reduces the numerous complexities to a manageable size.

Opponents of the large cybernetic system argue that it is both impossible and undesirable to direct the entire economy by computers. They favor a small computer system to determine the general plan and a price and incentive system to guide enterprise managers in making decisions consistent with the planned goals. In addition, they stress that a computer-directed economy is a long-range solution--15 to 20 years away at the earliest--whereas a smaller system could be achieved in the near future.

The problems of developing a comprehensive cybernetic system are staggering. The construction of a model capable of controlling the entire Soviet economy would require mathematical tools that have not been developed even in theory. Although two models are in the first stages of development, it will be many years before either can be made operational. Both seek to maximize "satisfaction of social requirements," a nebulous phrase that includes personal consumption, defense, investment, and science. The model will not utilize a single

criterion for weighing the end products in the maximization problem since this selection will be left to the "competent organs," i.e., the party leaders.

The proposed computer network, to be divided into three levels, would require a tremendous number of computers, auxiliary equipment, and trained personnel. The lowest level would consist of many small computer centers at individual firms or groups of enterprises. The second level would include a set of 50 to 80 regional computer centers, each connected with its own local centers and with the other regional centers. The third level would be a huge center in Moscow. A Soviet computer expert has estimated that this network would require at least 10 quadrillion operations a year. Using this figure and the average speed of the new series of Soviet computers, it is estimated that 14,000 computers would be required--compared with the 500 now used in economic work. A greatly strengthened communications network would also be required for this proposed computer system.

Planned Computer Network

The size and complexity of the obstacles to the development of a comprehensive cybernetic system have probably forced the Soviets to postpone serious efforts toward this end and to concentrate on a less ambitious goal--the development of a computerized information system, which is provided for in a decree of March 1966. This system, to be started during the current five-year plan, clearly is not intended to be a comprehensive cybernetic operation to direct all economic planning and it will not automate Gosplan's planning system.

The March decree gave the authority to operate the proposed network to the Central Statistical Administration, and it will be formed through an expansion and modernization of the existing CSA network. In addition, sectoral and departmental systems of planning, accounting, control, and data processing, are to be created as necessary, and are to be connected with the state network. Gosplan is charged with the initial planning of the computer centers and with projecting the production of computer equipment.

The requirements of the proposed network are not nearly as demanding in quantity and sophistication as those needed for complete cybernetic control of the economy. Even so, the Soviets admit that their computer industry cannot provide all of the equipment needed for the proposed network in 1966-70. Nevertheless, they propose to make a good start during this period. Moreover, if they eventually decide to proceed with a complex cybernetic system, it is likely that most of the system's developmental work would parallel that for the computer network. In all probability, they will work on the more localized and immediately profitable computer applications for the next decade and then examine further the case for a cybernetic system. (CONFIDENTIAL)

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