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Translation

SOVIET SCIENCE AND TECHNOLOGY POLICY

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SOVIET SCIENCE AND TECHNOLOGY POLICY

This non-serial report contains selected translations of Russian articles on the planning and administration of Soviet research and development and the introduction of scientific achievements into industry.

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Moscow VESTNIK AKADEMII NAUK SSSR in Russian No 5, 1980 pp 6-12, 110

[Remarks by Academician A. P. Aleksandrov, president of the USSR Academy of Sciences, to the General Assembly of the USSR Academy of Sciences: "Opening Remarks by the President of the USSR Academy of Sciences, Academician A. P. Aleksandrov" and "Closing Remarks by Academician A. P. Aleksandrov"]

Opening Remarks

[Text] Before opening the General Assembly, I would like to say that this is not our usual fall General Assembly where we discuss scientific and internal academy matters primarily. This meeting will be wholly directed toward the examination of the tasks of the Academy of Sciences in connection with the decisions that have been made on improving planning and strengthening the influence of the economic mechanism on increasing production efficiency and work quality. You are acquainted with the materials of the November (1979) Plenum of the CPSU Central Committee and with the speech to the Plenum by the General Secretary of the CPSU Central Committee and Chairman of the Presidium of the USSR Supreme Soviet, Comrade Leonid Il'ich Brezhnev, in which the positive aspects and existing shortcomings in the development of our economy were examined in great detail and with great care.

You are acquainted also with the decrees of the CPSU Central Committee and USSR Council of Ministers directed toward increasing the effectiveness of production.

In essence, the Academy of Sciences has received an assignment from the Central Committee of the party and from our government to join in the work of improving planning and strengthening the influence of the economic mechanism on production efficiency.

During the last five-year plan and the period after the 25th CPSU Congress, our economy developed steadily and intensively. Now our country has achieved first place in the world in many areas, setting the pace. For example, our output of steel has reached 150 million tons a year; this is significantly greater than in the United States of America. In a number of other key areas our country has also occupied outstanding positions. We produce more chemical fertilizers and cement than anyone. It would seem that in the basic areas that determine the pace of economic development, we are well off. Nevertheless, we keep feeling shortages of ferrous metals, cement, fertilizers, and a number of other types of industrial products.

On the one hand, this is related to the high rates of growth we are planning. But inevitably they must be high and they must grow: our social system provides such a possibility. On the other hand, turning our attention to chief areas, to the volume of products being manufactured, our planning bodies and, I would say, our science is insufficiently concerned about providing the economy with the kind of structure under which both raw materials and the products of industry and agriculture can be utilized with maximum effectiveness. The lack of effectiveness in utilizing raw materials and industrial products and great wastes in the economy are related to the fact that we have given too little attention to the policy of economical expenditure of energy resources, mineral resources, and, in general, all types of raw materials as well as agricultural products.

Here essential changes are required and, to bring about these essential changes, it is imperative that scientific organizations be actively included in the work on increasing labor effectiveness in our industry and agriculture.

A year ago the USSR Academy of Sciences together with the Academy of Agricultural Sciences, the USSR Ministry of Agriculture and other ministries and agencies conducted a special session devoted to agriculture. It must be stated that this session brought significant positive results: a large amount of work is being done on the corresponding programs. It will be possible to become acquainted with these results later in more detail. The present session of the General Assembly of the Academy of Sciences is directed toward more precisely determing the sensitive places in the economy where it is necessary to correct the proportions, to improve technology, and to direct industrial efforts toward the production of necessary quantities of those materials that will help raise the quality of basic industrial products. These are, for example, alloy materials for metallurgy, means for protecting metals and structures from corrosion, and so forth. Such is the task of this session of the General Assembly.

It would be very good if we could hear from members of our academy who cooperate closely with the various branches of the economy. In my introductory remarks I will try to provoke some of our comrades to speak.

I will speak about a situation that sometimes takes place in industry and I will show this in an example from ferrous metallurgy.

I have already stated that although we have an enormous production of steel we do not use it effectively enough. Why? First of all, because of direct loss from corrosion, which constitutes annually about 15 million tons of steel. This huge loss is caused by insufficient protection of steel from corrosive processes in salt water, in air environment, and in other types of hostile environments. If we add indirect losses, their total level almost doubles; that is, about 20 percent of the steel we produce we lose just because of corrosive processes. By applying measures for lowering corrosion loss, without any especially large expenditures, we could lower this figure from 15 to 5 million tons. This would be very substantial, because the deficit in ferrous metals is now about 10 million tons.

The shortness of service life of steel structures and machines because of corrosion, naturally, not only requires the increase in the scale of production of steel, structures, and machines, but also correspondingly increases the burden on machine building capacities, steel smelting and rolling equipment, and moreover it substantially increases the expenditures of fuel.

It is necessary to develop means on a broad scale which rationalize the utilization of metal and which increase the service life of metal goods. We are speaking not only of protection from corrosion, but also of improving the wear resistance, the heat resistance, and other characteristics on which depends the service life of machines, mechanisms, and structures. Are there such means? Yes, they are well known. This is continually being discussed at various types of conventions and meetings. The main thing is that we have the capabilities in our hands for their realization, and with the aid of comparatively small expenses.

