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ECONOMIC AFFAIRS

EKO: ECONOMICS AND ORGANIZATION
OF INDUSTRIAL PRODUCTION

No. 3, March 1985

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USSR REPORT ECONOMIC AFFAIRS

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No. 3, March 1985

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MOTIVE FORCES IN ECONOMY DESCRIBED

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA (EKO) in Russian No 3, Mar 85 pp 3-22

[Article by D. M. Palterovich, doctor of economic sciences, Institute of Economics of the USSR Academy of Sciences (Moscow): "Motors of Machines and Motors of the Economy"]

[Text] Of the millions of machines that are used in all branches of the national economy, most of them are put into motion with electric engines. Of all the energy capacities in industry, 67 percent is accounted for by electric engines, 16 percent--electrotechnological installations and equipment, and only 17 percent--mechanical engines, mainly internal combustion engines. Such a high proportion of electric engines in the energy capacity of industry and also the ratio between electric energy consumed for motive force, technological needs and lighting have remained practically stable in recent years.

In agriculture where the main machines--tractors, combines, trucks and others--are equipped with internal combustion engines, the proportion of electric motors is also increasing. The proportion of electric engines and electrical installations in 1970 amounted to 12.6 percent of all the energy capacities, and in 1983--21.1 percent. In rail transportation the proportion of electric locomotion in the cargo turnover increased during this same period from 48.7 percent to 58.9 percent. More and more electrical machines and instruments are being used in construction, trade, the sphere of services and daily life, and municipal services.

Being the basis of the electric capacities of the production apparatus, the fleet of electric engines makes it possible to approximately evaluate its dynamics. Reflected in the structure of electric engines is the capacity structure of machines which they put into motion. The degree of their utilization reflects also the level of utilization of equipment. Important reserves for increasing the effectiveness of production equipment lie in improving the designs of electric engines, increasing the degree to which they meet the requirements of the equipment for which they are used and also the degree of loading in terms of time and capacity.

In 1970 the magazine EKO published figures on the utilization of the capacities of electric motors in branches of USSR industry.¹ More than 15 years have passed since this investigation. The value of the fleet of machines, equipment and means of transportation in USSR industry had increased approximately 2.4-fold in 1982 as compared to 1970. Its structure had also changed. The production of alternating current electric engines increased during this period by 40 percent in terms of capacity. The capacity of the fleet approximately doubled, and the consumption of electric energy for motive force increased more than 1.7-fold. In and of itself the more rapid growth of capacities as compared to the growth of consumption of electric energy shows that the process of deterioration of the utilization of capacities is continuing. All this raises the need, in the first place, for more in-depth investigation of the development of the fleet of electric engines; in the second place, an analysis of the tendencies and causes of the lower level of utilization of the energy capacities of the fleet; in the third place, a determination of the seriousness for the national economy of those consequences that are entailed with the underutilization of equipment; and, finally, in the fourth place, the development of economic levers, ways and methods of improving the economic mechanism which would sharply increase the motivation of the enterprises and workers to find a more economic structure and to improve the utilization of the production equipment.

Where Do the Engines 'Disappear'?

In practice the number of electric engines can be determined only through calculation or estimates. One of the methods consists in assuming that the stock of electric engines is equal to their output during the normative service life. Here we disregard the import and export balance (it amounts to an insignificant proportion of the output) and we also assume that the actual services lives are equal to the normative ones (that is, calculated according to norms of amortization deductions for renovation). The norms that are in effect make it possible to evaluate the normative time period of the industrial electric engines in 11 years. This is precisely the average age of the electric engines that are removed from production as calculated according to a fairly large number of documents for writing equipment off at industrial enterprises.

From 1971 through 1981 (that is, 11 years) the USSR produced more than 92 million electric alternating current engines; 99.6 percent of these had a capacity of from 0.25 to 100 kilowatts and 0.4 percent had a capacity of more than 100 kilowatts.² This is what the fleet of machines should have been in 1982 if all of them had gone to branches of the national economy and remained there for the average normative service life.

But approximate calculations based on data concerning the total and average unit capacities of electric engines show that in 1982 there were considerably fewer machines--about 50-60 million of them. (According to calculations of certain specialists of the Soyuzelektroremont VPO, the fleet of electric engines is much greater. But these calculations are based on the average service life of most of the electric engines, which is equal to 17 years and which is significantly increased.) Let us note that this figure, according to our calculations, exceeds by 3.5- to fourfold the number of engines according

to the census of 1962. If one takes into account that the consumption of electric energy and industry and agriculture (the majority of electric engines are concentrated in these branches) increased from 1962 through 1981 3.3-fold, the estimate of the increase in the fleet of electric engines of 3.6-fold seems realistic. The fact that the consumption of electric energy has lagged behind the growth of the fleet can be explained by the deterioration of the utilization of electric engines.

The difference between the estimates of the fleet of 92 million and 50-60 million units can be explained by a number of factors. First, some of the engines that are produced go for export and for batching household equipment and do not enter the national economy.³ Second, because of the poor quality of manufacture, service and especially repair of some of the engines they do not last through the normative service life, and small engines are most frequently not repaired at all but are written off when they first break down, sometimes without documents. Third, many of the engines that are produced "settle down" in the warehouses of the enterprises.

It should be noted that because of the inadequate development of specialized capacities for repairing electric engines, in a number of cases they write off not only small, but also fairly large engines whose repair is extremely economically expedient since under the conditions of specialized repair enterprises the cost of the repair is no more than 40 percent of the cost of a new engine, and the useful properties with high-quality repair are fully restored, providing for an essential savings on labor and metal.

Based on the calculated number of engines and the average 7-year service life of the electric engine before the first capital repair, there are more than 4 million electric engines in the national economy that need to be repaired annually. About 16 percent of this number are included in centralized repair. Most of the engines are repaired by the consumers themselves. The repair is frequently done by primitive methods and its cost frequently approaches or even exceeds the cost of a new engine, while the service life after such a repair is considerably less.

Obviously not many machines from this category are used for household equipment, for the electrical equipment industry annually produces 2.5 times as many small engines for this kind of technical equipment as it does electric engines with capacities of more than 0.25 kilowatts. The import and export balance is not very great either. The main reason is the premature writing off of millions of engines, which is not always reflected in documents for writing off equipment and, consequently, is not reflected in the statistical indicator of the average age of engines that are removed either. Thus the aforementioned difference characterizes the scope of the reserve related to improvement of the quality of manufacture, service and repair of electric motors.

If one proceeds from the estimate of the fleet of electric engines given above, there arises the question: Is this a great deal or not? Are there no reserves here for reducing the load for the national economy which is involved with the production and maintenance of this immense amount of production equipment? In order to answer this question it is necessary first of all to

clarify how the fleet of electric engines is distributed among various branches and kinds of technical equipment, how the structure of the engines changes and what is the degree of their utilization. It would be very important to conduct each five-year plan a detailed census of the fleet of electric engines (which is true, incidentally, of other equipment as well) and to account for the engines in terms of the main groups and intervals of capacity.

An analysis of the utilization of equipment is impeded because of the lack of statistical publications concerning the quantity and capacity of the fleet of electric engines in industry. The only figures that are published are for agriculture, where the number of electric engines has increased from 4.8 million in 1970 to 13.4 million in 1981.⁴ But we do not know how many of them are used for mechanization of labor in animal husbandry, for transporting and processing agricultural products, for irrigation and other technological processes, how many of them are used for metal processing, wood processing and other equipment, whose concentration in agriculture is related to the inadequate development of specialized repair and other productions of an industrial type.

There is also a lack of data concerning how many electric engines are installed on equipment and how many are "frozen" as the repair reserve. According to the census of 1962, electric engines were not used on equipment amounted to 12 percent of the entire stock and this did not include engines intended for being used on machines that were being produced. There is reason to assume that now this proportion is even greater, that is, many millions of engines--this is an inactive fleet of machines awaiting repair or utilization for replacing other electric engines. The amount (and, consequently, the reserves for reduction) depends on the reliability of the supply of engines, the possible time periods for repair, and the "reserves" of the head mechanics' services which are sometimes guided by the principle of "a bird in the hand is worth two in the bush" and create for themselves reserves enough to last several years, thus freezing equipment which is critically needed by other enterprises. The USSR Central Statistical Administration should show what this "reserve" costs the national economy, and supply and sales agencies should redistribute surplus equipment more efficiently.

As for industry and a number of other branches, the majority of electric engines concentrated here are concentrated in machine building and other branches with a discrete character of production, where the level of utilization of engines is considerably lower than the average for industry. Obviously, here too there are many reserves for reducing both the number and the capacity of the fleet. But at the same time one should recall the tendency for raising the level of mechanization of those processes and operations where a good deal of manual labor is still being used.

The scope of production of high-powered electric engines becomes even more impressive when compared with the output of similar engines in the United States. If one does not count the less powerful electric engines for household instruments, automobiles, toys, means of minor mechanization and so forth (in the United States more than 200 million of this kind of engines with capacities of less than one horsepower or up to 0.736 kilowatts are produced

annually), the number of high-powered electric engines produced in the USSR and used mainly for the main drive of stationary equipment in recent years has been 1.7-1.8 times greater than in the United States. Moreover there is an especially great difference in the quantity of engines with the capacity of 4 kilowatts (5.5 horsepower) and greater. It is more difficult to compare the number of electric engines in the fleet for the data about the fleet come from estimates or calculations.⁵ An estimate of the fleet of electric engines in U.S. industry will amount to about 30-35 million units, and this includes some engines with a capacity of less than 0.75 kilowatts. Obviously the capacity make-up of these electric engines is comparable with the USSR fleet where engines from 0.25 kilowatts are taken into account. The overall number of engines in USSR industry, apparently, is considerably greater than in the United States, and their structures also differ. The main difference consists in the degree of differentiation of the engines in terms of capacity. The United States, obviously, has a higher level of this differentiation; there is a considerable number of large-capacity engines for large pumps, compressors, chemical and other installations for mass technologies, and they also have a larger proportion of small engines for small machine tools and other processing machines, for commercial equipment, air conditioners and ventilators than are found in the USSR. At the same time the USSR has more medium and medium-large-capacity engines for metal-processing, wood-processing and many other kinds of equipment in discrete productions.

The differences in the quantity and structure of electric engines reflect the differences in the number and structure of the fleet of equipment. It is known that the USSR has more metal-cutting machine tools, forge and press machines, more oil-drilling installations, coal-mining combines, looms and many other machines than the United States has. The worse the equipment is used, the lower its reliability and durability, and the more the universal machines are dispersed outside the specialized spheres of application, the more machines are required and, consequently, the more electric engines that are required for batching equipment and also for replacing electric motors that are being withdrawn.

Although it produces millions of engines and increases their output by hundreds of thousands of units each year, the electric equipment industry still does not satisfy the needs for certain special engines, particularly high-torque engines which are necessary for machine tools with numerical program control and certain other of the latest kinds of technical equipment. The question arises: Do not quantity and quality contradict one another here?

And so the question "where do the engines disappear?" can be answered: a considerable number of them go for batching "semifunctional" machines, or they are abandoned in the warehouses, or they are written off when their service life comes to an end.

Utilization of Engines and Utilization of Machines

The degree of utilization of electric engines can be characterized by a conventional or calculated number of hours of their operation, which is determined by the ratio between the consumption of electric energy per motive force in kilowatt-hours and the capacity of the engines in kilowatts. The

conventional or derived number of hours calculated this way depends on the degree of utilization of the engines both in terms of time and in terms of capacity.

The utilization engines in terms of time is determined by the proportions of working equipment in the entire fleet, the coefficient of shift work, intrashift down time, and the proportions of machine, auxiliary and preparatory and finishing time. Utilization in terms of capacity depends upon the correspondence of the equipment to the nature of the operations that are being performed, the quality of the blank pieces, the instruments and the optimization of working conditions with the help of an automated system for control of technological processes and so forth.

Thus the amount and dynamic of the calculated number of hours of operation of electric motors in a certain sense characterize the level of production organization, its specialization, series production, the condition of the equipment, shift work and down time.

If the shops and sections were equipped with electric meters and the indicators of the total number of hours were posted in the offices of the production managers, they could find out at any time how the equipment was being utilized. By comparing the utilization in terms of the number of hours in the shift, days in the week, and months in the year, it would be possible to quickly reveal reserves and to take measures to increase the load on the machines. Bringing the capacities of the engines closer to the needs and conditions of production in which the equipment is being utilized provides for increasing the conventional number of hours worked by a unit of capacity. The fleet of equipment in a number of branches has reached direct hypertrophied amounts. Many enterprises, particularly machine-building enterprises, continue to order and receive more and more equipment instead of utilizing their existing fleet better and being thrifty which each machine tool.

The results of periodic investigations conducted by the USSR Central Statistical Administration show that the utilization of metal-processing equipment in machine building decreased from the middle of the 1960's until the second half of the 1970's, and it has not actually improved in recent years. If one takes into account not only the coefficient of shift work, but also intrashift down time and the part of the equipment which was not operating at all at the time of the investigation, then each unit of equipment worked approximately one shift in 24 hours in the basic production, and 0.7 shifts in auxiliary production. It should be noted that on the day of the investigation for which they had prepared ahead of time the indicators of the utilization of equipment were undoubtedly higher than the average daily indicators.

Another reason for the reduction of the number of convention or calculated hours of operation of electric motors, as was already noted, is related to the underutilization of the nominal capacity of the engines. Possibly here there is an effect from the fact that machine tools and other machines are equipped right next to auxiliary engines which are used for a relatively short period of time. An underutilization of capacities is possible either because of the fact that the engine installed on the machine is more powerful than necessary

or that the given machine is being used outside the sphere of its efficient application: for example, a large or medium-sized machine tool for processing small items, a powerful drilling installation for drilling shallow wells, a large-capacity crane for lifting relatively light loads, and so forth. As concerns the correspondence of the installed engines to the requirements of each specific machine, here the NIPTIEM, by coordinating the application of electric motors with machine-building institutes, design bureaus and enterprises, is basically imposing a certain order.

The situation is considerably worse with respect to determining the efficient sphere of application of each machine and forming the optimal type and size structure of the equipment. The utilization of machines with two great or two small capacities, lifting capacities, sizes and weights is an extremely widespread phenomenon. For machine-building frequently does not provide the consumers with machines of the necessary types and sizes, and the consumers far from always strive to select the most economic technical equipment, and sometimes they do not even know for sure which machines to order.

Let us illustrate this with one example. A whole number of investigations have proved that approximately 80 percent of the parts that are processed on lathes have a diameter of up to 100 millimeters while 92 percent of the machine tools that are produced have a maximum diameter of more than 250 millimeters, and 63 percent of them have more than 400 millimeters. It would seem that the consumers should order more machine tools of the first size group (up to 200 millimeters). But in fact it is quite the contrary. Under the 10th Five-Year Plan the orders from this group amounted to only 3.3 percent of all the orders with lathes and they were satisfied by 65 percent. At the same time orders for machine tools with larger sizes with satisfied by 20 to 30 percent.

The fact obviously is that the consumers, when ordering machine tools, have been oriented not toward the sizes of the parts that are processed (that is, not toward the actual need), but toward models that have long been produced by machine tool building and have proved themselves, among which most of them have maximum processing diameters of 320, 400 and 630 millimeters. Thus machine tool building, by reproducing a size structure of machine tools which is not efficient enough, stimulates the consumption by the consumers of larger equipment than they need. How this affects the capacity of the engines of the equipment that is utilized is clear from the following figures: the engine for the main drive of the majority of universal lathes with a maximum diameter for processing of 400 millimeters has a capacity of 11 kilowatts, and simplified modifications of machine tools of the same size group are equipped with engines of 3 and 5.5 kilowatts, but lathes with a maximum diameter for processing 200 millimeters have engines of 3-4 kilowatts. According to approximate calculations, the changeover of only 1 percent of the lathes to the smaller size group would make it possible to reduce the total capacity of electric engines by 100,000 kilowatts. And at the same time one could increase (as compared to the need) the capacity not only of 1 percent of the machine tools and not only of lathes....

It is obviously no accident that in industrially developed countries, including the United States, approximately three-fourths of the machine tools

they produce annually are small and inexpensive ones, and up to half of the forge and press machines have an average cost of about \$300. On these machine tools they usually install engines with a capacity no more than 1-2 kilowatts, and sometimes up to 0.75 kilowatts. The degree of utilization of the capacities of these machine tools, as a rule, is high, while at the same time a whole number of investigations conducted in various years at our industrial enterprises show that the capacity of many kinds of metal-cutting equipment, compressors, cranes and other kinds of technical equipment are being utilized by 30-50 percent.

The not always justified increase in capacities of electric engines is one of the main reasons why the cost and also the weight of the machines are increasing more rapidly than their productivity. Let us illustrate this with an example. As one can see from the table, with a sharp increase in the capacity of the electric motor the increase in the cost of the machine tool takes place considerably more rapidly than the increase in its capacities and productivity. Taking into account the actual utilization, this disparity is even greater.

Growth of Capacities, Productivity and Prices of Machine Tools
of the Alapayev Machine Tool-Building Plant*

Model of Machine Tool	Year of Beginning of Series Production	Length of Time of Production, Years	Capacity of Electric Motor		Price of Machine Tool		Growth of Pro- ductivity, % of First Model for Given Purpose
			kW	% of First Model for Given Purpose	Rubles	% of First Model for Given Purpose	
IK36	1949	9	10	100	2700	100	100
IK37	1951	7	14	140	2900	107	115
IP365	1957	23	13	130	3340	124	128
IP371	1960	20	22	220	6960	258	141

* According to data in article by Ye. P. Gulicheva in the collection "Ekonomicheskkiye problemy intensifikatsii mashinostroyeniya Urala" [Economic Problems of Intensification of Machine Building in the Ural Area], Sverdlovsk, Ural Scientific Center of the USSR Academy of Sciences, 1982, pp 72-73.

Of course an increase in the capacity of a machine can be accompanied not only by increased productivity, but also by improvement in its other useful properties. But it is important to take into account the fact that the greater the capacity of the machine tool, the more frequently one usually finds a significant underutilization of this machine tool. Therefore the output of more powerful machines should be limited to the actual need for them, and an analysis of the structure of the need should be a mandatory prerequisite for selecting equipment. But what does one do if the capacities of already available equipment are not being utilized? According to the data of specialists, it is always expedient to replace an electric engine with a less powerful one when its average loading is less than 45 percent; when the

average loading is more than 70 percent this replacement is inexpedient, and when the average loading is from 45 to 70 percent the expediency of replacement should be confirmed by special calculations.⁶

Sometimes, along with powerful equipment, it is advantageous to have less powerful doubles in the shop. For example, along with a crane with a lifting capacity of 60 tons with an installed capacity of 75 kilowatts, which is used in one of the shops episodically, it is recommended to have for daily operation a second crane with a lifting capacity of 10-12 tons.⁷ The savings achieved from this as a result of prolonging the service life of the costly equipment and also reducing the expenditure of electric energy and other material expenditures will make up for the additional capital investments.

One should take into account the fact that the efficiency factor of engines decreases as the load decreases. For many types of engines with an optimal load the efficiency factor is equal to 0.85, but when loaded by 30-40 percent it is 0.65. Optimization of the capacity and the level of utilization of engines makes it possible, according to estimates of specialists, to save up to 20-25 percent of the electric energy.

According to calculations of B. Ya. Tatarskiye, each kilowatt of installed capacity costs an average of more than 10 rubles at the level of the enterprise. And this is only expenditures involved with the acquisition and operation of electrical equipment; there are considerably greater expenditures involved with the increased capacity parameters of the working machines. The investments in energy engineering are even greater.⁸ Taking into account the scope of production apparatus in industry, each percentage of increase of its electrical capacity alone above the necessary and, according to our calculations, costs the enterprise more than 50 million rubles, and the cost in additional expenditures of metal, production space, labor for manufacturing machines with increased capacities as well as additional expenditures on energy engineering amount to billions of rubles.

Incentives for Economizing on Means of Labor

The increased numbers and capacity of the stock of electrical engines reflects an increase in the scope of the production apparatus and the inadequate level of its utilization both in terms of time and in terms of capacity. How does one explain the fact that the immense reserves for economizing on means of labor are being poorly realized and that output-capital continues to drop in almost all branches of the national economy?

In our opinion, the main reasons lie in the shortcomings of the economic mechanism which is not fully arranged for economizing on means of labor. Engines of machines, like the machines themselves, are being utilized inadequately because they are not strongly affected by those economic levers which are the real engines of the economy and should provide for motivation on the part of enterprises (associations) to economize on all production resources.

Let us consider in greater detail the causes for the inadequate economy on means of labor, which is, moreover, even decreasing. First of all, the

equipment frequently acts as a kind of gift to the consumer. In a number of cases centralized capital investments are allotted along with funds for equipment, that is, it is as though the consumer receives the equipment free of charge. So why not order more equipment or equipment that is more expensive?

Consumers of equipment are not very interested in saving money that is spent from the fund for the development of production either since this money is frequently put together with centralized capital investments. The areas in which these funds can be spent, as a rule, are limited because of many factors. The list of machines that can be acquired is also limited; the allotment of funds for orders for equipment frequently cannot be predicted; plans of the enterprises with respect to the products list and the volume of output of products are frequently changed regardless of the degree to which this products list corresponds to the equipment and the nature of the production capacity of the enterprise.

Even more important is the fact that the underutilization of equipment with respect to capacity, productivity and other parameters is not directly reflected in the cost-accounting [khozraschet] indicators of the enterprises. A reduction of the output-capital ratio or an underutilization of the production capacity does not lead to any sanctions, and in the majority of cases there are no incentives to increase the output-capital ratio or to raise the level of loading of capacities. As a result the managers of the enterprises, as a rule, have more important concerns than saving on means of labor. In other words, the primary reason why the consumers frequently order and the machine builders produce equipment without taking into account the real needs is related to the overall shortcomings of the economic mechanism, the inadequate motivation of the enterprises to economize on means of production, and the limited possibilities of selecting equipment and forming a list of products that corresponds to the structure of the stock of equipment.

In order to eliminate this factor or a whole complex of factors, it is necessary, in our opinion, first of all to consistently realize principles of cost-accounting independence of the associations (enterprises) in the area of financing capital investments for technical re-equipment of production. The conditions of the experiment for expanding the independence of the enterprises stipulate that no entity except the enterprise itself can dispose of the development fund. But it is still a long ways from this principle to complete self-financing, for enterprises participating in the experiment frequently spend, along with money from development funds, centralized capital investments not only for expansion and reconstruction, but even for technical re-equipment of the enterprise.

It would seem that with further development of the experiment the principle of self-financing of expenditures on technical re-equipment should be realized more consistently: the development fund, as a rule, should be the only source of financing of technical re-equipment. But for this its amount must be increased and differentiated depending on the needs of the enterprise for funds for technical re-equipment: on the age of the fleet of equipment, the rate of technical progress in the given branch, and other factors.

But since the most important source of money for the development fund are amortization deductions, the need to increase this fund makes it necessary to have a more flexible amortization policy. Why not, for instance, permit the associations (enterprises) that have sufficient profit and material capabilities for accelerated technical updating of production to write off for amortization a relatively large portion of their income? If the enterprises use their own money to acquire equipment they will be more careful in taking into account their needs, they will look into the variants, and they will substantiate the effectiveness.

But in cases where the equipment is paid for through centralized capital investments (for example, during reconstruction or expansion of production) the decision concerning acquiring it must be made by the enterprise itself. Otherwise under modern conditions it could sustain considerable losses.

Here is one of the clear examples. In 1980 on orders from the Ministry of Heavy and Transport Machine Building, an imported automatic line for rolling steel cylinders for brakes with a productivity of 180,000 items a year was delivered to the Transmash Production Association. Centralized capital investments were allotted to pay for the line, which cost 9.7 million rubles. But there was delay in putting the line into operation because it took so long to construct the production premises and other facilities. In 1984 the association had to pay the bank a considerable penalty for uninstalled equipment, and in 1985 the increase in amortization deductions of approximately 1.5 rubles because of the introduction of the costly line, whose capacity will be utilized only partially until the completion of the construction and assimilation, will place a heavy burden on the production expenditures.

And because the association has been operating under the conditions of the economic experiment since 1984 and in 1985 its material incentive funds will increase (or decrease) by 5 percent for each percentage point of reduction (or increase) of expenditures per 1 ruble of commodity output, it will be forced to ask for help from the higher organization. Obviously, in the future the management of the association will not passively agree to deliver costly equipment if the conditions are not created for its effective utilization. In order to stimulate economizing on means of labor, it would be possible to go even further: with an increase in the output-capital ratio, to permit the enterprises to keep a certain amount of money that is saved from the fund for the development of production and deposit into the material incentive fund in order to provide incentives for the workers who provide for improvement of the utilization of equipment and also money spent on technical re-equipment of production. Or one could increase (reduce) the material incentive fund by 2-3 percent for every percentage point of increase (reduction) of the output-capital ratio.

But the motivation of the enterprises to economize on means of labor can be realized in practice only if the enterprises have real opportunities to display initiative in the area of the formation and perfection of the structure of their production apparatus. In this connection it is necessary, in particular, to further develop the distribution of means of production, above all those that are not in short supply, under the policy of wholesale

trade and direct economic ties and to expand the sale of machines and instruments. It would also be expedient to proceed toward an essential reduction of the volumes of production of certain kinds of traditional equipment in order to make it easier for the enterprises to rapidly assimilate the output of principally new, effective machines.

A most important role in improving the structure and increasing the effectiveness of machines and equipment should be played by scientifically substantiated methods for planning their structure. It must be recognized that the structure of the equipment has not become a special object of planning. At the basis of the planning of the production of machines is the establishment of the rates of growth and volumes of production of individual kinds of them while what should be in the foreground is a definition of the rational proportions among various kinds of technical equipment, particularly technologically related ones and those which augment one another in production.

Machine-building ministries and scientific research institutes do not devote enough attention to determining the need for equipment. Services that are in charge of keeping accounts of the needs, as a rule, are few in number. They determine the need in a consolidated way, in terms of the main kinds or groups of machines while they should determine it also according to type sizes and models. The determination of the need and structure of equipment is based on consolidated normatives. Here an investigation of the utilization of equipment in terms of time, capacities and other technical parameters is usually not conducted and is not usually used as a basis for determining an efficient structure for the equipment. As a rule, there is no feedback from the consumers to the producers of the equipment. As a result, the machine builders do not play a sufficient role in the formation of an optimal structure of the stock of equipment for the consumers, they study the structure rarely and inadequately, and they do not influence the level of utilization of the parameters of equipment through "adding on" the type size structure of the output of machines to the character of the operations they perform.

The technical documentation for the equipment that is produced does not indicate the specific conditions or the area of its efficient application. Yet the consumer, for example, of a metal-cutting machine tool must know when he acquires it how the time periods for recouping the money change depending on the level of shift work, series production, the complexity of the items that are processed, and so forth.

In the majority of cases the development of series of sizes does not lead to the assimilation of production of all the models envisioned in the type list or the type sizes of technical equipment. The gross methods of evaluating economic activity, the drive for quality of the products that are produced, the shortcoming in unification and other factors lead to a situation in which only the base model is assimilated, the output of machines of this model increases rapidly, and other type sizes or modifications of the given kind of machine are either not produced or are produced in a small quantity with a low technical level of production. As a result of this machines with small capacities or simplified designs frequently turn out to be more expensive and

the quality worse than that of the more complicated and powerful machines of the base models. Here the consumer, as was noted, orders not the machine which corresponds to the conditions of his production and the sizes of the items he processes, but the machine which is produced in large quantities, has managed to prove itself, is better supplied with spare parts, and so forth.

Thus it is necessary to considerably increase the role of machine building in the formation of an efficient structure for the output and, consequently, the stock of machines. We are speaking about having machine builders not be limited to a simple accounting for the orders of consumers, but to form their demand, offering for each specific sphere of application the most effective technical equipment, showing its advantages, removing outdated models from production, and, if necessary, participating in the introduction, service and repair of new technical equipment on the premises of the consumer.

In order for machine builders to strive to fulfill this role, it is necessary to eliminate conditions whereby the supplier is confident that he will be able to get rid of practically any product, in other words, conditions of short supply which are frequently artificially created and exist only because the enterprises are not interested in economizing on means of labor and are frequently ready to pay even for equipment for which they have no need. For this reason they frequently plan for enterprises to produce products for which there is no demand, and the consumers are allotted funds for the items which they have not ordered. This situation is taking form now, for example, with certain outdated kinds of tractors. Obviously this contradiction can be resolved only on the basis of measures directed toward expanding the independence and increasing the motivation of enterprises to efficiently expend funds for the creation of equipment. The volume of the demand will be less and the requirements of the consumer will be greater--so the suppliers will devote more attention to the structure, parameters and quality of the items.

In addition to stimulating the utilization of fixed capital, the degree of motivation of the enterprises to protect existing equipment and load it more effectively and also to apply new technical equipment under the conditions of the national economy can be influenced, in our opinion, in another way: by limiting the production of that traditional technical equipment which already exists in large quantities in the national economy. For it is known that during the years of industrialization, when we still did not have enough technical equipment, the manager of production strived not to let a single machine stand idle and eliminated any misrepair as soon as possible, and the equipment was sent first to places where it was needed most. Does an enterprise not have too much equipment now if at many of them when going into the shop even on the first shop one can see that half or sometimes more of the machines are not in operation? And would it not be better to reduce the resources allotted for production, say, of traditional machine tools, to two-thirds to one-half, thus freeing up machine-building capacities for assimilating new, highly productive equipment or equipment that is in shorter supply? And the consumers of machine tools, when they receive less of the traditional equipment, will simply be forced to operate existing machines better, handle them more thriftily, repair them more quickly, and introduce new technical equipment and technology into production more actively.

Let us sum up the results. First, there are considerable reserves for reducing the quantity of the ordinary electric engines that are produced as a result of improving their quality, reducing the stocks of them, and further developing specialized repair of these machines.

Second, the reserves related to increasing the load in electric engines can be realized with more correct determination of the areas of their application, the installation of the most appropriate engine on each machines, better utilization of equipment both in terms of time and in terms of capacity and, finally, bringing the type size structure of machines and equipment in line with the nature of the parts that are processed and the operations that are performed.

Third, in order to provide for greater economy of the stock of electric engines, which is reflected in the economy of the production apparatus of industry and a number of other branches of the national economy, it is necessary to create a mechanism of economic incentives for enterprises to utilize means of labor better. The best variant will be the mechanism whereby all of its elements--the policy for forming and distributing profit, the formation and utilization of economic funds, wages, bonuses for increasing labor productivity, savings on funds and objects of labor, self-financing in the area of capital investments and so forth--would provide for independence of the enterprises and their motivation to economize on all production resources. As long as this motivation is weak, it is necessary to have direct stimulation of the growth of the output-capital ratio and the loading of production capacities.

And finally, fourth, at industrial enterprises it is expedient to apply extensively energy indicators of the level of utilization of equipment--the conventional number of hours worked by a unit of capacity of electric motors and sets of electric equipment; and to install for this purpose additional electric meters in the shops and sections as well as to develop normative indicators for the utilization of capacities.

FOOTNOTES

1. Palterovich, D. M., "Energy Indicators of Production Effectiveness," EKO, No 3, 1970, p 37.
2. Calculated from data from the statistical collections "The USSR National Economy," 1975-1982,
3. In household appliances they use mainly engines with capacities of up to 0.25 kilowatts, however certain appliances require larger engines.
4. "The USSR National Economy During 1922-1982," pp 142, 143.
5. The question of the production and structure of electric engines as one of the most important indicators of the effectiveness of the utilization of industrial equipment was raised in the notes of the specialist of the electrical equipment industry, V. M. Pisarev, which were presented to the

Institute of Economics of the USSR Academy of Sciences. He also made a number of comparative calculations of the output of electric engines in the USSR and the United States.

6. Kopytov, Yu. V., Chulanov, B. A., "Ekonomiya elektroenergii v promyshlennosti" [Economizing on Electric Energy in Industry], Moscow, "Energoatomizdat", 1982, p 31.
7. Ibid., p 93.
8. Each kilowatt of installed capacity is evaluated for the national economy at an average of from 200 to 500 rubles, SOTSIALISTICHESKAYA INDUSTRIYA, 29 January 1983.

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NEED FOR IMPROVING REPAIR WORK STRESSED

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA (EKO) in Russian No 3, Mar 85 pp 23-33

[Article by I. M. Yegorov, chief of the technical division of the All-Union Soyuzelektroremont Association (Moscow)]

[Text] When speaking about increasing the effectiveness of public production one cannot forget about the need to maintain already created production capital at the proper technical level and with minimal expenditures. In this connection repair and modernization of equipment become more significant.

From the History of Centralized Repair of Electrical Equipment

Its origin dates back to the beginning of the 1930's when repair was carried out through the forces of the all-union trust Remmashtrest. After the trust was eliminated in 1939 its functions were transferred to Orgenergomash of the USSR People's Committee of Heavy Machine Building, and in 1940--to Energoremrest, which in 1959 was renamed as the All-Union Electrical Equipment Trust (VET) of the Ministry of the Electrical Equipment Industry.

The network of enterprises for centralized repair of electrical equipment has developed successfully, and by 1957 the VET included more than 30 of them. In addition to the repair and output of electrical equipment, they repaired up to 250,000 asynchronous engines with capacities of up to 100 kilowatts.

In 1954 the USSR Gosplan with the participation of the USSR Gosstroy, the Ministry of the Electrical Equipment Industry and a number of other ministries held a conference at which they adopted the following policy for the development of interbranch specialized repair of electrical equipment. As part of large new industrial units (objects) they were to construct electrical repair plants which were to be transferred to the Ministry of the Electrical Equipment Industry for servicing enterprises and organizations according to the territorial principle. By 1957 17 large electrical equipment repair enterprises were under construction.

The Ministry of the Electrical Equipment was the only union department which before the organization of the sovnarkhozes provided centralized repair of products that are produced and satisfied up to 25 percent of the needs of the

national economy for capital repair of the most widespread kind of electrical equipment--asynchronous engines with capacities of up to 100 kilowatts. During the first years of their existence the majority of sovnarkhozes not only did not contribute to the development of nonplant (interbranch) centralized repair of electrical equipment, but, on the contrary, changed the profile of many electrical repair enterprises that had been transferred to them from the Ministry of the Electrical Equipment Industry. But subsequently the objective need for reducing expenditures on repair brought about a reverse reaction. In a number of economic rayons the sovnarkhozes began to expand or to create electrical equipment repair enterprises for serving the consumers of various branches of industry.

Because of the reorganization of the management of the country's national economy in 1985, repair enterprises that were in existence or under construction were transferred to the jurisdiction of various branches of industry. And when in 1966 the All-Union Association for Repair and Modernization of Industrial Electrical Equipment (Glavelektroremont and now--Soyuzelektroremont) of the Ministry of the Electrical Equipment Industry was created, many specialized repair enterprises were not included in it and the electrical equipment repair subbranch of the Ministry of the Electrical Equipment Industry in 1966 had dropped considerably below the 1957 level in terms of the volume of repair work.

The transfer of a number of repair enterprises to the jurisdiction of the ministries and departments, whose tasks did not include serving consumers under the jurisdiction of various departments, violated the territorial principle for service and the established ties of repair enterprises with consumers of their products. They did not have the necessary material, labor or financial resources for filling orders from consumers under the jurisdiction of various departments, the enterprises were forced to curtail repair work, and the ministries began to plan changes in their profile or, for loading purposes, made it incumbent on enterprises under their jurisdiction to ship electrical equipment from various regions of the country for repair. This, in turn, considerably increased transportation expenditures.

Such were the basic stages in the development of the electrical equipment repair work in our country, the most widespread products of which are asynchronous engines.

Volume of Repair Work on Asynchronous Engines

The removal (physical wearing out) of asynchronous engines takes place several times more rapidly than the obsolescence process does. During the past 35 years 170-180 million electric engines were removed because of physical wear and tear. Of these 100-110 million were restored and 70-80 million were transformed into secondary raw material. We determined these figures on the basis of the volume of material resources allotted during this period for their repair. According to our estimates, the stock of asynchronous engines installed in the national economy amounts to about 100 million, with an overall capacity of 420-450 million kilowatts. With an average duration of the repair cycle¹ of 8 years, the quantity of engines that are removed for

capital repair because of physical wear and tear in 1980 amounted to 12.5 million.

An inspection of Vtorchermet bases which was conducted in 1981 by interbranch brigades showed that up to 60 percent of the electric engines that are sent to the bases, according to existing technical specifications for repair, can be repaired. Thus the equipment which is not obsolete and does not have physical wear that cannot be repaired is being used for secondary raw material on a large scale. Its workability can be almost fully restored by capital repair of worn-out parts, which would save on raw materials that are in short supply which are required for producing new engines.

One can draw the conclusion that the problems related to technical servicing and repair of asynchronous engines, in terms of their economic significance, have long ago crossed over the boundaries of individual branches and have become national economic problems.

The Pivotal Problem--Organization of Capital Repair

Traditionally there has been a situation in which the manufacturers of the equipment do not participate in its repair. This leads to semiprimitive, not very productive repair work. In terms of its organizational-technical and economic level it falls significantly short of modern requirements. There is a prevalence of the less effective, individual type of organization of production and extremely poor technical support for labor. Thus the proportion of manual labor in the repair of electric engines amounts to 85-90 percent. More than 100,000 enterprises and organizations in the country have their own repair shops and other facilities, including more than 40,000 electrical equipment repair shops.

From the economic standpoint it was expedient and in practice it turned out to be impossible to provide such a large number of electrical equipment repair shops and other facilities belonging to enterprises of various branches of the national economy with the necessary equipment and fittings or to provide them with the large list of materials and spare parts that were needed. As a result, the majority of electrical equipment repair shops and other repair facilities used simplified technologies and the quality of the repair remains low. In those cases in which problems with technological fittings and material and technical support have been solved, there arises the problem of utilization of fixed capital and circulating capital. Because of the lack of a sufficient concentration of electrical equipment and the individual nature of the work, costly equipment stands idle for a considerable amount of time and materials and spare parts lie in the warehouses for a long time waiting to be used.

The inadequate organizational-technical and economic level of repair enterprises, the dispersion of repair work among numerous shops and other facilities and the unified nature of repair work bring about the high labor-intensiveness and cost of repair, its poor quality, and the increased expenditure of material and labor resources. It has been calculated that if expenditures on repair of technical equipment in the country were reduced by 10 percent, the national economy would have a savings in the amount of 1.3-1.4

billion rubles a year. And as a result of increasing labor productivity in repair production to the level that is the average for branches of machine building, in 1971-1980 it would have been possible to release and send into the sphere of main production about 1 million auxiliary workers.

Asynchronous engines are now repaired in the following way: decentralized (repair by the consumer)--73-78 percent; branch centralized--12-15 percent; and interbranch centralized--10-12 percent. The volume of capital repair of asynchronous engines in all three of the aforementioned organizational forms is equal to the volume of output of new engines. But expenditures on repair which are made by the national economy are considerably higher than their value, and the number of workers exceeds the number of workers in the plants that manufacture the engines five- to sixfold.

There arises the question: Is repair advantageous? The answer can be obtained by analyzing the structure of expenditures on the production of new electric engines and their repair at specialized electrical equipment repair enterprises.

The labor-intensiveness of the repair of engines with a capacity of up to 10 kilowatts averages 20 percent higher than the labor-intensiveness of the manufacture of new ones. But the savings on the other elements of expenditures (raw and processed materials, overhead expenses and so forth) reduces the cost of repair by half as compared to manufacture of engines, and the release price after repair amounts to 40-70 percent of the wholesale price of new electric engines. For electric engines within the range of capacities of from 10 to 100 kilowatts repair is more advantageous in terms of all elements of expenditures, including labor expenditures, and the release price after repair is 30-45 percent of the price of new engines.

Specialized enterprises have been able to achieve results like these because of the introduction of the flow line method of repair. An organizational prerequisite for this is concentration of engines of the same type, which, in turn, is provided by the interbranch nature of the activity of enterprises according to the territorial indicator of service for the consumers. The introduction of standard technology for repair and a large complex of specialized technological equipment and means of mechanization at interbranch enterprises of Soyuzelektroremont of the Ministry of the Electrical Equipment Industry, with a comparable products list, provided for the lowest cost of repair work of the country and the highest labor productivity. The cost of repairing electric engines with capacities of up to 100 kilowatts here is one-third to two-sevenths the cost when these are repaired by the consumer, and labor productivity increases 4-4.5-fold.

But the proportion of engines that are repaired at these enterprises is insignificant (10-12 percent). Most of them are repaired by the consumers, with a two- to threefold increase in the cost of repair. Expenditures on repairing engines are covered by amortization deductions, and when these are inadequate--at the expense of the basic production. In either case this is included in the production cost of the products that are produced. But because of the fact that the proportion of expenditures on capital repair of engines in the production cost is not great, not enough attention is devoted

to reducing these expenditures. And in the country as a whole they amount to an impressive figure--more than 500 million rubles a year.

Research of the VPTIElektro (Leningrad) and the Lvov Polytechnical Institute (see table) confirm the need for priority development of specialized production capacities. This path solves a number of important problems. First and foremost there will be a rise in the technical and economic indicators of repair which depend to a large degree on the supply of materials and spare parts. The shortage of spare parts is explained by the inadequate volume of their production, and materials--by the inadequate volume of funds allotted for repair and operational needs. With respect to the repair of asynchronous engines, the main factor that creates a shortage of spare parts and materials is the imperfection of the organizational form for repair. Significant supplies of them are dispersed among numerous shops and other repair facilities, where the probability of their utilization is insignificant because of the immense products lists. And in the country as a whole there seems to be a shortage of spare parts and materials. Improvement of organizational forms for repair and a certain increase in the output of individual kinds of materials that are sent to the sphere of repair will completely solve this problem. Thus for specialized enterprises of Soyuzelektroremont the normative of reserve stocks of insulated and enamel wire is 24 days. And the supplies of these materials that have piled up over the years in repair shops belonging to the consumers exceed this amount severalfold and yet there is a chronic shortage of wires with the necessary characteristics.