The Academy of Sciences was included in the project for developing powder metallurgy for the protection of metals from corrosion, for increasing machine resources, for protection from corrosive cracking, for increasing wear and heat resistance, and so forth. The application of these means fully will have great significance. Powder coverings can protect structures for 20 to 25 years and expand machine resources by a factor of from 2 to 5. Of course, we are speaking of prolonging machine resources and structures to their optimum length of life, that is, to obsolescence.

In our machine building, the majority of machines are less than optimum in number, so here is a large field for activity. Prolonging their service life will not only increase the effectiveness of metal utilization, but will also lead to great savings in expenditures for the development of the machine-building sector. Increasing the service life of machines by a factor of from 3 to 5 would be the equivalent of increasing machine-building capacity by the same amount.

Activity by the Academy of Sciences in this direction has still not brought about satisfactory real results, but they are contemplated. May I give you an example: in a number of fields, developments by the Academy of Sciences, ministerial institutes, and, basically, the "Tulachermet" association closely tied to them, where this effort is directed by Corresponding Member A. I. Manokhim of the USSR Academy of Sciences, are providing substantial results. The application of protective coverings have yielded an increase in work life of such vulnerable structures as nozzles and loading devices for blast furnaces. Coverings for pipes in the fire zone of steam boilers has led to a resource increase of a factor of from 2 to 4, and this has not only led to a saving in metal but has also decreased the down-time of equipment and electric stations. This was also demonstrated in the protection from corrosion of components of looms working in an acid environment and in a number of other fields. In experimental procedures, good results have been achieved by applying coverings for increased service life to heavy trucks working in quarries.

Thus, this work is progressing. Now, in Belorussia, in Minsk, through our understanding with the Ministry of Higher and Secondary Specialized Education of the republic (which I consider very important), joint work in powder technology is also developing. In this, we are trying to create an interagency organization which would introduce all of these new methods into all branches of industry. Through the understanding with this republic ministry, the following collective is being formed: the Institute of Problems of Machine Reliability and Longevity of the Belorussian Academy of Sciences, the Physico-Technical Institute of the Belorussian Academy of Sciences, and the Institute for Powder Metallurgy of the republic Ministry of Higher and Secondary Specialized Education, which was organized on the basis of the laboratory for powder metallurgy of the Minsk Polytechnical Institute. This is a rather powerful organization which has already begun its operation and which has attracted the attention of party and Soviet management in Belorussia. This has decisive significance.

A special trip to Tula was organized for familiarization with various aspects of this work (I was a participant in the trip). The following individuals traveled to Tula: P. M. Masherov, candidate member of the Politburo of the CPSU Central Committee and first secretary of the Belorussian Communist Party Central Committee; A. N. Aksenov, chairman of the Belorussian Council of Ministers; N. A. Borisevich, president of the Belorussian Academy of Sciences; secretaries of the Belorussian Communist Party Central Committee; and a representative of Gosplan. These individuals became acquainted with the projects first hand and evaluated their significance for the development of industry and for raising the quality of production. I hope that this will lead to rapid development of powder technology in Belorussia.

A large amount of work in this direction has developed in the Ukraine. The institute directed by Academician V. I. Trefilov of the Ukrainian Academy of Sciences is conducting work on the technology of making powers and preparing pressed articles from them. But for the application of powders for surface alloying and for the creation of the necessary apparatus, work is being conducted at the institute headed by Academician B. Ye. Paton. This work, apparently, is developing satisfactorily; it is in good hands.

Analagous work has begun to develop in the Siberian Department of the USSR Academy of Sciences. I was there a few days ago. Together with Academician G. I. Marshak I came to the opinion that in the Siberian Department these projects have reached a relatively high tempo and here we are finding the right path.

Projects have begun in Sverdlovsk, where they are headed by our Institute of the Physics of Metals. Of course, the scale of these projects is still not commensurable with industrial projects, but nevertheless a rather large specialized laboratory is already operating there and, evidently, the operation will be developing.

It has been decided to organize the production of iron powders and high-quality iron and alloy powders for which electric energy from atomic electric stations will be utilized. We have ores of unusually high quality, and the super-concentration of this ore has been attempted in the production of powders. The powders made have been of a high grade, which today our industry has still not achieved and which we buy only in small quantities from abroad. The construction of a nuclear-metallurgical combine will be the harbinger of the direct utilization of nuclear energy in technology.

The solution of the task of increasing the service of life of machines and structures by a factor of 2 to 5 is the fundamental task of metallurgy and machine building, and it is the duty of the academy to participate in its solution.

I shall speak of another example in the field of ferrous metallurgy. Twenty-five years ago our scientists and metallurgical engineers developed the means for continuous steel casting. This was a way to conserve metal. If casting is not conducted by the continuous casting method, and the stock is poured off, it is then necessary to cast significantly more metal because the upper part of the casting is porous, with shrinkage cavities, and it must be cut off; and this is about a quarter of the weight of the casting. This metal is immediately put back into the cycle again. Consequently, it is necessary to consume fuel for re-heating. Continuous casting is the correct idea, for it shortens the internal cycle of the metal, and as it saves an appreciable quantity of fuel, it is naturally an advantage from the energy standpoint.