Wholesale Prices for New Items, Their Repair
and Actual Cost of Capital Repair

<u>Groups of Electrical Equipment</u>	<u>Present Capacity, kilowatts</u>	<u>Wholesale Prices of Capital Repair From Price List, rubles</u>	<u>Actual Cost of Capital Repair, rubles</u>	
			<u>At Specialized Enterprises</u>	<u>With Decen- tralized Repair</u>
General-purpose engines with capacity from 0.25-100 kW	5.5	26.0	20.8	63.4
Engines with capacity of more than 100 kW	200.0	990.0	890.0	1487.0
Crane engines	22.0	157.0	127.0	219.2
Explosion-protected engines	7.5	63.0	51.0	103.8

The problem that is second in terms of economic significance is reducing to a reasonable amount the quantity of uninstalled (annual) engines and those that are to be repaired. In the national economy there is a significant reserve of engines, and engines that are suitable for repair are being sent for salvage. The situation could be changed if the consumers were guaranteed repair within a certain amount of time and sales organizations would exchange or replace

engines with the proper orders. Under these conditions there would no longer be any need to accumulate too many of them, and the consumers, with a certain amount of incentive, would transfer surplus engines to the repair enterprises. The volume of deliveries under orders from sales organizations, taking into account obsolescence of the engines, in the stage of repair could be increased to 2 million a year. This would also reduce their production at electrical machine-building plants.

Centralization of repair will make it possible to organize the processing of asynchronous engines into secondary raw material with a separation of the ferrous and nonferrous metals. If one assumes that in 50 percent (and actually this figure is considerably higher) of the engines that are sent for salvage the starter coil has not been removed, and in certain cases also the rotor, as a result of mixing the scrap ferrous and nonferrous metals there is not only an essential loss of copper (during the past 35 years, according to the author's calculations, more than 180,000 tons have been lost for good), but also a sharp deterioration of the quality of the steel that is smelted from the secondary raw material.

The existing normative and technical documentation for receiving scrap ferrous metals does not allow aggregates and machines to be sent for scrap metal unless they are dismantled. But these requirements, as an interdepartmental inspection showed, are not always met. There are more and more complaints from metallurgical enterprises, particularly about the increased content of copper. Therefore associations and enterprises of Vtorchermet are trying to improve the quality of the preparation of scrap metal for resmelting, by removing the nonferrous and ferrous metals and improving the organization of work for sorting nonferrous scrap metal. The basic object of reprocessing are electrical machines. A certain amount of labor resources and capital investments is being expended on this work, but the cost of the nonferrous scrap metal that is obtained is extremely high. At the same time specialized electrical equipment repair enterprises of Soyuzelektroremont are also sorting and removing insulated wiring and subsequently turning the nonferrous scrap metal over to Vtortsvetmet. The technical level of this production meets modern requirements, and its equipment (a vertical closed cart conveyor with a hydraulic stand for dismantling engines, machine tools for cutting off the frontal parts of windings and removing the windings from the grooves, and so forth) in terms of technical parameters even surpasses those used in the United States, the FRG, England and France. But these production capacities are only utilized on one incomplete shift. With the insignificant reconstruction involved with expanding warehouse and transportation subdivisions they would make it possible to separate into secondary raw material up to 1 million engines a year. Moreover the suitable and unamortized parts and components could be used as spare parts for repairing engines. This would not only fully solve the problem of spare parts for repair, but would also make it possible to send surpluses to electrical machine-building plants to be used for manufacturing new engines. It would be necessary to grant the exclusive right for processing electrical machines to interbranch electrical equipment repair enterprises, and their reconstruction or new construction would be done with funds of the ministries of ferrous and nonferrous metallurgy.

Thus, on the one hand, we have significant achievements in the area of organization of the production and technology of repair at specialized enterprises, which in the area of repairing asynchronous engines, in terms of the organization and technology of production, surpass the achievements of a number of developed capitalist countries. At the same time, in the country as a whole the organization and level of repair production lag significantly behind domestic and foreign achievements, and they do not meet modern requirements for the development of the national economy.

Suggestions

Principal problems related to the organization of centralized repair of technical equipment and manufacture of spare parts were resolved in 1966. The machine-building ministries were instructed to develop and implement concrete measures for introducing centralized repair of the widely used technical equipment they produce, and the consumer ministries were instructed to organize centralized repair of machines and equipment for narrow branch application. In 1973 a decision was made concerning the development of suggestions for concentrating repair and other service productions for interbranch purposes in order to supply products and services for enterprises and organizations under various jurisdictions which are located on the territory of the corresponding republics. Prerequisites were created for embodying in planning assignments the decisions of the directive agencies in the area of increasing the effectiveness of repair work.

But because of the fact that, in our opinion, they have not yet solved the main problem--who specifically should handle problems of further development and improvement of repair work--no essential improvement has taken place in this area and the possible savings on monetary, labor and material resources have not been achieved.

In this regard we consider it necessary:

first of all--to provide for fulfillment of previously adopted decisions regarding improvement of repair work in the country;

to develop normative documents concerning further improvement of this area of the economic mechanism which envision a complex of mutually coordinated and mutually augmenting measures which are oriented toward satisfying the needs of the national economy;

to provide for the introduction of the measures that have been developed into the practice of economic activity.

The most important measures for improving repair work are centralized planning of repair at the level of the "Union Ministry--USSR Gosplan" and concentration of repair work for interbranch purposes in order to provide products and services for enterprises and organizations under various jurisdictions.

Meeting these two essential requirements of the party and government in the area of increasing the effectiveness of repair work will radically change the economic situation of repair of electrical equipment and will solve in the

most economical way the problems associated with the utilization of asynchronous engines and other electrical equipment for mass use.

We have calculated that the concentration of existing specialized repair productions in various branches of the national economy and their technical re-equipment to the level of the leading enterprises of Soyuzelektroremont will increase the volume of interbranch repair of asynchronous engines even without new construction to 4-4.5 million units. But this will still not fully solve the problem of repair work. Certain economic regions have no branch or interbranch electrical equipment repair enterprises or else their production capacities are insignificant. New construction is needed here.

At the same time it is possible that there will be certain difficulties on the path to implementing the aforementioned measures because the USSR Gosplan does not have a structural subdivision for managing the development of repair production and it is possible that there will be a narrow departmental approach and elements of local favoritism on the path to concentration of electrical equipment repair productions on the part of those who are in charge of them. We could suggest a second, alternative variant to the development of interbranch specialization of the repair of electrical equipment. It consists in having the consumer ministries and departments transfer to the producers the repair of certain kinds of resources not with an advance, which is not always used for intended purpose, but with payment for the actual volume of work performed during the past period, that is, the consumers of the repair work should settle with the producers of the repair work in terms of the volume of work that has been performed.

It is also necessary to transfer the limits on labor with the corresponding wage funds in keeping with normative approved under the established policy for the labor-intensiveness of repair work and normatives of wages for the planned unit of volume of repair work; material and technical resources in keeping with existing norms for expenditure; capital investments with the plan for contracting work in keeping with normatives for the construction of electrical equipment repair enterprises.

The basic principle of the proposed method--"having received assistance, one reimburses expenditures"--not only precludes any possibility of obtaining unilateral advantages, but also establishes mutual interest of both parties to develop interbranch production.

The consumers of the repair work receive on credit for 2 years additional labor and material resources in the form of repaired equipment. They return these resources in keeping with better normatives, for example, labor expenditures are one-third to one-fourth what they would be if they had repaired the corresponding equipment through their own efforts. They will be motivated to achieve high rates of growth of the volumes of production and labor productivity and to take from the consumers all kinds of resources for further development of centralized repair, thus redistributing the resources in favor of interbranch production.

This policy will provide for more rapid development of interbranch production since the increase in its volumes will be determined by two constituent

elements: growth as a result of the higher technical level of production and increased labor productivity at existing enterprises; and growth as a result of enlisting additional resources from the consumers of the repair work. Simple calculations show that while keeping the levels of growth of volumes of production and labor productivity achieved at enterprises of Soyuzelektroremont at 6.5-7 percent a year and with a corresponding increase in the volumes of production as a result of enlisting resources from the consumers, the volume of interbranch repair work during 10 years will increase fourfold, and 15 years--sevenfold.

We understand that transferring the limits for labor, material resources and capital investments for accelerated development of interbranch repair will be possible if the producers of the repair work will guarantee the consumers high quality, the performance of the work within the established time periods and a large list of repair jobs for equipment. Hence the need for a unionwide provision concerning interbranch repair which will regulate the relations between the producers and the consumers. It seems that it should come as close as possible to the provisions concerning the delivery of products for production and technical purposes and also have a section on principles of shared participation in the development of specialized capacities for interbranch repair work. On the basis of this provision it is necessary to conduct an economic experiment for increasing the effectiveness of the repair of electrical equipment.

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FLEXIBLE AUTOMATED PRODUCTION FURTHER EXPLORED

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA (EKO) in Russian No 3, Mar 85 pp 35-50

[Article by P. N. Belyanin, doctor of technical sciences, professor, director of the Scientific Research Institute of Technology and Organization of Production (Moscow): "Flexible Automated Productions: Their Capabilities and Prospects"]

[Text] The development of electronic computer equipment and the creation on the basis of this of robots and equipment with numerical program control marked the beginning of a new branch of automation. It became possible to organize automated production with principally new properties, which add to it the utilization of artificial intelligence.

Modern machine-building production, which is acquiring more products (more purposes) is usually divided into two sharply different kinds--small series and mass. Machine building with small series and series nature of production in our country and in other industrially developed countries produces up to 75-80 percent of the overall volume of products. It typically has a constant increase in volumes, complication of designs, increased labor-intensiveness and larger lists of products that are produced. Frequent replacement of objects of production requires a reduction of the time periods for assimilating the new products.

The key to success today is in the hands of those enterprises which have the highest rates of automation since further intensification of production and machine building and its increased effectiveness are possible only with an essential increase in the productivity of technological equipment (on the basis of its extensive automation) and improvement of organization and management of production. But the more automated the process that is carried out on a given kind of technological equipment, the more expensive it is, and this means the more difficult it is to recoup the investments. In connection with this there arises the problem of output-capital ratio--the most important economic indicator.

At present in our country there are fewer machine tool operators than there are machine tools. Hundreds of thousands of universal machine tools everywhere are being utilized with special adjustments whereby the machine

tool is arranged to perform some single, frequently fairly simple operation and is used during 5-15 percent (and sometimes even less) of the annual supply of working time. In a number of cases this is understandable since readjustment of the machine tools takes a good deal of time and requires highly skilled adjusters who are always in short supply. But immense funds are also frozen this way. If one adds to this the fact that practically all newly created technological equipment (machine tools, presses, installations) which have increased productivity (as a result of the high level of automation of the process performed on it) are more complicated and more expensive than the analogous old machines, and the relationship between the price and the productivity far from always turns out to be in favor of the new equipment, then it is not difficult to explain the reasons for the regular reduction of the output-capital ratio. In addition to the aforementioned factors in the reduction of the output-capital ratio, let us also point out the fact that the current costly "rigid" automated lines and special automated equipment of mass production cannot be utilized for a long time: as soon as the list of items changes it is necessary to replace the line.

Scientists and specialists who are engaged in the problem of increasing the effectiveness of production more and more frequently come to the conclusion that it is necessary to create equipment which would not have to be completely replaced when there is a change in the products that are produced. Utilizing all production equipment without replacing it for a long period of time (while the products are replaced several times) and learning to operate it in such a way that productivity does not decrease, but increases--here is where they see the possibility of improving the utilization of fixed capital. Thus there arose the idea of restructuring production on the basis of reprogramming equipment, for example, machine tools with numerical program control (ChPU). This idea was further developed when control computers appeared.

Industrial robots (automated manipulators with program control) are also a clear example of technological equipment with broad and universal capabilities of reprogramming (readjustment) for any work within the limits of their technical specifications. The range of this equipment is constantly being broadened and therefore on the basis of it, in spite of the relatively high cost of new means of production, under the condition of intensive and intelligent utilization, it is possible to create highly effective production.

Flexibility of Automated Production--What Is That?

The new kinds of production are flexible production complexes (GPK) and flexible automated productions (GAP) that are controlled by electronic computers. In the GPK practically all of the technological operations are automated, which provides for the achievement of a higher level of labor productivity.

For example, in a GPK for mechanical processing, not only the processing of parts according to a given program is automated, but also transportation and delivery of the blanks from the warehouse to the machine tools and the processed parts from the machine tools to the warehouse, the replacement of cutting and measurement instruments, monitoring of the quality of the processing of parts, removal of shavings from the machine tools and the

delivery of lubricant and cooling liquids, as well as replacement of the processing programs. The thing that distinguishes the GPK from the traditional automated lines for mass production is its flexibility, that is, the possibility of rapidly changing over to the processing of any part within the limits of the technical capabilities of the equipment.

The basis of the automation of the GPK is extensive utilization of systems of numerical program control (ChPU) and control computer complexes (UVK) for control and coordination of the operation of all technological equipment, for example, machine tools, transportation and all devices necessary for the functioning of the GPK. Here it is possible to realize the principles of "human-free" (or, rather, reduced human) technology of mechanical processing with 24-hour operation of the equipment, which is extremely important under the conditions of the constant shortage of skilled machine tool operators.

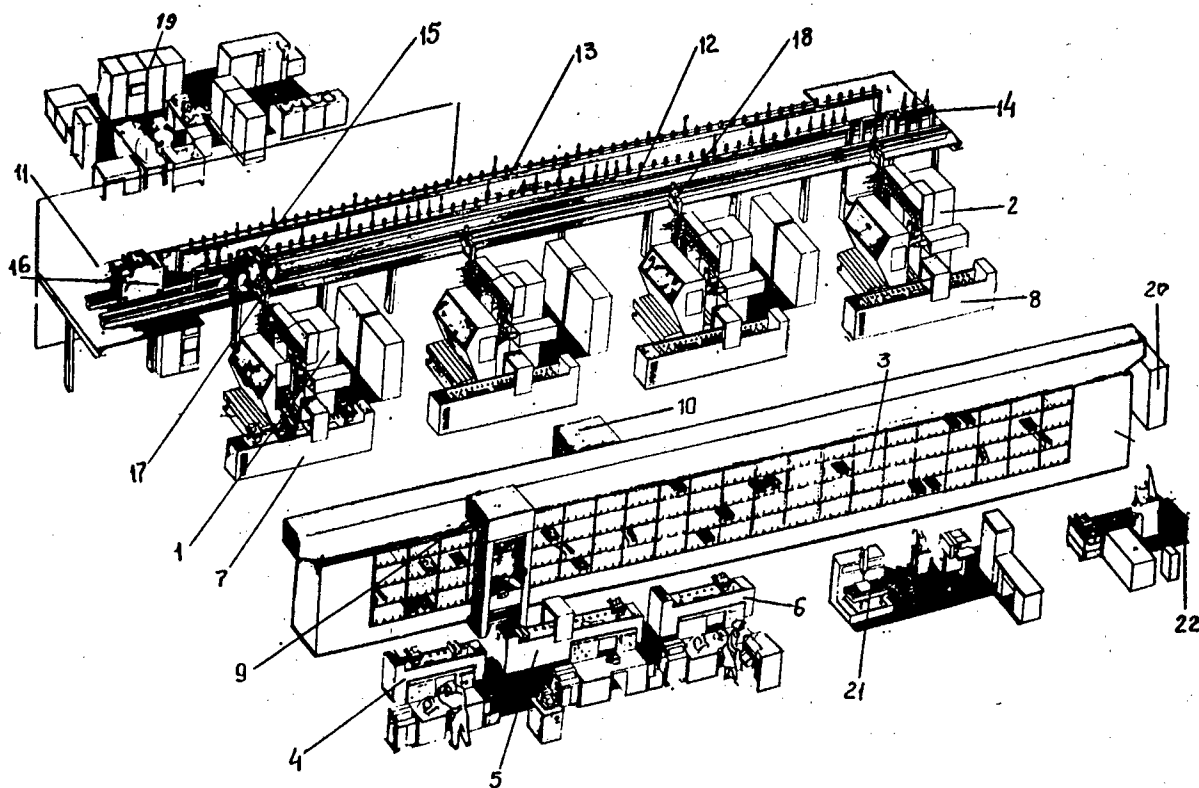
In small-series and single-unit productions the coefficient of loading machine tools with numerical program control usually amounts to 0.4-0.6, and the coefficient of shift work--no more than 1.3-1.6, as a result of which out of the 8,760 hours of annual time budget equipment with numerical program control is utilized productively for only 600-900 hours, which amounts to 7-10 percent of the time budget. Moreover, when parts are processed in batches they spend 80-95 percent of the time waiting in line and only 5-20 percent of the time being processed on machine tools.

The changeover from individual machine tools with numerical program control to automated complexes increases the effectiveness of equipment with numerical program control two- to threefold as a result of the minimization of the time for readjusting it to produce other products, and also the freeing of the operator from monotonous work and the need to constantly observe the machine tool. There is an essential reduction of the production cycle for processing the parts. It becomes possible to perform operations of processing parts with various structures in any sequence.

The GPK grows into a GAP when it includes two basic parts--the GPK and a flexible system for automatic technological preparation of production. The GAP makes it possible in small-series and single-unit multiproduct production at any desired moment to halt the manufacture of the products that have been assimilated and in a short period of time with minimal expenditures to begin to produce new items.

The most expedient and effective is the module construction of the GAP. Initially flexible production modules (GPM), cells, are produced and on the basis of these they produce flexible complexes--lines, sections and, finally, flexible automated productions--shops and plants.

The drawing shows a fragment of the ALP-3-2 flexible automated complex, which is intended for comprehensive mechanical processing of 70 kinds of body parts. The complex includes eight machine tools, a transport-warehouse system, automatic robot operators for changing the instruments, and a control computer complex which is located in a separate room.



Fragment of Flexible Production Complex ALP-3-2 for Mechanical Processing of Complex Housing Parts (Component Diagram)

Key:

1. Multi-operational five-coordinate machine tools with numerical program control of the "processing center" type
2. Multi-operational six-coordinate machine tools with numerical program control
3. Walling for protecting trays with blanks or parts
4. Loading aggregate
5. Unloading aggregate
6. Control device
- 7, 8. Aggregates for receiving trays of blanks
- 9, 10. Automatic robot-stackers of automated transport-warehouse system
11. External warehouse for instruments of the system of instrument supply
- 12, 13. Central instrument storehouses of the system of instrument supply of the line type
14. Cassette for instrument
- 15, 16. Automatic manipulators (auto-operators) of the transmission instrument

- 17, 18. Transfer box for transferring instruments
19. Control computer complex
20. Local system for numerical program control
21. Division for control of parts
22. Division for adjusting instrument.

Complete automation of all work related to mechanical processing of parts provides for changing over to processing parts in productions with small-series and series output while keeping conditions of mass production.

The introduction of this complex makes it possible:

to provide for flexibility of production;

to reduce the production cost of the products that are produced to one-third to one-fifth the previous cost;

to improve the quality of the parts and advance the art of production;

to reduce the production cycle two-fifths to one-third;

to increase the coefficient of utilization of equipment with numerical program two- to threefold and to double the coefficient of shift work under the conditions of technology without human participation;

to release up to 70-90 highly skilled universal machine tool operators or seven to eight operators of machine tools with numerical program control.

It is precisely the high effectiveness of the GPK that explains the fact that, in spite of the relatively short (10-12 years) time that has passed since the beginning of work on the creation of the complex, by 1980 in industrially developed countries of the world there were about 60 GPK's for mechanical processing in operations. These were developed mainly in the USSR, Japan and the United States. During the past 3 years all leading machine tool-building firms of developed Western countries have begun to create GPK's and the number of flexible production complexes that have been introduced have begun to increase sharply (in the middle of 1984 there were more than 250 GPK's in operation).

In our country design organizations of the Ministry of the Machine Tool and Tool Building Industry as well as other ministries are engaged in the creation of GPK's, and the work has been under way since 1970. A certain amount of experience has been accumulated in the creation, production and operation of GPK's, which makes it possible to evaluate the technical capabilities, the prospects for development and application, and also the technical and economic effectiveness of flexible automated complexes and productions.

Let Us Calculate the Economic Effect

Presented below are the results of a consolidated technical and economic calculation of the effectiveness of the GPK which is confirmed by the practice of operating them. For comparison we took the ALP-3-2 GPK (see figure) and a

section comprising 16 automatically operating machine tools with numerical program control of the "processing center" type which produced the same quantity of products. The conditions of the calculation were as follows:

the utilization in both cases of machine tools with the same technical specifications on two and three shifts, and it is taken into account that 16 machine tools are serviced by eight machine tool operators;

equal output of parts with the same design (of the "hydraulic unit housing" type) in a quantity of 6,600 a year with 50 different kinds;

the labor-intensiveness of the manufacture of the standard part (with an average cost of 100 rubles): in the complex--5.6 hours, on the machine tool--7.56 hours (an increase according to the norms of the ENIMS of 35 percent is explained by the additional expenditures of time on resetting the machine tools when changing over to processing a new part, changing blanks, and so forth);

the coefficient of shift work when operating on two shifts: the complex--2, machine tools--1.6; on three shifts: the complex--3, machine tools--2.2;

the coefficient of loading of the equipment: the complex--0.85 (taking into account prevention and repair), the machine tools--0.7 (taking into account organizational and technical losses for replacing worn-out instruments, cleaning up the shavings and so forth);

the production cycles: for the complex--6 days, for the machine tools--45 days.

The results of the consolidated calculation are presented in the table.

Economic Effectiveness of Flexible Production Complex Compared to Operation
of Autonomously Operating Machine Tools With Numerical Program Control
of the "Processing Center" Type, thousands of rubles

<u>Work on 3 Shifts</u>	<u>Work on 2 Shifts</u>		<u>Work on 3 Shifts</u>	
	<u>Flexible</u>	<u>16 OTs's</u>	<u>Flexible</u>	<u>16 OTs's</u>
Cost:				
Equipment and fittings				
for machine tools	1280	2560	1280	2560
SM-2M control computer complex	375	--	375	--
Transportation	380	25	380	25
Fittings	36	131	54	25
One-time investments in				
circulating capital	9	71	13	105
Total savings		707		784
Savings on wages for production				
and service personnel		93		122
Savings on expenditures for adjustment		20		23
Annual economic effect		820		929

From the calculation it is clear that the economic effectiveness of applying the complexes (for example, those composed of machine tools with numerical program control) as compared to independently operated units of equipment (machine tools with numerical program control) is formed mainly from three sources (when producing the same quantity of products of the same kind):

from the savings on fixed capital as a result of reducing the quantity of equipment, since there is an increase in the coefficients of its loading and shift work (in the ALP-3-2 complex, for example, eight machine tools are used instead of 16, and also the reduction of expenditures on the construction of production areas with a reduced quantity of equipment;

from the savings on the wage fund because of the reduction (to half and less) of the production and service personnel (from 70 to 36 when using, for example, the ALP-3-2 complex);

from savings on circulating capital because of the reduction of the production cycle for manufacturing the products, their batch sizes, the necessary supplies and so forth.

The Social Effect

The introduction of flexible automated complexes and productions not only produces a large economic effect and increases the return from fixed capital (equipment and production areas), but also causes important socioeconomic changes in production. These changes can easily be traced using the concrete example of the application of the GPK for mechanical processing, ALP-3-2. This makes it easier to solve the crucial problem of efficient utilization of the limited labor resources, it changes the nature of labor, and it advances the art of labor. This can be shown from the example of processing housing parts. In order to perform the same amount of work on universal machine tools it is necessary to have 90 machine tool operators and autonomously operating machine tools with numerical program control of the "processing center" types--30 operators, while on the GPK of the ALP-3-2 type--it takes only four operators. The number of shift and senior foremen decreases from seven to three (in a section of machine tools of the OTs type and the GPK), controllers and control foremen--from 10 to six (even in both cases), transportation workers from eight on sections with universal machine tools and OTs--to 0 on the GPK (here the transportation of blanks and parts is automated). At the same time new occupations appear--operators for loading, unloading and preparing fittings, computer equipment engineers and programmers. The overall number of workers in the section with universal machine tools is 115, processing centers--70, and flexible production complexes of the ALP-3-2 type--40:

raises the level of technical availability for labor since practically all of the basic and auxiliary operations are automated;

increases labor productivity, including as a result of reducing the number of workers;

to a considerable degree solves the problem of reducing the shortage of workers who perform both basic and auxiliary operations (transportation, warehouse and labor);

changes the conditions and nature of labor by increasing the proportion of mental labor and reducing to a minimum the proportion of physical labor. Reduces the number of foremen, senior foremen, workers of planning services, technological bureaus, bureaus for shop control, wage bureaus and also auxiliary workers--distributors, warehousemen, transportation workers and controllers. Moreover, new categories of workers appear who service GPK's, for example, operators for preparation and control of instrument adjustments, electronics adjusters, engineering specialists in magnetic disks and for devices for input and output of information on computers, computer equipment engineers and electronics operators;

reduces to one-half to one-third the number of personnel working on the second and third shifts by facilitating the organization and service of production;

increases the requirements on the qualifications of workers who service the complex; in a number of cases because of the complexity of the work that is performed the service personnel must have special secondary or higher education (engineers in computer equipment, programmers);

creates conditions for efficient, rhythmic operation of the enterprises.

The Organizational Effect

When flexible automated complexes and productions are introduced important and far-reaching changes take place in organization. With the help of GPK's and GAP's one finally manages to automate not only production, but also all of its organization. This comprises, in particular, what is new with the production of the GAP (along with other most important indicators--flexibility and the elimination of human labor).

The structure of small-series nonautomated production can be changed fairly easily, although this is not clearly expressed; the adaptation is strong since the main component of production is composed of people with their great adaptive capabilities, but the synchronization of production processes is weak.

The structure of conveyor production is rigid and permanent, the adaptation is weak, and synchronization is strong and compulsory (on the basis of conveyors, that is, as though external).

The structure of small-series and series productions which use equipment with numerical program control and robots changes with greater difficulty than nonautomated production, synchronization is stronger, and adaptation is weak or altogether lacking.

In flexible automated production the structure can be alternating and the synchronization and adaptation can be the strongest (the production plan is basically carried out by machines and not by people). The GAP (and only the

GAP) makes it possible in practice to realize the flexible (alternating) structure of organization, control and distribution of equipment and the technological preparation for production.

Among the major means of adaptation of the GAP are:

the system of automated planning (SAPR) of the items that are produced;

the SAPR of the technology and preparation for production with the help of which it is possible to rapidly develop and change technological processes, the design of the instrument, fittings and means of control and to select more suitable equipment, and so forth;

the SAPR of software for production;

the ASUP on the basis of microprocessor computer equipment for comprehensive control which changes the control of production, including replacement of the levels of hierarchy of control in emergency situations;

the ASUTP with a bank of technological and other data with dialogue operation and a changeable format for operative document which makes it possible to flexibly control technological equipment for production and also to change its organization, including changing a nonfixed format for input and output documentation, formats of documents, intersection and shop divisions, schedules for start-up--output, and so forth);

electronic computers for optimizing information flows and organizational structures;

a unified automated transport-warehouse system with changeable structure and program support that controls a unified network of control which makes it possible to change the composition of material flows and documentations (blanks, instruments, blueprints and so forth).

All means make it possible to solve problems of adaptation and optimization in a dynamic relationship with the help of fast-acting computer equipment.

Tasks of the Future

It should be noted, however, that in the GPK's and GAP's that are being used now in our country and abroad the degree of utilization of electronic computers is not great and it is quite inadequate. It is necessary to enlist highly skilled scientific forces to expand the scope of utilization of electronic computers and increase the range and raise the level of problems that are solved on computers.

The development of the concept and principles of constructing the GAP is an immediate task. In our opinion, when creating the GAP it is necessary to be guided by the following principles:

expanding the application of the SAPR, unified planning modules, and also unified components and blocks when creating individual devices, systems and subsystems of GAP's;

expanding the boundaries of the areas of application of GAP's for various kinds of technology--welding, control, assembly, thermal processing, testing models of technical equipment and so forth;

expanding automated complexes through the introduction of new modules (cells);

extensively utilizing standard plans of individual subsystems (transportation, instrument support and so forth).

In order to expand the scope of the utilization of the GPK and the GAP, it is necessary to step up the development of theoretical fundamentals for formalizing all kinds of technological processes (now the problem is being resolved at the required level only with respect to technologies for mechanical processing and assembly). One should create imitation models of flexible systems for various production purposes in order to study them, synthesize them and optimize them. And it is necessary to have systems for automated development of program support, including automated planning of technological fittings and various instruments and also automated programming of the operation of equipment with numerical program control.

Practical realization of the GPK's and GAP's requires an essential increase in the reliability of the work of all technical means. The shortage of skilled personnel and the unreliability of technical means of GPS constitute a serious impediment to their introduction.

In fact what kind of effectiveness of a flexible system can there be if each day there is at least one breakdown and a half day is spent looking for its causes and eliminating it (because of the poor training of personnel). And this happens quite frequently. It is also difficult to hope for effective operation of a GPS 24 hours a day and for a long overall period of time (and the main thing--without people or with minimum service personnel during the night shifts) if the durability of the metal-cutting instrument remains at the previous level. Each breakdown of an instrument, an inadmissible dulling of it or rapid wearing out stops the GPS. It is necessary to increase the durability and reliability of the instruments five- to eightfold.

Manufacturers of the equipment are also faced with a number of important tasks. It is necessary to develop and assimilate in series production machine tools and other technological equipment, means of transportation and systems of control that are suitable for arranging GPK's and GAP's. The peculiarity of this equipment consists in that it is necessary to have mechanisms for communications with automated transportation systems for delivering blanks, removing processed parts and components, and delivering and replacing instruments.

Moreover, a key problem in the creation of GPK's is the provision of automated quality control of the parts and components that are manufactured. Machine tools and other technological equipment must be supplied with means for

controlling the condition of the instruments, its wear and tear and its breakdown. Thus, for instance, inflexible systems for mechanical processing one can combine mainly only those multi-operational machine tools with numerical program control of the "processing center" type of the modern level. Several kinds of these tools have been developed in our country, but series production of them is only beginning.

Enterprises of the Ministry of the Instrument and Tool Building Industry, Ministry of the Electronics Industry and Ministry of the Radio Industry are not yet manufacturing in series modern devices with numerical program control for microprocessors with systems for adaptation and diagnosis of malfunctions which are suitable for using with machine tools. The development of experimental models of these devices was begun 4-5 years ago, but the completion is put off from year to year.

Unfortunately the development and assimilation of flexible production complexes are being carried out separately in many machine-building ministries, without the proper organizational and technical coordination.

It is possible to advance in the creation and application of flexible systems only with a sharp increase in series production of multi-operational machine tools with numerical program control and various automated technological equipment for building into the GPK's when supplying it with modern electronic equipment.

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FLEXIBLE SYSTEMS INTRODUCED IN MACHINE TOOL BUILDING

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA (EKO) in Russian No 3, Mar 85 pp 50-58

[Article by V. P. Kabaidze, winner of the USSR State Prize, general director of the Ivanovo Machine Tool-Building Association: "Machine Tool Building and Flexible Systems"]

[Text] Machine tool building is called the head technologist of machine building. It seems to me that this title correctly and fairly clearly formulates the role of the creators of metal-processing equipment in the development of machine tool building production. The key position of the branch in the national economy requires focusing attention on those aspects of its activity which have an especially strong influence on the development of the country's economy.

In the national economy there is a process of systematic reduction of the flow of labor force with an increase in volumes of production, and it will become even deeper for a certain amount of time. If at the same time the production of metal-cutting machine tools remains with the existing volumes and in the present structure of the stock of machine tools, it will be necessary to assign the entire increase in population to machine tools that are being produced. Moreover, each less productive machine tool 15-20 years in the future will doom the consumer plant to technical backwardness.

Is the situation really so hopeless? Undoubtedly not! The country has created an immense scientific, technical and economic potential, including in machine tool building. It is necessary to handle it correctly and direct it toward solving national economic problems. Five years ago the CPSU Central Committee conducted a conference on machine tool building with the participation of all supply branches and consumers, and here they clearly set the tasks for considerably raising the technical level of the products that are produced.

Five years is a short period of time, but still, in our opinion, less has been done than could have been done during this period.

The responsibility for the low level of machine tools is borne by other branches as well--radioelectronics, electronics and instrument building. But

still the basic blame lies with the machine tool builders. We can put ourselves in each other's place very easily and simply. "You do not give us the best radio and electronic equipment, and we give you machine tools of the same kind..." and, unfortunately, the two sides are satisfied with this balance of irresponsibility.

The scientific and technical revolution, like any revolution, does not tolerate bureaucratic orders and compensations or conventionalities. Yet the developers and creators of new technical equipment are entangled in them. According to the unified system for design documentation (YeSKD), when coordinating technical specifications for machine tools it is necessary to collect 100 signatures outside the plant, including 35 with stamps, and this alone takes 2-3 years. The coordination of the materials and putting them together is equally cumbersome and complicated.

As a result, the best designers are working not at drawing boards, but are fighting in various organizations, trying to retain at least a bit of their own design. Each level has the right to "veto" and practically nobody can override it. With this kind of system the designers lose the habit of taking responsibility on themselves. It is almost impossible to find the people responsible for designing a new machine--everyone individually is right, and there can be no criticism. And a good machine has too many "relatives" and co-authors.

The unified system for technical preparation of production (YeSTPP) is no better. It is necessary to prepare for small series production almost as much documentation as for mass production even though everyone knows that with small-series production this is a costly excess. In foreign machine-building firms I have had occasion to see the technology for processing parts--it is contained on one sheet. And for a similar part our technologist has to draw up a 20-30-page portfolio.

Today we should rely mainly on a sharp increase in the output of machine tools with numerical program control, but not those that are already being produced, but ones which can compete on the world market. Although technical equipment with numerical program control has been in existence for more than 20 years, up to this point it seems to us that machine builders and even science are not aware of its main advantages--the possibility of concentration of operations and mobility. The lack of clarity in theoretical issues and in evaluating the advantages of technical equipment with numerical program control causes a great deal of harm.

It is typical of traditional technology to try to break down metal processing into as many operations as possible and to achieve maximum productivity in each of them. Here one evaluates only the time spent by the machine tool operator (it is fairly carefully normed). But, as we know, the parts do not move by themselves from one machine tool to another. Somebody transports them, stacks them and delivers them. Somebody plans and monitors the work. The cycle for the manufacture of parts increases in a geometrical progression from being broken down, and the quality, as a rule, deteriorates since each worker is responsible only for his own operation. Control of production also becomes more complicated and less effective. A situation is created in which

certain machine tools stand idle while others are overloaded. And brigade organization of labor is not always the solution to the problem, although it clearly eases the difficulties and contradictions.

The existing indicator for the output of machine tools with numerical program control--the quantity of manufactured units--leads to the idea that their production is developing fairly rapidly. While 10 years ago this was tolerable since it gave the machine-building plants a push toward assimilating equipment with program control and the consumers were only entering the difficult era of applying these machines, now an uncritical attitude toward this indicator directly invites machine-building plants to manufacture not complicated machine tools with numerical program control, but primitive ones--on the basis of universal machine tools. It is considered progress when a milling machine or a lathe is produced with numerical program control, and the same is true for all groups of metal-processing equipment.

The major advantage of modern machine tools with numerical program control--processing centers--lies in the possibility of reducing the number of operations and concentrating them. But people are not always interested in this point since everyone has long been accustomed to checking only on the labor-intensiveness of the basic process--the work of the machine tool operator.

There is even greater confusion and various interpretations in the understanding of problems of flexible production systems (GPS) which are created on the basis of equipment with numerical program control and processing centers. This is especially noticeable in such a busy place as the Ivanovo Machine-Building Association, where representatives of dozens of plants go to order flexible systems. Here many people have not made clear to themselves which tasks they want to carry out with the GPS and they have not set the task of creating mobile productions.

It must be firmly established that the acquisition and installation of a GPS should be not the goal, but a means of increasing the flexibility and mobility of production. The GPS in the understanding of the majority, including, unfortunately, also people who determine the technical policy in entire branches, is a processing center, and any processing center, plus the warehouse plus transportation carts and computers. Almost every department is becoming good at inventing its own departmental GPS's. At some they are called GAP's--flexible automated production; at others, PAL's--production automated lines; at still others, GAK's--flexible automated complexes and so forth. In the midst of all these various terms we are staying with the literal translation of the international terminology of FMS--flexible manufacturing systems.

The creation of a GPS requires the solution to many technical and organizational problems both for the manufacturing plants and for the consumer enterprises, in controlling branches and even the national economy.

First. It is necessary to provide for maximum utilization of machine tool time, eliminating the dependency of the OTs [processing center] on the warehouse and transportation system. For some reason economic requirements

are sometimes forgotten when GPS's are being created, but these are precisely what should determine the expediency of a flexible system in one production or another. One should keep in mind that the cost of a unit of time of a machine tool in a GPS at least doubles as the result of the cost of the transportation and warehouse systems and computer technology. Therefore maximum utilization of machine tool time and increased coefficients of shift work are most important conditions for the effectiveness of the GPS. Now at many plants it is considered an achievement when the OTs works on two shifts since it is typical for it to be utilized with a 1.5 coefficient of shift work. But for the GPS two-shift operation is uneconomical. It is necessary to change over to three-shift or a continuous work schedule similar to what exists in the textile, metallurgical and chemical industries. Only then will it be possible to achieve rapid return from this costly technical system.

Continuous production is not any kind of miracle. It is not necessary for the entire plant to operate on this schedule. This pertains to a limited group of individuals.

Second. One cannot construct a GPS out of ordinary machine tools with numerical program control. The requirements for equipment in flexible systems should be higher than for machine tools operating separately in terms of supply, reliability and other parameters. If each machine tool operates individually with a coefficient of reliability of 0.9, by multiplying the coefficient by four to five machine tools one can see how the overall coefficient decreases. It is necessary to be aware of the fact that losses are inevitable during down time of the transportation system, warehouse and computer. We are given warehouses that cannot be used. A flexible line made up of unreliable elements is doomed to stand idle. Therefore increasing reliability is one of the main requirements.

In order for our plant's processing centers to meet these requirements, we are modernizing them and creating OTs-modules--unified units of the future flexible systems. They are equipped with accumulators with eight parts which enable the machine tool to operate for a maximum amount of time without the participation of a human being. An automated system has been created for replacing the instrument housing of the OTs, the development for which has been recognized as an invention, and means have been automated for delivering the blanks to the machine tool and gathering the prepared parts as well as delivering lubricant and cooling liquids to the cutting zone and gathering shavings. Work is being done on automating processes of measurement during the course of processing the part and adjusting the conditions for cutting. We ourselves will have to develop transportation systems and warehouses since we have neither suitable plans nor equipment from the Ministry of Heavy Machine Building and other branches which are supposed to deliver them to us.

The automated warehouses which are controlled by modern computers at the ZIL are good. Although one computer would do, they are delivered in pairs for reliability. When one of them breaks down the second computer is put to work within a couple of minutes. Thus conditions have been created for reliable operation of the GPS here. Along with the ZIL workers we are creating flexible lines for mass production on the basis of block-centers. Abroad these are sometimes called "multicenters" because the processing of parts is

carried out not by one instrument, but by many of them simultaneously--a multispindle head. The productivity can be higher in a rigid automated line than in a flexible one here. But with a rigid line, in order to transfer from one part to another, the entire line must be replaced. This is why it is so difficult to assimilate new products in mass production. Flexible lines increase mobility.

Third. The instrument support for the GPS. This again is the responsibility of the manufacturers of the equipment since specialized instrument plans of the Ministry of the Machine Tool and Tool Building Industry are not prepared for carrying out this task. Capital investments in their development are not only not increasing, but are even decreasing. The disparity between the level of development of machine tool building and instrument production is becoming excessively great.

Fourth. The role of the consumer in the utilization of flexible systems. The GPS is a new organization of production using electronic computers. One must keep this firmly in mind. Let us take the ASUP. How fashionable it was! But so far almost no effect has been produced in automation of control. This has not been the fault of the creators of the systems, but the fault of the technical means on the basis of which the systems were created and the fault of the clients, since the ASUP's were introduced without a radical restructuring of control at the enterprises. Therefore an analogy comes to mind. It is necessary for the client to be prepared to operate the GPS. From our standpoint the GPS's should be concentrated at especially important enterprises and production associations which are prepared to utilize them. But today flexible lines are distributed like simple machine tools--a couple to each so as to leave nobody out.

Today there is a considerable number of machine tool-building plants whose products do not meet the interests of technical progress. They can be utilized for a rapid changeover of domestic machine tool building to the output of progressive equipment. But this is impeded primarily by conservatism in thinking. For many years we cultivated the idea that a real plant is one which produces a completed product with its own brand name. With the introduction of the indicator of the normative net output, the enterprise which delivers an incomplete product which is intended for cooperation is becoming somewhat more equal to the enterprise that manufactures the final product. But this certainly does not mean that the process of expansion of cooperation will develop of its own accord. It must be organized. And this is the work that is not being undertaken in the branch. There is no question that this is a difficult job, but somebody must take responsibility for it. But to do this they need technical ideas and economic levers.

It would seem to be quite simple: release dozens of plants from the obligation to manufacture secondary products and organize there the production of batching items for the plants of the branch which decide the future. But no, even new plants are arranged for the output of final products alone, and thus immediately, 20-30 years in advance, the foundations are laid for a barter economy--the most uneconomical.

In our opinion, in order to produce GPS's it is necessary to carry out a serious restructuring of machine tool building:

to concentrate the efforts, funds and attention of about 20 of the most advanced and important machine tool-building plants on the output of equipment of a high technical level which can compete on the market, including processing centers and flexible manufacturing systems;

to release 15-20 plants (we can give an idea of which plants precisely) from the manufacture of machine tools and include them in the production of batching items for the deciding plants;

to use most of the capital investments of the Ministry of the Machine Tool and Tool Building Industry for instrument production, providing for it to grow more rapidly than machine tool building since for many decades there has been an opposing tendency and the arrears of instrument production are continuing to increase;

without waiting for the construction of new instrument enterprises, some of the machine tool-building plants should be reprofiled for the manufacture of instruments and fittings, for further output of machine tool-building equipment of a high technical level, which is not equipped with the corresponding set of instruments and fittings, is inexpedient;

questions related to electronic equipment for machine tools should be resolved as a primary statewide program. It is not permissible for electronics not to keep up with the needs of machine building;

finally, it is necessary to improve the control of the creation of new technical equipment at the level of the national economy. It is time to engage in bold economic experiments in order to discover which economic conditions are necessary for the stimulation of work on new technical equipment.

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ORGANIZATIONAL, ECONOMIC ASPECTS OF GAP DISCUSSED

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA (EKO) in Russian No 3, Mar 85 pp 58-64

[Article by Yu. I. Tychkov, candidate of technical sciences: "Clear-cut Organizational-Economic Concepts for GAP Needed"]

[Text] The organizational and economic problems of management of the GAP draw less attention than do the technical means of flexible systems. This is quite an alarming symptom because without improvement of the organization of production, accounting, planning, projection systems, diagnosis and control it is impossible to achieve effectiveness of the GAP. In flexible productions there are real possibilities of comprehensively utilizing electronic computer equipment both for purposes of controlling the technical object (individual technological installations and the technological complex as a whole) and for organizational and economic control.

When considering the control of the GAP one must emphasize that this is an interconnected unified complex, the important distinguishing features of which are:

the existence of a microprocessor, figuratively speaking, the simplest artificial intelligence as a part of each technological element of the GAP, including in transportation and accumulation devices, which provides for remote program control of them;

the existence of a general electronics network for control through which all elements of the GAP are joined together into a unified controlled system. This is a system of higher artificial intelligence and greater possibilities. Through it it is possible to program control, to change the program as a whole and to change the program for each unit of the complex;

the existence of an organizational and economic system of control which is based on a fairly high level of information support in the realization of both planning and accounting functions and functions of diagnosis of the system as a whole and its elements.

It should be emphasized here that these properties of the GAP are even more important than the high level of automation and mechanization of production.

Without them it would be impossible to provide for a principally new quality of flexible automated productions--mobility in the restructuring of the products list. A constant increase in the mobility of production is one of the most important tendencies in modern economics. The continuous appearance of new ideas which is inherent in the age of the scientific and technical revolution requires that they be dynamically translated into the sphere of material production. Otherwise the ideas rapidly become outdated and lose their value.

It is possible to create an automated shop or an automated enterprise where all of the external signs of the GAP exist, but if they are not controlled on the basis of computer equipment according to the principle of a unified complex it will not be a flexible production system.

Successful realization of the principles of control of the GAP depends on how the automated control system functions at a given enterprise or association. The comprehensive system of the ASUP at our enterprise encompasses planning and accounting functions of the main production. We have begun realistic work on creating an ASU at the level of the shops. Two shops have their own computer centers functioning and one is being created in the third shop (the mechanics shop). We are working on creating networks of electronic computers with a ramified terminal system (52 remote video terminals are already in operation). Designers, technologists, warehousemen, norm setters and managers of various ranks right up to the director have direct terminal access.

The general plant and shop computer centers have three large computers of the YeS-1033 type and two small computers of the E100/25, SM-2 and SM-4 type. In the flexible production modules, mechanized production lines and other equipment there are 62 microcomputers of the E-60 type in operation.

One must keep in mind that changing over to GAP's and GPS's affects the usual essence of control and determines serious, frequently new peculiarities in the activity of practically all functional services. Certain foreign firms are coming to the conclusion that the traditional division into designers and technologists has become outdated. Approximately the same position is held by certain enterprises of the Ministry of the Electronics Industry. There is an automated work station for the planner in which a specialist who is called a "developer" plans the detail or the part. There remains a group of designers-ideologists who develop the overall composition of the new item, and the working out of the components and the detailing of the plan are combined with the development of technology.

In the cycle of flexible automated production, which includes, as we know, four stages--planning of items and technological fittings (SAPR of design and technology), instrument preparation of production, manufacture of parts and control--the least flexible is the area of instrument preparation of production. If measures are not taken for creating flexible systems for manufacturing instruments and fittings, the mobility of the GAP as a whole will be limited to an ever-increasing degree precisely because of this unit since in the three others the work is being carried out much more energetically.

The role of unification and standardization in all production spheres (the basic items, fittings, technological conditions and materials) is increasing immeasurably and becoming decisively important.

Two factors are in effect here:

a) in the GPS there has been a sharp increase in the "price" of a unit of machine time (1 hour of idle time is evaluated: universal machine tools--7 rubles, machine tools with numerical program control--30 rubles, processing centers--70 rubles, a unit of equipment in the GAP--150 rubles). The lower the level of unification the more time it takes to readjust the GPS for the new products list and the losses increase correspondingly;

b) unless the problem of unification is solved the information base of the SAPR increases sharply, and questions of shift and day planning and machine planning of technological processes, including control programs, become more complicated. While previously it did not make a decisive difference whether or not screws, pins or bolts were 10 sizes larger or smaller or whether the technologist used not 10 but 100 different cutting configurations, in the SAPR this geometrically increases the volume of the information fund and makes the operation and utilization of the machine more complicated.

Serious changes should take place in the organization of the work of the head mechanic's service. For idle time of equipment in the GAP system costs immeasurably more than it does with an individually operating unit of equipment. Therefore the previous methods of organizing repair are becoming ineffective. The head mechanic's service should arrange its work on the basis of standard elements of replacement (TEZ). If some component of a machine has begun to malfunction the machine is halted, the component is removed and it is replaced with a spare one. This kind of experience in eliminating disrepairs and repairing equipment already exists in the operation of electronic computers: a malfunctioning block is removed, it is replaced with a spare one and the computer is again hooked up to the network.

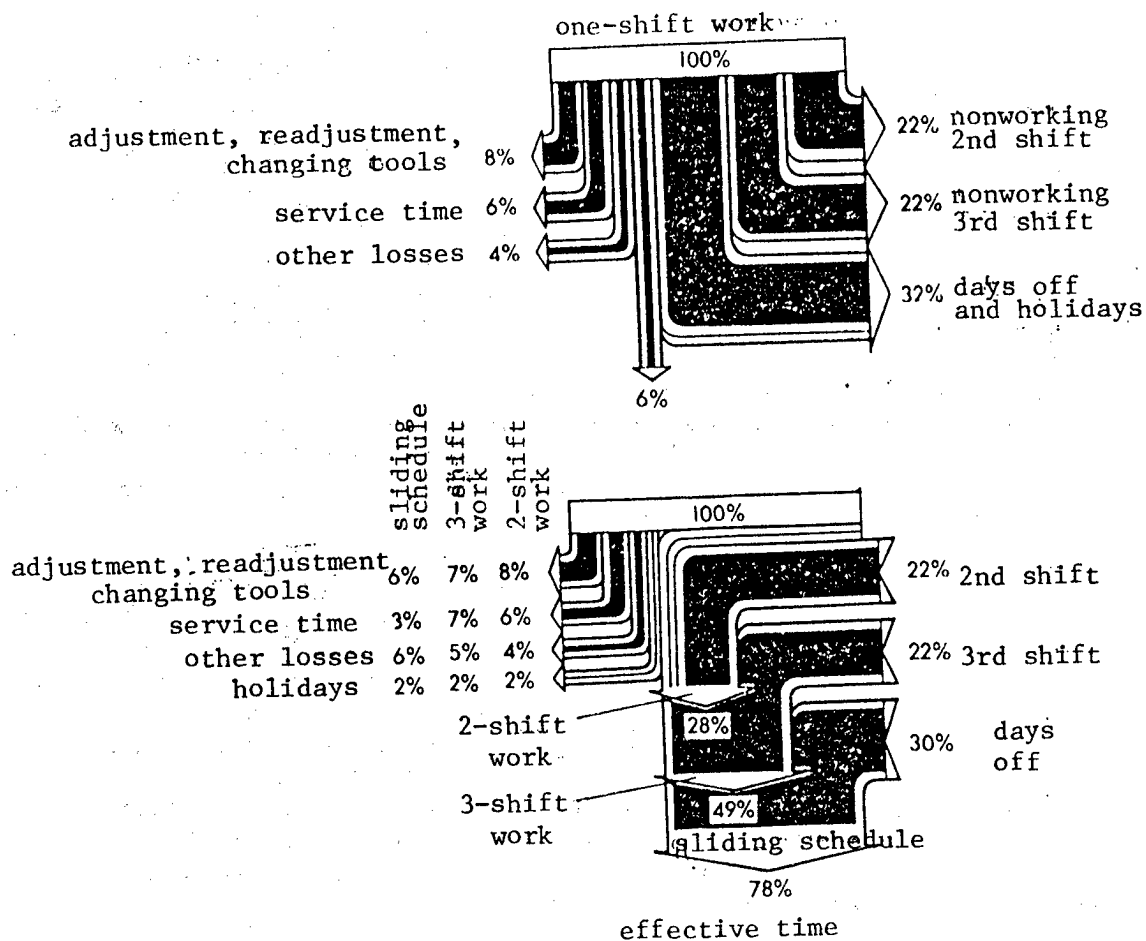
The standard elements for replacement can include the most diverse components that are built into the GAP--computer print boards, spindles of processing centers, and so forth. The head mechanic's service should include a TEZ warehouse.

There is also an immeasurable increase in the requirements on the service of the head energy engineer, which should guarantee the stability of parameters of the electrical networks which are required for reliable operation of the EVT. It is also necessary to stipulate the duties of all other functional and service subdivisions--for issuing normatives, expenditures and material resources.

In questions of effective utilization of the GAP it becomes especially important to increase the coefficient of the shift work for their utilization.

The creation of GAP's and the changeover to their operation are largely problems of personnel as well (developers, operators). Here it is necessary, above all, to have a clear understanding both on the part of the managers and

on the part of the developers of the overall concepts of the creation of the GPS and a knowledge of the capabilities of microprocessors and EVT's generally by a broad group of specialists.



Utilization of Production Capacity of Machine Tools With Numerical Program Control

Work Conditions	1-Shift	2-Shift	3-Shift	Sliding Schedule
Time for recouping expenditures on equipment (years)	2.2	6.5	4	2.5

The changeover to GAP's is a lengthy process. We began to create an SAPR for technological preparation of production and control programs and an SAPR for design developments (planning of circuit boards and technological fittings) 5 years ago.

As an example from our practice one can give the introduction of the GPS for controlling items which reduced the cycle for inspections from three shifts to 3 hours and made it possible to release about 75 people. It provided for control over various modifications of products without manufacturing special control and measurement equipment. Work is now being carried out to create flexible modules for machine tool processing, stamping and pressing of plastics. In the next few years it is intended to introduce more than 10 types of modules and in the future they are to be transferred into GPK's and GAP's.

One should also take note of the serious difficulties which will have to be overcome in the process of solving problems involved with the GAP.

Up to this point no concepts of flexible systems have been discussed and become generally accepted, including the sequence for conducting work for creating GAP's, the organizational and economic concept of the GAP or the scientific and methodological developments. No concept has been developed for creating computer control networks and the majority of technical means for them are not produced (except for computers of the SM and E-60 series). The software is extremely poor both for the systems as a whole and packages of applied programs, especially for diagnosing the systems.

There are practically no developments on organizational and economic issues related to changing the GPS over to three-shift and continuous working conditions.

There is no concept of a comprehensive solution to the problem of adaptive control of the installation of parts, their sizes, the condition of the instrument or the condition of the equipment.

The shortage of specialists who are competent in questions of the GPS is sharply increasing. It is necessary to have a network for training and retraining these specialists.

And, finally, one cannot forget about the technical means of the GPS. Up to this point we are not producing equipment (except for metal-cutting machine tools with numerical program control) for building into the GPS, and there is an especially small supply of robot equipment and transportation-warehouse complexes.

All these problems are so complicated that without centralization of efforts for developing and creating GAP's it will be difficult to solve them. As we know, head enterprises and specialized design bureaus have been determined in all the branches. One must assume that they will play the role assigned to them in accelerating the implementation of tasks for the development of flexible manufacturing systems.

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CHIEF OF GAP DIVISION INTERVIEWED

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA (EKO) in Russian No 3, Mar 85 pp 64-69

[Interview with G. I. Kachesov, chief of the GAP division of the Berdsk Radio Plant: "We Are Preparing To Introduce the GAP"]

[Text] [Question] The Bertsik Radio Plant is one of the first in the branch and in Novosibirsk Oblast to make a decision to create a GAP. What brought this about?

[Answer] The main reason is the essential need to expand production, to improve technological processes that are directed toward improving product quality, and to reduce the labor-intensiveness and cost and production cost of the products that are produced. Another, no less important reason is the increased demands on the assortment and quality of the items, which requires flexibility in restructuring production.

The BRZ [Bertsik Radio Plant] produces items for household radio equipment of the high and first classes--the Arktur-500 electrical phonograph, the Vega-115 music center, the Vega-117 set of components, and the popular carryover items--the Vega 328 stereo tape recorder, the Vega-326 monaural tape recorder for children, the Vega-323 stationary radio for rural areas and other items. On the whole the BRZ produces 17 percent of the union volume of household equipment.

Although the BRZ has no special problems with the sale of products and the enterprise is in good shape, nonetheless it is necessary to be prepared for rapid restructuring in order to satisfy the demand. It is time to think about the ability of our products to compete on the world market. The first steps in this direction have been taken. The BRZ is delivering the Vega-404 and the Vega-326 to CEMA countries (Hungary, Poland, Czechoslovakia) and the Vega-326 is also being delivered to France.

[Question] How essential are the changes that are brought about by the introduction of the GAP?

[Answer] The introduction will require complete restructuring of production. This will not take place at once, first there will appear islands of automated

production (flexible automated modules--GAM's) and then they will begin to merge with one another into flexible automated complexes (GAK's) and finally, systems will be formed (flexible automated productions--GAP's).

[Question] Thus the changeover to the GAP is a multistage process. Obviously certain elements of this process already exist at the plant. What does the plant have in the area of flexible automation of production during the current period and what are the plans for the future?

[Answer] The greatest percentage of unskilled manual labor is found in stamping and assembly production. Specialists of the plant and the Central Scientific Research Institute of Robot Equipment and Cybernetics (Leningrad) conducted an investigation of the stamping shop. As a result, a decision was made concerning the creation in the shop of 12 robot technological complexes (RTK) and 15 robot technological lines (RTL).

An automated section has been created in which we manufacture 128 kinds of parts; and three automated lines, nine RTK's and five RTL's have been assembled and put into production. In order to create a comprehensively automated shop it will be necessary to spend money on acquiring the necessary equipment and machine tools and expanding the production areas. "It is worth doing"; the fulfillment of the plan will release 170 workers and we will receive a total annual economic effect of about 2.5 million rubles. The completion of all the work is planned for 1990.

Before making a decision about the development and introduction of one technical innovation or another it is necessary to conduct a technical and economic substantiation of its expediency (and, perhaps, also its timeliness). In 1980 they wanted to create at the plant a GAP for mechanical processing on the basis of machine tools with numerical program control. But the technical and economic analysis showed that with expenditures of more than 1 million rubles the time period for recouping the money would amount to about 15 years. It was necessary to reject this idea.

As for assembly-installation, control-measurement and regulation operations, a number of jobs have been earmarked here for automation and comprehensive mechanization of production using computers, manipulators and transport-accumulator systems. Agreements have been concluded with scientific institutions of Moscow, Gorkiy and a number of institutes of the Siberian Branch of the USSR Academy of Sciences. It is planned to introduce these projects in stages.

For the first stage we have developed and introduced at the plant automated control posts (APK) of the parameters of diodes, transistors and microcircuits. In 1984 we introduced an automated section for input control of the parameters of small-capacity transistors with control from an Elektronika-60 computer. The formation of the first stage will end in 1985-1986 with the introduction of automated systems for technological control (ASTK) of the parameters of electrolytic condensers, transistors of medium and large capacities, blocks of ultra-short waves (UKV), a tape-drawing mechanism (LPM) and electric play-through devices (EPU).

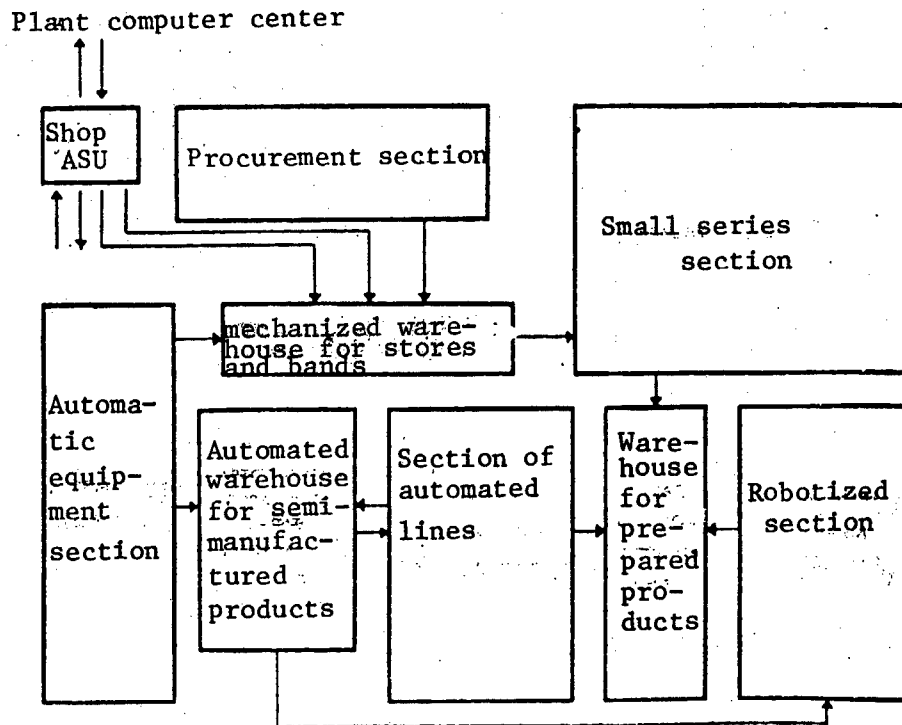


Diagram of Comprehensively Automated Shop

For control of electronic equipment items (IET) with the utilization of the existing equipment it would be necessary to introduce into the shop staff an additional 146 controllers. With the creation of the automated shop input control on the basis of the ASTK will require only 12 controllers and a group of five-six people for service and repair of the automated equipment in the first stage.

The second stage is carried out on the basis of Trassa-2 and Trassa-3 automated equipment which has been in operation since 1980. Automated machines have already been introduced for inserting radial elements of the same kind and there are also automated machines for installing plates on them. This released 72 workers of the shop for assembling components.

It is intended to complete the second stage on the basis of an automated flow line of the "Pana Sert" type, robot-manipulators for loading and unloading Trofey posts, a transporter line and a Stas-50 warehouse accumulator.

For the third stage--automation of control of the quality of assembly and adjustment--an automated system of technological control is being developed.

The utilization of computer equipment in all stages of automation of assembly-installation, control-measurement and adjustment operations will make it possible in the shortest period of time and without special expenditures to restructure production for the output of any other components of household radioelectronic equipment which are assembled on printed circuit cards. The planned work is to be completed in 1990. Systems of automated planning of the developed designs, technology and means of technological preparation of production (SAPR) will be introduced somewhat sooner.

It is planned to develop and introduce a GAP for galvanized coatings, a comprehensively automated shop for manufacturing printed circuit cards, a GAP for paint and lacquer coatings of plastic and housing parts, and we are working on the problem of creating a GAP for dynamic heads.

[Question] Gennadiy Ivanovich, judging from everything, you have good ties with science. Along what channels are they developing?

[Answer] During the period of the 10th and 11th five-year plans the plant introduced about 400 measures directed toward creating new technical equipment and technology, which encompass all stages from the idea to introduction. Some of them were carried out with the participation of scientific research institutes and design bureaus of the Siberian Branch of the USSR Academy of Sciences. The work is being done on the basis of economic agreements and agreements for scientific and technical cooperation. Such developments as the manufacture of printed circuit cards with partially metal openings, gridded templates based on the liquid compound Fotoset, plastic imitation leather parts, galvanic metallization of plastics, automatic printing of radio elements on printed circuit cards, efficient cutting of materials and other measures have produced an economic effect of more than 300,000 rubles.

The plant has 43 agreements with scientific and design organizations of the country. We have prepared a thematic plan which includes 62 subjects which must be carried out with the help of institutes of the country. After it was discussed at the plant's scientific and technical council with the participation of specialists from the institutes, the thematic plan became the basic program document for scientific and technical cooperation.

[Question] Tell us, please, more of the details about your ties with institutions of the Siberian Branch of the USSR Academy of Sciences.

[Answer] We have concluded 11 agreements with the Siberian Branch of the USSR Academy of Sciences, of which six projects have been introduced or are in the stage of experimental operation. For example, in conjunction with the Institute of Physics of Semiconductors we are working in the area of creating a new element base. Among the scientific partners of the BRZ for introducing the latest methods and technologies one can also include the institutes of automation and electrometry, economics, inorganic chemistry and so forth.

[Question] What difficulties have you encountered in introducing the GAP? What must be done to overcome them?

[Answer] In the first place, we need unification and standardization of the items. The broad assortment of housings for transistors and diodes, the failure to observe their geometrical sizes, and the diversity of outlets and housings for electrolytic condensers and other items nullify the attempts to automate input control and their installation on printed circuit cards.

In the second place, the list of kinds and the volume of robots, transportation-accumulators, warehouse systems and other means of technological supply that are produced are inadequate. The reliability is low both for the equipment itself and for the control systems.

In the third place, there is a separation between the enterprises that plan and those that introduce the GAP. As a result, there is a long list of computer equipment, technological equipment, machine tools and systems for controlling them which are used, which impedes the utilization of developments of other enterprises.

Finally, when introducing the GAP there is progress in the relationships between engineering and technical personnel and the basic workers in favor of engineering and technical personnel, although the standard structures and the tables of distribution of the enterprises do not allow any essential change in the relationships that have existed for decades.

Our suggestions:

the head institutes for consumer radio electronic equipment should develop and submit to the ministry recommendations for changing the design of IET in order to more fully automate assembly work;

create head plants for manufacturing flexible automated modules and complexes, testing the latter for reliability and introducing them at consumer plants with annual author's supervision.

GAP planners should:

use when developing main drafts of GAP plans a standard interface that is the same for all areas of the GAP, a unified series of microprocessor equipment, and micro- and minicomputers, and a unified system for gathering, processing and issuing information on various kinds of productions;

develop a unified system of meters, loading devices, technological fittings, and elements of interoperational and intrashop and intershop transportation;

carry out unification of the components of the GAP;

develop a unified technical solution for the creation of GAP's for all base plants, which will reduce the list of their components;

step up work for purchasing licenses for advanced technological processes and equipment.

[Question] Gennadiy Ivanovich, how is the plant solving the problem of placement of workers who have been released as a result of automation?

[Answer] There are simply not enough workers at the plant and therefore the released workers are transferred, with their agreement, to other work or they are sent to the division for technical training to raise their qualifications to the level which is determined by the automated production.

[Question] What essentially new things in the organization and payment for labor will come with the introduction of the GAP?

[Answer] In the standard staff structures and tables of distribution of the enterprises it is necessary to change the relationship that has formed over the years between engineering and technical personnel and basic workers in favor of increasing engineering and technical personnel and to introduce into the standard tables of distribution and structures of enterprises divisions for planning and introducing GAP, centralized subdivisions for repair and service of GPM's and GPK's, and centers for mathematical and program software for GAP's. In these subdivisions the payment will be made at the level of designer and technological subdivisions of the enterprises.

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DNEPROPETROVSK TECHNOLOGICAL COMPLEX DESCRIBED

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA (EKO) in Russian No 3, Mar 85 pp 70-76

[Article by S. B. Matushevich, head engineer of the Dnepropetrovsk Electric Locomotive Construction Plant: "Automated Technological Complex in Dnepropetrovsk"]

[Text] Our plant specializes in the production of pulling equipment intended for shipping rock in open pits of mining enterprises. A typical feature of the production is the large diversity of types of items and the small batches of them as well as the relatively frequent change in objects of production which is brought about by the change in the design of the items. Therefore technical preparation for production is difficult. It has been necessary to use insufficiently processed blanks and to limit the number of fittings. Mechanization and automation of technological processes were impeded, especially the processing of parts on universal metal-cutting machine tools. The coefficient of utilization of equipment was low. The changeover to flexible manufacturing systems was for us a way of solving all of these problems.

The idea of creating an ATK (automated technological complex) did not appear out of thin air. It was preceded by extensive and mass introduction of metal-cutting equipment with numerical program control at the plant.

As was shown by extensive practice in operating them at the plant, machine tools with numerical program control can automate in small series production those areas which until recently were difficult to automate.

The plant, in conjunction with the All-Union Planning and Design Institute of Technology of the Electrical Equipment Industry, the Experimental Scientific Research Institute of Metal-Cutting Machine Tools, the Orgstankinprom State Planning-Technological and Experimental Institute and the Leningrad Institute of Aviation Instrument Construction of the RSFSR MinVUZ, on the basis of machine tools with numerical program control, created an automated shop controlled from an electronic computer. The task that was set was to considerably increase the effectiveness of the utilization of machine tools with numerical program control and to accumulate experience in the organization of automated productions which would be used here and at other

enterprises of the branch when creating and planning similar sections and shops.

The shop included sections with automated machines (19 units) and machine tools with numerical program control (10 units), an automated technological complex (ATK), a bureau for repair and adjustment, and a section for size setting of cutting instruments and adapters.

The automated technological complex is located in a separate bay, which was reconstructed without halting production or reducing the production program. The complex includes: 37 different models of machine tools with numerical program control and one centering milling machine for milling and centering the ends of shafts; an automated transportation system with a carriage-operator; two automated shelved warehouses; two shavings removal conveyors with a monorail and mechanisms for loading scrap metal into the railroad car; a line for bringing in lubricant and cooling liquids; four robot-technical modules; and an automated system for control of technological processes (ASUTP). The machine tools are combined into groups which include from two to three units of equipment of the same type. Each of these groups is serviced by one operator.

The warehouses provide for automatically receiving blanks for storage, distributing them among the compartments on the shelves, sending the blanks to the working zone, receiving the semimanufactured products and prepared parts from the work stations and sending them to the warehouse to be delivered to other shops. The warehouses use standard containers with a capacity of 250 kilograms. The automated transportation system delivers the container from the warehouse to the work stations of the machine tool operators and returns it to the initial position. The transportation-warehouse system as a whole is controlled by a computer with a program from the control panel which is located at the dispatcher point. The instrument and the necessary fittings with the accompanying documentation goes through the transportation line from the section for sharpening and adjusting the instruments to the work station in keeping with the shift assignment, and upon completion of the work is returned to be restored.

The automated system for control of technological processes on the basis of the M-6000 control computer complex includes a number of subsystems. We shall describe them.

The subsystem for operational production planning provides for calculating the volumes of work in each technological group of equipment and the ATK as a whole in keeping with a monthly program; shift and daily planning of the load on machine tools taking into account the current condition of the equipment of the ATK; operational accounting for data concerning the preparation and course of production. For planning the load on machine tools they use a specially developed method of optimization of particular kinds, which makes it possible from the total available data concerning the adjustment of the machine tool, the fasteners and the cutting instrument for each controlling program to determine the sequence of processing parts at the machine tools which would reduce the time for adjustment to a minimum and would equalize the load on the machine tools.

The subsystem for accounting for the condition of the automated warehouse makes it possible to obtain from various blueprints the necessary information on the availability of blanks and prepared parts and to keep track of parts that are being processed.

The subsystem of technological preparation of production transforms design information about the parts into administrative and normative technological information for existing subsystems of the ASUTP, and as part of this it develops operational technology and control programs for machine tools with numerical program control and provides for norm setting of technological operations, preparation of accompanying documentation, and operational adjustment of control programs.

The subsystem of direct control of equipment provides for accumulation and adjustment of technological information, the selection of control programs in keeping with the shift and 24-hour assignment and the transfer of these to the numerical program control device for the machine tool operator. To accomplish this channels have been created for exchange of information, "computer--control device of machine tool." There are 10 machine tools with numerical program control hooked in for direct control from the computer. We do not consider it expedient to transfer all machine tools to control from the computer because the frequent interruptions in control have made it impossible for us to achieve sufficient reliability of the ATK yet.

On the basis of the ATK we have created a scientific production division for program processing which includes the service for technological preparation of production, and the repair, instrument and dispatcher services.

The introduction of the ATK in 1980 made it possible to introduce automated storage and delivery of blanks to the work stations, a system of preparing the shift assignments, the organization of multimachine tool service, centralization of the instrument business and concentration of all kinds of service. As a result, labor productivity increased 3.3-fold, 83 people were released, including 67 machine tool operators, the stock of machine tools was reduced by 63 units, and the coefficient of the utilization of machine tools with numerical program control increased. Moreover, the art of production advanced and working conditions improved. Labor turnover was eliminated. The reorganization of production provided the possibility of effective utilization of brigade methods of labor.

Each day the ATK keeps track of the wages for each work station. The computer for the complex, when it sums up the results, prints out the summary data of the operation of the shop for the day and since the beginning of the month, and it gives an overall evaluation of the operation of machine tools with numerical program control.

Our 3 years of experience in operating the ATK helped us to draw the conclusion that such complexes are a reliable means of intensifying and increasing the effectiveness of industrial production. While on universal machine tools the pure machine time in the overall expenditures of time on the manufacture of a part amounts to an average of about 15-30 percent, on machine

tools in the ATK it increases to 70-85 percent. As a result of this there is a sharp increase in productivity and the demand for the equipment decreases.

It is difficult to evaluate certain factors in value terms, for example, the availability of complete information about the course of production in any stage of it and centralized gathering of data, but they are very significant for improving the control of production. Discipline in the shop has increased as a result of strict control over the fulfillment of the production schedule.

One of the most important factors that contribute to increasing economic effectiveness is the reduction by 78 percent of the expenditures on auxiliary jobs. The proportional expenditures on the wages of industrial workers for one part has been decreased by 63 percent.

With the introduction of the ATK the parts which were previously always in "short supply" began to come in regularly and their quality was good.

The existing structure of the ATK creates prerequisites for further automation of production with the help of extensive application of industrial robots in a gradual changeover to technology that does not involve human beings. At the plant, in keeping with the comprehensive program entitled "robot," goal-directed work is being done for creating automatic robot equipment modules. With the first experiment in operating robot equipment modules we increased the number of machine tools with numerical control served by one adjuster-operator from two to five-eight, we reduced auxiliary time to a minimum, and we increased the productivity and effectiveness of machine tools with numerical program control. But the difficulties that were encountered were serious: the durability of the cutting instrument is low, there is no automatic control over its operation during the process of cutting, nor is there control over the precision of the processing or the diagnosis of the condition of the equipment and the controlling devices. It is necessary to have modern means of control. It is very important to improve the quality and reliability of machine tools with numerical program control and robot equipment, and to provide spare parts for the basic mechanisms of machine tools and systems for controlling them.

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DIFFICULTIES IN PROCESS OF CHANGE DESCRIBED

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[Article by Ye. L. Lysaya: "When Dynamism Is Professed"]

[Text] Before Getting Started

The unsmiling and taciturn division chief of the Special Design Bureau, Stanislav Yevgen'yevich Gurychev, who is in charge of creating the processing center, turned out to be extremely short on information: a couple of figures from the certification of the new machine, two or three phrases confirming the production date--1977, and that was all we managed to get out of him on our first trip to Ivanovo. Later I understood that behind this there was immense fatigue from the incredibly difficult work and from a lack of confidence because there were plenty of opponents both in the branch and in the departments with whom it was necessary to communicate, coordinating the design, the batching items, the orders and the funds.

It seemed to many that the Ivanovo workers had gone far beyond their rather modest capabilities. According to ordinary measurements the plant was at the very bottom of the table of ranks: the plan was not fulfilled, the design bureau was small, the products were not selling (it was even necessary to announce in EKONOMICHESKAYA GAZETA the sale of universal machine tools produced by the Ivanovo plant without funds and without orders). And suddenly they make a commitment to produce a multi-operational machine tool with program control in a year!

The autumn of 1976 passed. On the map of world machine tool building the Ivanovo plant was not even marked by a tiny dot....

It was as though time rebelled from the disrespectful treatment of it: at the most responsible moment of the planning work the director fell ill--when the appearance of the machine and its main components became clear, when it was necessary to have the rich engineering experience of Vladimir Pavlovich Kabaidze who before coming to Ivanovo had been for 17 years the head engineer of a large machine tool-building plant in Ryazan. An autumn fishing trip ended up with an aggravation of chronic pneumonia--a legacy from his years at the front.

His temperature had barely gone down before people with rolls of blueprints in their hands began to come to see the director who was lying in his hospital bed. A little later, when the doctors allowed the restless patient to convalesce at home, Kabaidze's apartment turned into a branch of the design bureau. The director's wife, Lyudmila Aleksandrovna, did nothing but check to make sure that there were no drafts, that he did not smoke as much and that he did not sit up too long. She could not demand any more even though as a doctor she knew how insidious pneumonia can be and how important the treatment conditions are. But she saw: there was a persistent battle with time. And therefore she did not demand any more.

When there is a large goal it is possible to compress time just as they compress metal, paper and cardboard, one can compress actions. The Ivanovo workers had such a goal: to make their products able to compete. The entire collective supported this goal which was set by the new plant director. There were no alternatives to it. It was possible to achieve fulfillment of the plan for the output of products, whose low evaluation had already been confirmed by the drop in the demand, only out of duty and with a great indifference to what one is doing. But the majority of people were not indifferent to their work.

Involvement in work in the prestige of the job are very strong sociopsychological factors which, unfortunately, are frequently not completely utilized. At the Ivanovo Machine Tool-Building Plant in the 1970's for a long time they were the main stimulus for the progress which was started here, for economic well-being does not come immediately to those who are creating the new technical equipment, especially under these conditions.

From a conversation with the designer Vladimir Dmitriyevich Timakov: "I have been in the design bureau for 15 years. During the first years I worked as I did everywhere else. The machine tools were planned for 6-7 years. Frequently people went to another enterprise without waiting to see the results of their work. When we began to plan the processing center and were given the planning period of a year, no one believed it. In itself it was interesting what would happen and how it could happen so quickly. Nobody forced us to stay in the evenings, but we stayed. In my opinion it was in the evenings, when everything had calmed down and there were no distracting obligations, that the real creativity began and new ideas were born."

In order to save the fleeting time, the plant joined together all three stages of work on the new machine: planning the design--preparing the technology--and production. As soon as the technical plan was ready, technologists and shop workers appeared in the Special Design Bureau: at the same time working blueprints were created, the technological value of the designs were estimated, and parts with a lengthy cycle for processing were sorted out and sent to the shops. In order to save time they used the method of work according to network schedules which has been tested by science and practice.

"At the Stanki-77 Exhibit in Sokolniki, which was devoted to the 60th anniversary of October, attention was drawn to the IR-500 processing center created in Ivanovo...."

"At the international exhibit in Hanover specialists displayed interest in the processing center of the Ivanovo Machine-Tool Building Plant"

From Newspaper Announcements

The enterprise which nobody knew of up to this point designated the beginning of its movement on the international machine tool-building route with a fine dotted line.

Race With Hurdles

"During the 12 years when Kabaidze was in charge of the plant we passed through three stages of development: assimilation and output of machine tools with numerical program control, the creation of multi-operational machine tools with numerical program control of the 'processing center' type, and the changeover to flexible production systems. We covered a marathon distance at a sprinter's pace, with hurdles and obstacles, for which the time had not been envisioned."

From the conversation of the head engineer of the Ivanovo Machine Tool-Building Association, Yu. V. Maslovskiy

A race with hurdles is an attractive spectacle when you are sitting in the viewing stands of a stadium on a bright sunny day. It seems that the sportsman has gathered too much speed--has he taken into account that there is a hurdle in front of him? The viewing stands freeze with excitement. But there--he has cleared one hurdle, a second, a third. Gathering speed the athlete rushes toward the finish. He has shown a record time! In the stands there is an unrepeatable feeling of elevation and a sense of being a part of what is taking place!

To participate in a hurdle race is much more difficult than to contemplate it, especially if there are unexpected obstacles on the route. The plant is being rearranged for the output of processing centers--they are increasing its plan for boring machines. "Withdraw the plan for ordinary products--they can be given to those enterprises which are not ready for dynamic production of new technical equipment," Kabaidze suggests to the VPO. They respond: "If you cannot fulfill the plan because of the assimilation of new technical equipment, it means that you are in too much of a hurry."

In the branch they do not agree to develop the Special Design Bureau, which is operating with an immense load: the plant was not intended to be a leading one--it was intended to be a backup for the Leningrad Machine Tool-Building Association. "But we have proved our ability to be not a leading one, but the leading one," insisted the director.

In such an administrative situation the majority of managers prefer to take travel paths. And it is difficult to blame them: they do not want to place the well-being of the enterprise and the collective under attack.

The director of one very respected machine-building plant told it to me this way: "It was easy for Kabaidze to take a risk--he had nothing to lose. After all, he had accepted a backward enterprise. Our plant cannot take on a radical restructuring. If there is no plan there are no bonuses, we would lose our reputation in the branch, and we would be accused of losing many years of labor traditions. We prefer to move gradually."

Possibly it would have been easier for the director of the Ivanovo Machine Tool-Building Plant to decide not to take a risk either. But this risk was not like in roulette--it was a well-considered course toward priority of new technical equipment. The plan was not fulfilled for universal machine tools--and moreover they had sharply increased the output of processing centers, and each year a new model was issued.

A machine tool with numerical program control performs one operation and a processing center concentrates many of them all at the same time. It sharpens, mills, bores and so forth. A housing for many instruments and automatic replacement of the instrument make it possible for it to perform all the diverse operations of processing parts with one installation. When manufacturing large housing parts, for which the Ivanovo processing centers are intended, these advantages are especially important.

The Ivanovo workers went through the entire range of heavy multi-operational machine tools with numerical program control, from the IR-500 to the IR-1600--the largest (such processing centers are made by three or four firms in the world). The IR-1600 can process parts weighing up to 120 tons which are up to 8 meters high. Then they begin to create machine tool models with changeable tables which were equipped with accumulators. If the table were preliminarily charged the machine tool could operate for many hours without human participation. The operator services several machines, and the path to technology with reduced human participation is opening up.

For a long time the leaders in the branch did not wish to notice the readiness of the Ivanovo Association to produce new technical equipment. At the beginning of 1981 the new minister noticed and evaluated it. Becoming familiar with the enterprises, he went to Ivanovo in order to "urge on" the backward plant. But once he had visited there he understood: other decisions were needed.

What seemed important to him? The idea of dynamic production of the latest machine tools was embodied in a developed way here. The time period was reduced as a result of parallel work of designers, technologists and production. The aggregate method of planning was applied: it was as though the machine tool were "cut up" into components which represent the completed whole. And because of this the assembly and testing also become dynamic and they are carried out by autonomous assembly stands which are well-equipped with electronic equipment and make it possible to imitate the working conditions for the operation of the aggregate. As a result the machine tool spends one-half to one-third the usual amount of time on the assembly stand.

In Ivanovo they do not divide the stages into the production of the experimental and the series model. Here the series model is produced

immediately--again a gain of time. But the plant keeps the first machines itself in the TOPO--technological division for program support. Their operation provides rich information about the behavior of new machine tools, which is taken into account in subsequent developments.

To keep the first machine tool for themselves is the law for all firms that value their reputations. They must clearly determine for themselves what they are offering the clients. In the TOPO at the plant there are more than 148 machine tools with program control which have been produced in various years. The division fulfills the role of a research station, an advertising center and a training class. Specialists from client plants spend time here and representatives of many plants who come to Ivanovo to visit gather experience in how to organize the operation of machine tools with numerical program control. But the production effect in the TOPO is also fairly large. Having one-fourth of the plant metal-processing equipment, it performs more than 60 percent of the work for metal processing of parts. The TOPO combines the engineering subdivisions engaged in program support and adjustment of machine tools with numerical program control, repair workers and production sections.

The new minister looked over the entire plant business carefully, even looking for faults. At the time when he arrived in the main assembly stand they were completing the testing of "Junior"--IR-320--the smallest of the processing centers created in Ivanovo. The clients had asked that it be produced. The IR-500 was too heavy for processing small parts.

"This we are manufacturing in excess of the plan," Kabaidze informed him.

"But you are not fulfilling the plans."

"We increase the production volumes up to 17 percent a year and we are still included among those who are not fulfilling the plan. We could produce 180 processing centers and they would still assign us 150 ordinary machine tools. If I were to come and say: 'You do not need an OTs, I will produce 400 universal machine tools,' I would be a hero."

"You must argue before the plan has been approved, because after that it is too late," responded the minister. "But let us think about how best to utilize the creative and technical potential of your plant," he suggested, "we will think about the future structure of the plan. Apparently it would be expedient to reorganize your association into a scientific production association."

The conference lasted for 5 hours without a single break. In Ivanovo they keep a memento of this unusual meeting at which the minister, interpreting and analyzing each suggestion, personally formulated the measures for the development of the association and its transformation into an NPO.

"But what about the ENIMS?" objected one of the people accompanying the minister.

"The ENIMS and its experimental plant are the head scientific complex in the branch. Along with it there can be other scientific production associations if they have the potential readiness for such a role."

Surprising sharp conversational exchanges are sometimes suggested by life! When reading about them in a novel many would say: "They are contrived." It was exactly 2 weeks after the trip to Ivanovo that the minister left the machine tool builders and took up the post of the deceased minister of that branch in which for many years before being appointed to the Ministry of the Machine Tool and Tool Building Industry he was the deputy. But even in the flurry of current affairs he did not forget about the draft of his order and he came to sign it when the preparations were complete.

Although the order remained almost unfulfilled, the course of the history could not be turned back. First the program of the Ivanovo Association was relieved of 50 percent of the output of outdated machine tools, and since 1983 the association has been producing only processing centers. This fact was registered in No 19 of EKONOMICHESKAYA GAZETA for 1983: "Beginning this year the USSR Gosplan and Ministry of the Machine Tool and Tool Building Industry have completely relieved the association of the output of universal machine tools. The annual production of the "OTs" (processing centers) has reached 200 units, and in the future this figure will increase continually with a simultaneous improvement in the characteristics of the technical equipment that is produced."

The first hurdles were cleared, but the race with the obstacles continues.

Alliance With the Clients

"When planning the future one must dream and dare. Let us continue the conversation about the development of the association after the trip to Ivanovo. The people there are bold and are able to look toward the future. You have met the head designer of the block centers for flexible automated lines, with which we intend to increase the maneuverability of our production. Do not let the fact that the designer is so young bother you. In his 33 years he has traveled over half of the world--he has visited all countries where Ivanovo processing centers are used."

From the statement of the general director of ZIL, D. V. Saykin,
at a meeting of the association's council of directors

The fact that specialists are now coming to Ivanovo from all ends of the country and from abroad is regarded by everyone as a quite ordinary situation. In the middle of the 1970's these trips seemed mysterious and simply sensational to some people. Yet everything was explained fairly simply: the clients saw and valued the plant's desire to arrange relations with the consumers on a new basis: to sell not the machine, but the technology--the machine tool with the set of instruments and software--to provide service from the company, and to train specialists of the client enterprises to work with the complicated new equipment.