But what has happened? In due course, this capability of ours was highly valued and the decision was adopted that all new metallurgical enterprises were obligated to create plants for continuous casting. Various modifications of such plants were developed. Now, in the USSR, at all new enterprises systems have been created for continuous steel casting. And still we cast only 10 percent of the steel by this method. Foreign firms bought licenses from us for this process, and now various countries and firms make from 20 to 60 percent of their steel by the continuous casting method. But we make 10 percent. Even though we proposed this process.

Now, new variants of this process have been developed which permit its organization at operating enterprises with relatively minor expense. Of course, this technology must be introduced rapidly; it will aid the rational expenditure of metal and the saving of fuel.

And still on the subject of ferrous metallurgy. This is addressed not to technical people, but to economists. This is the fact that ferrous metallurgy does not produce at all the broad assortment of rolled metal that it ought to produce. Press equipment permits the preparation of components by methods that are practically waste-free or involve little waste. Meanwhile, the existing structure of shop equipment leads to the loss of about 8 million tons of metal a year in shavings. This is about a fourth of the metal being used by machine-building sectors of the economy.

It is the academy organizations that should have done thorough economic analysis to achieve a change in the structure of the machine tool stock in operation, thereby helping to reduce the expenditure of fuel and to eliminate unnecessary reprocessing of metal.

Finally, it would probably be correct for the Academy of Sciences and its economic institutes to examine in a more complex fashion the problems of metal supply for the whole country, after determining the rational balance of nonferrous metals and plastics, and also the problems of rational geographical distribution of capacities.

Our machines and structures are often too heavy: we still use welded construction relatively little in place of casting, although in the technology of welding, thanks to B. Ye Paton, we occupy an advanced place in the world. We little use heat-strengthened metal, and this again leads to overexpenditure.

Rationalization in this field is an extremely important matter for our country. I would be very grateful to Academician A. I. Tselikov if he would speak here. It would also be very good to hear from the director of "Tulachermet" and director of our Institute of Metallurgy, Corresponding Member of the USSR Academy of Scicnes, A. I. Manokhin. They are making a large contribution to the improvement of the metallurgical industry.

Now, I will turn to other problems, the solution of which also depends on us to a significant degree.

You know--and this was noted at the session of the General Assembly devoted to problems in the development of agriculture--that, although we produce the largest quantity of mineral fertilizers in the world, we pay little attention to the growth in output of herbicides and other means of plant protection. This leads to the result that the volume of labor in our agriculture is not being reduced at the needed rate, and the effectiveness of fertilizers is being reduced because of their consumption by weeds.

The production of means for plant protection should equal from 5 to 10 percent of the quantity of fertilizers. It is natural that the industry is occupied with the production of such an enormous quantity of fertilizers, for that is where the basic capital investment goes. Production of the means for plant protection--with little prestige--receives insufficient attention, and because of this, much fertilizer is expended for naught. It would be interesting to hear the opinion on this subject from the leading specialist in the field of agricultural chemicalization, Academician S. I. Vol'fkovich.

We have other areas of little prestige that sometimes remain outside the bounds of interest of agencies and outside the bounds of Gosplan's attention. For example, medicines. In many instances we buy medicines from abroad, and this is completely unjustified, because the level of development of the corresponding fields of chemistry and microbiology is substantially higher here than in those countries from whom we buy the medicines. It is the same way with reagents, means for analysis, and other products of small-quantity production.

Such types of problems require much attention from the Academy of Sciences. Explanation of the significance of these problems and assistance in organizing corresponding plants and in assimilating progressive technology, it seems to me, can lead to our making substantial contribution to the development of our economy and to the improvement of its structure.

Now I would like to turn your attention to certain aspects of the program for developing the productive forces of Siberia that were proposed by USSR Gosplan to the Siberian Department of the USSR Academy of Sciences.

This program is very interesting and has improtant significance. However, it seems to me that the Academy, not only the Siberian Department but the Academy as a whole, and the Academy of Agricultural Sciences still have not determined the ways to solve some of the most important tasks. There is the opinion that to increase the productivity of Siberian agriculture we must increase the area under cultivation. Without denying the important significance of increasing the area under cultivation, it is evident that, first of all, we ought to try to increase the production of agricultural products per hectare of land already under cultivation; this is significantly more achievable. The harvest of grains in Siberia is now around 1,100 kilograms per hectare. Land in the cultivated areas of Siberia are roughly similar to those in the Baltic Area and Belorussia. Some time ago in Belorussia the yield also was 900 to 1,100 kilograms per hectare. Party organs of the republic gave a large amount of attention to agriculture and just in the last 10 years the yield in the Belorussian SSR has been raised to 27,600 kilograms per hectare, that is, almost to the level of the Baltic Area and the Ukraine.

Such a solution is also possible in Siberia--there, already, there are a number of farms where steady yields up to 30,000 kilograms per hectare are achieved and, according to initial data, these farms are not particularly outstanding either in land or in work force. In them, the administration is civilized and responsible; in them, there is excellent self-discipline and there are few losses. It is a matter of people, of self-discipline, and conscientious work!

Should we not, while increasing the area of cultivation, turn special attention to raising output per hectare and to diffusing the experience of the best farms? This could have great economic significance. The example of Belorussia is before our eyes. And here the opinion of the Academy of Sciences, of economists, is important: which variant to implement, where and how much investment is needed, and not some time in the future, but right in the coming five-year plan. The time is now coming to make these proposals.

The second problem on Siberia is that there is a sharp lack of protein in the feed balance. There are two possible ways to solve this task. One alternative is to increase the production of plant proteins, but this requires planting legumes and soy, and these can be grown well only in Amurskaya Oblast and in the southern part of Krasnoyarskiy Kray--these are the two regions where good yields can be counted on. The other alternative is to develop the production of microbiological proteins by utilizing methane from local natural gas; now, in the institute headed by Academician G. K. Skryabin, jointly with the microbiological industry, such technology has been developed. This would be a rational utilization of gas near the place of extraction as, for example, in Tomskaya Oblast. Now, good outputs of protein are being achieved from methane. But microbiological protein can be achieved not only from methane, but also from methanol or from ethyl spirits which, in turn, can be obtained from natural gas, condensate, or from wood wastes that are now uselessly burned in wood cutting areas. This problem also must be solved on the basis of economic analysis. Such analysis up to now has not been done. It is necessary to do it and I call Siberian economists' attention to it.

You well understand that we have rather a large number of such problems and I consider that the Academy of Sciences, through careful development, must influence the decisions of Gosplan and make corresponding proposals to the USSR Council of Ministers and to the CPSU Central Committee, the better to promote increased effectiveness of our economy.

I shall speak of still another matter that much disturbs me. At one time, on the basis of developments by the Leningrad Physico-Technical Institute and the All-union Electrotechnical Institute, proposals were made for a direct current transmission line. This electric transmission line was already well proven and has a large experimental background. Since these proposals were made, the Ministry of Power and Electrification and the Ministry of Power Machine Building have conducted further improvements in the transformer equipment which have reduced losses and have lowered the cost of such lines.

The direct current electric transmission line from Ekibastuz to Moscow should have been constructed, but its construction was delayed for reasons that are not understood. No means whatsoever were allotted to it. And now attempts are being made to find a way out of the situation by forming shorter segments of alternating current line. But there is a strong need for introducing a direct current line into our energy system: it would substantially increase the stability of the whole energy system. This is precisely the significance that the Ekibastuz-Moscow direct current line had. It was looked upon as the first line for obtaining large-scale engineering experience so that it could be further disseminated to an electric transmission line in the Kansk-Achinsk Basin. This is a serious matter and, if we put off the construction of a direct current line now, we will fall into a rather serious situation in the future. It is very important that Comrade L. I. Brezhnev, at the November (1979) Plenum of the CPSU Central Committee, called attention to the intolerable delay in implementing the decision on the construction of this line. It seems to me that the Academy of Sciences must take this firm position. It would be good if Academician V. M. Tuchkevich, director of the Leningrad Physico-Technical Institute, would address this issue.

I have touched on only a few of the large number of problems, but you can well imagine that they do not cover the fields in which our economy awaits assistance from the Academy of Sciences. I would ask that all departments of the Academy, the affiliates, and the republic academies strengthen work directed toward aiding industry and the whole economy. It is especially important to hasten the development of those fields in which our science and industry are excessively dependent on supplies from abroad. I can absolutely decisively state that there is no field of science, engineering, or technology which we are not capable of developing ourselves at a fully modern level. And the solution of this is the important and noble task of all scientific collectives.

It would be very desirable if our comrades that are concerned with topics or other branches of industry, and especially economists, would speak here so that we could more fully formulate the decisions of the meeting.

Permit me to open this session of the General Assembly.

Closing Remarks

It seems to me that our meeting has been very interesting. Many important considerations and practical proposals were stated and, particularly, in my opinion, the thought was very important on the necessity for strengthening the utilization of economic levers for improving the structure and raising the effectiveness of our economy. This is one of the chief tasks that was well and clearly formulated.

The exchange of opinions showed that we have real and achievable possibilities for substantially aiding our economy and raising its effectiveness. And I call upon those who have made one or another proposal here, and our departments and institutes, to give special attention to this and to prepare programs for the realization of their proposals. By the way, it seems to me that work in one or another field of science is the responsibility not only of academician-secretaries of departments but of all Academy members, because the people chosen to be members of the Academy are precisely the leading scientists in definite fields of science. Therefore, I ask that all members of the Academy actively join in the development of these programs.

Until now, the world economy and world economics in general have not felt shortages of raw material resources. In any event, if this danger did arise somewhere, it was not decisive and only in some particular instances did it put any pressure on economics and politics in some or another direction. Now, for the first time, the most powerful Western countries have fallen into a very heavy general energy crisis. National reserves of many types of raw materials have become very limited in industrially advanced countries. In general, a very tense economic situation has come about, which could lead to all sorts of excesses and to any kind of attempt to control sources of energy resources and raw materials. At the same time, our country finds itself in a favorable position: we have sufficient resources of our own.

As a result of the energy crisis now throughout the world, the tempo of economic development is retarding, but we do not need to allow such retardation of tempo in our country's development. We have no basis for retardation. We need relatively uncomplicated organizational measures to increase the tempo of development, and we scientists to a great degree are responsible to see that measures be proposed for the economy that are more economical and more achievable in form. I ask our institutions not to lose time but to concentrate all their efforts on this direction as responsibly as possible.