These "unnecessary innovations of Kabaidze," as they were called in the branch, turned into a long and tortuous litigation for him. He insisted that the "software" and service be planned in the same way as one plans the products--the "hardware." Referring to the instructions, he was refused. Still, beginning in 1976 he expanded his service.

"Someone must create a precedent. Service is beginning to develop in any case," he explained his stubbornness to someone who had suggested that he not "beat his head against the wall." And even his fellow directors considered him a "violinist of convention," since nobody wanted to take on the concerns about service--an extra burden and it was also disadvantageous.

"Our service," they told me in the plant's service department, "works on the basis of internal cost accounting [khozraschet]. A separate estimate is drawn up for the installation and startup of processing centers. We have formed 12 brigades for adjusting them. We have a permanent representation abroad because there are already quite a few of our machines in Europe. The service, of course, must be expanded. But with our conditions it is difficult to attract people. The engineer's salary for patronage installation is only 135-145 rubles. And there are also the constant business trips. The adjusters have higher wages. Certain electronic engineers who are carrying out engineering duties prefer to hold a labor position."

"One can make no sense out of the service," confirms Vladimir Pavlovich, "but one cannot do without it. In the West 'software' is more expensive than 'hardware.' For us it is the contrary: the person who makes 'hardware' will flourish, but 'software' without which science-intensive products are impossible, is disadvantageous. We have resolved everything for ourselves fairly definitely: service is our cross to bear but it is also our acquisition. Without it we would not be able to earn to the confidence of the client."

The clients have turned out to be faithful allies. And this is one more confirmation of the administrative truism: direct contacts between the manufacturer and the consumer is fruitful. The barriers which seemed insurmountable have been largely surmounted because of the clients.

The Special Design Bureau does not have enough designers--and the consumer branches are offering it their staff units along with the wage fund.

"For a particular period of time?" I asked Stanislav Yevgen'yevich Gurychev (he is now head engineer of the Special Design Bureau).

"No. They detach them for good, understanding how important it is for machine tool building to help to re-equip the plant more rapidly. During the past 5 years the size of the Special Design Bureau has almost doubled because of the staff that has been transferred by the clients."

Difficulties arise with the program devices--the consumer plants allot some of their currency funds for purchasing imported batching items. It is more advantageous for them to pay for the ChPU with one-third or one-fourth of the

currency which is intended for purchasing machine tools and also to acquire several processing centers that are just as good as those acquired abroad.

The portfolio of orders is growing, but the production capacities of the Ivanovo workers remain almost the same--a joint solution is being produced by the manufacturers and the clients: organizing cooperation for individual components and parts and releasing capacities for increasing the output of processing centers.

Vladimir Pavlovich recently showed me a curious map diagram. There were 15 circles from the west to the north of the country which were joined together by solid straight lines from Ivanovo. From one client, under cooperation, the plant receives mountings, from another--accessory tables, a third makes instrument housings, a fourth--walls for the cutting zone.... There are 15 fine dotted lines interwoven with these solid lines and partially moving toward the east: these are the future participants in cooperation.

"Are you not afraid that they will let you down?" I asked Kabaidze.

"Not at all. There is not a single self-respecting manager who will violate an agreement which he has made himself without any coercion. As one director joked: 'The agreement is dearer than the Gosplan.' Very frequently horizontal cooperation on the basis of informal mutual agreements is successful in places where vertical cooperation has turned out to be ineffectual. Today everyone has begun to order flexible production systems, even plants with mass production. I completely understand them," says Vladimir Pavlovich. "I tested 'rigid lines' by the sweat of my own brow: in 1962 I sat around with nothing to do in Kharkov for 11 months...."

Kabaidze now recalls this episode frequently. He was put in charge of a group of engineers and adjusters from the Ryazan Machine Tool-Building Plant and sent on a business trip to Kharkov to the plant for engines and was told: "Stay there until you produce some new equipment." At that time the Kharkov, Volgograd and several other tractor plants were in a threatening situation. It was necessary to assimilate a new engine immediately. At the Kharkov engine plant they had replaced almost all the automated lines--they had completely cut off the old equipment and dug up the foundations. About 100 people representing many machine tool-building plants were employed in Kharkov for about a year assembling and adjusting their own equipment. Within several years, when changing over to a new model of engine, the situation was repeated....

"With flexible systems one does not need this universal confusion: simply replace the control program and continue on. But a desire to 'move' is mandatory. We always ask the clients: 'Why do you need the GPS?' if with the mobile equipment they intend to construct mobile production--to rapidly change models and expand the list of products--this is one thing. If we see that they are ordering the GPS for prestige alone, we refuse to accept the order," says Kabaidze.

The GPS is like custom tailoring. Each plant selects and orders lines taking into consideration its own needs and the specific features of its own

production, similar to the way a client in an atelier has a suit tailored to fit him. But the cutter must suggest whether or not a particular fashion is becoming to the client.

Of course one cannot put one's trust in every tailor. He must have authority. The Ivanovo machine tool builders have earned such authority from their clients. Therefore they are so bold as not only to suggest "items that are fitting," but also to recommend how to use them.

"The GPS is too costly a luxury," says Kabaidze, "to deliver it and play with it like a toy. I ask: 'How do you intend to use the line?' Some directors proudly answer: 'On two shifts, Vladimir Pavlovich, we have complete staffed the second shift.' Does this mean two shifts with such costly equipment? While the machine tools are being loaded and unloaded the machine time is 0, and the microprocessors are spinning idly. We have calculated that two shifts is only 28 percent of the machine time, and three shifts--only 49 percent. But when a GPS operates continuously--that is a different matter, the machine time will be 81 percent of the calendar time. Therefore when concluding an agreement for the delivery of a GPS we set the condition--change over to continuous operation as suggested in Ivanovo with a sliding schedule of days off, as the textile workers work in our branch."

From a conversation of the designer V. D. Timakov:

"The two of us, my colleague and I (I am an engineer-mechanic, he is an electronics specialist), at the request of a Japanese firm, in 1983 went to modernize an IR-180 processing center which the firm had acquired 5 years ago. It was the only foreign machine tool here that had been built into the flexible production system. The automated mechanics shop consisting of the GPS operates 24 hours a day in the Japanese firm. We also visited several other firms where machine tools from our plant have been installed, and they have the same work schedule for the GPS. The official work shift is 8 hours, but the costly housing and the costly education of children force the head of the family to search for additional earnings. Therefore after completing the shift the workers work for another 3-4 hours for additional wages. Actually the working day continues for 12 hours. Among the engineers combining of jobs has become widespread. The engineer works for 8 hours in the office or in the design bureau, and works for 4 hours as a machine tool adjuster or in some other job.

"In essence it turns out to be two shifts of 12 hours each that are needed for servicing flexible production systems. On the first shift for each processing center there is an operator who services the machine tools and prepares everything necessary so that the machine tool can operate on the second shift without human participation. At night for every TPS there remains one operator in charge who observes the operation of the line in the shop office on a display terminal. If there is a breakdown he turns off the machine tool until morning. In the firm they think that this is more advantageous than keeping repair personnel on duty at night.

During the first days we were in the shop until 5-6 o'clock in the evening. But because of circumstances over which we had no control we fell behind the

schedule that had been set for us and were afraid that we would not be able to finish our work during the remaining days. Therefore, we decided to stay longer. At 7 in the evening we went to have dinner and when we returned to the shop we were impressed by the picture we saw there. I have even dreamt about it several times since. The entire shop was shrouded in darkness, the only light burning was in the glassed-in office on the second floor where the operators on duty were sitting and the computer was located. Green signal lights were flickering on the machine tools. There was not a person in sight. Like something out of a fairy tale the carts of the transportation systems crawled along, their movement accompanied by a penetrating signal whistle (warning of danger). We stopped as if rooted to the ground.

"Then, of course, we requested that they turn on an individual light over our machine tool and we worked as long as it seemed necessary to us. But our first impression was stunning. It seemed as though some immense mechanical monster was living and breathing in the shop."

"Understandably, Japanese methods are not suitable for us and our people do not need to prolong the working day to 12 hours for the sake of earnings. But it is even more necessary to solve social problems related to the utilization of the GPS if we want to obtain the effect we seek and change over to technologies that do not involve human beings," comments Vladimir Pavlovich.

From the plant's suggestions which were sent to the State Committee for Labor and Social Problems: "...flexible systems during the night shift should operate with a minimum number of service personnel, and all preparatory work will be carried out during the day. But taking into account the rising standard of living of the workers, we think that it would be expedient to grant workers with a continuous schedule the following benefits:

"an additional vacation of 12 days;

"to pay the 13th wage for the results of the first year of work, having established for it in subsequent years coefficients that are higher than the average for the enterprise;

"to establish a remuneration for length of service depending on the length of work with the GPS, the monthly wage rate and the salary;

"to organize food service free of charge during the night shifts to be paid for from the fund for social, cultural and domestic purposes;

"to grant benefits for housing, passes for recreation and treatment, and passes to children's institutions."

...Teletype message from Tula: "Come to the celebration of the awarding of the order stop Without the fraternal assistance of your labor collective the victory would have been impossible stop You have delivered 20 excellent processing centers comma you have taught the people comma you have drawn up the technology comma you have adjusted the systems stop."

Verbal approval of the suggestions has been received, but no official decision has been made yet. A number of benefits, of course, can be provided by the enterprise itself. But Kabaidze would like for the social system for continuous work to "operate" as a whole so that the directors would not have any reprimands or penalties for excessive "enterprisingness."

The authority of the Ivanovo workers is also based on the fact that everything they suggest is tested at their own enterprise. The Talka-500 flexible system appeared first at home. It was here that the Ivanovo workers saw: the warehouse is not good for anything, the transportation system needs to be rearranged, the automation of the equipment needs to be strengthened and the control computer needs to be replaced--it is too powerful for servicing a single line. They began first to do what was within their power--they completely modernized the IR-500 machine tool. The only thing left of the 1977 machine tool was the name: they automated the cleaning up of shavings, the delivery of lubricant and cooling liquids to the cutting zone, the replacement of the instrument housing and they created side table with multiposition accumulators. The current IR-500 is a unit of the GPS.

"To award the USSR state bonus to Borisovskiy, Yuriy Vladimirovich, division chief, Gurichev, Stanislav, Yevgen'yevich, head engineer, and workers of the special design bureau for boring machines of the Ivanovo Machine Tool-Building Association imeni 50-Letiye USSR, Kabaidze, Vladimir Pavlovich, general director, Maslovskiy, Yuriy Vital'yevich, head engineer, Chekanov, Boris Antonovich, leader of the brigade of assembly-welders, and workers of the same association...for the creation and industrial introduction of highly effective equipment for flexible automated productions."

PRAVDA, 7 November 1983

From a decree of the CPSU Central Committee and the USSR Council of Ministers

Man With an Internal Chronometer

"I studied at a machine tool and instrument institute during the postwar years. At that time certain instructors used the system of training of Kagan-Shabshay who created our institute in 1930 on the basis of the faculty by the same name of the State Electrical Machine-Building Institute. We recognize the value of time from the first days of the first course. The load was such that it was impossible not to stay up late. When the student village of dormitories of Moscow VUZes on Dorogomilovskaya was sound asleep the dormitory group of Stankin was still lit up for a long time, like a lonely ship on the ocean which had turned on all of its lighting."

From the memoirs of V. P. Kabaidze

The school years in Stankin probably contributed to the dynamic concept of production. The system of Yakov Fabianovich Kagan-Shabshay was highly valued by Academician Mikhail Alekseyevich Lavrent'yev, who thought that he "understood the main thing: a flow line, standard system is not suitable for producing such precision 'products' as specialists. Here one needs an

innovative approach--enlisting important scientists for instruction and combining training of students with work at the enterprises."¹ But the lessons of the Shabshay school combined favorably with the qualities of the active and mobile nature of Kabaidze, with his world view as a former frontline infantryman for whom almost 3 years of his life were evaluated in terms of each moment one away from the enemy, when he had no right to make a mistake, and these were combined with a real idea of tasks and responsibility for matters entrusted to him, without which there can be no real manager.

The designers called Kabaidze a "man with an internal chronometer." He does not allow himself or them to lose even a month, even a day. As if according to the most precise mechanism he takes the pulse of the world market for machine tool building and electronics.

"'They' have accelerated the rate of updating of machine tool-building equipment (with an expressive gesture he leaves no doubt who 'they' are), and we cannot fall behind, he responds to anyone who reproaches him for being too hasty. "The scientific and technical revolution does not forgive slowness. I think that 'they' can teach us about dynamism."

The dynamism of the Ivanovo Plant is such that regardless of how many times you come here each time something new is waiting for you. Eight models in 5 years and again, tempo, tempo, tempo....

From the work log of the division chief of the special design bureau, A. M. Markov:

"11 October 1983. A conference with the director. The clients are requesting processing centers for manufacturing small parts made of light alloys. The task has been formulated as follows: utilize the maximum of domestic batching items; the machine tool should have fewer parts than preceding models--no more than 250."

"21 November 1983. Another conference. The director generalizes the proposals: 'We are making IR-200 minicenters to be built into the GPS. A variant with a robot is being sketched. We are oriented toward robots from the Krasnyyproletariy Plant which are manufactured under a Japanese license. There ought to be accumulators for three-shift operation of the machine tool. We have a year to solve the problem."

"Is that difficult?" I ask Anatoliy Mikhaylovich Markov.

"It is not easy, but the work is surprisingly interesting. Kabaidze knows how to set a task."

To this same question the designer Aleksandr Mikolayevich Mankin answers this way: "I am from here, Ivanovo, and I graduated from the institute here. Five of us from the same class came to the machine tool-building plant in 1977. There are three of us left. One of my friends transferred to the plant for automotive crane equipment because it was easier to get an apartment there. For a long time he was pleased with everything, but now he is complaining: 'The work is boring and one can see no growth.' You cannot say that about us.

It is all you can do to take everything in--everything is interesting. I participated in the designing of a flexible system comprising IR-500 processing centers. We called it Talka after our river. Our GPS was exhibited in an international exhibition in Moscow, Metal Processing-84."

Yuriy Vital'yevich Maslovskiy: "The reliance on youth is deliberate. People with a lot of work experience who come to us cannot stand the pace, it is too rapid. A young engineer who is not burdened with past traditions, who has not drowned in the turbulent sea of ideas and possibilities of proving himself rapidly, floats on it as naturally as a 2-week-old child who still has his innate instincts for swimming. For an institute graduate it is just as predictable, in our opinion, to see a thirst for creativity and a desire for self-assertion. This should not be allowed to die out.

"We have frequent business trips abroad since our ties with the consumers of the equipment and the suppliers of products are extensive. When there is equal engineering competence preference is given to those who know a foreign language. Young engineers master languages more rapidly and can make themselves well-understood without a translator. As a rule, we entrust our foreign representation to youth."

Vladimir Nikolayevich Churkin, division chief of the special design bureau: I have been at the plant for 20 years. I can compare. Under Kabaidze the atmosphere has changed in the design bureau, the spirit of creativity and interest in our work have been increased immeasurably, but the strain is unbearable. The number of people is the same, but the pace is increasing. There are not enough programmers or mathematicians. We have to go to the clients again for personnel. There is no housing, and the service areas are insufficient. In my division there are two designers at several tables. It is all right when one of them is on a business trip or on vacation."

As if racing with one another, first catching up with and then surpassing one another, they rush through designs and technologies at the plant. And the buildings and the laboratories remain the same. The plans for the development of the plant are becoming outdated. Everyone has been waiting for the planned buildings for the engineering and the new production facilities. Construction is slow in Ivanovo. The construction trusts do not have enough production capacity.

What about buildings with their own forces? Many people reproach Kabaidze for the fact that he is not doing this. When I tried to clarify his attitude toward construction by the internal method he burst out in a heated monologue. One can sense that this is a painful question for him: "Why should I build a building for the builders? I do not ask them to assemble machine tools! And building production facilities without housing is the same thing as digging money into the ground. There are so many new industries that cannot reach their planned capacity without the proper labor force, and this cannot be acquired without housing. It turns out to be a vicious circle...."

Later, having cooled down a little, he mentioned a nine-story building for small families which the construction workers were to have released this year:

"If there is a building here we can first solve the problem of providing housing for youth to some degree."

"And if it is not provided?"

"To this question he answers with conviction: 'It will be there! As soon as the builders put up the frame we will get the people together, put all our efforts into it and complete the building. Previously I said that they are not dependent. But in principle I do not recognize 'self-building.' If one is to build then one needs a brick plant, a mine--another 'business in kind.' Why? Everyone should be able to do his main job well.'"

That minister who had spent a short time in the branch and who seemed to immediately have a favorable understanding of the essence of Kabaidze as a manager said to him at that time: "With your involvement in new technical equipment you need good deputies for production and construction." Mainly he hears reproaches for his devotion to new technical equipment.

A couple of figures from the correspondent's notepad:

In 1984 the production volume in the association increased by 64 percent as compared to 1980, and the output of processing centers--2.8-fold. More than 70 percent of the products were certified with the Emblem of Quality. The Ivanovo Association accounts for 90 percent of the science-intensive metal-cutting equipment that is exported from the USSR....

These are the kinds of statistics which express the director's passion for new technical equipment--it is expressed in the national economic effect--the "external effect" which for Western firms is the main one for regardless of the internal effectiveness of the product, if there is no demand for it, the firm sustains losses.

Academician Yuriy Yefremovich Nesterikhin, an eminent specialist in the area of automation, when he became familiar with the Ivanovo Association, said this: "In the branches of industry where they solve essential problems of scientific and technical progress, the design divisions headed by the head designer should be the leading ones in the association. There are branches where this structure is legitimized, for example, the aviation industry. In these branches scientific ideas are embodied in production more rapidly. There are branches where this should be the case, for example in machine building, on which progress in other branches depends, but it is not the case. In the Ivanovo Machine Tool-Building Association the most expedient work methods have taken form. In many production, especially scientific-production associations, the general director of the association according to the accepted organizational structure is the chief of the design bureau or the director of the scientific research institute. This structure has been officially approved, but actually the director does not play the role of a scientific manager."

The director of the Ivanovo Association is a maximalist by nature. He does not stop in the face of critical situations in order to reach the goals he has set. And therefore, although he has many allies, he is not protected against

opponents. He speaks out against bureaucratic favoritism when coordinating the output of new items and the agreement is drawn out. When certifying the most ordinary machine tool for the Emblem of Quality, the procedure for filling out the documents at the corresponding levels of authority take other associations a day and a half. Ivanovo specialists have to lose a week and a half to 2 weeks to certify processing centers which are in demand abroad.

Kabaidze is reproached for the fact that he utilizes only imported systems of program control. "Suggest better ones," he parries, "and we would be glad to use them." He also gives this weighty counterargument: "One cannot forget the fact that work with foreign partners makes it possible for us to easily restructure for new electronic systems. 'They' during this time have changed four generations of ChPU systems, and we have to flexibly take this into account each time in our designs. This kind of cooperation is useful."

When it became known that the association would not be reorganized into a scientific production association, Kaibadze came up with another idea; in order to increase the production of processing centers, to include as part of the Ivanovo Production Association five plants (he included a list of specific enterprises that produce obsolete products). The answer from the branch was condescending and apologetic: "The gosplans of the union republics will not go for this since the volumes of products in the republic are declining." A second proposal was made: "The plant leader and the plant fellow travelers, remaining independent, but participating in the creation of flexible production systems that are developed in Ivanovo instead of producing their own machine tools, which today are not being sold." The answer comes from the area of fine psychology: "It is inconvenient to suggest this because one might offend the plant managers...."

At the December Plenum of the CPSU Central Committee (1983) it was noted what consequences ensue when "fixers" and "do-gooders" try in all ways to cover for a backward enterprise instead of setting serious tasks for it.

Passion and goal direction are related qualities. When an individual is impassioned with a great idea he will fight for it and will search for new ways of achieving the goal. The ideas proposed by the director of the Ivanovo Association deserve more serious attention from all of those who are responsible for their realization.

FOOTNOTE

1. See EKO No 8, 1979; No 3, 1983.

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MACHINE TOOL MINISTRY WORKER INTERVIEWED

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA (EKO) in Russian No 3, Mar 85 pp 93-96

[Interview with A. A. Naumov, deputy chief of the technical administration of the USSR Ministry of the Machine Tool and Tool-Building Industry, by N. M. Zhuravel', candidate of economic sciences: "Metal Processing-84': The Best Domestic and Foreign Equipment Exhibited"]

[Text] [Question] Please describe the scope of the exhibit--how representative was it?

[Answer] "Metal Processing-84" was the first large international exhibit in the country for metal-cutting equipment, tools and instruments for machine building. Participating in the exhibit were 83 enterprises and organizations from our country and 510 foreign firms from the socialist and capitalist countries of Europe and also Japan. The countries represented at the exhibition produce a total of approximately 80-85 percent of the overall quantity of metal-cutting machine tools, forge-press machines, control-measurement devices and instruments and metal-cutting tools in the world.

The exhibition was visited by about 300,000 people.

The exhibition included about 2,000 exhibits, and about 400 included machines in operation: machine tools and forge-press machines, and also devices with numerical program control and sets of electric drives. Most of the exposition involved comprehensively mechanized equipment with multifunctional devices with numerical program control which automated not only work cycles, but also various service cycles--loading and unloading parts, changing instruments, control and measurement operations, diagnosis of the condition of the instrument, mechanisms and devices of the machine tool, and gathering of shavings. Principles of "human-free" technology are realized with the help of these devices.

[Question] How extensively are flexibly automated productions (GAP) represented at the exhibition? Please give us the most interesting examples in the area of GAP--Soviet and foreign.

[Answer] Flexible production systems were represented by demonstrations with variants using two machine tools which are like fragments of more complicated GPS's.

A number of firms exhibited mock-ups of GPS's.

The visitors expressed a great deal of interest in the Talka 500-800 flexible production system for processing housing parts which was created by the Ivanovo Machine Tool-Building Production Association. It includes two flexible production modules based on IR-500 and IR-800 processing centers, each of which has an eight-position accumulator of parts which are fastened to adjacent tables.

The machine tools are loaded with a robot trailer--a self-propelled cart which also takes processed parts to the warehouse. The system is controlled by an SM-4 computer with a device for numerical program control and microprocessors. The number of machine tools in the Talka 500-800 can be increased to 8-10. With the appropriate capacity of the warehouse it can operate on one-two shifts without the participation of machine tool operators.

Readjustable automatic lines are being created for series and large-series production. As distinct from flexible production systems, in which, as a rule, a single instrument is used for processing, they operate with the application of multispindle boxes. Many instruments are operated simultaneously at each machine tools of the line, and most of the processing is done from two or three sides at the same time. The productivity increases many times over. The main kind of machine tool equipment for these automatic lines are readjusted aggregate machine tools with changeable multispindle boxes which are controlled by programmed command equipment or devices with numerical program control.

In the Soviet section a machine tool was demonstrated in operation. It was created by the Moscow Special Design Bureau for Automatic Lines and Aggregate Machine Tools and the ENIMS Scientific Production Association, and was manufactured by the Moscow Stankoagregat and Stankokonstruktsiya plants. The machine tool is intended for processing sets of seven type sizes of housing parts for compressors.

For processing housing parts with five sides (even with six and a fastening device) it is effective to utilize a two-machine tool robotized flexible section from the Italian firm Olivetti based on vertical and horizontal multipurpose machine tools. I would call it a two-machine tool flexible production module since it has one common accumulator for processed parts which are fastened to adjacent tables. From the accumulator they are put in waiting positions and after the completion of the cycle of sequently processing on machine tools and control they are sent back. The installation of the adjacent tables on the machine tools and the reloading from machine tool to machine tool are done by an industrial robot. Before sending a processed part to the accumulator it installs it in the control-measurement machine which is a part of the section in order to test it. When deviations are discovered the system either gives an order to readjust the instrument or stops the work of the section.

The most interesting of the lathe flexible production modules are the models that are based on two-spindle lathes with numerical program control which are intended for processing parts with two sides without removing them from the machine tool. Two models of these modules were demonstrated in the Soviet exhibit. One of them--the two-spindle frontal model--is produced by the Machine Tool Plant imeni S. Ordzhonikidze. It is equipped with a large accumulator for processed parts, two automatic manipulators of the built-in type and a catcher which turns the part 180 degrees when moving it from the first spindle to the second. All sides of the part are processed at the same time.

The second--a two-spindle flexible production module for the rod jobs--was created by the Leningrad Experimental Design Bureau for Automated Equipment and revolver machine tools in conjunction with the Kovosvit enterprise (Czechoslovakia). It is being produced at the Novosibirsk Plant imeni XVI Parts"yezd. This flexible production model has no analogues in terms of design. As distinct from machine tools of the frontal type in which the spindles are parallel, its spindles are coaxial.

Flexible production modules of other technological groups were also demonstrated at the exhibition. The toothed flexible production module created by the ENIMS Scientific Production Association on the basis of a toothed boring machine with numerical program control was a unique exhibit. It included several magazines which contain working supplies of worm bores, fasteners for the cut tooth wheels, and blanks. There is a special magazine-accumulator for distributing the processed wheels.

The replacement of the instrument, the fasteners and the processed parts is done by automatic manipulators. The readjustment for a new batch of processed parts is completed with the replacement of the control punch card.

[Question] From the results of the exhibition can one not give an overall evaluation of the condition and prospects for the development of the GAP in the USSR?

[Answer] The results of the exhibition cannot serve directly as a basis for evaluating the condition and the prospects for the development of flexible production systems in the USSR. Because of the limited demonstration area not all the innovations in this area were demonstrated. The selection of exhibits in the Soviet section was compiled in such a way that our machine builders would be able to present the most immediate prospects for the output of equipment for flexible automated productions and robotized complexes with the utilization of the most modern batching items: microprocessor devices with numerical program control, wide-range and high-torque electric drives with constant and alternating current, and also precision control and measurement devices and high-precision cutting instruments and technological fittings.

I think we succeeded in doing this. The approximately 1,200 responses left at the Soviet pavilion by visitors are evidence of this. They contain approval of the exhibits. There were also critical remarks which show the attentive study of our exhibits. We shall take them into account in our further work.

I wish to say that on all the days of the exhibition the Soviet section had the most people.

The flexible production modules, robotized complexes and multipurpose machine tools with numerical program control which were exhibited in the Soviet section were partially series-produced and partially being assimilated in production. Their output under the next five-year plan will constitute the basic part of production of machine tools with numerical program control both as part of flexible production modules and flexible production systems and individually. In the Soviet section of the exhibition a great deal of interest was shown in the completely "computerized" cycle of the creation and manufacture of multispindle boxes of aggregate machine tools. On the small SM-1420 computer on an assignment from a visitor they developed the cinematics and design of the multispindle box and compiled a control program with which using the multioperational machine tool with numerical program control they also carried out the processing of housing parts.

[Question] We are aware of the following opinion of specialists concerning the exhibition: "Soviet models are as good as foreign ones but, unfortunately, as a rule these are only single representatives of new technical equipment while the foreign ones have been assimilated in series production." What do you have to say about this?

[Answer] One can agree with the first part. But the second opinion contradicts the essence and purpose of the exhibition of equipment. As a rule, at such exhibitions they show innovations and not what is being produced by industry and what everybody knows about. The exhibits in our pavilion mainly represented new models. If a series-produced model was exhibited, it was distinguished by certain features which raise the technical level or increase the technical capabilities.

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ACCELERATION OF SCIENTIFIC AND TECHNICAL PROGRESS DISCUSSED

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA (EKO) in Russian No 3, Mar 85 pp 97-103

[Article by P. P. Mel'nik, general director of the Production Association for Radioelectronic Equipment (Tallinn): "New Items--At the Level of Inventions"]

[Text] In this issue we are publishing two articles by general directors of associations which are devoted to problems of accelerating scientific and technical projects.

They are taking different paths to their goal.

Petr Petrovich Mel'nik has devoted his attention to organizing a system for creating new items at the level of inventions. This path is extremely effective and promises a great time advantage.

Candidate of Technical Sciences Yuriy Grigor'yevich Shelyukhin, who for more than 20 years was in charge of a scientific production association, saw the possibility of more rapid realization of scientific and technical ideas in strengthening the integration between science and production and eliminating those barriers which frequently separate research and development from production in scientific-production and production associations. There is much that is valuable and instructive in both areas of work.

These problems will be discussed at an all-union scientific and practical conference entitled "Scientific and Technical Progress and Labor Productivity" which will be held during the first 10 days of April in Tallinn.

From the time of the formation of the association (10 years ago) one of the main tasks was to raise the technical level of developments. During that time we have already produced individual kinds of products which were reported as new ones although they were only new because of the date of output and not because of their technical certifications.

In-depth and comprehensive analysis has shown that the utilization of certain circuit and design decisions and the updating of only the element base of items does not lead to an essential improvement in the technical specifications. We have become convinced that the main lever in raising the technical level of developments is the creation of items and technological processes at the level of inventions, that is, those that are essentially different from the analogues and meet the criteria for inventions in the USSR and abroad. Therefore special attention has been devoted to the development of invention activity. The following initial position was selected: invention creativity should be directed toward creating better and principally new items and technological processes, and it is not a goal in itself.

In order to control invention work, in 1976 a head patent division was created in the association which was given equal status to an independent scientific and thematic subdivision. In order to augment knowledge in the area of patent work the main technical specialists of the design bureau were sent to the Central Institute for Increasing Qualifications of Management Workers and Specialists in the national economy in the area of patent work.

Invention, as an indispensable part of the creation of new technical equipment, became a strictly directed process.

One of the bases of invention work is patent research in all stages of development and especially in the preplanning stages. Unfortunately, many developers clearly underestimate patent information. When beginning the creation of a new item they usually study extremely carefully the information about analogues from the literary sources, and they rarely look into patent information. Yet in the majority of magazine and other publications the essence of the innovation is presented very briefly, frequently in advertising style. Life has many times failed to confirm the predictions and advance notices that are given in the literary description of the new item. There are many cases in which the developer has not managed to create new technical equipment of a high level simply because he did not have a complete idea of what this level was.

Comparing a new development with analogues that are already known from the literature deliberately programs delay. In patent information at this time there is undoubtedly already a description of the most radical new technical decisions. Moreover it gives a detailed and precise description of the object of invention. For patent legislation requires that the information reveal the essence of the given technical decision. The reliability of this information source is becoming greater because of the fact that everything that goes into a patent description is carefully evaluated by experts.

The publication of the description for the patent is the first publication of a new technical decision. On the basis of an analysis of patents one can find out the firms that are dealing with a specific problem and learn when they began to engage in it, what volume and what kinds of technical decisions have been created, and the sales markets for which the firms intend to produce the product.

According to data of research from one English firm, 80 percent of the decisions for new technical equipment were published in patent descriptions and 20 percent in magazines. Consequently, if one can convince the developers to analyze patent information, only on the basis of this, when creating a new item it will be possible to gain a minimum of 2 or 3 years as compared to work with known models.

Since 1976 we have legitimized patent research in design bureaus, and we attach special significance to this research in the stages of prognostication and planning. The policy for conducting patent research was regulated by the standard of the enterprise where we clearly established the interconnection between the developers and the patent experts. And this has produced results.

Now all developments are carried out at the level of inventions and are protected comprehensively, that is, the technical diagram, design and technological solutions, and also the external appearance. For patenting they select key solutions which have a number of variants which form a block of inventions and when they protected abroad they do not allow one to get around the patent.

Beginning in 1976 comprehensive patent protection was provided for more than 50 percent of the instruments that were developed. The high proportion of instruments that were patentable because of their design solutions and external appearances was achieved particularly because of the application of standardized housings that were protected by authors' certificates in the USSR and certificates for the industrial model in the USSR. (Components created at the level of developments were the first to be standardized.) It seems to us that if it is impossible to create a new external appearance it is expedient to use artistic and design decisions that have been previously protected by patents for an industrial model.

It should be emphasized that designers and artists do not devote enough attention to independent elements of the appearance (arms of switches, regulators and so forth) which essentially influence the external appearance of the instrument and are also objects of protection. The creation of independent elements with high artistic and design indicators and their protection makes it possible to use these elements for a long time in many items.

It would be expedient to standardize design components and elements with high technical specifications and use them until more effective new inventions appear.

The degree of utilization of protected diagram and technical decisions is the main factor when determining the patentability of instruments. An analysis of the previously utilized inventions showed that in the majority of cases authors' certificates protected individual components. But even under the 10th Five-Year Plan in the association there was a tendency to protect simultaneously a principle diagram and one of the main components. Moreover, in items of various types they began to use the same technical solutions which were protected by authors' certificates of the USSR. This made it possible to develop unified series of diagrams (for example for amplifiers, voltage

stabilizers and so forth) which can be used for a long period of time in many items, and the efforts of developers are concentrated on more crucial problems.

Stepping up invention and patent work has produced positive results (see table). But the final goal--more rapid assimilation of series production of items at the level of inventions--has not been achieved. The cycle for conducting experimental design work has amounted to an average of 2.5-3 years, the preparation of production--1.5-2 years, and the output of the first batch--a half year. Thus from the time of the creation of the new instrument (the application of the invention or patent in a newly developed item) until its assimilation 5-7 years have passed, as a result of which the economic effect has been considerably lost. Therefore for experimental testing of the possibilities of reducing the cycle of "development--assimilation" with the agreement of the branch, beginning in 1979 in the special design bureau they created a division for accelerated development and introduction of patented inventions. The work experience of the division during the past 5 years has demonstrated the expediency of this kind of organizational form. Because of it we managed to organize parallel development of items, manufacture of fittings, sketches and the development of new technological processes; to conduct testing on models of the first experimental batch, which makes it possible to comprehensively verify and adjust all documentation for the item, including technological documentation; to form a specialized service with an all-encompassing cycle of work under unified management; to appoint as head designer of the item the official with the administrative right to control the activity of the developers of the item and the technology, the designers of the fittings and the service for their manufacture, and also the services that provide for preparation of production and the output of batches of the items.

Dynamics of Invention Work in RET Association, Pieces

<u>Indicator</u>	<u>9th Five-Year Plan</u>	<u>10th Five-Year Plan</u>	<u>11th Five-Year Plan</u>
Authors' certificates of the USSR	27	67	42
Certificates for industrial model of the USSR	0	4	20
Foreign patents	0	10	41

The Division for Accelerated Development and Introduction operates in close cooperation with institutes of the USSR Academy of Sciences and the USSR Ministry of Higher and Secondary Specialized Education, which contributes to rapid introduction of new theoretical achievements into production. All instruments which have been developed and introduced by the division are created at the level of inventions and are protected by authors' certificates in the USSR and patents in the leading countries of the world.

The division includes a developing sector which includes engineers and designers, and an experimental team which includes mechanics, installation-assembly and regulating sections. The division operates according to the principle of the all-encompassing brigade and is located on a single area. According to the method of accelerated introduction, during the past 4 years

five items have been assimilated and 35 kinds of special means have been manufactured which provide for qualitative testing of the items and increased labor productivity when performing regulating work.

But along with the positive results when performing work according to the accelerated cycle there were also certain problems, especially in the work with associated branches.

For rapid advancement it is also necessary to have a better reserve in the related branches. One of the problems is the application of batching items in new developments. In the stage of development one can use only those batching items which are produced by industry at the given moment. But they have been developed considerably earlier (an average of 5-7 years ago). Consequently, the technical level of these batching items too, as a rule, corresponds to the level 5-7 years ago. Taking into account the fact that the cycle of "development--assimilation" of our items takes 3-5 years, one can determine that we will produce developed items in which batching items are used which are 9-12 years behind the times in terms of the technical level.

If one utilizes new batching elements whose development is being perfected or has just been perfected, one can gain 3-4 years. In this case the lag in the technical level of the batching elements is reduced to 6-8 years. But the manufacturer risks not being provided with new batching items since the supply enterprises do not guarantee, as a rule, the necessary volume of their output.

Increasing the degree of integration of the element base is a principal problem. In order to produce modern items it is extremely necessary to have a modern element base with a high degree of integration. But the interest of the suppliers depends on the quantitative need of the enterprises and of the branch. If the element base with a high degree of integration is necessary only for several enterprises and in a limited quantity, the supplier is not interested in developing it. Should the consumer enterprise in this case start from zero and develop its own development base with a high degree of integration? In our opinion, no. Probably the solution to this problem consists in increasing the motivation of the suppliers.

In order to step up the activity of the design bureau collective in the area of invention, socialist competition has been developed both among specialists and among divisions of the design bureau under the motto "In Each New Item--An Invention, Each New Item--At the Level of World Achievements."

Indicators of invention and patent-license work were included as the basic ones in the comprehensive system for product quality control and also the provisions concerning bonuses for the collective of the design bureau. This is contributing to creating new technical equipment at the level of inventions.

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MANAGEMENT OF THE SCIENTIFIC PRODUCTION ASSOCIATION DISCUSSED

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA (EKO) in Russian No 3, Mar 85 pp 104-110

[Article by Yu. G. Shelyukhin, candidate of technical sciences: "New Forms of Management in the Scientific Production Association"]

[Text] The high rates of updating of items in instrument building and the fact that they are becoming more complicated lead to a situation where expenditures of time and money on assimilation exceed the corresponding expenditures on development. The traditional system "Scientific Research Institute--Experimental Production--Series Plants" turns out to be unacceptable. It is necessary to search for new methods of control and organization of the process "Research--Production."

Previously we went through the process of creating new technical equipment in the following way. The developments were carried out in divisions and laboratories of scientific research institutes and then they were turned over the experimental plant. As the developed items became more complicated a situation was created in which, on the one hand, the laboratory base could not provide solutions to many technical problems and, on the other hand, the plant collective could not assimilate the products at the necessary rate (in the situation of "Scientific Research Institute--Plant" it was natural that the most qualified and able engineers tried by any means to work in the scientific research institute). The developers, having received several models of items and reported on the scene, were no longer interested in its destiny although frequently the level of its development did not provide the possibility of manufacturing the item in series. And the plant workers when they encountered difficulties were forced to begin almost at the beginning, digging for developers with all their might.

In order to bring the interests of the developers and the manufacturers of new products closer together, a decision was made to radically revise the structure of the organization. We entered upon a bold experiment, even from today's standpoint. The production sections of the plant shop were placed under the jurisdiction of the laboratories of the institute. Scientific production sectors were formed. The chief of the sector and the laboratory were now the same person, and the chief of the section was the deputy chief of the sector. All engineering and technical personnel except for line personnel

were transferred to the laboratories and the workers were transferred to plant sections. The specialization of certain sectors was determined taking into account the design and specific features of the creation of the items (object specialization) and others--for certain kinds of technological processes.

On the basis of the equipment of the laboratories and sections of shops capacities were created which made it possible to develop new items and manufacture previously developed ones, but in large quantities than before. The sectors developed a desire to expand capacities in order to balance the volume of developments with the volume of production.

Previously the problem of the new had to be solved twice--when developing and creating the experimental model and when introducing the item into series production. Now, when the development is carried out in the production section, these stages are combined. Along with the release of the item to the state commission a document is assigned for its assimilation. The head designer is fully responsible for the item as long as it is in production. Of course he does not sit with his arms folded, but begins the next development. But if something is not going right he must return to the previously developed item. And previously, once the document concerning the fulfillment of the development was signed by the state commission, the developer was relieved of all responsibility for the further destiny of the product.

We have been working in the new way for almost 10 years now. Traditions have been formed and a new generation of managers has grown up. Now nobody would even think of saying: "Why are you imposing on me the duty of engaging in commercial output!" The developers are displaying considerable interest in raising the technical level of production. For the section is also the production base for the laboratory. Whatever the level of the overall culture of the section, in the broad sense of this word, such is the sector's capability of realizing new developments.

Under the conditions of the sectoral structure, the training of the developer begins with his study of production. Only a person who studies all the specifics of the work on an item can become a developer. This circumstance improves the psychological climate. People understand: their advancement depends on them themselves.

Having created scientific production subdivisions and having been convinced that their structure is rational, we have followed the same principle in reorganizing the service subdivisions. We joined together under the aegis of the deputy head engineer the divisions of the head mechanic, the head energy engineer and the corresponding production section as well as the construction shop, having organized a unified repair and operations service and made it responsible for solving all problems related to the reconstruction of the areas.

The organization of material and technical supply has improved as well. Previously in the stage of manufacturing the mockups and experimental models the developers encountered serious difficulties with materials and batching items, which they found it difficult to obtain for the institute and which did not appear until the stage of series production.

The sales service has undergone significant changes. Previously there were two independent subdivisions:

the division for application within the institute whose duties included studying the demand and determining the sales market;

the sales division of the plant which, like all analogous subdivisions of other enterprises, dispatched products to the consumers according to funds and orders.

Neither one of these divisions was responsible for the final result. The first did not know what the actual demand for the products was or whether it corresponded to the predicted demand. The second had no influence on production. The chief of sales was previously always saying: "I need warehouses, there is nowhere to keep the unsold items." He explained this by the fact that the division for application had again made mistakes in predictions and had incorrectly determined the production volume.

It was decided to combine the two divisions and place them under the jurisdiction of the deputy head engineer. In the stage of development they study the market demand and organize the advertising of the items. The advertising has been arranged fairly well-catalogues of the items and information sheets. The production volume is formulated on the basis of the demand. There is more responsibility for fulfilling the sales plan taking into account deliveries under agreements. We now have no unsold items in the warehouse. We keep careful track of the fulfillment of the delivery plan.

We have managed to regulate wages and eliminate the "gap" in the wages of engineers, which were previously higher. Previously the role of production had been reduced. While bearing responsibility for the output of products, technical safety and social issues, the section chief received much less than the developer did and even less than the skilled worker did. With this level of responsibility and the low wages it was difficult to find qualified managers of production subdivisions. Now we have no problem with line engineering and technical personnel.

After working for several years in the new way we became convinced that the production has an effect on the psychology of the developer. Each day it dictates its own problems and can put scientific interests onto the back burner. Therefore a mandatory condition for incentives is the fulfillment of the plan in terms of science. The plan for science is monitored from network schedules. Nonetheless there is a danger of reducing the scientific stockpile. In order to prevent this we established contractual ties with institutes of the Siberian Branch of the Academy of Sciences which in time grew into cooperation through the so-called interbranch scientific subdivisions.

In the Siberian Branch of the USSR Academy of Sciences and on its territory the laboratories we have created are in operation and, in conjunction with scientists from academic institutes, they are determining the future directions of the work and creating a scientific stockpile.

These laboratories and the division depending on their specialization, are included in the organizational structure of one subdivision or another of the scientific production association. With the help of the Institute of Automation and Electrometry, for example, we are developing a system of automated planning and have changed over to the KAMAK standard, in keeping with which for 7 years now we have been developing and manufacturing automated systems for measurement with control from an electronic computer.

The system of incentives in the association have been arranged in the following way: the maximum amounts of bonuses for engineering and technical personnel and employees--50 percent of the monthly salary, the specialist can obtain 25 percent as a result of fulfillment of the plan for science, and the other 25 percent--for production, but with mandatory fulfillment of the plan for science. The amounts of the bonuses are differentiated depending on the personal contribution of one worker or another. A system of coefficients has been introduced for this.

Each engineer bears responsibility for 2-3 indicators that are included in the sphere of his activity. The chiefs of the sectors and divisions are given the right to take into account the level of individual coefficients. We pose the question this way: if the manager of the subdivision does not differentiate the amounts of bonuses depending on the coefficients, this means that he is not very familiar with the work of his people.

As a result of improvement of the organizational structure and technical re-equipment, the volume of production in the association has increased as compared to 1980. During the past two five-year plans the annual growth rate of labor productivity has amounted to an average of 25 percent, and the proportion of new items produced in less than 3 years--50 percent of the overall quantity. Of the products 25 percent go for export. During past years the proportion of financing of the institute's developments from the budget has been cut in half, and the financing on the basis of economic agreements has increased correspondingly.

Previously, after the assimilation of the items at the experimental plant, those which promised to increase production were transferred to series plant. With the creation of the scientific production association we set the task of increasing production capacities and satisfying all clients ourselves. A good deal has been done in this area. But because of the difficulties in construction we have not managed to solve the problem completely. We still transfer certain items for series production to other enterprises. But because of the fact that in the new organizational structure we have greater integration of science and production, the technology for manufacturing new products is now brought to such a level that the cooperating plants did not have to encounter the same difficulties which they previously had to overcome. Because of this our relations with our developers have improved. Having assimilated one items, representatives of production associations go for the next ones.

In my opinion, the scientific production association should be less loaded with reproducing series items and a greater part of their scientific potential should be used for creating new products.

Recently the press has been devoting a great deal of attention to scientific production associations. Judging from the publications the public is bothered by the fact that scientific production associations do not have a particular status and that, while they are called associations, they actually consist of two independent parts--an institute or design bureau and a plant with their various plans, estimates and sources of forming incentive funds. All these problems and difficulties have affected us to a greater degree since we have made an attempt to improve the organizational structure of the scientific production association.

In the first place, our structure has not yet been approved, although we have received approval from the branch. The only thing they have managed to decide is that the director of the institute is the general director of the scientific production association and the director of the plant. Therefore through our influence we manage to form the services in the way that is dictated by the need. Some services are concentrated in the plant while others are concentrated in the institute. We have thus avoided duplication.

In the second place, like everyone else, we have a separate plan for NIOKR and an individual technical and industrial financial plan for the plant. And although our new structural subdivisions are simultaneously directed toward fulfilling the same plan, it is necessary to report separately for each of them.

In the third place, the sources for the formation of the incentive fund are also different. There is one source in the institute and another one in the plant. The evaluation of the activity of the plant that is included in the scientific production association is the same as for independent plants--the results of the production activity in terms of the normative net output and the products list and also in terms of the reduction of production cost and the growth of labor productivity. The specific features of the enterprise whose main task is to create new technical equipment are in no way taken into account.

We have combined the incentive funds and pay bonuses on the basis of our own methodological provisions concerning incentives. But it is necessary to report separately for the fulfillment of the same bonus fund. With each inspection we have to explain our organizational structure for an hour and a half or 2 hours. When they find no abuses the inspectors still write in the inspection documents that the staff distribution has been violated. There are sometimes very understanding inspectors who even try to help us. In particular, having become familiar with the structure of our sales service and considering it expedient, one inspector, having indicated in the document the lack of a standard structure, made the suggestion to permit the scientific production association to use the actually existing organization of the sales service as the one that corresponds most completely to its specific features.

The decree of the CPSU Central Committee and the USSR Council of Ministers of 18 August 1983 on measures for accelerating scientific and technical progress need to improve the control of the cycle "Development--Introduction" of new technical equipment. One of these measures should be the reorganization of the scientific production association. How long will the scientific production associations be considered centaurs, as they are now called? It is time to grant the managers of the scientific production associations the right to determine for themselves the most expedient structure of management. It is necessary to have methods for forming a unified plan for the operation of scientific subdivisions and productions, wage funds and incentives. All this will make it possible to increase the effectiveness of the work of the scientific production association.

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GOALS OF SOCIAL DEVELOPMENT CONTEMPLATED

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[Article by V. G. Eydinov, candidate of technical sciences (Leninigrad): "Social Development--Both a Goal and a Means!"]

[Text] Let us delve once again into the lines of the Basic Directions for the Economic and Social Development of the USSR During 1981-1985 and the Period Up to 1990": "Under the 11th Five-Year Plan the development of science and technology should be to an even greater degree subordinated to solving economic and social problems of the Soviet society, accelerating the changeover of the economy to the path of intensive development, and increasing the effectiveness of public production." Taking this into account it would be expedient to regard as a means of solving social problems the development and introduction of highly productive machines, reduced-operation, reduced-waste and waste-free technologies, automatic manipulators (industrial robots), automated shops and plants, and many other things.

As we know, the development and introduction of new machines and any other scientific and technical achievements are accompanied by a technical and economic substantiation of their effectiveness. There are numerous branch and interbranch, general and particular, approved and unapproved methods for calculating economic effectiveness. Many methods for calculating the economic effectiveness of capital investments and new technical equipment, the effectiveness of innovations and so forth recommend calculating only the economic effect (and the calculation is sometimes developed into the highest art, for example, when it is suggested that they calculate the savings on the expenditures of compressed air). Concerning the social effect, as a rule, they say: "One should also take into account...." How does one take it into account? However you wish! You can cover dozens of pages describing the remarkable social consequences and the person that distributes the credit will skip over them without reading them since he is a busy person and he wants a concrete figure. An experienced manager tries to place this figure on the last page of the report, which will also be the only one that is discussed.

As long as the problem of intensification was not so critical it was possible to do without economic equivalents of social consequences of innovations: they could be calculated as makeweights which had little effect on the main

technical and economic decisions. But today the lack of such equivalents is intolerable because the problem of the shortage of labor has become crucial in all branches and in many regions of the country because extensive management has become an impossible luxury and frequently reduction of manual, less skilled and heavy physical labor (and, the main thing, nonproductive labor) have become an immediate task.

Necessary, But Not Advantageous

The temporary Standard Methods for determining the effectiveness of capital investments appeared at the end of 1980. It was prepared by the scientific council for the economic effectiveness of fixed capital, capital investments and new technical equipment of the USSR Academy of Sciences with the participation of the USSR Stroybank, and it was approved by the USSR Gosplan and Gosstroy. The method opens up broad possibilities of accounting for expenditures and the effect from investments in the nonindustrial sphere, environmental protection, the sphere of circulation and so forth. Many social results (and the expenditures associated with them) are taken into account with the help of this, for example, capital investments in social, cultural and domestic services in order to enlist and retain personnel, and so forth. During reconstruction and technical re-equipment which are directed toward achieving social results, the methods suggest solving the problem of the expediency of work in the broad socioeconomic plane.

How is this done?

The situation is especially clear with respect to industrial robots. Everyone knows that robots are an important means of reducing less skilled labor. But in the majority of cases, what with all the coefficients and increments, the savings on wages do not make up for the expenditures on the production and operation of robots.

What turns out to be the case? We know that they are necessary, but according to calculations it turns out that they are disadvantageous. Two conclusions suggest themselves here. The first: in the interests of the matter it is necessary to consider the effectiveness in the broad socioeconomic plane without paying attention to the fact that this means turning away from precise calculations and from economical utilization of resources. The second conclusion: Possibly we are not taking something into account and our formula did not reflect our goals?...

Let us think. We must strive for such an arrangement of economic equivalents of social results which would reflect the peculiarities of socialist production relations. In the first place, when speaking about innovations and new technologies we only calculate the profit and the savings, but these are not goals in themselves for us, but only means of solving social problems. And this being the case why do we strive to take into account the social effect as it "passes through money" and ignore the effect that is obtained directly? First and foremost this pertains to improving conditions for labor and life: by establishing mandatory social-cultural and social-labor norms (standards for the level of life and working conditions) in one stage of the society's development or another, we thus determine the

acceptable level of expenditures on the achievement of these normatives. And if one of the results of the introduction of technical equipment is progress toward these normatives, this means that we are saving on the corresponding expenditures. In this case they become the economic equivalent of the given social consequences.

In the second place, when analyzing the effects of new technical equipment, we do not pay attention to the proportion of national income that goes for the creation of public consumption funds and for the granting of social benefits. These include capital investments in housing and cultural-domestic construction (movies and houses of recreation, stadiums and a new park) and current expenditures on benefits that have come to be taken for granted: free medicine and education, inexpensive housing. What does this have to do with new technical equipment? It is relevant in the most immediate way, especially when there is a shortage of labor. By releasing one worker we save not only his wages, but also that part of the national income that goes for each individual in the population, regardless of whether we are speaking about capital investments or current expenditures. A robot, for example, does not need to be taken into account either when constructing a movie theater or when organizing a kindergarten. And when we determine how much to spend each year on public health or education we do not have to take the robot into account either.

With such a normative approach one pays attention to the expenditures not only of one enterprise, but of the entire national economy per one worker and the expenditures that are saved when he is released (even if it only conventional, that is, when there is an increase in the volumes of production instead of a reduction of the number of workers). Payments from public consumption funds in 1983 amounted to 134.5 billion rubles, or 495 rubles per capita.

Who Should Bear the Cost of Fighting the Labor Shortage?

The difficulty is that public funds are distributed unevenly, reflecting the demographic and economic policy. Problems arise here which are related to another proportion of the national income--that which goes for accumulation.

I have before me a rayon newspaper SUZDAL'SKAYA NOV' for 2 March 1982. An announcement is printed on the last page. I shall present it here with some abridgement: "Leningrad PTU No 13 invites boys and girls to study in specialties on the basis of 10 grades--painter, plasterer, slab facer, parquet applier, mason-installer of reinforced concrete items. The students are paid 50 percent of the sums earned during the period of production practice. The stipend is 75 rubles. The training time is 1 year. A well-arranged dormitory with rooms for 2-4 people is provided." And now the main thing: "Graduates are sent to work in Leningrad with provision of housing...."

The largest enterprise in Suzdal is a bakery. This means that youth are deliberately taken out of agriculture in the Nonchernozem Zone where they are so needed. And they are invited to Leningrad, attracted not by an interesting occupation (let us not deceive ourselves), but by housing in the city for the volumes of housing construction have long exceeded the limit envisioned by the general plan, where hundreds of thousands of people live in dormitories. It

is easy to see how crucial the situation with workers in construction specialties is if one remembers that Suzdal is certainly not a suburb of Leningrad.

And yet in casting and forge-press productions, vegetable storehouses and many other places this situation is similar. It is simply that PTU No 13 has taken a desperate step--placed an advertisement in the newspaper from another oblast. But it is the same everywhere: they can manage to attract youth to less skilled, heavy physical labor or occupations that have no prestige only by granting passports and housing in a large city. And they come...from agriculture.

The limitation on the development of large cities, the movement of industry into Siberia, the Far East and the North, and the enlistment and retention of specialists in agriculture were predetermined by the Basic Directions and are being carried out in the interests of the entire society, that is, each of us. But we must be aware that granting housing (or even passports) in many cities of the European part will continue to be a benefit for a long time. This means that enticing workers into the large city, say, from agriculture must be regarded as loss-producing capital investments in the creation of social, cultural and domestic facilities and public consumption funds in this city since one loses part of the national income that goes for accumulation and is related to the migration of able-bodied population from the corresponding regions. Moreover when attracting a worker for heavy physical and unprestigious work at this price one should keep in mind that we will not keep them forever: having received a passport and housing and having moved their family to the large city and worked the necessary amount of time, the worker will leave this job. And his work position will require additional capital investments in a new apartment for the next worker. These are all payments for extensive management under the conditions of a labor shortage.

There is also another path to "fighting" against labor shortage. Highly skilled workers--scientists, programmers, engineers and so forth--are sent to the footwear conveyor, to file in the printing office, to weed and harvest the crop according to "production necessity" or "under the policy of patronage." In any event this is a difficult and compulsory measure. But, after all, we are achieving a significant return and high effectiveness of the work of scientific subdivisions as well. They too increase the national income (contribute to economizing on resources, increasing labor productivity and so forth). Consequently, by reducing the annual time fund of the work of scientists we are thus eliminating part of the national income. Or, perhaps, there are far too many workers in these subdivisions? If this is the case, then let us reduce the number--they are needed in other places, and if not, then...on the doors of an academic institute which has nothing to do with agriculture there will appear the announcement: "A laboratory worker is needed to work on a kolkhoz." Then in the Shchekinskiy rayon printing office they explain why they would like to but are unable to change over to the Shchekino method: if you do not have a surplus of labor force then work on the kolkhoz or at the vegetable base undermines the fulfillment of the plan. Who do we blame for this? This is again extensive economics and undermining of labor resources.

It becomes a vicious circle: low labor productivity and an extravagant attitude toward labor resources in the city make it necessary to attract workers there from rural areas where they are no less needed. Thus it becomes difficult to increase labor productivity in agriculture. And because of low productivity and high expenditures of unskilled manual labor in agriculture, city dwellers are taken away from skilled, highly productive work and the shortage of personnel in the city becomes worse. The key to solving the problems of eliminating less skilled heavy and nonproductive labor lies in refraining from extensive methods of management.

But how does one motivate executives to search for the key precisely in intensification and not "under the spotlight because it is brighter here"? How does one reach a point where the manager of a city enterprise does not get the idea of placing an advertisement in a newspaper for rural residents of the Nonchernozem Zone with the words "housing in the city," so that he will be embarrassed to tell his highly skilled coworkers about the "production necessity"? How does one make it an indispensable matter for these managers to introduce progressive new technical equipment and technology?

In the first place it is necessary to have a clear idea of what it costs the state when one has an extravagant attitude toward labor resources--unjustified expenditures and a lost portion of the national income. Scientific and technical progress waits for no man. We lose time and priority. And we must see the cost of this "compulsory" extensive policy to the national economy as a whole and know the people who are guilty of it in each specific case.

In the second place, it is necessary for the enterprise (industrial or agricultural) to compensate for this damage to the state, at least partially. Not the other specific enterprise, from which the unskilled labor force has been taken (here the national economic harm need not be experienced so critically), but precisely the state--the budget. Then a robot will be more advantageous than an advertisement in a newspaper, and the acquisition, careful storage and skillful utilization of a potato-harvesting combine will be more advantageous than a telephone call: "Send the patrons!" Then the chairman of the kolkhoz will ask for a quite different kind of help--arranging the repair base, constructing sheds for storing equipment, assimilating combines and working on them, thinking about and making devices, that is, helping in intensification of production.

Technical Equipment Improves Working Conditions

The introduction of new technical equipment usually results not only in a reduction of the shortage of labor for production, but also in an improvement in working conditions. And although these results are interconnected, let us try to consider the latter separately. We must regard releasing workers from harmful and heavy industries and improving working conditions and living conditions as an independent, primary social good, and not as a means of obtaining any other kinds of goods. Actually, anyone should be ashamed to calculate how much labor productivity will increase if do not crush people in the bus on the way to work and we do not make them waste time standing in lines. Perhaps it will increase. But we should delve into human conditions simply because we are people and we should not spend time waiting in lines

because, as K. Marx said, time is the most valuable commodity for a human in a communist society! It is necessary to speak about improvement of working conditions as a kind of final goal, and economic advantages should be regarded as a means, as a side result, and not vice versa.

Considering improvement of working conditions as an independent social good, one can speak about direct and indirect methods of construction economic equivalents. The direct method can be applied if one knows the alternative ways and means of achieving the same results--applying air conditioners, ventilation, means of minor mechanization, manipulators (nonautomated or semi-automated), conducting protective measures, and so forth. Releasing the worker from difficult conditions saves the corresponding expenditures on compensating for them or improving them.

Let us say that we have calculated the economic equivalents of social consequences. What will the person who distributes credit, the person who finances the development of new technical equipment or the manager of the enterprise that is introducing it say? They will not feel the effect if it does not influence indicators of economic activity. But who then will confirm that there has been a social effect? The manager has two solutions:

Either not to sign anything since he does want to be responsible for these figures or to sign anything he wants to since he does not need to be responsible for them. Obviously, neither one of these solutions is suitable.

Improvement of the conditions for the life and labor of the people is a primary task of the soviets of people's deputies. The soviet guides the social development of the region and controls a considerable amount of money that is spent on solving social problems. He must also evaluate the contribution of the enterprises to solving these problems.

Standards for the Level of Life

Comparing concrete social results with the expenditures that are objectively necessary for achieving them requires a modification of social and cultural normatives (standards for the level of life). It is necessary to establish for each of them not a single value, but a permissible interval between maximum and minimum limits of comfort (lighting, air pollution, heat and moisture conditions, provision of production space and so forth). The upper limit determines maximum permissible expenditures on solving social problems (and this means also economic equivalents of the corresponding results that are obtained by other methods). The lower level is the permissible limit of the level of living as already determined, say, by the minimum wage. In various stages of the development of the society these indicators can change in the direction of raising the standard of living. But in each stage one will know the level at which the state will begin to require that the enterprise (or citizen) compensate for surpluses--for supercomfortable working (or living) conditions, and the level at which the state will require immediate changes in poor conditions.

Taking into account both the positive and the negative indicators of the level of social development, we will be able more purposively (with the help of

economic equivalents) to utilize the resources for solving social problems. On the one hand, we will manage to reduce the negative indicators not only directly for example, by using capital investments for the nonindustrial sphere or environmental protection, but also in a mediated way--when introducing new technical equipment, say, by installing robots that replace workers in hot shops.

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EDUCATION PLAYS IMPORTANT ROLE IN ECONOMY

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA (EKO) in Russian No 3, Mar 85 pp 123-132

[Article by V. I. Martsinkevich, candidate of economic sciences, Institute of World Economics and International Relations of the USSR Academy of Sciences (Moscow): "Education and the Needs of the Economy"]

[Text] An examination of foreign experience certain does not mean borrowing prepared decisions from the practice of other countries. The systems of education in capitalist countries, along with the entire social and economic system, are experiencing a prolonged aggravation of contradictions. Yet the systems of education reflect constant searches for effective ties, without which success is impossible under the conditions of the competitive struggle. The economic and organizational forms of education which are used in the interests of the ruling circles of the capitalist countries cannot but take into account the requirements of modern productive forces and the way of life of the population. Purified of class peculiarities which distort their essence, there is every reason to use them in our country more and more consistently and with better results than under capitalism.

Has There Been "Overproduction of Education"?

Since the beginning of the 1960's the development of education in the leading capitalist countries has outpaced other spheres of the economy, including research and development. During the 1970's, because of the overall deterioration of the conditions of capitalist reproduction (labor productivity decreased, unemployment increased, especially among youth, the increase in real earnings slowed down and even stopped increasing, and social instability increased) many Western economists revised their evaluation of the role of education, according to which it accounted for a considerable part of the product that was produced. There was a spreading of interpretations which reduced the role of education to particular functions in the formation of the labor force and the disclosure of the natural capabilities of the students, which facilitates their distribution among the corresponding working positions. Certain of them even went further and fully denied the economic role of education. The greatest response was elicited by conclusions concerning the "reproduction of education."

But the facts show that all of the economic significance of education remains, and the main indicators of its role have not decreased but in some cases have even increased. The different is between the maximum and minimum payment for workers with higher education and those who completed graduate school in the 1970's increased, and for graduates of the secondary school they remained the same. Nor was there a drop in the level of the initial pay for young specialists. At the same time there was sharp drop and the payment for workers with a primary education. These people are, as a rule, older who have not kept up with technical progress and frequently work only part-time.

During the 1970s the requirements for the quality of education became stricter and the market mechanism began to evaluate these qualities more precisely. The great expansion of unemployment also affected people with higher education. The reason was not education as such, but the slow rates of economic development. If they had remained at the level of the 1960s, then there would have been hardly any reduction of the possibility of placing unskilled personnel. It is remarkable that concrete calculations by those same Western economists who were so glad to discuss "overproduction" of education, do not corroborate the reduction of the return from it in the 1970's.¹ All of this shows that lowering the economic significance of education is nothing more than an attempt to make it responsible for economic crises and the structural irregularities in the capitalist economy during the past decade. They are swept up in that general conservative trend of "Reaganomics" which is directed toward cutting expenditures in the social sphere.

By the beginning of the 1980's there was a dual tendency in the development of education. On the one hand, the narrowly pragmatic approach was spreading everywhere: in the secondary school occupational training was developing at an accelerated rate to the detriment of general educational training, the training was being adapted to the "career," and its results were evaluated according to the suitability for work. In the United States there was a drop in the average level of scores received by school graduates on tests for college entrance, the proportion of senior classmen studying difficult courses in mathematics and natural sciences decreased, and at the same time there was a sharp deterioration of the results of the study of elementary mathematics, reading and writing. As a result, up to 20 percent of the so-called functional illiterates in the United States were youth.² Numerous short-term courses of a practical orientation were introduced into postsecondary education in order to increase its diversity.

On the other hand, they are relying not on extensive expansion of the contingents of students, but on qualitative improvement, structural changes and strengthening of the weak links in the sphere of education. During the past decade in the United States, 3,000 of the 19,000 school districts have been closed and 171 colleges have been closed because they do not meet the modern requirements for the quality of training. At the same time the overall number of colleges has increased by 300, and the number of students has increased more than 1.5-fold. In educational institutions a larger role is being played by precision accounting for the needs of the economy and the economic effectiveness of education. Of course, under real conditions at every step this degenerates into bourgeois practical measures to the detriment

of the long-term interests of the development of science and production and the social needs of the workers.

In the leading capitalist countries there will apparently soon be a qualitative change in the structuring of education. This is shown, in particular, by the unprecedented severity of the "self-disclosure" of shortcomings in education, although in terms of objective indicators, its quality has not deteriorated. The fact is that the requirements on the quality of education have increased sharply as a result of the growth of the scientific and technical knowledge required for jobs, the principal changes in the content of labor in science-intensive branches, and the need for mass retraining of people who lost their job and their specialty. The new requirements that industry makes on the quality of the labor force are incompatible with the neglected condition of school buildings and equipment in many regions.

Improvement of the quality of education is still crucial also because in the modern stage the ratio between the development of education and science is one of the important national economic proportions which strategically influences the scientific and technical development of each country. In all developed capitalist countries education is the leader in terms of resources that are expended. During the 1970s's expenditures on education exceeded expenditures on science in the United States 2.6-3-fold, and in Japan, France and Great Britain--3-3.5-fold. Japan's position is extremely symptomatic. During the 1960's, leaping ahead of the other countries in terms of the development of its own science base, it allotted 3 times more funds for education than it did for science. This ratio remains up to this point, in spite of the forced rates of development of their own NIOKR.

Expenditures on education in the leading capitalist countries, according to the official count, amount to from 6 to 9 percent of the national income. The countries are making these expenditures because without them it is impossible to have effective development of education or to obtain the expected profit from it.

In the first place, the quality of knowledge is directly related to the material support for training institutions. In the United States expenditures on one student in the schools of the regions with various social compositions of the population differ by an average of threefold. The national evaluation of the knowledge of American students showed that above-average success is found only in schools with material support that essentially exceeds the average level. Thus in the richer areas the overall development of 17-year-old adolescents is 6 percent higher than the average level, the knowledge of mathematics--10 percent higher, and the knowledge of natural sciences--5 percent higher. At the same time in poor sections of cities the overall development of schoolchildren is lower than the average in the country by 14 percent, and in mathematical and natural scientific knowledge--14 and 7 percent lower, respectively.

The schools have begun to be rapidly saturated with electronic computer equipment. The widespread introduction of computers is based on the fact that they have become much less expensive and that training programs are available.

For example, the firm Control Data spent \$750,000 on the development of a databank for the information training system Plato, to which it annually adds up to 2,000 programs--from training in reading to the training of pilots and stockbrokers. There is a growing interest in computer teaching, which creates strong additional incentives for the schoolchildren and students.

In the second place, while the pay for teachers (it comprises half of the expenditures on schools) lags behind the pay of other specialists with equal qualifications, there is an inevitable degradation of pedagogical personnel. In developed countries the rate of increase of wages of teachers during the postwar period has outstripped the average analogous indicator. The payment for workers in kindergartens and primary schools has been brought up to the level of the senior classes (in the United States they are practically equal). In Japan secondary school teachers are considered to be one of the most prestigious groups of specialists. In the United States the earnings of teachers are higher than the average level of earnings in the country and higher than the average earnings of laborers. But it turns out that this is not enough--more and more skilled educators are moving into other spheres of labor.

It is generally recognized that expenditures on education are not so great as compared to the needs of other spheres (for instance, capital investments in school construction and equipment comprise only about 3.5 percent of the overall sum of capital investments in the economy of developed countries). Nonetheless there is practically not a single country in which all of the financing comes for the state budget. Funds come in from many sources--from industrial firms, banks, and cooperative and public organizations. They also extensively take advantage of the fact that it is easier to raise various voluntary and donated resources from the population for the sphere of education than it is for other spheres. In the United States up to 90 percent of the funds for education come from local tax sources, and campaigns are always being organized for special collection of money, say, for purchasing computers. Naturally, the multitude of sources of financing in and of itself does not generate new funds, but it mobilizes the dispersion of resources and redistributes them in favor of education.

Where Is It Best To Train Labor Personnel?

It is hardly possible to give a simple answer to this question. The systems of general and vocational education differ essentially in the various countries. In Japan 7 percent of the influx of new workers are graduates of the incomplete secondary school, 58 percent have a complete secondary education, and 35 percent are graduates of higher educational institutions (including 22 percent with a higher education). In the United States dropouts from secondary school comprise 26 percent of the overall influx of youth into the economy,³ graduates of secondary schools--28 percent, and individuals with various kinds of postsecondary education (including incomplete secondary)--23 percent, and college graduates--23 percent. In this country approximately 40 percent of the schoolchildren are included in occupational orientation and acquire labor skills in shops and interschool combines. They are trained in home economics, automotive repair, other kinds of repair work and other specialities in the sphere of services. This creates a basis for occupational

mobility. The firms are provided with narrower specialization with the help of special courses. Questionnaires of American enterprises show that they give preference primarily to the workers' love of their job, their loyalty, their responsibility, and their ability to be further trained, and they give least preference to a narrow specialty. A statement from one of the managers of the General Motors company is typical: "Very rarely are young workers fired because of their inability to perform their job. The majority of these cases involve negative personal qualities and not job requirements." Nor should one forget about the relations that take form in capitalist production.

In the FRG, on the contrary, all who go to work must take occupational and special training. In this country 55 percent of the youth come to industry from an incomplete secondary school, and 25 percent from 10-year "real" schools (but after graduation from the school they go through mandatory professional training). The remaining 20 percent are former gymnasium graduates who have received a complete or incomplete higher education. A small proportion of the graduates from gymnasiums do not continue training and immediately go to work. They have good educational training and therefore there is a high demand for them. American and German specialists are studying the pluses and minuses of both systems of training labor personnel.

In spite of the nuances of occupational training, in various countries in schools, as a rule, there is a prevalence of general suitability for production activity over the utilitarian goals of acquiring a narrow specialty. Experience shows that the final effectiveness of training personnel is determined not by the place where it is conducted, but by how qualified the instructors are, how strong the material base is, and to what degree the development of education corresponds to the real economic and social goals. Disproportions between the educational potential and the other elements of productive forces inevitably lead to a surplus or a shortage of skilled personnel, dissatisfaction with labor, a reduction of labor productivity, a drop in the prestige of education and individual forms of it, and so forth.

How many and what kinds of engineers are needed?

In industrial countries of the West there is a clearly expressed tendency not to expand extensively costly specialties which are fraught with direct responsibility for the lack of people and material values (above all, technical and medical), but to more strictly select for them people who are capable and to improve the quality of their training. It is typical that the proportion of natural, technical and agricultural profiles is decreasing everywhere without leading to a serious shortage of these personnel. The economies of developed capitalist countries operate with a relatively small number and influx of specialists in key industries. In Japan the proportion of engineers in the graduating classes of VUZes amounts to 25 percent, in France--10-15 percent, and in the United States since 1910 it has not exceeded 10 percent. There are not many engineers but this is not because of the large number of technicians. In the United States, the FRG and France there are fewer technicians than engineers, and only in the less scientific and technically dynamic countries--Great Britain and Italy (in which there is not

such a shortage of engineers either) are the numbers of technicians 2 and 1.5 times greater, respectively, than the numbers of engineers.

In spite of this, during the 1970s in the capitalist world there was a surplus of engineers. As a result, under the conditions of a spontaneous economy there was a reduction of the influx of youth into technical colleges and, consequently, a reduction, a reduction of the output of specialists, especially in the United States. Many specialists hastened to associate this fact with the essential decline in the United States share in world trade in science-intensive products during this period. This kind of logic reflects the existing "piecemeal" approach to engineers as to objects of large "capital investments" from which it is logical to expect a concrete return. The influx of graduate students into technical colleges exceeded their capabilities only in the beginning of the 1980s. But the training institutions did not proceed toward expansion of the contingents, preferring to maintain the standards of the quality of training.

On the other hand, in capitalist countries with mass higher education the training of specialists in the humanities and general educational profiles always exceeds the number of jobs in science, journalism, education, culture and so forth. Therefore people who enter these specialties are oriented beforehand not toward vacancies, but toward the fact that a higher education will enable them to advance more rapidly than less educated people in the most varied occupations. The final result of this approach is an overall increase in the quality of the labor force, as has taken place as a result of the continuous saturation of the trade, clerical and service spheres in the United States and Japan with workers who have higher education in the humanities. A similar role is played by transforming the secondary school diploma into a standard requirement for young workers who are hoping for advancement. The initially unusual enlistment of doctors (candidates) of sciences into American production firms was oriented toward the utilization of science and helped to introduce many achievements of fundamental research into U.S. industry more rapidly than in other countries.

Training in humanities profiles is less expensive and there are greater differences in the quality of individual training than there are in technology and medicine. Because of the keep competition only the best-trained graduates become professional specialists in the area of humanities and social scientists (for example, in Japan only 15 percent of the graduates).

It is regarded as proved that, since the economic requirements on personnel are complex and mobile, it is possible to satisfy them to the extent that the methods and content of education are capable of utilizing the flexibility and adaptability of workers to the changing production conditions. The United States needed several decades in order basically to overcome the widespread narrow specialization in the training of personnel by the beginning of the postwar period. Now training is conducted in 22 consolidated specialties with a predominance of general scientific and general engineering content, and approximately one-fifth of the training plan is composed of the humanitarian and social cycle. Narrow specialization is carried out in the first years of work introduction taking into account the business qualities of the young specialist which have been revealed by the firm. The majority of large

American firms are opening up training centers and arranging ties with colleges for specialization of college graduates who have a broad profile of training.

The cost of training is increasing rapidly. In 1980 the average expenses of a student in the United States approached 4 months' average earnings in the economy. In many colleges the fees have reached truly astronomical levels. Both in the private and the state sectors payment for education and the critical interest of the training institutions in economizing on funds, which has ensued from their operational and economic independence, create reliable obstacles to extensive expansion of the training process. It is typical of American colleges to have condensed training periods (the standard course lasts for 4 years), a small volume of in-class studies, reliance on independent work of the students, and extensive individualization of training. In the best American universities mandatory attendance of lectures have been reduced to 12-14 hours a week, and taking laboratory time into account--20 hours a week. For example, the proportion of individually selected active courses at Massachusetts Institute of Technology for the aviation profile has increased from 4 percent in the 1951-52 training year to 28 percent in 1978-1979, and for the chemical and technological profile--from 9 to 58 percent.⁴ Of course, this is accompanied by postgraduate increasing of qualifications. Training according to individual plans increases the requirements for the skills of the instructor-consultants, the interdisciplinary nature of training, and it opens up broad possibilities for displaying initiative.

The independence of the sequential stages of postsecondary education plays a large role in keeping the training of personnel in line with the needs for personnel. In Japan and the United States a four-stage system of higher education has taken form: junior colleges (2 years of training) which provide a formally recognized incomplete higher education, 4- and 5-year colleges with broad general training and a minimum of specialization (these also include technical higher educational institutions), and proportional specialized training at the master's level (1-2 years) and graduate school--a 2-3-year course in intensive specialization and scientific research for preparing scientific and pedagogical personnel (on graduation they are awarded the scholarly degree of doctor of sciences).

Thus one can single out the following main features in the training of personnel which make it possible for the economy to manage with a relatively small number of engineers: the broad program of training in a small number of consolidated specialties; the differentiation of various categories of specialists in terms of level and functions, beginning with junior specialists, operations workers, planners and so forth with various amounts and kinds of training; special measures for selecting capable engineers and the prevalence of intensive, individual forms of training, the ranking of technical postsecondary training institutions in terms of their material support and the 12 occasions of personnel with an orientation toward various levels of training of specialists. Moreover, in the sphere of education in capitalist countries the most important funds, methods and content of education are extensively utilized in the economic and political interests of the ruling circles.

FOOTNOTES

1. MIROVAYA EKONOMIKA I MEZHDUNARODNYIE OTNOSHENIYA, No 3, 1983, pp 146-147.
2. This concept reflects the modern approach to illiteracy. The functionally illiterate include those who cannot be completely oriented in the conditions of production and life, for example, understand simple instructions regarding technical safety, bus schedules, leases for appointments and so forth.
3. Herein lies one of the immediate reasons why in the United States more than in Western Europe and Japan functional illiteracy pertains to the labor force. In order not to allow a catastrophic increase in unemployment, the United States is forced to retain in the structure of the economy "old" branches which other countries abolish or eliminate.
4. Filippova, L. D., "Vyssheye obrazovaniye v SShA" [Higher Education in the United States], Moscow, "Nauka", 1981.

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TIMBER INDUSTRY PROGRESS DISCUSSED

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA (EKO) in Russian No 3, Mar 85 pp 133-149

[Article by I. N. Voyevoda, doctor of economic sciences, Institute of Economics and Organization of Industrial Production of the Siberian Branch of the USSR Academy of Sciences (Novosibirsk), and A. P. Petrov, doctor of economic sciences, Forestry Technical Academy imeni S. M. Kirov (Leningrad): "The Effectiveness of the Timber Complex"]

[Text] The forest is a great gift of nature. It plays an immense role in protecting the water and land resources, in improving the environment and, one might say, in making all life on earth healthier. The forests are of great significance for the country's economy. It is necessary to handle them thriftily, like the land.

...Obviously, there is a question here and it must be taken seriously. This pertains also to efficient utilization of timber raw material resources, the restoration of forests, and the reproduction of them at more rapid rates. One should think about this more deeply and, perhaps, change certain points of view.

From the speech by K. U. Chernenko
at the October (1984) Plenum of the
CPSU Central Committee

In November 1983 the Politburo of the CPSU Central Committee discussed the question of improving the utilization of forests in the country and earmarked the basic directions for the development of the forestry complex for the 12th Five-Year Plan and the longer-range future. The corresponding suggestions were submitted to the USSR Council of Ministers, which adopted a decree regarding this issue. The attention of higher party and government agencies to problems of the utilization and reproduction of forestry resources in the country is no accident. The forestry complex is a large element of the USSR National Economy. Under the 11th Five-Year Plan about 4 percent of the gross output from industry is being created at its enterprises, and 4.5 percent of the industrial production funds are being used here. It accounts for an even

more significant proportion of the shipment of cargo with all kinds of transportation. Almost 3 million people work here. Timber products occupy an eminent place in foreign trade. In past years currency income from the sale of timber products have amounted to 2 billion rubles.

Some divisions of the forestry complex are related to practically all branches of the USSR economy. These ties are especially significant with the investment complex, above all the builders.

The multifunctional role of forest vegetation is well known. Enterprises of the forestry complex participate not only in the utilization, but also in the reproduction of forestry resources, which exerts an influence on agriculture, including on solving the food problem, the environment and all aspects of the life of the society. Taking these circumstances into account, many problems related to the utilization and reproduction of forestry resources go far beyond the framework of branch interests and acquire great national economic significance.

When considering the problems of the development of the forestry complex one cannot, of course, fail to take into account the large positive strides in the volume of product output, the branch structure and the distribution of production which have taken place in the branches which comprise it during the past 20-25 years. During 1960-1980 the overall volume of forestry industry products has approximately doubled, including fiberboard (DVP)--7-fold, chipboard (DSP)--32-fold, veneers--1.5-fold, furniture--4.8-fold, and pulp, paper and cardboard--3.1, 2.3 and 3.9-fold, respectively. At the same time the volumes of production in timber procurements and logging has not only not increased, but in 1980-1983 even decreased somewhat.

Exonerated development of the production of progressive design materials and thorough processing of timber have made it possible to organize on a significant scale the utilization of low-grade raw material and wood-processing wastes, which can replace approximately 100 million cubic meters of commercial timber a year.

In the country's forestry complex during the past four five-year plans we have constructed dozens of large and extremely large enterprises, including the Bratsk, Syktyvkar, and Ust-Ilim timber industry complexes and many others. As time goes by the share of Siberia and the Far East in timber production increases. At the beginning of the 1980's more than 37 percent of the timber procurements, 31 percent of the timber materials, more than 27 percent of the pulp, 21 percent of the cardboard and more than 12 percent of the veneer and DSP were produced in these regions. In 1980-1982 as compared to 1960 the proportion of lumbering in the overall volume of production decreased from 41 percent to 27 percent while there was an increase in the proportion of products of the pulp and paper industry from 10 to 20 percent.

In spite of the undoubtedly positive changes that have been mentioned above, on the whole one must evaluate the situation in the development of the forestry complex as unfavorable in many respects. A regular deterioration of certain important economic indicators is typical of its branches.

One cannot but pay attention to the fact that the tendency toward deterioration has affected the production of all the main kinds of timber industry products.

An especially unfavorable situation has taken form in the plywood and pulp and paper industry, where the volume of production in 1980 remained practically at the 1975 level, even though the plans envisioned a significant increase.

Table 1--Rates of Growth of Production Volumes, Labor Productivity and Output-Capital Ratio, %

<u>Indicators</u>	<u>1966-1970</u>	<u>1971-1975</u>	<u>1976-1980</u>
Production volume	130	129	108
Labor productivity	129	129	109
Output-capital ratio	107	118	127

Table 2--Production of Main Kinds of Products

<u>Products</u>	<u>1970</u>	<u>1975</u>	<u>1980</u>
Commercial timber and firewood, millions of cubic meters	385	395	357
Lumber, millions of cubic meters	116.4	116.2	98.2
Plywood, millions of cubic meters	2.04	2.20	2.02
DSP, millions of cubic meters	1.99	3.99	5.12
DVP, millions of square meters	208	408	469
Furniture, billions of rubles	2.8	4.3	5.3
Pulp, millions of tons	5.1	6.8	7.1
Paper, millions of tons	4.2	5.2	5.3
Cardboard, millions of tons	2.5	3.4	3.4

For many kinds of products the production cost increases from year to year, and in the branch as a whole expenditures are increasing for each 1 ruble of commercial output while profitability is decreasing. Under the 10th Five-Year Plan the production of the most important kinds of products by timber industry enterprises was carried out by only 90-98 percent. For this reason the national economy failed to receive a considerable quantity of considerable materials and was unable to fulfill planned assignments in other branches. In 1980 alone the delivery shortages amounted to: for commercial timber--34.4 million cubic meters, timber materials--6.3 million cubic meters, plywood--370,000 cubic meters, DSP--300,000 cubic meters, pulp--more than 900,000 tons, and cardboard and paper--about 800,000 tons. There are serious dangers with respect to the fulfillment of the assignments for the 11th Five-Year Plan.

During 1981-1985 the branches intend to increase the volume of output by 17-19 percent, to increase labor productivity by 16-18 percent, and to provide for accelerated development of the processes of thorough processing of timber. Certain successes have already been achieved in carrying out these intentions, but every third association and enterprise of the USSR Ministry of the Timber, Pulp and Paper and Wood-Processing Industry is not keeping up with the

assignments that have been set. For this reason in 1982 the national economy failed to receive 23.2 million cubic meters of commercial timber, 6.6 million cubic meters of lumber materials, 656,000 tons of pulp, and a considerable quantity of paper, cardboard, plywood, wood slabs, wooden buildings and parts for them as well as forest chemical products. In 1983 the branch's position improved somewhat, but even in this year enterprises of the USSR Ministry of the Timber, Pulp and Paper and Wood-Processing Industry failed to deliver to the national economy about 18 million cubic meters of commercial timber, 4 million cubic meters of lumber materials, and a large quantity of pulp, cardboard and other products.

The chronic delivery shortages of timber materials to the national economy is not an accidental phenomenon. Having at its disposal one-fourth of the timber resources in the world, the USSR forestry complex, because of various limitations on the utilization of timber, is forced to keep its enterprises on a subsistence amount of raw materials and to make excessive expenditures in remote regions for timber procurements and long-distance shipments of round timber while in many regions the timber consumers inefficiently keep immense supplies of mature timber still growing. These and other factors have led to a situation where under the 10th Five-Year Plan there was practically no increase in the production volumes of such progressive products which are critically needed in the national economy as pulp, paper, cardboard, plywood and so forth. There has been a continuous reduction of the production of timber materials. The increase in the production of these products has been inadmissibly slow under the 11th Five-Year Plan as well, which stands in contradiction both to the needs of our economy and to world practice.

From the figures presented in Table 3 one can draw at least three conclusions: 1) the production of items made of wood is a highly effective area for the development of the national economy; 2) in terms of the scale of production, its branch structure and the per capita consumption of the corresponding products (paper, cardboard, plywood and so forth), our country is essentially lagging behind the leading countries in this area; 3) the retardation of the growth rates of the main kinds of products which has been noted in the USSR forestry complex cannot be justified by any considerations of an economic or social nature.

An analysis of the existing situation shows that new approaches which are based on the utilization of the achievements and planning practice and our rich production experience are needed for planning, administration, improvement of management and the introduction of the achievements of scientific and technical progress in the forestry complex in the modern stage.