We must prepare concrete, economically weighed programs which, jointly with the State Committee for Science and Technology, we will need to bring about as rapidly as possible.

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PATON REPORT TO ACADEMY OF SCIENCES' MEETING ON ECONOMY

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[Report by Academician B. Ye. Paton, president of the Ukrainian Academy of Sciences, to the General Assembly of the USSR Academy of Sciences: "Science and Production"]

[Text] The 25th CPSU Congress designated the all-out hastening of scientific and technical progress as one of the central problems of the Soviet economy at the present stage of development. It is here that great potential lies for increasing the effectiveness of civil production and quality of work in all of the sectors of communist construction.

The decree of the CPSU Central Committee and the USSR Council of Ministers "On Improving Planning and Strengthening the Influence of the Economic Mechanism on Increasing Production Efficiency and Work Quality," enacted in fulfillment of the decisions of the Congress, orients the workers of science toward accelerated realization in the economy of scientific and technical discoveries and developments that are directed toward raising the growth rate of labor productivity and quality of products.

The solution of these tasks is inseparably linked with the broadening and deepening, first of all, of fundamental research, along with the further development of applied research, and also experimental, planning, and design work.

It is fundamental research that establishes the scientific base for technical progress, for advancement forward along the entire front of science, and for raising production to a new qualitative level. It is therefore understandable that the party has given so much attention to the development of such research.

The whole history of the development of science convincingly demonstrates that the most revolutionary changes in engineering, technology, and economics takes place on the basis of fundamental research. This research shows the way for practical exploitation of the most profound and general laws of nature. It is not regulated strictly by the demands of the day but works toward the future.

Thus, the study of the structure of the atomic nucleus, leading to the discovery of thermonuclear synthesis and disintegrative chain reaction, gave mankind conceptually new sources of energy. Fundamental research on radiospectroscopy of gases has led to the appearance of optical-range lasers. Their application has introduced revolutionary changes in a number of technologies.

Scientists of the Ukrainian Academy of Sciences are giving a large amount of attention to the development of fundamental research. Projects fulfilled by them in recent years have resulted in the creation of large scientific works as well as important discoveries. Their results have made possible the explanation of many phenomena of nuclear fission, the attainment of conceptually new states of matter with predetermined characteristics, the deciphering of the structure of complex chemical compounds, the creation of certain scientific preconditions for the control of heredity and variability of living organisms, and others.

Applied research and technological development are a necessary link which ties science to technology and production. Their significance consists of the search for the shortest and most rational ways to utilize the laws of the objective world that have been apprehended by fundamental science. This research represents an important factor in transforming science into a direct productive force. Precisely here lie the foundation and general outlines of the technology of the future.

Applied research unites information flowing both from fundamental sciences and from production and engineering. In the process of this research the information is transformed and refined into applied knowledge, which becomes the immediate basis for the development of new technological solutions and new forms for organizing production.

Under present conditions, fundamental and applied research are drawing closer to one another. The establishment of an optimum relationship between them is one of the most important tasks of planning in the field of science.

On the basis of applied science achievements, engineering and technological prototypes are developed and their introduction into production is begun. During the developmental stage, science is directly united with engineering and is embodied in it, and new engineering and technology are included in production. Because of its special characteristics, development is a very complicated and laborious link in the system of science-engineering-production. On it directly depends progress in the production of new types of products.

An indicator of the functional effectiveness of the system science-engineering-production is the time during which discoveries and the achievements of fundamental and especially applied research become property of production. The tendency toward shortening this segment of time is quite obvious. Today it is not centuries and not even decades but a few years that separate many fundamental discoveries from their introduction into production. For example whereas from the time of the discovery of radio and electron tubes until their assimilation into production it was more than 30 years, less than 3 years elapsed from the creation to the practical application of solar batteries and masers.

But things do not always happen this way. As experience shows, with the current swift progress of productive forces, the length of life of new engineering and technology does not exceed 6 to 8 years. After this they become obsolescent. This is roughly also the lifetime of technical ideas. If the later are not realized during this time, as often still happens, technical innovation is significantly retarded. Hence arises the urgent necessity for finding the forms of relationships between science and production that will substantially shorten the time from the birth of an idea to its practical embodiment.

The Ukrainian Academy of Sciences gives a large amount of attention to questions relating to the hastening of the utilization of the results of scientific research in the practice of communist construction and to the search for new and improved existing forms of relationships with production. The efforts of scientific collectives are directed toward the further broadening of applied research and development, the creation of conceptually new technology on the basis of fundamental achievements, and their rapid transfer to the economy.

In this work, we proceed from the decree of the 25th CPSU Congress in that the practical introduction of new scientific ideas into production is today as important a task as their development.

In the Ukrainian Academy of Sciences there are many examples where the results of profound scientific search for important technological solutions have been realized.

Thus, the study of kinetics and the mechanism of the processes of liquid-metal and slag melting and the properties of substances in a wide range of temperatures and in various sets of conditions, even including plasmas, has resulted in the development of electroslag technology, which has received worldwide recognition. This technology has become the basis for the creation of such special production processes as electroslag remelting, casting, welding, and fusing and has given rise to a new branch of industry--special electrometallurgy.