The main direction here is improvement of the branch and territorial structure of production and accelerated development of the branches for thorough processing of timber, above all the pulp and paper industry, which is the main factor in sharply increasing the final results of the work of the branch and creates the necessary prerequisites for a radical change in the proportions and the composition of the raw material base of the forestry complex. Along with the development of timber chemistry and the industry for producing wood slabs, this branch makes it possible to radically restructure the conditions for the utilization of timber as a result of a flexible combination of

complete fellings, selective fellings and maintenance fellings, expansion of the utilization of deciduous and coniferous trees, and extensive utilization of timber wastes for processing.

Table 3--Production of Main Kinds of Timber Products per 1,000 Residents (Numerator) and 1,000 M³ of Procured Timber (Denominator) in USSR, U.S., Canada, Japan and Entire World*

<u>Products</u>	<u>Units of Measurement</u>	<u>Regions and Countries of the World</u>			
		<u>USSR</u>	<u>U.S. & Canada</u>	<u>Japan</u>	<u>Entire World</u>
Volume of procured commercial timber and firewood	m ³ /1,000 residents	357	548	33	3143
		1320	2190	270	710
Lumber	m ³ /1,000 residents	363	486	308	95
	m ³ /1,000 m ³ of lumber	275	199	112	133
Plywood	"	9.2	69.6	61.6	9.6
		7.0	31.7	224	13.5
DSP	"	18.9	27.2	9.1	9.0
		14.3	12.4	33.0	12.6
DVP	"	11.1	22.4	4.1	3.5
		8.4	10.2	15.1	4.9
Pulp and wood mass	kg/1,000 residents	32.6	264.4	65.8	28.4
	kg/1,000 m ³ of lumber	34.6	120.6	239.0	39.8
Paper and cardboard	"	32.2	291.2	149.1	39.7
		24.4	132.8	542.0	55.6

* Authors' calculations from the materials: "The USSR National Economy" in 1981 and 1982, Moscow, "Finansy i statistika", 1981, 1983; Annual of Forestry Statistics, Helsinki, 1972-1982.

One should take into account the fact that underutilization of the reserves contained in the timber complex with the modern scope of production ends up in large losses for our economy. Thus, according to our calculations, the application of an unsubstantiated system of timber utilization (excluding selective fellings with an improved assortment structure) leads to annual losses of about 500 million rubles. A reduction of the utilization of byproducts from processing coniferous varieties of approximately 20 percent as compared to the optimal level will increase outlays by 200-250 million rubles a year. A reduction of the production of timber materials in the European part of the USSR in an amount of 12 million cubic meters as a result of transferring them to the Asian part of the country would make it possible to

increase the annual savings by one-fourth of a billion rubles. Coordination of the branch structure of the timber complex and the varietal structure of its raw material base, that is, coordination taking into account the regional specifics, is becoming the most crucial problem and at the same time a decisive condition for increasing the effectiveness of economic decisions.

It is necessary to have greater balance in the development of the timber complex along with other branches of the national economy. Attention is drawn above all to the serious arrears in timber machine building. The current level of mechanization of labor in timber procurements and many branches of timber processing does not exceed 45-50 percent. Machines and equipment are worn out to a significant degree. This leads to a large amount of idle time. Thus a large proportion of the paper-making machines have been in operation for more than 20 years at the Solombalskiy, Segezhskiy, Kamskiy and Sakhalinskiy pulp and paper combines. There are frequent cases of operation of equipment and machines that are even older.

The inadequate level of development of timber machine building can be illustrated from the example of wood processing. The main producer of machines, machine tools and equipment for the wood-processing industry is the Soyuzdrevstankoprom All-Union Production Association which joins together 21 specialized plants. The overall volume of output of products for timber enterprises does not exceed 160-200 million rubles a year (8-10 million rubles per enterprise). These volumes of production satisfy only 30-50 percent of the demand when calculated according to points, and if one takes into account the indicators of completeness, the degree of satisfaction drops at least by half.

Improvement of the machine-building base for wood processing cannot be considered in isolation from improvement of the forms of organization of wood-processing production itself. Equipment is delivered by 60,000 enterprises of practically all departments which are registered in official statistics. Under these conditions it is impossible to bring order into the deliveries of equipment or to organize the planning and provision of even relatively large enterprises with systems (sets, lines) of machines. The course toward concentration of production in wood processing and a sharp reduction of smaller subdivisions constitutes one of the decisive prerequisites for advancing machine building for this branch.

A second important condition is the need for considerable technical re-equipment of machine building enterprises for wood processing. The shortcomings in this area are well-known. They were the reason for adopting special decrees which envision weak construction and expansion of almost all existing enterprises and the construction of a number of large new ones.

But the decrees that have been adopted are slow in being realized and capital investments in machine building for wood processing are decreasing. During past years they have annually amounted to 20-25 million rubles. This is less than one-fifth of the need for them. Machine building for other branches of the forestry complex are also in a similar condition. Being a great forestry power of the world, the USSR practically has no specialized machine-building base of its own. The timber industry plays the role of a supplicant before

the Ministry of Construction, Road and Municipal Machine Building, Ministry of Agriculture, Ministry of the Machine Tool and Tool Building Industry, and so forth and so on. There is no need to seriously strengthen specialized timber machine building in the country, to fill in its gaps, to improve management, and to combine its interests with the demands of the production subdivisions of the timber complex. Department barriers and the lack of proper responsibility for the development of new machines and equipment, for their technical level and reliability, promptness in assimilation and delivery on the part of machine-building plants leave unrealized many planning commitments of enterprises of the USSR Ministry of the Timber, Pulp and Paper, and Wood-Processing Industry regarding increasing labor productivity and introducing the achievements of scientific and technical progress--these remain on paper, with all the chain of interruptions, lack of coordination and unrealized plans which ensue from this.

The capacities of the timber complex are not sufficiently balanced with the capabilities of the country's transportation system: the plans for shipping timber cargo by rail under the 10th Five-Year Plan were fulfilled, as a rule, by only 70-80 percent. The state of affairs remains crucial under the current five-year plan. The question arises: if transportation cannot ship the timber materials, is there any point in producing them? One should take into account the fact that round timber becomes spoiled when it remains for a long time at the stations from which it is dispatched, it loses its quality and, finally, it becomes unsuitable for youth.

A significant impeding factor in the development of the timber and wood-processing industry is the unsatisfactory work of the construction complex, a division of which annually fails to carry out the planned assignments for constructing timber projects. The time periods for construction and reconstruction of enterprises in the branch are greatly prolonged and exceed the normative times 1.5-2-fold and more (the Bratsk and Ust-Ilim timber industry and complexes, a number of facilities of Dal'lesprom, Arkhangel'sklesprom and others).

The problem of balanced development of the timber complex should be regarded not only from interbranch, but also from intrabranh positions, from the standpoint of coordination in time, scope and other aspects of coordinated development of associated timber productions within the framework of the timber complex itself. Here there are also frequent large "gaps" which lead to immense losses. A good example of this is the Ust-Ilim Timber Industry Enterprise. The pulp production here has been in operation for more than a year, processing high-grade lumber into chips, and the milling production (the first current) will not be introduced and assimilated until this year. There are many examples like this in the branch.

It seems that the main reason for interbranch and intrabranh disbalance in the timber complex lies in the violation of the requirements of the socialist principle of singling out the leading unit. Regarding the importance of this principle, V. I. Lenin once wrote: "It is not enough to be a revolutionary or a proponent of socialism or even a communist. It is necessary to be able to find in each the special aspect, the special link in the chains which must be grasped with all forces in order to hold the entire chain and prepare firmly

for a changeover to the next link, and the order of the links, their form, their connection, and their distinction from one another in the historical chain of events is not so simple as in an ordinary forged chain."¹ The main idea in this statement is finding the "special link" in grasping it, holding the entire chain and preparing to move on to solving the next problem. In fact, however, frequently singling out the main link becomes a goal in itself, and reaching it does not contribute to an overall increase in the effectiveness of the functioning of the economic system, and sometimes even ends up in large losses.

Under modern conditions the principle of evaluating the activity of economic elements and units in terms of the final result becomes more important than ever before. Its consistent implementation will make it possible, in our opinion, to eliminate situations in which "the main unit" develops successfully, and all the rest of them are doomed to oblivion. This principle does not mean allowing any disproportions in the national economy. On the contrary, singling out the main unit should make it possible to have balanced functioning of the entire economic system.

What has been said pertains also to the requirement for providing priorities in solving production and economic problems. Thus in the timber complex consistently following a course toward priority development of the branches with thorough processing of timber (DSP, DZP, pulp, paper, nutritive yeasts and so forth) certainly does not involve a weakening of the necessary attention to the development of forest operation, reproduction of forest resources and intensification of the utilization of forests. But in practice events frequently develop along a different path. Many enterprises of the branch regularly experience a critical shortage of timber raw material. During 1976-1980 pulp and paper enterprises of the Russian Federation failed to receive 13 million cubic meters of timber. The situation has not improved under the 11th Five-Year Plan either, and the provision of raw materials for many enterprises amounts to only 70-80 percent of the planned need. Of course the provision of raw material depends also on the operation of rail transportation, the level of development of production for processing industrial chips from wastes, and other factors. But there is no doubt that timber procurement production has been unlucky during the past decade. It has ended up in the position of Cinderella and reduced production volumes by almost 40 million cubic meters a year. And yet this is precisely the branch that is the foundation for the entire timber complex, which determines success both in the utilization and in the reproduction of timber resources.

The third and no less important area for increasing the effectiveness of the timber complex consists in improving management of its subdivisions and perfecting the forms of organization of production. Shortcomings in this sphere cause large and varied losses throughout the entire chain of forestry work--reproduction of forestry resources, forest operation, timber processing and the final consumption of products made of timber.

The difficulties that exist in timber supply for the national economy are largely predetermined by the multidepartmental management of the forestry complex (the USSR Gosleskhoz, the USSR Ministry of the Timber, Pulp and Wood Processing Industry, the RSFSR Ministry of the Timber Industry, the Main

Administration of the Microbiology Industry Under the USSR Council of Ministers and so forth) as well as the great dispersion of production among many unspecialized associations, enterprises and other economic units. Suffice it to note that the lists of the USSR Central Statistical Administration include almost 50,000 enterprises that engage in forestry, which are spread throughout several dozens of ministries and departments. One can say without exaggeration that the departmental confusion like that which reigns in the timber complex does not exist in any other branch.

It is not surprising that these departments have not yet been able to stabilize the work of the timber procurement industry, which for a long time has been operating without stability and continues to be the narrowest unit in all of the timber complex. It was pointed out in an announcement of a meeting of the Politburo of the CPSU Central Committee (November 1983) that the activity of the USSR Ministry of the Timber, Pulp and Paper and Wood-Processing Industry and the USSR Gosleskhoz and their managers is not smooth enough, they do not have a sufficiently unified approach to forestry work, and they do not devote the proper attention to the development of capacities for procurements and restorations of forests, comprehensive mechanization of work, the construction of logging roads, and the building up of forest villages. They are slow in conducting work for improving the structure of production, increasing the output of timber products and improving the technology for processing timber.

The escape from the difficulties is seen in a significant increase in the role of the USSR Ministry of the Timber, Pulp and Paper, and Wood-Processing Industry. Most of the final products of the branch are formed at its enterprises. This ministry bears basic responsibility for supplying the national economy with timber materials and for the effectiveness of the utilization of timber resources. It seems to us that all other departments that engage in forestry work should be under the jurisdiction of the USSR Ministry of the Timber, Pulp and Paper and Wood-Processing Industry in the technical and technological respects, along the line of efficient utilization of production capacities, timber and other resources. Such a measure would make it possible to sharply reduce the scale of self-procurement, to raise the level of concentration of production and to achieve an essential improvement in the utilization of timber resources.

In solving the problem of increasing the effectiveness of production, streamlining timber utilization and improving the technical and economic indicators a great deal depends on the forms of organization of production. The course that has been tested here is the one for creating comprehensive timber enterprises--timber industry complexes. The experience of Ivano-Frankov Oblast, the Baltic republics, the Belorussian SSR, the Mary ASSR, and the Ust-Ilim Timber Industry Enterprise is valuable in this respect. The creation in Ivano-Frankov Oblast of large comprehensive enterprises (timber combines) that are responsible for the entire cycle of work for the utilization and reproduction of timber resources--from the planting and caring for the forested areas to waste-free processing of raw material and the output of the final product--have enabled the Prikarpatles Association to reduce fellings for primary use to one-fourth with a simultaneous essential development of maintenance fellings for the forests.² The effectiveness

achieved as a result of intensification of timber utilization is obvious. During the period of comprehensive forestry the output of the gross product increased more than fourfold. Favorable prerequisites were created for a significant increase in the yield of timber from 1 hectare of area covered in forest. During the first 2 years of the 11th Five-Year Plan the enterprises achieved a 1.1-fold increase in the output of products per unit of raw material.

It is typical that a well-thought-out policy in the area of intensification with comprehensive forestry not only is not an impediment to expanded reproduction of timber resources, but acts as a main condition for advancing the science of forestry to a new level. Practice confirms the high effectiveness of the organization and functioning of comprehensive timber enterprises. This is also shown by foreign experience, particularly in Finland, Czechoslovakia and other countries.

The experience accumulated in the country makes it possible to come to several generalizations. Organization of comprehensive timber enterprises provides an advantage primarily as a result of eliminating intradepartmental barriers and increasing maneuverability in the utilization of labor resources, technical equipment and capital investments. In this case the most visible are the final results of the entire complex, and the position of each section in the technological process and the economy of the enterprise is clearly designated. A certain dependency can be traced between organizational forms of the timber complex and a broad group of regional factors and the history of the development of forestry in one area or another.

In the Prikarpatles Association all production is grouped in 12 timber combines which have the rights of corporate bodies. There are also other examples of integration of timber procurements and wood processing. We have timber industry enterprises in areas with many trees, where processing productions are also developed. The totality of enterprises of the timber procurement and wood-processing industries is comprised of timber industry territorial units. On a cooperative basis they interact in delivering raw materials and semimanufactured processes on the basis of the territorial proximity and consumer qualities of the raw material (the Arkhangelsk, Karelian and other industrial centers). We also know of timber procurement and wood processing associations which include timber procurement and wood-processing enterprises that operate in the status of a corporate body as well as in the status of branches. But in both cases they are under the same legal jurisdiction and have unified planning assignments in terms of results and production resources. Highly effective timber procurement and wood-processing associations have been formed in the Belorussian SSR, Sverdlovsk and Novgorod Oblast, and the Buryat ASSR.

A decisive step has been taken in the creation of a large-scale comprehensive enterprise which combines timber procurements and timber processing on the basis of the Ust-Ilim Timber Industry Complex. Next in line is the inclusion of a tree farm. A study of the work experience of this complex and other enterprises show that there can be no unimaginative routine work in the organization of comprehensive timber enterprises. In realizing the economic mechanism and organizing autonomous financing [khozraschet] it is important to

take into account such factors as the provision of labor resources and their distribution, the production and technological organization, the region of location of the enterprise and many others. Thus the immense concentration of the automotive business in Ust-Ilim which involves service both for basic production and for the urban economy requires a special approach to the organization of intrabusiness accounting, the mechanism for interaction between timber procurement and timber-processing productions, road construction and the repair business.

Even now it is clear that effective operation of such enterprises cannot be ensured simply by improving intrabusiness cost accounting and the intrabusiness system of indicators. It is necessary to carry out a serious restructuring of the system of evaluation indicators, administrative levers and the entire sum of drive belts along the line from the ministry to the Ust-Ilim Timber Industry Complex. Without this kind of restructuring one cannot expect a sharp change in the direction of increasing effectiveness or the possibility of directing the entire system of the subdivision of the Timber Industry Enterprise toward evaluation according to the final result.

The complex now receives more than 50 evaluation indicators, many of which do not orient the corresponding subdivisions to the final results and even involve negative consequences. For example, there is probably no point in giving the timber industry complex an assignment for increasing procurements of commercial timber since pulp production can process chips from any kind of wood. But unless they fulfill this assignment the timber procurement workers do not have the right to a remuneration. And so excellent timber goes into the chopping machine. It seems to us that there is now a need to conduct an economic experiment on the work of the economic mechanism using the Ust-Ilim Timber Industry Complex as a base.

The position of local agencies in questions of developing the forestry complex is becoming very important in the modern state. The Politburo of the CPSU Central Committee pointed out that certain local party and soviet agencies do not deal sufficiently with questions of more complete utilization of existing timber resources, have weakened their attention to the work of timber industry enterprises and wood-processing enterprises, and they are not taking measures to create a broad network of comprehensive businesses. Moreover, certain regions of the country are clearly following a course toward dependency, counting on obtaining timber materials from distant zones which have abundant forests. Such a course is costly to the national economy now and it promises no economic advantages in the future since it "preserves" local potentially fairly rich forests in a less productive condition, and makes the work of rail transportation more and more difficult.

In conclusion let us point that underestimation of the role of the forestry complex by planning and economic agencies brings about such large losses that one should hardly try to forget about them. According to calculations done by the Institute of Economics and Organization of Industrial Production of the Siberian Branch of the USSR Academy of Sciences, an additional output by the timber complex of 1 percent of its products on the scale of the national economy would provide an addition to the gross social product in the amount of 2.5-2.8 billion rubles. With a 5 percent additional increase in production

the advantage increases to 13-14 billion rubles. Such is the reward from eliminating existing losses if they are actually evaluated according to the final result.

The branch has many positive examples which confirm the possibility of sharply increasing the effectiveness of production at timber enterprises. Now it is important to reach a point where a sharp turnabout in the direction of intensification and effectiveness becomes the affair of all subdivisions of the branch.

FOOTNOTES

1. Lenin, V. I., "Poln. Sobr. Soch." [Complete Collected Works], vol 41, p 205.
2. Concerning the work experience of the Prikarpatles Association imeni 60-Letiya Sovetskoy Ukrainy, EKO No 9, 1984.

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BETTER UTILIZATION OF CAPACITIES URGED

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA (EKO) in Russian No 3, Mar 85 pp 151-163

[Article by V. Ya. Medikov, candidate of economic sciences, Siberian Metallurgical Institute (Novokuznetsk): "What Is Customary and What Is Not Obvious in the Utilization of Capacities"]

[Text] As was noted at the 26th Party Congress, one of the directions for intensification of the economy is improvement of the utilization of production capacities and fixed production capital.

The problem of justifying production capacities (PM) and the level of their utilization has not been completely resolved. Research shows that the rational degree of utilization of PM is 92-94 percent. One should take into account that the threshold level of loading capacities is not universal and "there really is no unified threshold for all branches since this amount is determined by a complex set of factors, including intrabranh factors."

One usually considers first of all the conditions for the utilization for capacities which are external to the enterprise. The level of utilization of PM is evaluated according to the loading of the leading unit, whose proportion in the fixed capital of the enterprise is frequently not great: less than 5-10 percent. Underutilization of other (auxiliary) units, as a rule, is greater than in the leading units. Naturally, economic losses are great. But the level of utilization of PM depends on internal factors and on the enterprise itself just as much as it does on external ones. One must know what a production system can provide and what level of utilization of its capacities is economically expedient.

Are the Enterprises Interested in a Complete Evaluation of Production Capacities?

The amount of PM is frequently reduced. The fact is that the enterprises are not motivated to correctly estimate their production capacities. The potential capacities of production are substituted for the actually achieved level. Thus they place an equal sign between PM and production program.

To calculate capacities correctly means to show the reserves for expanding production. Planning "from the achieved level," the instability of normatives and production assignments, and the imbalance of plans motivate managers not to reveal, but to conceal reserves--a fact which one might say is generally known. The imperfection of the economic mechanism brings about the lack of objectivity when enterprises evaluate their own PM. Calculations of the capacities of agglomerate, blast furnace, steel smelting and rolling production at certain metallurgical enterprises which were conducted by the author of the article according to methods currently in effect showed that the PM at enterprises is reduced by 20-30 percent. Naturally, the level of their utilization seems high. One can say that the correct evaluation of the production capacities (even according to existing methods) will inevitably show that the actual level of their utilization is much lower than the one reported and lower than the threshold significance at 92-94 percent.

Is It Necessary To Completely Load the Leading Unit?

In the methods the production capacity of a system which consists of several elements (shops, sections, aggregates) is actually equated to the PM of the leading unit (the main stage). The indicator of the utilization of the PM of the system as a whole and of each element of it actually depends on how correctly the leading unit is selected. In the system "converters--machines for continuous smelting of billets (MNLZ)," for example, the existing provisions single out converters as the leading unit. Therefore the coefficient of the utilization of the PM for converters is taken as equal to 1, and for the MNLZ it is considerably lower (according to calculations, for one of the metallurgical plants it 0.53). But if one regards as the leading unit the MNLZ which is twice as expensive as converters, the optimal coefficient of the utilization of their PM is one, and for converters--0.72.

Analysis shows that the leading unit is far from always selected with proper justification and that when evaluating the PM of a system with optimization of the ratio of the capacities of its elements there is some point in refraining from complete loading of the leading units. The system should be designed and its loading and development should be planned from the standpoint of the system.

In the current practice of designing production systems a paradoxical situation has arisen. On the one hand one should fully provide the leading unit with the capabilities of the auxiliary subdivisions. On the other, according to the methods for determining the economic effectiveness of capital investments, it is recommended that the optimal variant be selected on the basis of the minimum of calculated expenditures. Thus when designing production systems one uses two criteria: complete loading of the unit that is considered to be the leading one, and a minimum of calculated expenditures. Calculations of the production capacities of the systems ("roasting," "press-forge complex--conversion mill," "converters--MNLZ," sections of converter and rolling shops (in terms of two criteria diverge essentially and lead to different conclusions.

When we give preference to the criterion of the minimum calculated expenditures we come to the conclusion that the units that have been

traditionally singled out as the leading ones can be fully loaded only under certain conditions. In other words, only in certain cases is it expedient to combine the "bottleneck" of the process with its "leading unit."

The shortcomings of the criterion of complete loading of the leading unit are obvious with respect to the system of "converters--MNLZ." According to calculations of the GIPROMEZ, the best variant in terms of this criterion is a system with two converters and a family of MNLZ (the production capacity of each MNLZ is taken as equal to 1.2 million tons). But calculations in terms of the criterion of the minimum calculated expenditures without limitation on the loading of converters as the leading unit of the system showed that the minimum expenditures is achieved with three converters and four MNLV. This variant produces an annual economic effect of 19.5 million rubles as compared to the plan of the GIPROMEZ. Output increased by 0.6 million tons and capital investments decrease by 51.4 million rubles. The effect on the scale of the branch, understandably, is more appreciable. Let us note that departing from the primacy of the leading unit in the system of "converters--MNLZ" increases the productive capacity of the MNLZ from 1.2 million tons to 2 million tons a year. In fact, in Japan using Uralmash machines they cast 1.8 million tons of steel a year.²

The production capacity of a system should be determined not in terms of the leading units, but in terms of the optimal (in keeping with the criterion of the minimum calculated expenditures) ratio among elements of the system. Of course the level of utilization of the system then differs from the utilization of the production capacity of its leading unit.

Is It Necessary To Eliminate "Bottlenecks"?

Next to the problem of the "leading unit" is the problem of the "bottleneck." What is the economic meaning of this concept? A "bottleneck" is understood as a lack of correspondence between the production capacities of groups of equipment, individual sections and shops and the capacities of those structural subdivisions which are recognized as leading and according to which the PM of the enterprise or shop is evaluated.

According to the methods of the USSR Gosplan, the "bottlenecks" are not given attention when calculating the PM; they should be eliminated. In order to eliminate "bottlenecks," as a rule, one needs capital investments, and sometimes significant amounts of them. Frequently the capital investments turn out to be economically unjustified although they create conditions for complete loading of the leading unit.

As was already mentioned, the PM of the system can be expediently determined not in terms of the leading unit, but in keeping with the optimal (in the sense of calculated expenditures) proportions of the capacities of the elements of the system and proportions that are different from the optimal ones are considered to be disproportions. If the production capacity of the auxiliary (in the traditional understanding) element is lower than the PM of the leading (in the same sense) unit, but their ratio corresponds to the optimum, then this cannot be considered a disproportion (in spite of tradition), but the auxiliary element is a "bottleneck." In such situations

it is economically inexpedient to get rid of "bottlenecks" and the level of utilization of the system's PM is determined by the production capacity not of the leading unit, but of the "bottleneck."

Economically justified "bottlenecks" must become a factor in improving the utilization of production capacities.

The Possible and Efficient Level of Utilization of Production Capacities

In complicated production systems with a broad assortment of products and multistage technology it is hardly possible to achieve complete loading of all elements. It would be expedient to establish a production program for such a system taking into account factors that are both intensive and extensive in nature. For example, in metallurgical production the decisive factors are: the mutual influence of elements that are related by the flow of metal; the ratios of the handling capacities of the associated elements; the quality of raw material and the final product; the periodicity and duration of repairs; supplies of implements of labor and the capacity of intermediate storage facilities (warehouses for charges, blanks and so forth).

Of course it is very complicated to take into account the influence of all factors that are simultaneously operating in all elements of complicated production systems. Such problems are distinguished by how large they are and it is impossible to solve them by traditional methods. They presume the application of imitation modeling, the theory of mass service, the theory of supply control and linear programming. Thus for metallurgical production imitation models of systems have been constructed and realized on computers: blast furnaces--the section for smelting iron--iron transport buckets--locomotives--the transportation section--converters; converters--machines for continuous smelting of billets; press--conversion machines; holding furnace--rolling mill--section for removing vinyl rolled product, and also molds for other subsystems.

Calculations, for example, for the model of the rolling mill which consists of five sections (furnaces, machine tools, refrigeration capacities, cutters, packaging) showed that for the 250-2 machine tool the efficient ratio of capacities of the sections (thousand tons) are as follows: $M_1:M_2:M_3:M_4:M_5 = 1603:1500:1565:3635:2133$. Calculations by traditional methods produced different results: 1781:1667:1739:3058:1766. The annual economic effect from the plan with the optimal proportions reaches 1.2 million rubles. For effective machine tools the model makes it possible to single out the sections that require special attention. Thus a much greater effect is produced by capital investments not in the machine tool itself, but in the section for cutting and packaging. Streamlining the proportions in the rolling shop can increase the utilization of the machine tool to 0.97 and provide for obtaining an additional 250,000 tons of rolled metal a year.

Examinations of rolling mills showed that in the interests of saving on raw materials and fuel and energy resources it is advantageous to have differing productivity for holding furnaces with a given total productivity for them. The work of the furnaces according to the proposed systems makes it possible on the wire mill alone to reduce the melting loss of metal, to increase the

output by 1,560 tons and to reduce the expenditure of convention fuel by 17,500 tons.

With the help of the model of the converter shop one can solve not only the problem of proportions, but also the problem of the utilization of reserve time of the computers. They now operate according to the classical conditions and the reserve converter is turned on only when there is a threat that the plan will not be met. Analysis has shown that the handling capacities of auxiliary sections of the Western Siberian Metallurgical Combine make it possible to utilize the reserve time in the first shop by 31.5 percent, and in the second shop--by 24 percent. Without capital investments in converter production it is possible to obtain an additional 580,000 tons of steel a year. The annual economic effect in the first shop is 2.8 million rubles, and in the second--3.1 million.

The imitation model of the system "Conversions--MNLZ" was applied in order to justify the number of MNLZ's and coefficients for the utilization of the PM in the oxygen converter shop of one of the metallurgical plants with two converters for 320 tons each. According to data of the GIPROMEZ, the efficient number of MNLZ's with one working converter (another in reserve) is 5, and with two (with the utilization of reserve time)--7. Calculations have shown that in the first case the efficient number of MNLZ's is 3, and in the second--4. The best ratio of coefficients of the utilization of the PM of converters and MNLZ's with one working converter is 1.00:0.76 and not 1.00:0.46; with two working converters--1.00:0.93 and not 1.00:0.53. The annual economic effect in the former case is 5.1 million rubles, and in the latter--3.3 million. These results were obtained for the system in operation with two converters. And the optimal variant of the development of the system suggests constructing a third converter and for MNLZ's.

Reserves of Production Capacities

Efficient utilization of capacities depends on their reserve. Questions of classifying reserves and the approach to calculating certain kinds of them are discussed in the literature.³ We are speaking about three main kinds of reserves to which the theory devotes relatively little attention.

Reserves of PM and the reliability of the fulfillment of the plan. One of the sore spots in the methods for evaluating the level of the utilization of production capacities are the rigid causal ties. And after all the utilization of capacities depends on many factors which are probable in nature. Among them, for example, are those such as the arrival of raw material, fuel and processed materials in the production system, their quality and composition; reserves; the quality of repair jobs, their periodicity and their duration; the assortment of prepared products; variations of shift, 24-hour and annual outputs. Their influence on production can be foreseen only with greater or lesser probability. Therefore the level of the utilization of the PM is also a probable amount.

Since one degree or another of fulfillment of the plan is a probable amount, when determining the planned output there arises a collision of goals: the lower the planned assignment the greater the reliability of its fulfillment

and the less the losses from underfulfillment. But the less the planned output, the greater the losses from underutilization of the PM. And, conversely, the greater the assignment the lower the reliability of its fulfillment, and the greater the losses from underfulfillment but, on the other hand, the less the losses from underutilization of capacities.

The calculation for the sinter factory of one of the metallurgical plants showed that losses change from 1.9 million rubles a year (the planned output is established at the level of 84 percent of the production capacity) to 21 million (the planned output presupposes complete utilization of capacities). The annual economic effect with 84 percent utilization of the PM thus reaches 19.1 million rubles as compared to planned complete utilization of capacities. In other words, the reserve of capacities exceeds the effectiveness of the production system.

Reserves, dynamics and proportions of PM. One of the manifestations of dynamism is the growth of capacities of the production systems. Industrial enterprises and shops are complicated systems which consist of interconnected elements (shops, sections and aggregates). During the course of operation their elements increase capacities. Certain elements are "active," that is, they react quickly to efforts to increase their capacity; the basic aggregates are usually included here. But other elements are "passive" and it is fairly difficult to increase their capacities as a result of internal reserves; this usually includes auxiliary equipment.

One can notice a pattern: the more complicated the aggregates, the more receptive they are to measures for increasing their capacities, and vice versa. With time the "passive" elements are transformed into "bottlenecks," even if this is not the case initially. The elimination of disproportions can require complete or partial halting of the entire complex, which leads to essential losses. Therefore when planning and reconstructing production systems it is necessary to take into account the dynamics of the capacities of their elements and, possibly, to arrange a certain reserve of "passive" elements ahead of time.

The question of this kind of reserves is resolved by predicting the dynamics of the capacities. Here one can see the following economic dilemma: if one places in "passive" sections reserves which will subsequently make it possible either fully or partially to utilize the increase in the capacities of "active" elements, there will be inevitable losses from the underutilization of the reserve capacities (the capacity of the system increases not immediately, but gradually). Moreover there is the effect from expanding the output and more fully utilizing the "active" sections. And, conversely, if the reserve is not placed there, then, having saved on capital investments, in the future there will be losses from underutilization of the capacities of the "active" sections. Therefore it is necessary to compare the losses from the creation of reserves with the effect from their further utilization.

The reserve of PM and the assimilation of new kinds of products and progressive technologies. The assimilation of new products frequently runs up against a lack of reserve capacities, the more since such reserves are not planned. And since during the course of the assimilation of new products and

progressive technologies the productivity of shops and enterprises decreases significantly, it is not even ruled out that the plan may not be met, the people immediately responsible are not inclined toward innovations, even if in the future they promise a significant improvement of technical and economic indicators. In order to overcome the obstacles on the path to the new it is necessary to plan reserves of PM. The task of planning reserves becomes especially significant because of the intensification of the economy, when there is a sharp increase in the number of newly assimilated kinds of products and technologies.

In rolling production, for example, it is possible to use a means of evaluating the efficient amount of reserves of PM with the assimilation of new products. The normatives for the assimilation are established according to groups of machine tools: individually for sheet rolling mills, small part mills and so forth. The assortment of machine tools is broken down into several groups. They join together into one group profiles and sizes for whose assimilation the time expenditures are essentially the same. For machine tools the number of groups is not the same. Thus for machine tools for rails and medium-sized parts there are more groups than there are for sheet-rolling mills. For small parts the machine tools can be divided into groups of types and sizes and normatives can be established for each group. From the report data one knows the sizes of the batches of metal whose profile and size is considered to be assimilated after they are rolled, and also the time period for the assimilation of one profile and size or another. One also knows the productivity of the machine tool after assimilation. Thus one calculates the average productivity of a machine tool during the period of assimilation and the time from which one determines the reserve PM for the assimilation of new products. For the group of profiles and sizes one calculates the average amount of time of the reserve. And if it is intended to assimilate a profile and size which is included in this group, the time fund for the operation of the machine tool is reduced by this amount when the production program is drawn up. Reserves for production capacities for other productions are planned in an analogous way.

The Quality and Level of Utilization of Capacities

The possibilities of eliminating disproportions through product quality at individual technology stages (of course with the same or better quality of the final product) are practically not utilized. Disproportions are usually smoothed out as a result of widening the "bottlenecks" and in installing additional equipment in the sections, which sometimes requires considerable capital expenditures and time. There are frequent situations in which the disproportion between the PM's of two adjoining stages should be smoothed out as a result of change in the product quality of the first of these.

As a result of changing the quality of semimanufactured products in the intermediate technological stages without lowering the quality of the final product it is possible to improve the utilization of capacities of interconnected stages and to increase the overall output. Increased effectiveness is frequently possible without additional capital investments. The problem of the interchangeability of product quality and the productivity of equipment goes far beyond the scope of this subject. In this case we can

consider that we are speaking not about the quality of the final product, but only about the quality of semimanufactured products.

Is It Possible To Improve the Utilization of Capacities When There Is a Shortage?

There is a shortage of resources for production capacities--labor and energy. In ferrous metallurgy, for example, there is a shortage of iron-containing raw material. The shortage of resources, naturally, brings about an underutilization of the PM.

The considerable reserves of capacities which appear because of the shortage of resources can be regarded as possibilities of maneuvering in order to increase production effectiveness. But these possibilities are poorly utilized. Thus when planning the loading of the PM and distributing resources that are in short supply one does not take into account the circumstance that certain production systems (enterprises, shops, sections, aggregates) operate more efficiently than others do, that the working conditions differ essentially, that systems with the same purposes differ because of ecological characteristics, and so forth. It frequently turns out that progressive production systems with relatively high technical and economic indicators, better working conditions, lower discharges of dust, gas and so forth are essentially underutilized, and systems with comparatively low characteristics in all respects operate at the limit of their capacities.

For example, the lack of clear-cut methodological recommendations and a scientifically substantiated line of behavior was expressed particularly in the fact that during the first quarter of 1982 production at the Kuznetsk Metallurgical Combine increased compared to the first quarter of 1981 by 2.6 percent (in spite of the shortage), and in Zapsib--it decreased by 11.5 percent. In other words, the PM of an enterprise that is constructed in keeping with the last word in technical equipment was essentially underutilized while at an old enterprise, critically in need of renovation, which is located in the center of the city production increased. Undoubtedly the opposite decision would have been more effective: to utilize more fully (or completely) the capacity for Zapsib, and to shift the underloading of capacities because of the shortage of resources to the KMK.

Improvement of the utilization of PM under conditions of a shortage of resources contributes to increasing the economic, social and ecological effectiveness of production systems without additional capital expenditures. Methodological recommendations have been developed⁴ for optimizing the load on sinter, blast furnace, steel smelting and rolling productions. The results of calculations show the possibility of expanding production, reducing the need for raw material and fuel and energy resources, reducing production costs, increasing profit and improving working conditions and the condition of the water and air basis.

FOOTNOTES

1. Baryshnikov, N. N., Lavrovskiy, B. L., "Capacities and Reserves," EKO, No 3, 1982.

2. Khimich, G. L., "Problems of Metallurgical Machine Building," EKO, No 9, 1980.
3. See Kvash, Ya. B., "Rezervnyye moshchnosti" [Reserve Capacities], Moscow, "Nauka", 1971.
4. Medikov, V. Ya., Planovoye Khozyaystvo, No 4, 1984.

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EFFICIENT UTILIZATION OF MILK URGED

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA (EKO) in Russian No 3, Mar 85 pp 165-174

[Article by I. N. Khrustev, economics laboratory of the IEiOPP of the Siberian Branch of the USSR Academy of Sciences (Barnaul): "Not Processed--Means Lost"]

[Text] As was noted at the November (1982) Plenum of the CPSU Central Committee, "there remains the problem of the different rates in the development of the raw material and processing branches." One of the examples of this difference is the disproportion between the production of meat and milk in agriculture and the capacities of the meat and dairy industry.

The problem is especially crucial for the southern part of Western Siberia: Altay Kray and Novosibirsk and Omsk oblasts. The region is one of the largest producers of meat and milk in the country; it delivers to other regions grain, meat, meat products, animal fat, fatty cheeses and other dairy products, egg mixtures and powdered eggs. Concentrated on the farms of the region are 10 percent of the cattle in the Russian Federation. It has a relatively large share of the cows, goats and sheep. In the average annual calculations for the five-year plans the farms of the region produced 8.1-8.5 percent of the animal husbandry products in the republic--almost as large a quantity as Belorussia produced.

In 1981, for example, the industrial output of meat and meat products amounted to 376,000 tons or 8.2 percent of the republic output. The area produced 76,000 tons of animal fat, that is, 13.3 percent of all that was produced in the RSFSR.¹ Each year the region produces 9 percent of the fatty cheeses in the country and more than 15 percent of the amount produced in the republic.

Agricultural products produced in the southern part of Western Siberia are distinguished by their high quality, especially meat and cheese. Farms of the region sell the state better-nourished and larger livestock and milk with a higher fat content than the average for the RSFSR. The region is favorably distinguished by the relatively low productive cost of grain, milk and weight gain of cattle, and labor productivity on the kolkhoses and sovkhozes and the output-capital ratio here are much higher than the republic average.

Yet the shortage of capacities for processing products of the meat and dairy industry as well as the technical backwardness of the enterprises are impeding animal husbandry in the southern part of Western Siberia and are leading to inefficient utilization and direct losses of animal husbandry products. The capacities of meat combines in Altay Kray can process only 70 percent of the cattle that are turned over to it. The shortage of refrigeration capacities is even greater--42 percent of the required amount. It is intended to create new and reconstruct existing enterprises, but not a single one of the meat combines is being constructed. The Blagoveshchenskiy and Aleyskiy Meat Combines for processing 150 and 100 tons of livestock per shift should have been opened under the 9th Five-Year Plan. As a result, the farms of the kray have been forced to ship cattle to the Semipalatansk and Kemerovo Meat Combines over a distance of 250-500 kilometers. The kolkhozes and sovkhoses sustain losses, and the weight and nutritional condition of the livestock deteriorate not only because of being shipped over long distances and being made to wait at the gates of the meat combines, but also because fattened cattle are kept grazing too long on the farms.

Of the 86 butter and cheese plants of the Altay Association of the Dairy Industry 36 were constructed during 1924-1939. And six of them have not been hooked up to state electric power transmission lines and certain plants have been used for gathering sewage from cesspools. The physical wear and tear on 40 percent of the buildings of the enterprises exceeds 70 percent. Many of them have not been provided with a sufficient quantity of steam or water, they are poorly supplied with equipment and means of transportation, and they do not have installations for condensing and drying milk. There are not enough capacities for processing milk during the period when mass quantities of it come in.

In addition to constructing large enterprises for processing and storing agricultural products, the Food Program envisions, where expedient, the creation of small enterprises near kolkhozes and also directly on the farms. But the Ministry of the Meat and Dairy Industry has a somewhat different viewpoint--under the pretext of centralization of production it is closing butter and cheese plants, separator divisions and milk receiving points without taking into account the local situation, the possible losses or the deterioration of the quality of the products. Ties between farms and production which go back for many years are being broken.

During 1976-1980 alone in Altay Kray the number of lower-level butter and cheese plants was reduced by half: 41 butter and cheese plants were closed, and 15 of them were transformed into separator divisions while two were transformed into milk receiving points, and 24 plants were eliminated. In Novosibirsk Oblast at enterprises of the dairy industry 383 separator divisions and 25 butter and cheese plants were closed.

As a result there has been an increase in the radius of deliveries of milk to enterprises and the quality of the milk has deteriorated during shipments over long distances, especially during the summer months; the farms are experiencing difficulties in selling milk during the periods when the roads are bad. During 1977-1980 an average of 2,000 tons of milk that had been

delivered were returned to the kolkhozes and sovkhoses of Altay Kray and Omsk Oblast because of the poor quality.

In Novosibirsk Oblast many separator divisions are under the jurisdiction of the dairy industry and because of centralized shipment the return of milk was insignificant. During past years the quality of milk sold to the state has improved on the average. But still a considerable proportion of it is released with poor quality even though a large part of the milk is cooled and pasteurized. In 1980 alone the kolkhozes and sovkhoses of the region delivered to the dairy enterprises 362,000 tons of nongraded milk and 214,000 tons with increased acidity.

Enterprises of the Ministry of the Meat and Dairy Industry regularly fail to carry out assignments for centralized shipment of milk, especially when it is received directly from the kolkhozes and sovkhoses, and the shipments are increasing slowly. In 1982 in Altay Kray only 17 percent of the procured milk was shipped by centralized means, including less than 8 percent that was acquired locally; in Novosibirsk Oblast these figures were 44 and 30 percent, respectively, in Omsk Oblast--29 and 28 percent, and in the RSFSR--24 and 19 percent, respectively.

Efficiently Utilizing Whole Milk and Products From Processing It

As Early as 1965 Prof R. Davidov wrote that byproducts from processing milk which were produced annually in the country are equivalent in nutritional value to almost 5 million tons of beef. But "of the 540,000 tons of milk protein only 80,000 tons are used for feeding the population. Even less goes for milk sugar, mineral salts and vitamins. The rest...is fed to livestock, is used for industrial purposes or simply goes into sewage."²

And now after a decade and a half the director of the Northern Caucasus branch of the All-Union Scientific Research Institute of the Butter and Cheese Industry, V. V. Molochnikov, writes that during the season of mass delivery of milk, there are large losses as before. Fat and products from the breakdown of casein are extracted from the milk, and "the rest--like real wastes--we either pour out or, at best, release for feeding livestock...not because it is surplus, but because we do not have the capabilities of processing it, and a miserly amount of valuable products are left for humans.... And from the 19 million tons of nonfat milk and the 6.6 million tons of whey which we return to agriculture one could obtain 700,000 tons of milk protein. In order to gain this quantity of meat protein it would be necessary to slaughter 17.5 million head of cattle! Moreover 700,000 tons of milk protein is sufficient for efficiently feeding more than 58 million people, more than one-fourth of our country's population."³

Unfortunately, a considerable quantity of whole milk also goes for feeding livestock. The backward technology for feeding young livestock uses up 12-15 percent of the gross milk yield on the kolkhozes and sovkhoses. Practically every eighth cow on public farms is kept for feeding young animals.