High pressures have a powerful influence on the physical, chemical, and mechanical parameters of matter. Their utilization has opened up broad opportunities for creating new materials with unique combinations of properties and for studying many important processes and phenomena relating to solids.

On the basis of research done at the Institute of High Pressure Physics of the USSR Academy of Sciences, the scientists of our academy have developed the technology for the synthesis of diamonds and cubic nitride of boron authorized for industrial production at many specialized plants. Instruments and other items prepared through their application are permitting a substantial increase in labor productivity and a sharp improvement in the quality of products.

Research on the realtionship between electronic structure, chemical and phase composition, and physical-technical parameters of matter have created the conditions for making materials with predetermined characteristics. Technologies have been developed in the Ukrainian Academy of Sciences in cooperation with scientists of other ministries and agencies of the country, for obtaining highly plastic refractory metals--molybdenum, chrome, beryllium, and a whole range of heat-strengthened alloys and super-hard materials with high technological parameters. These technologies, widely being used by industry in our country, substantially exceed those abroad.

The study of the basic laws of the dispersed state of matter and surface phenomena has created scientific possibilities for attaining various forms of dispersion systems. In particular, a new technology has been developed for pneumatic dispersion. Its application has provided substantial improvement in the technology for the production of glue compositions for printing, which is extremely necessary for the economy, coverings for artificial leather and film, polishing compositions for optical electronic devices, carriers for biologically active compounds, and fillers for polymers.

The theory of digital automatic machines and algorithms, which was developed by our scientists, provided for the creation of a conceptually new indigenous technology for producing means for mathematical support for computing technology, which permits the replacement of individual work of programmers with an industrial process for creating whole classes of programs.

The results of fundamental research done by the Ukrainian Academy of Sciences in creative cooperation with the USSR Academy of Sciences, republic academies of sciences, and ministerial scientific research establishments, permitted the creation of more than 300 new technologies of various level and scales just from 1974 to 1978. The introduction of these technologies provided and increase in the level of mechanization and automation of productive processes, the quality and reliability of products, a decrease in the amounts of materials used, and helped in the improvement of the environment. Acknowledgement of the high level of the technologies being created at the Ukrainian Academy of Sciences is the sale of 42 licenses for them in industrially developed countries.

In orienting natural-science and technical institutes toward the development of fundamental research as a basis for the newest technology, we understand that this basis may be the fundamental research and discoveries of other organizations. Fundamental scientific achievements, as a rule, become public property. They can and must be used for creating conceptually new technologies. It is known that from the scientific or the scientific-technical point of view, this work at times is more complicated than some fundamental research.

Organizational measures in developing a technological plan are invariably strengthened by corresponding financing and provision of supplies and equipment. We strive to effect a financing policy that favors the maximum development of progressive technology. Although we make optimum distribution of state allotments for science, we also attract funds from interested ministries and agencies. This hastens the creative process, especially the introduction of conceptually new technologies into production, and helps bring science closer to production.

The presidium of our academy constantly gives a large amount of attention also to providing scientific institutions with modern experimental facilities, instruments, machines, and necessary materials as an effective factor in further increasing the effectiveness of fundamental research and rapid realization of scientific results in highly effective progressive technologies.

Enterprises with an experimental-production base have a large role in creating the conditions for developing fundamental research, in insuring a high degree of follow-through in applied developments, and in bringing them up to the production level.

In our opinion, only with the aid of such a base can fundamental science really be developed, can its ties with industry be strengthened, can its achievements in new technologies be realized in greater output and, in the final analysis, can scientific-technical progress be significantly speeded up.

The Ukrainian Academy of Sciences utilizes various forms of ties with industry for the transfer of new technologies to the economy: participation in projects provided for by state plans for the economic and social development of the country and the republic; the fulfillment of decrees by directive bodies which have prepared on academy initiative; the organization of joint work by the academy with separate republican and national ministries according to complex plans for scientific research and innovation; the conduct of projects for associations and large enterprises according to complex scientific-technical programs; the organization of laboratories for branches of the economy; and agreements with enterprises for socialist cooperation.

The broadening of creative cooperation between academy institutions and ministries and agencies is an important factor in raising the technical level of corresponding branches of industry and of the indicators of their economic activity.

In light of the measures laid down by the party and government for improving planning and strengthening the influence of the economic mechanism on increasing production efficiency and work quality, we should dwell a bit on the important tasks that face scientists in such leading branches of industry as metallurgy and machine building.

As is known, these are the foundation of our economics. We are all acquainted with the successes and achievements in these branches. In recent years our country has firmly held world leadership in the production of pig iron, steel, and rolled metal. The Soviet Union has equipped the world's largest metallurgical systems: super-capacity blast furnaces, unique complexes for smelting and continuous casting of oxygen-blown converter steel, and modern rolling mills. We mine more iron ore and coking coal, magnesium, and chrome ore than any other country. The production of machinery is growing from year to year. These are the quantitative indicators of our economy in these fields. Unfortunately, the qualitative characteristics are not always favorable.

For each ton of rolled metal we use almost 1.5 tons of steel, whereas in the U.S. it is about 1.3, and in Japan, even 1.2. Our assortment of rolled metal suffers a serious defect: the very small proportion of hot-rolled and cold-rolled sheet steel.

The Soviet Union, although the birth place of continuous steel casting, unfortunately seriously lags a number of other countries in the application of this progressive technology. Next year, the proportion of steel poured into continuous casting machines will reach about 11 percent of the stock in this country, while in the Federal Republic of Germany more than one-third of all steel was poured using this technology and in Japan, about 41 percent. We still have insufficient production of shaped hot-rolled and cold-pressed pipe, heat-treated rolled metal, sheet steel with metallic and polymer coverings and so forth.

For some years, I have been participating in the work of a specially created group of scientists and specialists who are authorized annually to conduct an analysis of the status and plans of future ferrous metallurgy development. In our conclusions we frequently pointed out that questions relating to the production of pig iron, steel, and rolled metal must be examined not independently, not in isolation, but in very close relationship with the problem of metal consumption.

We cannot expand the production of steel without any restraint nor can we travel the route of extensive development. We must persistently pursue the path of optimum, more rational utilization of the products of ferrous metallurgy in metal-consuming branches of the economy, especially in machine building, but also in industrial and transport construction.

We cannot help being disturbed, for example, that during the last decade the coefficient of rolled steel utilization in machine building stabilized at a level of about 0.7 and there are no signs of its improving. Today, we produce substantially less finished products from each ton of metal than does the U.S., Japan, or the Federal Republic of Germany. The reasons for this alarming phenomenon are well known. On the one hand, they are related to the unsatisfactory structure for producing metal products, including also those of nonferrous metallurgy (it is clear to us, for example, that there is insufficient rolled aluminum), and on the other hand, they are related to the serious lag in preparational production for machine building. We have too great a volume of mechanical processing. The quantity of shavings during the last 10 years has grown by a factor of 1.5 and now exceeds 8 million tons a year. In this connection, there is quite an insufficient volume of forge-press processing, which differs significantly from shop processing in having less metal losses. Meanwhile, from year to year we have growing production of metal-cutting machine tools; at the same time, we do not have enough forge-press equipment.

If very energetic measures are not taken toward basic improvement in the structure of preparational production in machine building on the basis of the newest wear-resistent and wear-proof technologies, we are not satisfying the needs of the economy for metal.

It is necessary also to state that in developed capitalistic countries, the output of steel casting is constantly going down in relation to the production of rolled steel.

In Italy, for example from 1960 to 1974 the ratio of steel casting output to the production of rolled metal decreased from 1.3 to 0.8 percent, and in 1976 already was 0.6 percent.

Analogous tendencies are characteristic also for other countries, including the U.S., although there the structure of metal consumption is improving more slowly than, for example, in Japan and the Federal Republic of Germany.

Unfortunately, in our country the share of steel casting is exorbitantly great, which entails an unjustifiably larger loss of metal.

The decree of the party and government that we are discussing opens new possibilities for our whole economy. The duty of materials scientists and economists is to take a very active creative part in realizing these possibilities. It should be noted that scientists have already actively participated in working out the basic lines of development of a number of very important branches of the country's economy up to 1990 and up to 2000, including prospects for the development of ferrous metallurgy. Envisaged are the further improvement of the assortment of ferrous metals and improvement in their quality and in the characteristics of interest to the consumers, which will provide a fuller and more effective utilization of metals.

Such a path in the development of the metallurgical industry will provide the possibility of lowering the relative expenditure of metal at all stages of allocation and of reducing capital investment in the extraction of raw materials and fuel.

Outlined for the period up to 1990 is a significant broadening of the more economical, heat-resistant types of finished rolled metal, including that from alloy and low-alloy steel, and also with various coverings. There will be an increase in the varieties of shaped, bent, and thin-walled types, wide-bar beams, calibrated steel, cold-rolled ribbon and drawn wire.

The most important trend in improving the quality of carbon steel for general purposes will be the improvement of its uniformity and purity, degree of surface finishing, and precision of geometric measurements. Rolled metal from such steel will be supplied with consideration of the consumers' requirements for process automation, which will permit reduction in the expenditure of metal and increase in the effectiveness of production in the metal-using branches of the economy.

Industry will assimilate several hundred new grades of steel and alloys.

Special attention will be given to the more progressive means of producing steel, particularly to smelting in electro-slag, vacuum-arc, vacuum-induction, electron-beam, and plasma furnaces.

The quantity of rolled metal from metal made by special electrometallurgical methods will increase by a factor of about three.

But if we are speaking of economic utilization of metal, then we must strengthen the work of academy institutions in creating, on the basis of fundamental theoretical and experimental research, conceptually new technologies for obtaining and forming metal stock with optimum predetermined characteristics. Before us stands serious and heavy work in creating a new system of planning the production of metal products which will be devoid of large defects peculiar to such criteria, for example, as weight and cost in evaluating production output. Probably, a good way of accounting for actual consumption values of products would be to introduce a plan indicator such as the coefficient of metal utilization or the degree to which steel is replaced by nonmetallic materials, aluminum, composition board, and so forth.