The marketability of milk on the kolkhozes and sovkhoses of the country amounts to about 86.7 percent. In the Russian Federation almost 3.5 million

tons of milk are used each year for feeding calves and the marketability is equal to 87.5 percent. The marketability of milk is higher than the average republic level in Novosibirsk (90.1 percent) and Omsk (90.8 percent) oblasts. Therefore when the average annual milk production in Novosibirsk Oblast was increased by 57,000 tons under the 10th Five-Year Plan as compared to the 8th Five-Year Plan the sales increased by 161,000 tons, and in Omsk Oblast these figures were 123,000 and 180,000 tons, respectively.

One of the ways of improving the utilization of this valuable food product and increasing the marketability of milk is the utilization in animal husbandry of whole milk substitutes (ZTsM). In 1976 the minister of the USSR Meat and Dairy Industry, S. F. Antonov, pointed out that if instead of 50 percent of the whole milk used for feeding calves we were to use ZTsM, the dairy industry would obtain an additional 3 million tons of milk for processing and would increase the output of creamery butter by 130,000 tons.⁴

Scientists and specialists think that the marketability of milk production should be increased to 93-94 percent and that for feeding calves one should use 20 kilograms of ZTsM and no more than 100 kilograms of whole milk instead of the present 220-300 kilograms, and nonfat milk should be completely replaced; in order to produce ZTsM one should use more dry whey and protein of vegetable origin. These measures will produce a great savings of valuable raw material, they will make it possible to reduce labor expenditures on animal husbandry and transportation expenditures on shipping nonfat milk over long distances, and they will reduce the disease rate and death rate of young animals.

But the Ministry of the Meat and Dairy Industry is not taking the proper measures for technical re-equipment of the dairy industry for efficient utilization of dairy products and increased marketability of milk. In many cases even for the period up to 1990 they have not envisioned either improvement of the utilization of dairy products for feeding the population or increased marketability of milk. On certain kolkhozes and sovkhoses of Altay Kray and Novosibirsk and Omsk oblasts it is intended to use more than 10 percent of the milk yield (276-400 kilograms) for feeding calves, to return 55 percent of the nonfat milk and buttermilk to the suppliers for feeding livestock and so forth. There are no plans for creating sufficient capacities for producing ZTsM, dry and condensed milk, buttermilk or whey.

Fresh nonfat milk is used to produce ZTsM, which holds up production. But in places where dry milk is used, because of the poor local production it is shipped from a long ways away, which makes the product more expensive. For example, the Voronovskiy Plant ships 18,000 tons of nonfat milk by rail over an average distance of 1,300 kilometers. The production cost of a ton of ZTsM is 37 rubles 20 kopecks more than at the Smorgonskiy Plant which uses local raw material.⁵ ZTsM shops that are being constructed at existing large butter and cheese plants are even more economical.

Whey is almost never used in the production of ZTsM although this makes it possible to save nonfat milk for food purposes (up to 3 tons per ton of ZTsM). Calculations show that the ZTsM plant requires one-sixth the amount of capital investments and two-sevenths the amount of labor resources that are required

by animal husbandry complexes in order to produce the equivalent amount of savings on milk. Therefore in the south of Western Siberia it would be expedient to construct ZTsM plants and shops for producing nonfat dry milk and dry whey to be used for these products not only on the farms of the rayon, but also outside it.

It was intended to increase the production of nonfat dry milk 2.2-fold by 1985 as compared to 1981, ZTsM--1.7-fold, dry whey--9-fold, and so forth. It is intended to construct the Kargatskiy Cheese Plant in Novosibirsk Oblast with an output of 6 tons of ZTsM per shift, and the Bolsherechenskiy Plant in Omsk Oblast for 12 tons, and to expand the Rubtsovskiy Cheese and Dairy Combine in Altay Kray for 6 tons of ZTsM and the Biyskiy Butter and Cheese Combine for 4.5 tons of whey per shift. But small amounts of money were allotted for expanding the Rubtsovskiy Combine in 1981, and the reconstruction of the Biyskiy Combine was not even included in the 1984 plan, although according to the decree they were to have been put into operation in 1985 and 1986. The construction of these enterprises must be accelerated.

Because of the shortage of production capacities, the elimination of separator divisions and milk receiving points, and the closing of lower-level butter and cheese plants, many kolkhozes and sovkhoses in the southern part of Western Siberia are separating their milks themselves, thus losing a good deal of valuable product. Additionally, when delivering the cream the farms lose income since the prices for milk translated into cream are much lower than for whole milk.

Under the 10th Five-Year Plan from the sale of milk as cream the farms of Western Siberia annually lost 12 million rubles, which amounted to 26 percent of the losses in the republic. On an annual average the state received 15,900 tons less milk than when it was separated under industrial conditions. If for a ton of whole milk sold to the state in 1980 the kolkhozes and sovkhoses of the rayon received 270 rubles (not including the 50 percent increment), for a tons of cream they received 208 rubles--such is the price of separating milk on the farms.

Reserves of Nonfat Milk, Buttermilk and Whey

Such valuable milk products as nonfat milk and whey are especially poorly utilized even though they contain 70-73 percent of the dried substances of whole milk, more than half of its nutritive value and an equal quantity of milk sugar and mineral salts as well as a large proportion of the vitamins.

At enterprises of the RSFSR Ministry of the Meat and Dairy Industry during the same year they produced 536,500 tons of butter, but they produced only 60,000 tons of nonfat dry milk--112 kilograms per ton of butter or two-nineteenths the amount that is produced in countries that are leading in terms of this indicator. Altay Kray produced 85 kilograms and Novosibirsk and Omsk oblasts--120-170 kilograms each per ton of butter.⁶

In recent years the utilization of nonfat milk, buttermilk and whey for food purposes in our country has improved somewhat. Still, a lot of these products

are used not for food, but for feeding livestock, for technical purposes or they are lost.

By 1982 state procurements of milk on the kolkhozes, sovkhoses and other state farms of the country increased more than 1.5-fold as compared to 1965. The production of butter increased during this time by 20 percent, and cheese--2.3-fold. There was a corresponding increase in the output of nonfat milk, buttermilk and whey. By 1990 it is intended to increase the production of cheese to 1 million tons (a 1.5-fold increase over 1981), animal fat--to 1,570,000 tons, or 30 percent more than is required by the rapid development of capacities for processing dairy products.

While increasing capacities for producing butter and cheese the Ministry of the Meat and Dairy Industry did not take the proper measures for processing nonfat milk products or improving their utilization for food. They did not expand the production of whole milk substitutes. The decrees of the directive agencies regarding these questions were not carried out.⁸

In 1981 the Russian Federation used 47 percent of the nonfat milk (including that produced on the kolkhozes and sovkhoses) for feeding livestock, and in the southern part of Western Siberia--48 percent. The plan for the output of nonfat milk products in the RSFSR was fulfilled by only 75 percent and they received 177,000 tons less products than in the preceding year. The assignment for producing sour milk drinks with fruit and berries added was fulfilled by only 44 percent in the republic in 1981, and in the southern part of Western Siberia--by 36 percent.⁹ In subsequent years the situation has not improved much.

The seasonal nature of dairy animal husbandry has a negative effect on the utilization of these products. Butter and cheese plants of the region produce about 50 percent of the butter and cheese as well as nonfat milk, buttermilk and whey during the summer months. The needs of agriculture for feeding young animals during the summertime are minimal, and the dairy industry is not able to process these products. And during the winter period, because of the shortage of nonfat milk, the farms are forced to overexpend whole milk for feeding young animals. Drying of the products would help to smooth out the seasonality. The possibilities of utilizing whey for livestock are even less, especially during the summer months, since practically all of it is used for feeding hogs, and the distribution of the cheese plants does not coincide with that of the hog farms in the various regions. Only 32 percent of the whey resources were processed directly at enterprises of the RSFSR dairy industry during 1981.

Good results are achieved when whey is used in bread baking. As early as the 1930's, in the Scientific Research Institute of the Bread-Baking Industry they developed technology for baking bread with whey. In 1965 12 bread plants and 10 bakeries of Altay Kray baked bread with whey. The bread made with whey is distinguished by its fluffiness, its uniform fine texture, and its light inner part; it tastes and smells good, and like shortbread it is slow to become stale. The whey makes up for the shortage of nitrogen compounds, essential amino acids and potassium and phosphorus salts in the bread, and it enriches the bread with vitamins. The yield of baked bread increases by approximately

1 percent, and for every 100 kilograms of raw whey one saves 3-5 kilograms of flour.

The use of whey in bread baking has just begun to increase in recent years. Deliveries of it to the bread-baking industry have increased from 420,000 tons in 1975 to 1.4 million tons in 1981 (about 14 percent of its production); we have processed 3,400 tons of dry whey (with an assignment for 6,600 tons) and 11,000 tons of concentrated whey.¹⁰ In Altay Kray only 5.5 percent of the whey resources have been used for bread baking, and in Novosibirsk and Omsk oblasts--11 and 9 percent, respectively. They have not engaged in drying whey. Practice shows that even within a single city the utilization of fresh whey, nonfat milk and buttermilk in bread baking and in the confectionery and meat and food industry entails serious difficulties. The organization of the drying of these products and the production of ZTsM would help to satisfy not only local needs, but also to deliver them to other regions.

The production of nonfat dairy products and dry defatted dairy products, as a rule, is more profitable than the production of whole milk. In 1981 at enterprises of the RSFSR the profitability of the production of dry nonfat milk and butter milk increased by 37 percent, and they obtained 247 rubles in profit for every ton. A ton of dry ZTsM produced 29 rubles in profit. The profitability of producing nonfat curds was 26 percent, and processed cheeses--only 10 percent, and dry whole milk--12 percent.

An important issue in the operation of the dairy industry is environmental protection. In terms of the harmfulness of the discharges a cheese plant is perhaps as bad as any chemical enterprise. It is impossible to construct at every cheese plant the complicated and costly purification installations. An effective means of protection is drying nonfat dairy products, which eliminates discharging them.

The general direction of the development of the dairy industry, especially in the southern part of Western Siberia, is rapid technical re-equipment and construction of new enterprises. This will provide for a sharp upsurge in the production of whole milk substitutes and young animals and nonfat dry milk products, the expansion of the assortment of products for food, deeper processing and more extensive utilization of products in the bread-baking, confectionery, food, meat and dairy industry, and increased output of dietetic products.

One of the immediate tasks is to provide the dairy industry with specialized (milk trucks) and cargo trucks, mainly with increased passability. The construction of warm garages and shops for technical servicing of motor vehicles will make it possible to solve the problem of centralized shipping and local receiving of milk, will sharply reduce losses of milk and dairy products, and will improve their quality.

The USSR Ministry of the Meat and Dairy Industry is doing a certain amount of work for creating capacities for producing dry milk and whey by constructing interfarm shops using the funds of the kolkhozes and sovkhoses. Thus in Korenovsk in Krasnodar Kray they are constructing a shop with a capacity of 10,000 tons of dry whey. But for such a large butter and cheese region as the

southern part of Western Siberia, which has relatively low profitability of the kolkhozes and sovkhozes, such a variant is unacceptable. In the next few years here it will be necessary to create several large plants for producing ZTsM, nonfat dry milk, buttermilk and whey, and to accelerate the construction of new butter and dairy plants, and shops for producing ZTsM and dry and concentrated dairy products.

Such measures will require significant one-time expenditures which, however, will be rapidly recouped. It is necessary to bring processing enterprises closer to the places of production of meat and milk and to reduce the radii for the delivery of products and livestock for processing. Managers of the USSR Ministry of the Meat and Dairy Industry now agree with this.¹¹

It is also necessary to transfer separator points now in operation on the kolkhozes and sovkhozes to the jurisdiction of the dairy industry. The processing of milk should be concentrated in the hands of the state, which will make it possible to utilize its products more efficiently and to reduce losses of them.

FOOTNOTES

1. "Narodnoye Khozyaystvo RSFSR v 1981" [The RSFSR National Economy in 1981], Moscow, "Finansy i Statistika", 1982, pp 121-124.
2. "Dairy Products in Wastes," PRAVDA, 22 November 1965.
3. SOTSIALISTICHESKAYA INDUSTRIYA, 6 March 1982.
4. Antonov, S. F., "Myasnaya i molochnaya promyshlennost' SSSR" [The USSR Meat and Dairy Industry], Moscow, "Pishchevaya Promyshlennost'", 1976, p 51.
5. Galaktionov, O. N., Prokop'yev, N. A., "Research on the Influence of the Concentration of Production of Regenerated Milk on Its Production Cost," Bulletin of the Scientific Research Institute of Information and Technical-Economic Research of the USSR Ministry of the Meat and Dairy Industry, No 9, 1982.
6. "Narodnoye Khozyaystvo RSFSR v 1981," p 123; "Basic Technical and Economic Indicators of the Operation of the Dairy Industry in 1981," Moscow, RSFSR Ministry of the Meat and Dairy Industry, 1981.
7. "Narodnoye Khozyaystvo SSSR v 1982", Moscow, "Finansy i Statistika", 1983, p 183; Antonov, S. F. "The Food Program and Our Tasks," MOLOCHNAYA PROMYSHLENNOST', No 7, 1982.
8. We are speaking about milk procurements on public farms. Private subsidiary farms produce about 30 percent of the milk, but less than 2 percent of the procurement. Additionally, milk is used more efficiently on private subsidiary farms. Therefore shortcomings in the work of the dairy industry are reflected primarily in the supply for the urban population.

9. "Main Technical and Economic Indicators of the Dairy Industry in 1981, Moscow, RSFSR Ministry of the Meat and Dairy Industry, 1982.

10. Bulletin of the Scientific Research Institute of Information and Technical and Economic Resources of the USSR Ministry of the Meat and Dairy Industry, Moscow, 1982, Nos 9-12.

11. KOMMUNIST, No 4, 1983 p 80.

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WRITER RELATES EVERYDAY EXPERIENCES

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA (EKO) in Russian No 3, Mar 85 pp 175-180

[Article by Petr Dudochkin (Kalinin): "How Goes It With Ivan Stepanovich? (From the Diary of a Writer)"]

[Text] It is customary to quote eminent activists and celebrities. But I should like to begin this session with an excerpt of a letter received from an ordinary person who is not known for anything special, with whom I have been friends for many years. "First," he writes, "I thought that a pension was that long-awaited happiness, something like the ultimate in well-being: the money comes in and there is nothing to worry about. I do not know how such paradise began to bore me, a poor sinner, so quickly. Happiness cannot be measured in money alone. One's soul in one's hands wants something to do, but a person is bound up as if in swaddling clothes. Only there is no pacifier to suck on. Everything that I knew and was able to do is locked away: for myself and for other people.

"And yet in our Constitution in the 17th Article it says directly: 'In the USSR according to the law individual labor activity is allowed in the sphere of handicraft and cottage industries, agriculture, domestic service for the population, and also other kinds of activities that are based exclusively on the personal labor of the citizens and members of their family. The state regulates individual labor activity, providing for its utilization in the interests of the society.' All this must be executed, transformed, as they say, into life, in order for each person at pension age to be able to work according to his own capabilities and desires for his own joy and for the benefit of himself, his family and his homeland."

At my friend's request I shall not give his name, but in everything else I shall neither add nor subtract anything. And so there was a time when my friend Ivan Stepanovich was so confident in his life's happiness that it never occurred to him that something might threaten it. It seemed that it was inviolable--legitimate happiness earned through an honorable life. The problem began during that sunny summer when he, an officer, retired and, like many others, became a pensioner. For a month or two he rested without any cares. He did nothing. He spent all his time with his family. Soon the idleness began to bore him. He wanted to take up a plane and chisel as he did

when he worked as a carpenter before going into the army, and hark back to the days of old. Sometimes he would drop into the industrial combine to see a friend of his youth and there at his work bench he would pour out his soul and help make desks for the school which the combine was helping with. He helped, and from day to day he increasingly felt: How wonderful this is, simple physical labor! What cheerfulness, what joy! You get tired, and it is somehow especially pleasant.

No matter what else one might say, there is no question that Academician Pavlov was right when he called labor life's happiness and considered that the level of man's culture is directly dependent on his love of labor, and inactivity harms a person many times more severely than the most difficult work. It is no wonder that Ivan Stepanovich was drawn to the work bench! True, the wounds he sustained at the front begin to bother him and he could not always keep up with his friends, but still he always experienced the greatest pleasure. He made a school bench, then a shelf for the office of the young naturalists. They asked for a little stand and he made that. And a table. Just a little at a time. For his own satisfaction. And he continued to visit the shop.

"It turns out that it was not a hardship on him, but a joy. And it was to the benefit of both the school and the state!" they explained in the hospital when Ivan Stepanovich visited there after a half-year.

The carpenters joked:

"We're going to have to install a bench for Ivan Stepanovich too!"

"And actually why not do that?" Ivan Stepanovich was overjoyed. "I am quite capable of working 2-3 days a week! I am not very strong any more, but I am sure that I could handle a couple of hours, and even the doctor would be glad."

The director of the combine, a strong old man who came from a long line of carpenters, winced sarcastically:

"Well, if you have an urge to work, then help yourself. Get a job and work 7 hours a day. But you are coming up with something too original.... A little bit each day."

And the director recalled the owner of the furniture factory for whom he had worked as a boy, before the Revolution. On Mondays the nobleman worked from morning till evening at his desk and cut up all kinds of little knickknacks.

"What has a nobleman got to do with this?" Ivan Stepanovich did not understand.

The director grinned and either as a joke or seriously he advised:

"This will be a breakthrough.... Come on in, until...." and then he threw up his hands significantly. To himself he thought: "An extra bench--extra space. A new person--a new order. Extra instruments will be needed. There

will be problems in the accounts and the report. It will be more trouble than it's worthy."

Sooner or later the final scene come in the interrelations between the pensioner and the combine.

"That eccentric has come to see you again," the director's secretary reported to him.

"What eccentric?"

"The pensioner. Who wants to smell sawdust 2 days a week."

"Explain to him that we do not have a vacancy now and do not foresee one, and the time of the nobility has passed."

The secretary did this. Ivan Stepanovich was left with only confusion: "What does the nobility have to do with this? What was so bad in my request?"

The director of the combine himself was confused when he thought about it: "After all, the 'eccentric' was right: Why not have shops for labor leisure or shops for voluntary labor for pensioners--precisely voluntary labor, voluntary!--and not only for pensioners, but for anyone who wants to work, right down to various work inventions. like the left-handed skilled worker who shod a flea. Let his fantasy go or let him make consumer goods, whatever he wants. On a public basis! At each enterprises, and at each housing administration! We must think about this."

But, concerned about more important things, the director did not get a chance to think about this any more. Not to mention doing anything practical. In fact there turns out to be a kind of paradox: to put out a wall newspaper in a housing administration or gather books for a library--this is possible on a public basis, but to make a table or shelves for the book--these must be ordered from the furniture factory, for in the housing administration they have neither shops nor tools nor materials. They can raise hell in the courtyard until midnight and this is considered the normal order of things, but to lose oneself in one's favorite work in some shop--for some reason this is not acceptable.

For a week or two Ivan Stepanovich did not go anywhere. He cleaned up the square in the courtyard. He went fishing. But still some unknown force drew him to the work bench. He tried to get work at the furniture factory--and was given the same reception as at the combine: if you want to work roll up your sleeves for the entire shift, and 5 days a week.

But he could not roll up his sleeves that much any more: his health was not good enough.

He could not stand it and went for help to the rayon military command. They gave it some thought and sympathized with the person. They sympathized and threw up their hands. Well, what can you do, dear Ivan Stepanovich. It is not so nice to do whatever you want to. All this must be mulled over and

organized. Not just any manager will be kind-hearted enough to take on such a bothersome project. He was advised to go to the rayispolkom.

In the rayispolkom first they smiled and then they fell into deep thought. Excellent! The person was thinking primarily not about earnings (he has a good pension), but about not sitting around with nothing to do, growing decrepit without physical labor, and instead being of some benefit to the people and doing something. For this was not only a question of the physical health of people, and not only question of economic advantage, but also a question of the moral health of the society.

"Let us figure out how many people there are like me in the rayon!" insisted the pensioner, not wanting to doom himself to a passive way of life.

They figured it out. They came up with a considerable figure. A four-digit one! It turns out that in this city alone there are thousands of people who have an unsatisfied urge to work with their hands and in their hearts.

"And what about the neighboring city?"

They too made a calculation. It turned to be not a four-digit, but a five-digit figure. In all the oblast centers there are tens of thousands of people like Ivan Stepanovich. And a good half of them are in good health! A forgotten army! And what if they were all to work a couple of hours a week--how much additional output this would be! If these conditions existed in the plants and factories one could not count the number of applicants that would show up. There are carpenters and welders, electricians and porters, masons and painters who are hanging around bored with nothing to do. Who knows how many there are!

"And throughout the country?" Ivan Stepanovich could not forget about this. He took a newspaper from his pocket. "There are 53 million of our brothers with pensions! One-sixth of the country's population."

Pencil in hand they figured out how and how much these idle Ivan Stepanoviches could increase the material and spiritual wealth of the homeland. What immense reserves of experience and knowledge! It turns out that the pensioner was right. Then they put themselves in the places of the directors of the industrial combine and the furniture factory. And they agreed with them: it was a lot of trouble! Then there was nothing left for the rayispolkom activists to do but again to put themselves in the place of representatives of local authority whose duty it was to find a solution to any problem.

In this case the solution that was recognized as best was as follows: to reconcile both highly agreeable sides, that is to say both the pensioners desiring to work a couple of hours a week and the managers of the enterprises who can help created on a public basis so-called shops or work places for voluntary labor, and not only for pensioners, but for everyone who desires this. Such enterprises could be not only on a public basis with free labor, but also cost accounting with piece-rate earnings and planned output of the products which are necessary to the population.

Yes, there is a solution to the problem, but the situation itself remains the same as it was. Old. Weeks and months and years pass. And no change.

And there is something moderated and restrained in Ivan Stepanovich's angry words: "What is happening in our city? Labor is the main source of happiness, but is this happiness not allowed to me? Can it really not be arranged so that pensioners can work a little bit, as much as they are capable of and want to, and do something for themselves and for their homeland? "

Of course it is a complicated matter and one cannot approach it with any single formula, because people have various capabilities and desires and various kinds of lives. And the conditions are different everywhere: whether it be a city, a village or a rural area--it is a special world with its own production spirit, with its own tasks and peculiarities. But let us think together! What would have to happen in order for Ivan Stepanovich and his numerous countrymen on pensions in order for their good situation not to be considered fatal, and for all the rest of the years of their life to be a joyous continuation and culmination of their previous labor activity!

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STATE COMMITTEE COMMENTS ON PREVIOUS ARTICLE

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA (EKO) in Russian No 3, Mar 85 pp 180-181.

[Article by L. A. Kostin, deputy chairman of the committee: "Comment From USSR State Committee for Labor and Social Problems Regarding the P. Dudochkin Article"]

[Text] The problem of improving the organizational forms of the utilization of the labor of pensioners indeed deserves a great deal of attention. In spite of the measures that are being taken, in the country we have still not sufficiently developed such forms of employment of citizens with limited ability to work as part-time work, work at home, work in home production sections, enterprises and associations that are especially intended for the use of labor of old-age and disability pensioners.

For information we announce that the labor of pensioners in the national economy is stimulated by the state both materially and morally, and measures are constantly being taken to expand the sphere of application of their labor, and the practice of establishing light-duty (privileged) working conditions for pensioners is being developed, which contributes to increasing their employment in the spheres of material production and service for the population. While by the beginning of 1970 there were 2.5 million old-age pensioners working among the workers and employees, or 19 percent of the overall number, by the beginning of 1980 these indicators amounted to 6.7 million pensioners and 28.9 percent, respectively. In the following 4 years the number of working old-age pensioners increased to 9.8 million, which amounts to 35 percent of the overall number of them. Of the kolkhoz worker pensioners who are receiving an old-age pension about 2 million people are participating in the work of the public economy of the kolkhozes.

Pensioners also have great opportunities for social activity. But the results of an analysis of the materials from a one-time selective questionnaire investigation conducted by the USSR Central Statistical Administration of old-age pensioners concerning the conditions for their life and their being hired for work in the national economy (1983) shows that the leading motives for employment of pensioners are material.

At the present time the USSR State Committee for Labor and Social Problems is developing programs for the utilization of the labor of pensioners in the USSR national economy during the period up to 1990, including a system of moral and material incentives. The implementation of this program will contribute to increasing the labor activity of this category of the population, which corresponds both to the interests of the state and to the interests of the pensioners themselves.

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WAYS OF ORGANIZING PERSONAL WORK CONVEYED

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA (EKO) in Russian No 3, Mar 85 pp 182-190

[Article by S. D. Reznik, candidate of economic sciences, chief of the department of economics and organization of construction of the Penza Engineering Construction Institute: "Business Trip"]

[Text] As economic ties develop (and sometimes even in spite of them) the number of business trips increases. Statistics are not kept for them in the country as a whole, but at the level of individual enterprises and organizations the increase in the number of business trips and people sent on business trips is obvious.

The businessman's work during a business trip is specific in terms of its conditions.

In the first place, it is necessary to accomplish a great deal in a relatively short period, that is, to work with high intensiveness.

In the second place, the working conditions are unusual: one does not have "one's own" desk, office, subordinates, that is, the usual work station and the usual surroundings, capabilities, and agenda.

In the third place, the living conditions are crowded and far away from home.

People who are sent on business trips frequently learn from their own experience, repeatedly enduring great difficulties because they have failed to bring with them something they needed or they had failed to look into something beforehand. Many develop for themselves particular rules of behavior on business trips and draw up lists of the necessary items and papers. This facilitates their labor during the course of the trip and increases the effectiveness of this trip.

But nonetheless even when one prepares ahead of time one still forgets something, leaves something out or fails to make some decision. And one wastes a good deal of time each time when one thinks over and plans something that is typical, fairly routine from the standpoint of administrative problems.

The question arises: if we learn to organize and plan our working time in the ordinary situation, why not develop useful rules and standards for working under the unusual conditions of a business trip, which are more complicated for each businessman? For business trips do not relieve the worker of the responsibility of working productively, the more since this is what he himself is striving for.

For each of us one business trip is a nonstandard phenomenon. But when one goes on business trips frequently one notices that one makes the same mistakes, and that each new business trip is somehow like the preceding one, that the tasks and conditions of the business trip for one business person are quite similar to the tasks and conditions for the business trips of another. And this being the case, from the organizational standpoint one can and should analyze business trips and develop the necessary practical recommendations.

Let us try to single out the key aspects, that is, those points at which we lose the most time and, in the final analysis, reduce the effectiveness of business trips.

Preparation for the Business Trip

We can expect considerable losses of time if we

do not resolve before departure all production problems, without which the business assignment cannot be carried out;

do not take the necessary business papers with us (materials, instruments and so forth);

forget the necessary personal items without which our living conditions deteriorate appreciably (for not everyone has the opportunity of staying in a first-class hotel and they do not exist everywhere), and this has an effect on our ability to work;

do not write down a list of business beforehand (tasks, issues), which must be carried out or resolved during the time of the business trip.

Figure 1 shows the form "Preparation for Business Trip," which I have been using for several years now.

An ordinary sheet of writing paper is divided into four parts:

1. Issues (jobs) which must be resolved (done) before departure on the business trip.
2. Basic issues (jobs) which must be resolved (done) on the business trip.
3. A list of what must be taken along (the variable part).
4. A list of personal necessities for the business trip (permanent part).

Preparation for business trip

Solve problems				Take along	
I. Before depart.				A. Job part	B. Permanent part
1.		8.		1.	1. Tbileries 2. Food 3. Clothing 4. Office supplies 5. Personal documents 6. Medicines 7. Misc.
2.		9.		2.	
3.		10.		3.	
4.		11.		4.	
5.		12.		5.	
6.		13.		6.	
7.		14.		7.	
II. During trip				8.	
1.		9.		9.	
2.		10.		10.	
3.		11.		11.	
4.		12.		12.	
5.		13.		13.	
6.		14.		14.	
7.		15.		15.	
8.		16.		16.	

Fig. 1

I begin to fill out the first three sections of the form and carry out the tasks as soon as possible, immediately after making a decision to take a business trip, so as to prepare promptly in the business sense. As for the fourth, permanent, section, over many years I have developed a standard set of things that I need to have at hand in order to ensure a "tolerable" life during the business trip.

Of course everyone has his own personal items, but as the basic ones I can suggest the standard "male" set. It includes seven basic items: toilet items, food, clothing, office equipment, personal documents, medicines, an alarm clock, and so forth. The business trip briefcase or attache case is packed ahead of time with the standard set of everything necessary for a regular business trip and is just waiting for the right time. Therefore practically no time is spent on it before the business trip.

The Business Trip Itself

And so you have selected the place of the business trip and determined where you are going to stay. As they say, you have arranged things (I will not give advice about this. It is purely an individual matter. It is interesting that everybody manages somehow!). It is necessary to work. Where to begin? How does one correctly plan work on a business trip in order to get everything done?

Figures 2 and 3 show the front and back sides of the form "Business Trip." It is tied to the work week: most people on business trips try to get into a weekly rhythm. In essence, we have a weekly calendar with a time schedule which is augmented with the sections: "Main Tasks of the Business Trip" and "Main Tasks of the Day."

Business trip city _____ from _____ to _____ 198 r.
place of trip month

days of hrs week	Mon.	Tues	Wed	Thurs	Fri	Sat	Sun	Main tasks of trip
8.00 — 9.00								
9.00 — 10.00								
10.00 — 11.00								
11.00 — 12.00								
12.00 — 13.00								
13.00 — 14.00								
14.00 — 15.00								
15.00 — 16.00								
16.00 — 17.00								
17.00 — 18.00								
18.00 — 19.00								
19.00 — 20.00								
Main jobs of day								

Fig. 2

The list of jobs is developed on the basis of the form entitled "Preparations for the Business Trip," but in greater detail. As the planned jobs are carried out tasks are determined for when one returns.

And, finally, the section entitled "Economic Issues." Every person on a business trip, in addition to being a worker, is also simply an individual with his personal needs, concerns, assignments and requests from his wife, children, relatives and friends. All this too must be carried out "in between business" and it is also necessary to account for financial expenditures--to the bookkeeping office, the wife, the other "clients." The form entitled "Business Trip" conveniently folds into four parts and is kept in a notebook.

A good plan for a business trip is a good support, but it is certainly not a guarantee of success. The plan must be implemented. In this stage the person on the business trip has a lot of tasks to carry out.

The pivotal assignment of the business trip, as a rule, involves the need for solving some particular problem or signing some document in one or several institutions. This task must be carried out with specific people for whom our arrival is most frequently unexpected and unplanned. We people on business trips frequently forget about this. A meeting for which one is not prepared, in which we approach an official without warning, is a poor beginning. A person who has been taken away from this work finds it psychologically difficult to have a positive attitude toward solving others' problems.

Fig. 3

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Let us imagine that we have agreed upon a meeting. They are waiting for us. What should we discuss and how? What should we have with us?

In textbooks on administration they teach a great deal of the art of conducting a conversation with a subordinate or a manager; But here is a different case. It is good if the worker whom we have come to see has a direct interest in the problem. And if not? Then it is desirable beforehand to "play through" the forthcoming conversation, to put ourselves in the place of the person whom we intend to visit, to weigh the pluses of argument, and to find something that will interest the person with whom we are speaking. This is a most important aspect of the forthcoming meeting.

Here it might help if we draw up a preliminary plan of the conversation, a written formulation of the questions which we might be asked and those which we intend to ask.

Of course one cannot foresee everything in advance. Much in ensuring the success of a business meeting depends not only on the nature and mood of the other person, but also on our own behavior during the course of the discussion and our ability to persuade. Several far from new pieces of practical advice can be useful here:

1. Conduct the conversation in the vein of the interests of the organization to which you are being sent and the official with whom you are speaking.
2. Try to make sure that your problem does not create additional difficulties for other people.
3. Do not ask questions which can place the individual in a difficult or awkward position and avoid words and expressions which might seem unpleasant.
4. Maintain a correct and polite tone, speak quietly and calmly, and avoid gesticulation. This adds weight to your words and creates a businesslike mood.
5. Do not interrupt the person with whom you are speaking, learn to listen.
6. Try to make the other person a participant in your ideas and proposals.
7. Enlist the support of other people who are authorities in the eyes of the person with whom you are speaking.
8. Have with you documents in the form of business letters, drafts of documents, references to directive and legal documents and so forth.
9. Do not be pushy. If the person with whom you are speaking has said "no," let up for a while, think of some new approaches, and select ways out which leave the gates open for the next meeting. To do this it is sufficient to excuse yourself and say that you are not ready for the conversation but would like to continue it.

It is fatal to be categorical in a business conversation. It is necessary to listen to the arguments of the other person without giving him the idea that he is wrong, show self-criticism when well-substantiated counterarguments are given, and listen to objections patiently.

When speaking one can also recall that one's speech should be simple and comprehensible, logical, brief, full of content and interesting for the other person.

The businessman's appearance also has an influence on the effectiveness of business meetings. The clothing makes the man--so goes the old saying. Cleanliness, neatness, and elegance have a good effect and elicit a pleasant feeling and a kind attitude.

Information that is received during the course of the conversation must be registered in a form that is suitable for further use (notepad and so forth). After the conversation (usually in the evening at the hotel) one must analyze one's behavior and the results of the conversations.

The plan of the business trip must be flexible. You must not be bothered if on some particular day you have not managed to fully keep up with the program. This is quite natural when a lot has been planned and there is little time. Taking this into account, each evening one should sum up the results and make adjustments to the program of actions for the remaining period. In order to increase the effectiveness of business trips it is important to learn to work in a "condensed" way, using every minute of spare time for work. There are no boundaries between working and nonworking time on a business trip; we select the necessary schedule for ourselves. To a certain degree it depends on the schedule of various institutions and on where and when people can receive us.

Adjusting to these conditions you must also plan your actions during the course of the day, filling gaps with those jobs which depend on you alone and do not involve external circumstances. The latter include an analysis of the course of the business trip, the planning of work, the preparation of business papers, the scanning of newspapers and magazines, telephone conversations and so forth.

In order to find time to do a great deal in a small amount of time, organization and self-discipline are required on a business trip more than anywhere else. From the rules that have been formulated for management it seems to me that the following are suitable for the conditions of a business trip:

determine precisely the main tasks of the trip, draw up a plan for achieving them and concentrate on its implementations;

learn to be decisive, because without it nothing will be done on the business trip;

do not be distracted by telephone conversations, personal contacts are more important;

acquire the habit of keeping notes and do not rely on your memory;
do not forget about trivia, which frequently lead to large losses of time;
approach any matter immediately, and do not put anything off;
change the kinds of work, this makes it possible to do more;
begin the working day as early as possible and use all of the time during the day!
and, finally, about your feelings and mood during the business trip.

Not everything, of course, will be accomplished, or else it will not be accomplished as quickly as you would like. It is important not to let your spirits fall because of failures, but to search for ways of solving problems persistently and patiently.

A person can master his emotions. He can learn to control them, make them his ally, in order not to leave room for a bad mood--herein lies the psychological preparations for the business trip.

Daily exercise, a cool shower (if this is possible) or a rubdown will create a good mood. Well, and if one has fallen ill (and this cannot be ruled out) a first-aid kit and the conviction that one can be ill only at home will help to see you through.

The Business Trip Is Over, the Work Continues

And so, the business trip is over. You are at home. Straighten out your papers and enter the information from the section entitled "Results of the Business Trip" in your working plan for the week or month.

Fill up your briefcase according to the list and leave it ready for the next trip.

Fill out your expense account and technical reports concerning the business trip (there are forms in the standard set of equipment). Now one can go back to work.

The author understands that his modest experience does not exhaust all problems and collisions involved in a business trip. Therefore he will be thankful to those readers who will share their suggestions regarding improving the technique of personal work on a business trip.

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SUMY ASSOCIATION EXPERIENCE RELATED

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA (EKO) in Russian No 3, Mar 85 pp 191-192

[Article by B. I. Vyugov, director of the Tomsk Repair-Mechanics Plant of the Tomlesprom Association: "We Are Utilizing the Experience of the Sumy Association"]

[Text] Three years ago our collective began to introduce a comprehensive system of control of the effectiveness of production following the experience of the Sumy Machine-Building Association imeni M. V. Frunze, which we learned about from an article in EKO.¹ We visited the association, studied its experience and began to introduce it.

What caused us to turn to this system? Under the 10th Five-Year Plan our plant failed to put new production areas into operation, and the plan increased from year to year. Many workers of the enterprise considered possibilities of growth only as expansion of capacities and increased numbers of workers. Yet calculations showed that with the same production capacities the plant could increase the volume of production output by 367,000 rubles if it would use these capacities better. The system of the Sumy Association helped us to put this reserve into action. It is based on normative methods of planning accounting and control of production capacities. We have changed it somewhat and augmented it taking into account the specific features of our production.

As a basis for the accounting and planning we use the work station, whether it be a machine tool or a working post with a high degree of energy availability. In the Sumy Association the shop chief will not "maintain" surplus equipment in the shop, and we are doing the same thing with equipment, but the brigade leader and shop chief will not "maintain" a surplus working post either, since it is included in the calculations of the normative production capacity.

In this way we obtained comparative results of the utilization of the normative production capacities of the shops and brigades expressed in machine tool hours and norm hours and registered in the shop's passport figures on the number of work posts (stations) in the brigade or shop. When there is a shortage of labor resources this kind of accounting makes it possible to halt the further increase in work stations if there is no justification for them.

In 2 years the collectives of the brigades and shops of the plant rejected 25 "extra" work posts and many units of equipment, as a result of which the return from each work station increased from 13,300 rubles in 1982 to 16,900 rubles in 1983. We have brought the planning of capacities and work stations up to the level of the brigade, which has made it possible to approach the very sources of improving the work of the shops and of the plant as a whole. Brigade forms of labor organization cover 80 percent of the workers.

The incentive systems are drawn up taking into account normative utilization of capacities and work positions. Half of the bonus remunerations are calculated from the level of these indicators as compared to the normative. Because of this workers, brigade leaders and foremen have begun to check more attentively on everything which influences the result with respect to the normative.

Thus there was a staff shortage in the brigade of N. N. Mikhaylov from the electrical repair shop. In order to fulfill the planned assignment in norm hours the brigade either had to be fully staffed or increase productivity. If the brigade had taken the former path the coefficient of the utilization of capacities would have been low. So it rejected the extra work posts and began to fulfill the assignment with the original number of workers. Labor productivity and the earnings of the workers both increased.

Our system, like the Sumy system, envisions a new model for drawing up the plan for social development on the basis of normatives. Moreover, for mobilizing reserves of the social activity of the workers, it is especially important to have the reverse influence from measures for improving working conditions and raising the standard of living. Housing conditions are also improving: existing residential buildings are being remodeled, new residences are being constructed, and the supply of meat products from the subsidiary farm for the collective is improving.

The results of the plant's work show the system's effectiveness. During 3 years of the 11th Five-Year Plan the growth rates as compared to the base year (1980) were: for producing commercial output--11.5 percent, and labor productivity --19.3 percent with a reduction of the number of workers by 6.6 percent.

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LOCAL PARTICIPATION IN RECONSTRUCTION WORK REPORTED

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA (EKO) in Russian No 3, Mar 85 pp 193-196

[Article by L. Itkin, engineer of the Southern Ore Enriching Combine (Krivoy Rog): "Construction: They Do Not Build For Us: We Do the Building"]

[Text] The Krivoy Rog Ore Enriching Combine is distinguished by the lowest production cost of products and the highest profitability and labor productivity among related enterprises of the branch. The achievement of such indicators while increasing the initial production capacities more than 4 fold became possible because of the technical improvement of production. The fourth radical reconstruction of the combine has now been completed. The introduction of such capacities with new construction would have required 121 million rubles more than with reconstruction.

The plan for reconstruction of the enriching complex envisioned halting two sections of the enriching factors for 4.5 months. Everyone understood that this could not be avoided. But how were they to compensate for the losses? The solution was suggested by engineering and technical personnel of the combine: provide for more rapid introduction of the crushing capacities, install large-volume grinding mills and magnetic separators with higher productivity, and create temporary systems of technology, water supply and energy supply.

The associates, suppliers of equipment and construction workers supported the initiative of the combine. The Novokramatorsk machine building plant made a commitment to manufacture the grinders ahead of schedule; the Krivbasstroy combine and the Krivorozhaglostroy Trust promised to do the construction and installation work for more rapid installation of the ball mills; and the Mekhanobrchermet Institute promised to issue technical documentation to provide for early startup of the capacities.

In keeping with the tradition which has taken form over many years of cooperation, during the time of reconstruction we were especially attentive to builders at the combine. The best accommodations were given to the builders and in the dining rooms they were served out of turn. The combine manufactures nonstandard equipment and means of minor mechanization, it produces bridge and railroad cranes, dump trucks, dump railroad cars, and

platforms for construction materials, and the brigades for installation and removal work promptly provide a work front.

"They do not build for us, we do the building"--such is the combine's position. With this kind of approach to the matter everything has become common property at the construction sites: the work, the technical equipment, the responsibility for the achievement of the final results. All work for reconstruction is headed, as a rule, by the chiefs of the shops that are being reconstructed. Who is more interested in reducing the time periods than they are?

For concentration of material and technical resources and maximum construction and installation work without halting the existing shop, the unit method of work was used. The objects of reconstruction were broken down into seven units, and a unit-by-unit consolidated network schedule was drawn up. This accelerated reconstruction. The production of concentrate began 3 weeks ahead of schedule, and on the same areas the production capacities of the Enriching Factory No 2 and the productivity of labor doubled. Because of the early assimilation of capacities the combine avoided losing 765,000 tons of concentrate.

Advanced technical decisions in plans and in construction were of great significance. The planners used standardized prefabricated reinforced concrete items for covering the foundations instead of solid ones, and in places where it was necessary to leave the solid structures they used self-bearing armored blocks and networks.

One can name many things that have been used for the first time: because work was being done in the existing shop the equipment was installed on a special stand and was then transferred for installation in large blocks weighing up to 220 tons. For the first time in the country the blocks of the ground part of the conveyor track were lifted up when in a condition of complete plant readiness.

The reconstruction is advantageous to the country and the national economy--this is obvious. But so far it is still disadvantageous to the planners and the builders. We are speaking not at all about unforeseen obstacles and not about worthless work or changes that depress the soul, which they have not managed to avoid (one planning institute, for example, when planning the ore tract "lost" the connection to underground communications, which led to a sum of 350,000 rubles' worth of additional work). They can be regarded as particular cases. Under the 10th Five-Year Plan at reconstructed facilities of Dnepropetrovsk Oblast in the production of concrete work the output decreased to 70 percent. This is official. In practice it was even considerably lower. And not because the people did not work as well, but because the payment per cubic meter of concrete and groundwork was the same both at a new construction site and when reconstructing existing production.

A certain part of the losses to the contractor can be compensated for by applying the corrective coefficient to the estimated cost of the work. The coefficient compensated for additional expenditures on materials, mechanisms and transportation. But the necessary additional wage fund was not allotted.

The planners have similar problems. For they are paid according to the volumes of construction and their correcting coefficients do not reflect all the difficulties of planning reconstructed facilities.

The following issue has not been resolved yet: who is to dismantle the old equipment during the time of reconstruction? In one document it says that this is the affair of the client, and in another it says that this work can be done by the contractor....

And mechanism of the work? It is clear to everyone that many mechanisms used in new construction sites are not suitable for reconstruction. Here it is necessary to have maneuverable, mobile construction machines, attachments mounted on small tractors, and highly productive electropneumatic tools which so far, unfortunately, can be found only at exhibitions....

And here is a paradox which was told to me by the chief of the enriching factory. According to the plan for reconstruction, 2.5 million rubles were spent on the introduction of an ASUTP system. The corresponding staff for servicing this system was also envisioned by the plan. But the workers of the labor divisions stubbornly refused to provide the people. In response to all requests they assign additional limits on the labor for training personnel and adjustments to the system and means of ASUTP--a stereotypical answer: fill in the staff with the technological personnel who have been released.

But, after all, logic says: first comes the introduction of the ASUTP! The release of technological personnel comes next, as a result of the introduction of the means of automation. The more so since at the factory for two five-year plans in a row the Shchekino Experiment has been working successfully and the personnel have been reduced to the limit. Under the 11th Five-Year Plan Dnepropetrovsk Oblast gave over 53 percent of all capital investments for reconstruction and technical re-equipment of its enterprises. In order to successfully assimilate these in the oblast they think that it would be expedient to establish coefficients to the estimated cost of construction and installation work in order to compensate for all additional expenditures of the contractor; the wage fund and labor productivity should be planned taking into account the proportion of reconstruction in the overall volume of work of the contractor; equipment, materials and metal structure should be delivered before the beginning of construction work because at existing sites it is possible to do the work without losses only with 100 percent supply.

The social problems also require attention. For years the builders have been working under the same roof with the miners and metallurgists, but they receive none of the benefits for working under harmful conditions.

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STANDARDS INTERFERE WITH DEMAND

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA (EKO) in Russian No 3, Mar 85 pp 196-198

[Article by A. V. Kondyreva, candidate of technical sciences, Leningrad Branch of the All-Union Scientific Research Institute of Economics of Trade and the System of Management (VNIETsistem), and R. N. Shmaneva, candidate of technical sciences, Leningrad Institute of Soviet Trade: "Unsatisfied Demand and Standards"]

[Text] Numerous investigations show that while there is an abundance of sewn and knitted items for adults, more than half of the population is unable to purchase an item for the necessary height, size or fullness.

One of the reasons for this is the lack of correspondence between standards adopted by industry for heights, sizes and fullness of outer clothing and knitwear that are produced and the actual distribution of these parameters among the population. A panel investigation conducted in 1982 by the Leningrad Branch of the VNIETsistem showed the distribution of 3,500 Leningrad residents in terms of sizes, heights and fullness of clothing. The comparison of these data with the scale for these parameters in effect in industry and also the materials of trade organizations shows considerable divergences between them. According to materials of the questionnaire with a chest size of 112 centimeters and more comprise 15.7 percent, while the scale envisions only 0.6 percent of these sizes; women with the same sizes--19.6 percent (according to the scale--only 17.4 percent). Consequently, from 12 to 14 percent of the Leningrad residents do not fit within the accepted size ranges for clothing for adults. The divergences in the distribution according to height are even more significant: 21.7 percent of the men in Leningrad are 179 centimeters tall and taller, and according to the scale their proportion is only 3.8 percent. women more than 167 centimeters tall comprise 18.5 percent, and according to the scale--1.7 percent. As a result, almost every sixth Leningrad resident cannot find an item which is long enough. In half of the cases these are young people under 29 years of age. Unfortunately, the standards for some reason do not take into account the phenomenon of acceleration.

As data from the investigation showed, the existing division of standard figures into three groups in terms of fullness, and women into four groups,

requires revision of the interval that is accepted between the groups. Judging from the results of the questionnaire, 28.7 percent of the men and 24 percent of the women are "nonstandard" in terms of fullness, and among these about 70 percent have figures that are fuller than the minimum fullness envisioned by the OST's. Special difficulties are experienced in cases where men try to select a suit: the jacket fits, but the trousers must be tailored.

According to data from measurements of the adult population¹ in the USSR, there are 253 standard female figures and 144 male figures (data from 1967 with refinements in the 1970's). The scales of the percentage distribution² and branch standards of typical figures of men and women take into account only 93 of the standard figures for men and 105 for women, that is, far from all the types, and for women--less than half. As a result, even if industry were to produce items for all of the typical figures listed in the OST's a considerable proportion of the adult population would be unable to acquire an item of the necessary size, height and fullness. How does the consumer get around the existing situation? He must turn to custom tailoring.

The investigation established that more than half of the men who were questioned and 72.3 percent of the women take advantage of the services of ateliers for custom tailoring. Almost every 10th man and every fourth woman is a client of the knitwear ateliers of the city.

An analysis of the reasons for turning to the services of ateliers and manufacturing items under household conditions showed that the dominant motives for this were the uniformity of the fashions and models that are produced, and also the large batches of items that are produced and the lack of sale of items in the necessary size and height, and also dissatisfaction with the material, colors and quality of items from mass sewing. More than 70 percent of those who responded gave these reasons. A large proportion of the individuals who take advantage of the services of ateliers are consumers who wear large sizes of clothing with nonstandard fullness. Consequently, the reason why consumers go to the more costly individual sewing (knitting) which require considerable expenditures of time is the completely justified and explicable wish to have a nonstandard original item or the fact that their figure is not standard (no more than 20 percent gave this reason), and the shortcomings of mass production and the lack of correspondence of the standards to the real situation make a large proportion of the consumers "nonstandard."

The labor-intensive and important work for anthropometric research of the population and refining the scales is being done by the Scientific Research Institute of Anthropology of the MGU, but this research should be conducted more frequently and more regularly.

But if for sewn and knitted items the consumers find some solution to the existing problem, then with footwear, especially children's, the situation is more complicated. Footwear cannot be resewn. It is very difficult to order children's footwear. Moreover during a year a child's foot can grow up to 8 sizes. Yet the questionnaires of the population revealed that almost half of the children have difficulties in purchasing footwear: the necessary sizes are not available. It is difficult for every sixth child to find shoes of the

necessary fullness. Children's shoes are produced actually only in two widths, although the GOST envisions the output of children's footwear in 7-9 widths, and men's and women's footwear--in 12 widths. As the research showed, the abundance of standard widths and their various numerical designations in various kinds of shoes are not comprehensible to the population. Moreover this makes it more difficult the structure of the output of leather footwear according to width and leaves many gaps for the industrial enterprises. Probably one should listen to the suggestions of the consumers: the marking of the width on the footwear should be the first letters of the indicated width "narrow," "medium," "wide," as has been done for a long time abroad.

Certification of products should play a large role in improving quality. The consumers make many complaints against those manufacturers who give awards to items which do not deserve them. Thus, according to the evidence of Leningrad trade specialists, of the 39 models of children's footwear with the Emblem of Quality that came into the regional market in 1983, it was suggested that the Emblem of Quality be removed from nine of these models since they did not meet the high requirements.

The existing standards are becoming a poor obstacle on the path to poor-quality products. When outdated GOST's are replaced with new ones frequently the requirements for quality are not only not increased, but are even weakened. For example, while the GOST that was abolished in 1973 envisioned for the second grade of knitted material for underwear up to three defects in fabric, in the one that is in effect for the first grade the number of defects has been increased to eight (those that are not noticeable are not taken into account), and eight sewing defects have been added to these. The same thing is true regarding outer knitwear items: the abolished GOST envisioned in items of grades I and II no more than three defects in fabric, while the new GOST added to them eight (grade I) and 10 (grade II) sewing defects.

What kind of quality can there be if, for example, in outer knitwear items of Grade 1 they envision 16 defects, and the ones that are not very noticeable are not taken into account. The sewing defects allowed by the GOST include: sleeves of different lengths (Grade I--no more than 1 centimeter, Grade II--no more than 2 centimeters), lapels of different lengths, misshapen collars, different lengths of front panels (no more than 1.5 centimeters) and so forth. These are quite significant defects which can be seen by the naked eye and should be eliminated immediately. Imagine a jacket with eight defects!

At the same time the standards for light industry items do not take into account such indicators as convenience (comfort) of clothing or footwear, a good fit, lightness, elegance, fashion, that is, those indicators of the external appearance which the consumer values so highly these days. The population and the trade workers have developed a common opinion--the standards should include requirements which provide in the prepared products not only high quality indicators, but also the ability of our items to compete on the foreign market and their correspondence to the best modern models.

FOOTNOTES

1. Dunayevskaya, T. N., Koblyakova, Ye. B., Ivleva, G .S., "Razmernaya tipologiya naseleniya s osnovami anatomii i morfologii" [Size Topology of the Population With the Fundamentals of Anatomy and Morphology], Moscow, "Legkaya industriya", 1908.
2. The scales of the percentage distribution of standard figures of men and women in the various regions of the USSR for mass production of clothing. Parts I and II, Moscow, TsNIITELegprom, 1980.

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BOOK ON ENVIRONMENT REVIEWED

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA (EKO) in Russian No 3, Mar 85 pp 202-209

[Review by Yu. P. Voronov, candidate of economic sciences, Institute of Economics and Organization of Industrial Production of the Scientific Branch of the USSR Academy of Sciences (Novosibirsk) of the book "Pod Zemlyu, Chtoby Spasti Zemlyu" [Under the Earth in Order To Save the Earth], Moscow, "Nauka", 1983]

[Text] It is apparently a rare reader who does not have an equivocal attitude as to the first reading of the book under review. It is desirable to read it, set it aside, delve into the ideas presented by the authors then read it again. This will guarantee a calm and reasonable perception of the book.

The publication is a detailed, soundly argued appeal to give preference to underground structures as compared to above-ground ones. The arguments are dispersed throughout the entire book and bringing them together means additional work for the readers. Here is the list which the reviewer came up with.

The surface of the earth must be freed for agricultural utilization. On the global scale the figures cry out: mankind now has 15 million square kilometers of plowed land, and throughout history has lost--20 million. According to the most optimistic estimates, it is possible to add 0.3 million square kilometers to what already exists, no more. At the same time in the USSR alone by the year 2000 an additional 0.5 million square kilometers will be occupied by housing and engineering facilities, and in the entire world--4 percent of the dry land (pp 41-42).

Underground structures last longer than those above the ground. They serve for sentries, and there are even those which have existed for millenia. Tunnels, for example, are intended for 500 years of service, while above-ground structures last 25-125 years.

A considerable proportion of the underground structures do not require large expenditures since many mining developments are not being used.

The operational expenditures on maintaining underground structures are less because of the greater stability of the external conditions, mainly the humidity and temperature.

Underground structures are especially attractive for high-frequency productions which cannot tolerate vibrations and fluctuations in the temperature, and also for storing radioactive and other harmful substances.

Underground structures are more resistant to earthquakes than those above ground.

A bibliography is provided at the end of the book: from articles in popular magazines to decrees of the USSR Council of Ministers. Typically, it does not contain any preceding works. Each of the titles on the list mentions one of the frequent problems that are touched upon in the book under review. Is it correct that in popular literature problems are raised which combine the efforts of specialists of various branches? At first glance, the fact that it is popular means that it is largely superficial. But as one reads one becomes convinced: this popular book has raised a fundamental problem which is not raised in specialized literature not because it is not crucial, but because of its interbranch nature. Usually when any subject emerges in the space between departments, academic science helps to pull it out. But in this case everything is more complicated. It is not enough to investigate underground construction. It is necessary to build it, and to assimilate millions of rubles in capital investments. And this goes beyond the domain of science.

What Can Be Built Underground?

The kinds of structures that can be constructed underground must also be gathered from throughout the text of the book. It turns out that the list includes practically everything built by the people in the kingdom of Pluto: all kinds of storehouses--from food refrigeration facilities and vegetable bases to reservoirs for petroleum and gas.¹ Even the existing museums are among the structures that take advantage of stable temperature and humidity. Stability can be found at a depth of several meters. "In the underground space one can store gases, petroleum products, water, mineral fertilizers, grain, sugar, vegetables and fruits, cooled and frozen meat and fish, spare parts, industrial goods, state archives, radioactive wastes from atomic electric power stations," write the authors of the book under review. "During the past 20 years in Sweden, Norway and Finland almost all the new storehouses for petroleum and its products are located in mining developments which are not being used" (p 52).

Khodzha Nasreddin recommended that high minarets be constructed this way: dig a deep well and then turn it inside out.... In the book by P. F. Shvetsov and A. F. Zil'berbord in the paragraph entitled "Elevators the Other Way Around" the recommendations are exactly the opposite, but more possible (pp 110-111).

The Underground Food Program

The book under review gives a detailed discussion of agrarian utilization of underground space. Underground farming was originated in our country by

Academician K. A. Maksimov at the beginning of the 1930's. Now most of the work in this area is concentrated in the Agrophysical Scientific Research Institute.

It is possible to raise various agricultural crops underground. P. F. Shvetsov and A. F. Zil'berbord give examples of direct replacement of agricultural land with underground plantations. In underground hothouses with artificial lighting they obtain 20-25 kilograms of tomatoes a year from one square meter. The record is 180 kilograms. They gather six harvests a year. There are even experiments with wheat--three crops a year with a productivity of 15 kilograms per 1 square meter (!). But wheat in underground hothouses is exotic or, better, a matter of the distant future. New strains of vegetable crops have been propagated especially for underground hothouses. In particular, hybrids of cabbage and radish produce 21 crops a year--150 kilograms of tops and roots per 1 square meter.

Advanced experience has been accumulated in the Apatit Association on the Kola Peninsula, the Gigant-Glubokaya mine in Krivoy Rog, the Bebyayevskiy gypsum mine near Gorkiy, the Belousovskiy Mine imeni XXVI S'yezda KPSS in Eastern Kazakhstan. In underground hothouses the days usually last 18 hours, and the temperature ranges from +24-28 degrees "during the day" to +18-24 degrees "during the night." There are recommendations for lighting, building shelves and so forth. In a word, the enterprising director of the mine has something with which to begin and someone with whom to compare himself. Thus in the Gigant-Glubokaya mine year from 1 square meter of underground hothouses they harvest 60 kilograms of cucumbers or 30 kilograms of tomatoes.

A not altogether usual, but extremely effective area for the underground food program is the raising of mushrooms. The fungi themselves do not need light; it is enough to maintain the appropriate nutritive environment. In the USSR experiments in raising mushrooms were started for the first time in the mines near Tashkent (p 128).

Not Only the Subway

One of the children's books shows a vertical cross-section of land next to the Moscow station of the "Park of Culture" subway, which gives five levels of movement. Why is the earth under the city used primarily for transportation needs? After all, it is especially valuable, and no less expensive than productive Chernozem. P. F. Shvetsov and A. F. Zil'berbord give the value of a square meter of earth within the city limits: Paris--from \$235 to \$2,350, London (not the center)--about \$130, New York--\$150-\$8,300, Tokyo (Center)--up to \$5,000. There is a source reference for these figures. The value of a square meter of land in Moscow is from 20.4 to 112.6 rubles. There are no references for these figures. The reader has a right to think that the authors are responsible for these figures, for no further explanations follow. A pity. We should like to know how the basic theme--"Saving the Land"--is transformed into concrete figures. And another thing. When do these figures keep anybody from constructing single-story warehouses which usually take up as much space as residential apartments in cities. The examples given by the authors show the nonmonetary need for underground structures in cities. The appearance of an 800-meter tunnel with warehouses, garages, and unloading

sites under the Rossiya Hotel and the underground warehouses of the stores in Noviy Arbat are quite understandable: there is no need to go into this. But the next example--the planning of Sochi, where all of the business structures are underground and located in the mountains beyond the residential regions--shows a lack of interest in underground construction under the most favorable conditions. But it is not only the strip of beach that must be protected!

On the whole, the problem of assimilating space under the city, as one can see from the book under review, is at the level of primitive developments. For example, the authors obtained consultation concerning the minimum depth for replacing underground garages in Moscow in an academic institute whose profile is global problems of tectonics.

The Mysteries of an Abandoned Mine

The list of variants of underground structures evokes contradictory feelings. It is good that they have thought about this. But do these problems pertain to many ministries, state committees and departments? Will underground construction overcome the numerous barriers created by the existing system of management of the economy?

Let us take, for example, underground refrigeration facilities. The book under review describes a large storehouse located in the Northern Volga area. There is a photograph of the industrial site. The lime line was exhausted as early as 1939. It was suggested that the refrigeration facilities be equipped when the mine was regarded as a free gift of nature. The underground grape storehouses located in the south of our country are essentially the same kind of premises.

Having received the underground mining galleries which are not to be used for anything else, the new master fixes them up and expands them. But he begins this activity because of his good fortune. The authors of the book warn not to count on such a case. At best, in our view, the paragraph entitled "Where To Begin?" raises the problem of inventorying underground developments of former lime and gypsum mines. But who is to do this? Perhaps the Ministry of Construction Materials Industry, whose enterprises created the underground empty spaces as a byproduct? It is known that the mining enterprises are obligated to recultivate the land that has been left after their activity. Nor is it any secret that the funds for recultivation are usually assimilated with the obvious financial advantage of recultivation work. Why should the Ministry of the Construction Materials Industry suffer because of the fact that lime and gypsum developments are practically eternal? The coal miners are responsible for the coal. But here the ministry is supposed to be responsible for a product which is alien to it--some holes in the ground....

There is also another chain of deductions. What do underground structures replace? Construction projects. So let one of the construction ministries engage in this under the control of the Gosstroy. In this ministry one can create a main board for underground construction and the corresponding subdivision in the Gosplan, and let them work.

To many people almost the only way of improving the organization of management and accounting and solving large new problems is to create some new department. One encounters these suggestions in EKO as well. But this is a blind alley. There are always more problems than there are departments. The most frequent reorganizations cannot keep up with the need for recognizing and solving these problems.

And so, where to begin? The authors of the book list the mining areas where it would now be possible to undertake construction using existing underground developments. In addition to the aforementioned lime and dipthum mines, the list includes deposits of local sand mines and dzhezkazgan, the rock and potassium salts of the Ural area, and so forth. It is necessary to begin with an inventory of former mines--the obvious wealth of the country. But the problem is considerably broader than underground construction or even protection of the environment as the primary motive for this kind of construction. Protection of the environment has been entrusted to those who were available--meteorologists who had somewhat expanded their functions and epidemiologists who were previously only experts in infectious diseases. The cultural heritage is protected by the Ministry of Culture. There is a Society for the Protection of Nature and a Society for the Protection of Monuments of History and Culture.

An abandoned mine, which is a part of the national property, shows that the means of "preservation" are still very fragmentary. Counterposed to these fragments of protection departments is the basic part of the structure of management which is oriented toward "extract, utilize and put to work." There is not a single new institution that is to account for the underground empty spaces which are suitable for economic utilization but half of the organization of the organizational structure. Thus half of it is concerned about producing products while the other half is concerned about what will be left for the future. Along with industrial departments we would need resource departments which protect national property.

And this is what happens when you try to get rid of the idea of creating a new department and come to the conclusion that it would be good to create a new type of department...but any good book is not an end, but only a beginning of the readers' thinking on the subject.

Indebtedness to Economic Science

Economic computations are found in many places in the book under review. Their fragmentary nature cannot be regarded as shortcomings in the presentation. Each time when the authors refer to calculations of the effect from changing over to underground structures they come up against the fact that principal problems that are more general than those touched upon have not been solved.

P. F. Shvetsov and A. F. Zil'berbord are miners. One worked in the mines of Khakasiya and the other in the mines of Shpitsbergen. Their relation to economic calculations is that of outsiders, who use them on the basis that they are the result of the work of people who have greater authority in the area than they do, specialists. This approach is typical for technical and

economic substantiations of plans. The authors cannot refrain from making remarks about the existing methods. And in places where they restrain themselves, the doubts appear with the readers. In fact the USSR Ministry of Trade has established for 1976-1980 normative time periods for recouping the money for distribution refrigeration capacities--4.3 years, general commodity warehouses--4 years, and vegetable storage facilities--7.7 years. Only the last figure is close to the broad "interministry" time period, about which people prefer to remain silent when it is ignored.

Where did the Ministry of Trade get these normatives? It is not necessary to think very long in order to guess: they were derived from the actual statistics in such a way that with the existing structure of storage facilities none of them would "stand out" because of their effectiveness. But here it is being suggested that this structure be changed and that underground refrigeration facilities, warehouses and vegetable storehouses be constructed. Moreover, the evaluation of their effectiveness, as before, would be related to the structure of the construction of a given ministry. Is this objective? Unfortunately, the authors of the book do not ask this question. Possibly they are following the rules of the popular science genre or have asked many people but nobody has answered. The answer to this question is the age-old debt of Soviet economic science to the practice of economic construction.

They are not paying back old debts, but running up more and more new ones. Following the authors of the book under review, we shall list just a few of them. The evaluation of the effectiveness of underground structures requires the inclusion of "reimbursements to compensate land users for land that is taken from agriculture, expenditures on recultivation, the possibilities of utilizing the worked space in the national economy, expenditures on fighting against noise, vibration, gas pollution and dust pollution of the air base" (p 86). As we see, "the possibility of utilizing worked space" is only one of many factors which must be taken into account when evaluating the effectiveness of underground structures. But it is inseparably interwoven with them. One can increase the aforementioned possibility but then it is necessary to agree to higher losses of minerals. How does one translate the one into the other? Or how does one take into account the length of time for practical use of underground structures? For with the existing methods of calculation a ruble of capital investments which we spend in 20 years is equal to 23 kopecks today. And a ruble which will be spent in 100 years is equivalent to "nothing" today.... With the current methods for calculating the economic effect, it is absurd to do construction work for centuries! These are the kinds of tough nuts the economists have to crack when construction workers want to go underground.

There is hardly anybody today who will object to the idea that the changeover to the intensive path of development requires a new style of economic thinking. But let us state the problem more strictly and address it to directors of mining enterprises: "Are you willing to place a sports hall in an old mining development?" The first (but not the only) sports hall of this kind was constructed in 1972 in the Norwegian city of Odda (p 117). The book under review unquestionably shows that a positive answer can and should be given to this and other similar questions.

FOOTNOTE

1. The magazine has already addressed this subject. See the article by A. A. Bovin, "A New Resource--Underground Developments," EKO, No 7, 1982.

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BOOK ON MANAGEMENT REVIEWED

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA (EKO) in Russian No 3, Mar 85 pp 209-212

[Review by A. B. Fel'zer, candidate of economic sciences, Institute for Increasing Qualifications of the Ukrainian SSR Ministry of Housing and Municipal Services (Kiev) of the book "Upravleniye Narodnym Khozyaystvom" [Management of the National Economy], Moscow, "Politizdat", 1983]

[Text] In our day there is hardly anybody who does not know of the key role of management in solving the problems that face our country. The range of people who are seriously interested in these problems is extremely broad, and therefore the publication of the dictionary entitled "Management of the National Economy" (Moscow, "Politizdat", 1983) can only be welcomed.

We shall not undertake an entire evaluation of the publication. In any case this is a necessary book. It has long been awaited. But in it one encounters vexing mistakes and imprecisions which motivated us to take up our pen.

For example, in the item entitled "One-Man Management," it says "when planning a system of management it is necessary to observe the norm of controllability, that is, to envision that each worker will be given clear assignments and, in turn, each manager will be responsible for the work of a strictly determined group of people." But, in the first place, the norm of controllability has nothing to do with the clarity of assignments, which can be either clear or unclear both when these norms are observed and when they are not. In the second place, the manager is responsible for the work "not of a "strictly determined group of people," but all the workers under his jurisdiction. And the norm of controllability determines the number of workers (subdivisions) who can be directly and effectively under the jurisdiction of one manager in keeping with organizational and technical conditions. It can explain the success or failure of a manager, but it can hardly be construed in the sense of "a strictly determined group of people who are under his jurisdiction. The practice of leading enterprises shows that the managers are directly responsible for 5-7 and sometimes 12-15 workers.

The concept of "Record-keeping" is interpreted imprecisely. The functions of record-keeping do not include "the utilization of documentary information" and registration and accounting for documents are the same thing. The definition

given in this dictionary differs essentially from those contained in the books "Record-Keeping and Archive Work. Terms and Definitions," "Basic Provisions of the Unified State System of Record-Keeping" and "Dictionary of Modern Archive Terminology of the Socialist Countries" (Moscow, Glavarkhiv SSSR, 1982).

From the entry entitled "Orders" one could draw the conclusion that this document is published by all institutions, organizations and enterprises. Yet according to existing legislation and the practice that has come into being, orders are issued only by the USSR Council of Ministers, and also the councils of ministers of the union and autonomous republics, ispolkoms of local soviets of people's deputies (this is mentioned in the dictionary) and officials of enterprises and production associations (this is not mentioned). Officials of institutions and organizations do not issue orders (this important detail is also lacking in the dictionary).

The concept of "Collegiality" is interpreted as "joint performance of managerial functions by the collective agency." It would be more precise to say that this is a principle of management whereby decisions are made by a group of people. And the functions are mainly carried out on the basis of one-man management.

It is also necessary to refine the idea contained in the entry entitled "Board": "being a representative of the board, the minister has a right to insist on his personal decision which may not coincide with the decisions of the board." But can the board make a decision that does not coincide with the opinion of the chairman? Or can it only make a decision which is approved by the chairman?...

Among administrative workers it is accepted to separate managers, specialists and technical workers. The compilers gave the item "Economic Managers" and did not even mention the other two categories. Moreover, the concept of "economic manager" is not clearly explained. What categories of workers are included among economic managers? The minister, the director, the chief, the manager, and so forth. But the brigade leader, the foreman, the deputy head bookkeeper, the brigade leader in a planning institute, the senior typist, who is in charge of the messenger typist and expeditor, the senior personnel engineer in the organization where there is not personnel division, the head physician of a sanatorium, the deputy director for scientific work! The following question is also unclear: are the concepts "manager" and "economic manager" identical? If so, then this should be clearly stated. If not, it would be expedient to explain the differences between them. Obviously, one should indicate the overall criteria that make it possible to include workers among managers in general or among economic managers in particular.

From the multitude of public structural subdivisions at enterprises, associations and organizations (public design bureaus, bureaus for economic analysis and so forth) it gives only the public personnel division. Incidentally, it is only mentioned in the item entitled "Participation of Workers in Management." It would probably be expedient to include it also in the item entitled "Public Subdivisions in the Management Staff."

There is no uniformity in the distribution of the items, which makes it difficult to find information. For example, "Labor Agreement" and "Economic Agreement" are included under the letter A, but "Collective Agreement" must be found under the letter C. One of the items is called "Social Planning of the Development of the Collective." It would be more correct to say "Planning the Social Development of the Collective."

In the alphabetical index it gives the item "Thriftiness." But here is its text: "thriftiness--see regimen of economy." But attempts to find an explanation of this term in the dictionary are in vein. It is not there.

The large size of the edition (100,000 copies), the popular presentation and the capacious title ("Dictionary," and not, say, "Brief Dictionary") give the reader the right to hope to find generally accepted terms in it. But these hopes are not always justified. It lacks such important concepts as economic mechanism, organizational structure of management, final results, comprehensive approach, product quality, administrative staff, administrative labor, team organization in management, control of performance, job instructions, norm of manageability, organizational planning, hierarchy, centralization, decentralization, target program management and many others.

At the same time the dictionary is overloaded with terms which even in the broadest interpretation of management are very remotely related to it and are used fairly rarely. We are thinking about the concepts: "Automated System of Planning," "Package of Applied Programs," "Counteragent," "Rebate," "Fixed Rent Payment," "Mathematical Statistics," "Consolidated Financial Balance," "Increments to Prices," "Element Base for Electronic Computer," and so forth. Compiling the list of words is a separate matter. It would be good to discuss the lists of concepts to be included in the dictionary preliminarily, before the dictionary is written.

Any manager would be glad to have on his desk a good dictionary on management of the national economy. When the book under consideration is republished it will be necessary to eliminate the more glaring shortcomings. A good dictionary should be good in terms of all items.

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IMPORTANCE OF GOOD HEALTH STRESSED

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA (EKO) in Russian No 3, Mar 85 pp 213-218

[Article by N. N. Dombrovskiy, biologist (Alma-Ata) and M. N. Levina, journalist (Novosibirsk): "When We Have Very Little Time." Continuation. For beginning see EKO No 2, 1985]

[Text] What the Scales Do Not Tell Us

The best indicator of the results of your work is your external appearance and its reflection in the mirror. In order to determine what condition you are in it is necessary to introduce a new standard: the size of the waist for men and the thickness of the fat layer for women. For men one can suggest a table of comparison of weight with the waist size: it is necessary to draw a line between the figures reflecting your weight and the size of your waist. If the line drops downwards you are getting fat, and a horizontal or a line that goes upwards means that everything is in order. The structure of the male body is fairly standard and the fat layer on it is distributed in almost the same places in various men.

Kg	Cm	Kg	Cm
45	76	81	91
49.5	78	85.5	91
54	81	90	94
58.5	81	94.5	97
63	84	99	97
67.5	86	103.5	99
73	86	108	102
76.5	89	112.5	102

Women have been created more individually. For them the authors suggest another measure of normal distribution of the fat layer: "The pinch per inch." A layer of fat about 2 centimeters thick in a woman means that her body contains approximately 18 kilograms of fat. This is the norm for the majority of adult women. Every extra half-centimeter in the layer of skin corresponds to 4.5 kilograms of excess fat. If you discover that you have extra half-

centimeters it is better to listen to the advice of Morehouse and Gross and work a little bit.

Fasting is also a reliable means of losing weight if your body can withstand this. Certain people find it easy to switch to water and, without any harm to their health, stay on this regimen for a day or two. Others can hardly go for 12 hours without eating.

Any weight loss program should combine physical activity with limited food intake. So long as these limitations are not significant, no problems arise. But if you completely refrain from any constituent part of your ordinary diet, you might get in trouble. Any diet which uses the organism's protein as fuel is destructive. In order to maintain the organism in normal condition it is necessary only to regulate food intake and increase activity. To do this the authors suggest:

An Extensive and Varied Diet

"Avoidance" diets are for patients who are suffering from various kinds of food allergies. The authors categorically reject the currently fashionable theory of mononutrition and suggest extensive diversity in everything.

"If you like beef, eat beef. Eat everything you want," suggests Dr Morehouse. Variety of nutrition means full-value nutrition: proteins, fats, carbohydrates plus trace elements and vitamins.

Purified carbohydrates--white sugar, flour--are quickly transformed into fat if their consumption exceeds the expenditure of energy. Cholesterol in the blood vessels is a consequence of excessive sugar in the diet, and not of excess fats as was previously thought. The notion that the tissues of our body depend directly on the food we eat, in the authors' opinion, is a fairly widespread error. Beef is not so much protein as it is carbohydrates that are synthesized in the bodies of the animals in proteins. In our body the process of synthesis can do wonders and when we absorb beef we acquire carbohydrates and protein with equal success.

Instead of swallowing vitamin tables or taking powders that contain trace elements it is better to obtain varied food which provides all the necessary substances. Our organism itself can prepare carbohydrates from proteins or fats, proteins from fats and carbohydrates, and fats from carbohydrates and proteins. It is important to learn to eat no more than is necessary. For those who have become accustomed to eating strictly on schedule, it is fairly difficult to get through the customary mealtime. It will seem to you that you are fatally hungry. In fact this is nothing more than a syndrome. You do not really need to eat any more, but you have become accustomed to eating at this time. Try changing the daily rhythm somewhat, do not be slaves to your schedule and you will begin to eat only when you actually want to. To keep to a schedule too seriously is an unhealthy habit which has been instilled in you for too long for you to get rid of it easily. There is no need to devote your life to the restrictions, but do not forget to stop your whims promptly. If you are expecting to have an elegant dinner and have been warned about this beforehand, breakfast should be very light. But on an ordinary day you can

have as much breakfast as you want so that you will not feel hungry all day long. An old rule: eat all your breakfast yourself, share lunch with someone, and give your supper to an enemy--this would be the optimal regimen for nutrition throughout the day.

The best diet is a wide variety of food in quantities necessary for regulating the weight of the body.

In Order To Be Thinner, One Must Gain Weight

Dr Morehouse gives this paradoxical advice to everyone who wants to become fit under his system. Taking into account the psychological notion of his patients that a new life must be started on Monday, he advises them to eat properly before Monday. The first 2 weeks of the fitness program are the most difficult and therefore he recommends beginning with a fairly easy diet. Forced restraint, as a rule, ends up in excesses, and this is not a part of the fitness program. Moreover, fasting does not eliminate so much fat as it does water. Most frequently such fasts end with the patient returning fairly rapidly to his initial weight and becoming firmly convinced that his efforts have been in vain.

When you begin the program set the pointer on the scale to zero, fasten its regulating screw with a bandaid and do not touch it until you have completed the entire program. When you stand on the scales do not look at the dial until you find a convenient balance or else you will automatically try to find a position in which the arrow on the scale shows the least weight.... Weigh before breakfast and after taking care of natural necessities. And now select the weight that you would like to have. The goal should be realistic and not fantastic. Try to remember the years in which you looked best and what your weight was then.

And now take a piece of graph paper and in the upper left-hand corner right your starting weight. Place a big fat period after this. Each square on the graph paper is equivalent to 200 grams (along the left side). In every other square we write the corresponding figure of the declining parameters. On the lower edge of the sheet, beginning with the first day of training, number the days since the beginning of the fitness program, a square for each along the entire width. Now return to the upper left-hand corner and count off seven squares from left to right, beginning with the initial weight. In the seventh horizontal square drop two squares down and put a period there. On the 14th and 21st squares it is necessary to drop down two squares again. Joint the upper left-hand corner with the third point of the line which is going through the other two points. This will be the program for controlling weight during the first 3 weeks. Until you have achieved the desired weight you must lose a half-kilo per week. You will have as many 3-week schedules and as many weeks as you need in order to achieve the desired weight.

Every day before breakfast you will weigh yourself and mark your weight on the graph. If it is above the line this is bad, and if it is on the line it is fine. If the indicator is lower than the line, on that day you can allow yourself to eat as much as you want so as to be on the line the next day. And if you are above the line you must reduce your food intake and add physical

exercise. You should not be in a constant battle with yourself, the program is fairly tolerant of small violations which cannot be avoided. It is always possible to make up for what has been lost. As in any regimen, the individual schedule will suggest to you how best to this. If you force success and in a couple of days drop below the line, allow yourself a portion of ice cream. Your task is to be on the line. A half-kilo a week is not too burdensome, it is quite feasible and it is extremely noticeable.

You decide for yourself what to eat and what not to eat when after a week you can clearly see what changes on the graph are made by one ration or another.

Consider the following list:

Portions of Food Per 100 Calories	Minutes of Various Kinds of Activity in Order to Assimilate 100 Calories
1 cup of coffee with milk	7 minutes--running for 1.5 km (5-10 km/hour)
3/4 cup of hot cereal	9 minutes--bicycle riding for 3 km (20 km/ hour)
2 tsp sugar	9 minutes--swimming for 360 meters (40 meters/minute)
1 fried egg	10 minutes--snow skiing
150 grams of milk	14 minutes--tennis
3 grams cheese	20 minutes--work in the garden
1/2 bowl vegetable soup	20 minutes--walking for 1.5 km (3-7 km/hour)
250 grams weak wine	30 minutes--bathe, shave, etc.

In order to process 100 calories it is necessary to have a fairly large amount of some single exercise. But one exercise performed for a long period of time for a particular purpose causes depression, which reduces the effect. The authors suggest more effective means of metabolizing the fat cells into muscle tissue.

Exercises According to the Pulse

All known programs are concentrated on results. Dr Morehouse singles out the physiological effect of what we do. This is the fundamental difference. If we have become accustomed to running a certain distance for a certain amount of time, according to the Morehouse program, both the distance and the rate of the run should be determined according to the number of contractions of the heart. It is very important to distinguish physical activity as an object of physical culture and physical activity as a kind of sport. From the medical standpoint monitoring the effectiveness of exercises according to the pulse has an indisputable advantage over other kinds of monitoring.

In the middle of the 1960s in San Francisco Bay physiologists studied the energy expenditures in the work of dock workers and longshoremen. According

to the rules, this research was conducted in a laboratory utilizing scientific instruments. Since it was not possible to conduct research for the entire program in the port, it was suggested that the number of pulse beats be used to calculate the load with various assignments. As a result, a recommendation was made: when the physical load increases the number of heart contractions to 150 beats per minute, the loaders can work stably for no more than a half hour. But if the pulse is kept at the level of 120 beats per minute, they can work calmly for more than an hour without harm to their health.

Participation in drawing up the specialized program for the American astronauts convinced Dr Morehouse of the idea that selecting the load according to the pulse is the correct way to maintain endurance and physical fitness. The next step in the introduction of the new program was an attack on "killer No 1"--coronary heart disease. It turned out that the method of maintaining the health and physical fitness program proposed for the astronauts was quite acceptable for preventive purposes as well.

Our needs for exertion are different from those needed by the astronauts, but the principle for calculating the load remains the same. And so if you need to reach 130 heartbeats in 5 minutes you will always expend the same amount of effort on this exercise. If you are tired you will have to work less, and when you train you will have to work more to achieve the same level. For the physiologist the concepts of "effort" and "work" are not the same. Effort is energy which you expend. Work is the physical action that is accomplished by the effort. Physiological effort is man's reaction during the time of physical activity. The main thing is not the physical results, but the expended effort.

(Continuation follows)

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IMPORTANCE OF LISTENING STRESSED

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA (EKO) in Russian No 3, Mar 85 pp 219-221

[Article by V. Roshchakhovskiy: "The Ability To Listen"]

[Text] Psychologists think that many of us are not able to listen to (and hear!) what others are telling us. Even when we do not interrupt the person who is speaking and when we look at him, much of what he says "passes us by." And this is mainly because at this moment our thoughts are wandering very far. This leads to unpleasantness, and sometimes to catastrophic consequences. Friendly relations and even families are destroyed, and managers are given a bad opinion of their subordinates, and the subordinates get a bad opinion of their managers. When the reasons for this situation are clarified it turns out that we forgotten how (or never knew how?) to listen attentively, to understand the problems of others, and to consider their difficulties. Is this really unfamiliar to you: you begin to discuss an issue which bothers you and the other person interrupts you in the middle of a sentence and continues a long recounting of an analogous (but also extremely remote) instance which he himself experienced. Or you see in the eyes of the person to whom you are confessing your problem such boredom and indifference that any desire to continue a sincere conversation fades away.

The ability to be attentive to the words of others is of primary importance in human communal living. The statistics of several countries have been calculated: of the time necessary to communicate with others at work and at home we spend 9 percent writing, 16 percent reading, 30 percent speaking and 45 percent listening (or rather: we should be listening).

But how can each of us listen--at work, at home, in the company of friends--in an unexpected situation?

Various periodicals and also psychologists have produced many tests in order to determine the ability to listen. This ability has been evaluated according to a 100-point scale--from 0 to 100. The evaluation was made not taking into account some abstract individual in the role of the interlocutor, but with quite specific individuals. The boss, a subordinate, the wife (husband), good friend, colleague, randomly encountered individual.

What were the conclusions?

The majority of people think that the best interlocutor is a close friend (woman friend). This is apparently explained by the fact that the friendship itself originated on the basis of the ability to listen to one another, to relate with sincere interest and participation in the problems of the comrade. Many are inclined to think that the best listeners also include the majority of subordinates in a conversation with a higher official. This can also be explained by the fact that here not the least important is the desire to understand the official immediately in order not to appear stupid in his eyes.

By combining, classifying and analyzing the results of the tests the organizers came to the conclusion that the "average points" of listeners are estimated at 55. It was noted incidentally that in family life this "average point" is always lower and as years pass becomes lower and lower. And frequently many men acquire the habit of listening to the wife without hearing her. One cannot say that the women are not guilty of this too--their excessive involvement in nagging and repetition of the same information creates in their partner something like a protective immunity.

In order to determine your ability to ~~listen~~ we are suggesting a test which was drawn up on the basis of analogous tests published in the foreign press.

To the 10 questions you should give answers which are evaluated:

"Almost always"--2 points,
"In the majority of cases"--4 points,
"Sometimes"--6 points,
"Rarely"--8 points,
"Almost never"--10 points.

1. Do you try to "change" the topic in most cases when the conversation (or the person with whom you were speaking) is not interesting to you?
2. Do the manners of your interlocutor irritate you?
3. Can an unsuccessful expression on the part of your interlocutor provoke you to sharpness or rudeness?
4. Do you avoid getting into a conversation with someone you do not know or with whom you are not very familiar?
5. Do you have the habit of interrupting your interlocutor?
6. Do you give the appearance that you are listening attentively when in fact you are thinking about something else?
7. Do you change your tone, voice and the expression on your face depending on the person with whom you are talking?
8. Do you change the subject if the interlocutor touches upon something that is unpleasant to you?

9. Do you correct your interlocutor if in his speech there are incorrectly pronounced words, names or vulgarisms?

10. Do you have a condescending attitude with a tinge of scorn and irony toward the person with whom you were talking?

It would not be out of place to remember the precise answer you receive when trying to answer all questions as sincerely as possible.

If your total is more than 62, you are a listener "above the average level." In other words, the more points you have the more developed is your ability to listen.

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