Success in this important national state matter depends to a significant degree on the achievements of indigenous science, on the operability of introducing the results of fundamental research into production, and on their realization in progressive technological processes and new technology.

Existing technological developments by the USSR Academy of Sciences, republican academies, and ministerial institutes already now permit the beginning of an engineering and technological rearmament of certain branches of metallurgy. This will be done by reconstructing and modernizing enterprises, by putting into operation new powerful metallurgical plants and replacing obsolescent technology, and also by fuller utilization of production capacities and improvement in the structure of production.

At the same time, scientists must develop and introduce conceptually new progressive processes into metallurgy. It is time to undertake intensive development of direct recovery of iron from iron-ore concentrates and further new reconversions of it. The development of an industry for direct recovery is appropriate today because of the curtailment in production of coking coal, successes with mine-concentration techniques, and for a number of other reasons. The method of direct recovery requires significantly less capital investment and at the same time permits achieving steel with minimum content of harmful impurities. It is necessary that by 1990 the productivity of direct recovery plants reach the productivity of blast furnaces: 8 to 10 thousand tons of raw metal a day.

In conclusion, please let me speak briefly on the question of powder metallurgy. L. I. Brezhnev, speaking at the Novemenber (1979) Plenum of the CPSU Central Committee, stressed the necessity for faster and bolder development of this branch of metallurgy, which can do much for our economy.

Statistics show that the use in machine building of 1 thousand tons of components made from powder frees from 2 to 2.5 thousand tons of rolled metal or cast metal, about 80 units of metal-cutting machine tools, and 190 workers. In terms of money, for a thousand tons of products there is a saving of about 1.5 million rubles.

Powder metallurgy methods are creating conceptually new materials for atomic energy machine building, cryogenic technology, space technology, and high-pressure technology. Conceptually new machines, mechanisms, and instruments prepared from these materials are efficient in extreme conditions. The utilization of powders of steel, alloys, and refractory compounds as carriers of wear-resistant coverings and coverings with special properties is providing an increase by a factor of 10 the durability of metal constructions, machine components, and instruments and a sharp decrease in metal waste.

In our academy powder metallurgy is given a large amount of attention. The Institute for Problems of Materials Science of the Ukrainian Academy of Sciences is the head institute in this field. It coordinates the activity of 130 scientific research organizations and industrial enterprises in the country and works on fundamental trends together with the Institutes of Physical Chemistry. Chemical Physics, High Pressure Physics, High Temperatures, and Metallurgy of the USSR Academy of Sciences.

In this field scientists still face many questions, the solution of which is necessary for bold and confident development of a future industry--powder metallurgy.

One field of production has been sufficiently examined here to be used as an example to show what great potential there is in various branches of our economy and how much work still remains for scientists in order to put this potential into the service of our people.

Scientists of the Ukrainian Academy of Sciences, as all the workers of science in our country, have accepted for steadfast fulfillment the tasks that stem from the decree of the CPSU Central Committee and USSR Council of Ministers "On Improving Planning and Strengthening the Influence of the Economic Mechanism on Increasing Production Efficiency and Work Quality," and will do all they can to make a worthwhile contribution to their realization, for strengthening the economic power of the country and raising the well-being of the Soviet people.

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VONSOVSKIY REPORT TO ACADEMY OF SCIENCES' MEETING ON ECONOMY

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[Report by Academician S. V. Vonsovskiy, chairman of the presidium of the Rural Scientific Center of the USSR Academy of Sciences, to the General Assembly of the USSR Academy of Sciences: "The Complex Development of the Productive Forces of the Urals"]

[Text] In my speech I will address the chief questions facing science in the Urals and the complex programs for the development of our economic region that have been developed by the Ural Scientific Center of the USSR Academy of Sciences.

In recent years, scientists of the Ural Scientific Center have completed a number of fundamental research projects in the fields of mathematics and mechanics, solid physics and chemistry, high-temperature electrochemistry, the theory of population ecology, materials sciences, and the theory of metallurgical processes; a large amount of work has been conducted on the geological and geophysical study of the Ural geological province and on problems connected with increasing the effectiveness of civil production and optimum geographical distribution of Ural productive forces.

Raising the effectiveness and scientific level of research, the collectives of scientific institutions of the Ural Scientific Center of the USSR Academy of Sciences have striven to deal harmoniously with the fulfillment of fundamental research projects, broadening the ties between science and production, and have directed their efforts to the study of the chief economic problems of the Urals. The output of Ural academic science has been significantly raised by its orientation toward meaningful final practical results and by its utilization of effective forms of cooperation for the most rapid introduction of developments into production. During the Ninth Five-Year Plan, the economic effect from utilizing the results of scientific research in cases of innovation alone was 44.3 rubles, and for the last 3 years it was greater by a factor of three--150 million rubles.

The Center has significantly expanded its ties with economic sectors. Today, it is tied by long-term agreement-programs with a family of ministries that includes the USSR Ministry of Nonferrous Metallurgy, the RSFSR Ministry of Geology, and the RSFSR Ministry of Higher and Secondary Specialized Education. These programs determine the main lines of development for long-term cooperation between institutes of the Ural Scientific Center and enterprises of the branches of the economy.

The agreement with the RSFSR Ministry of Geology has allowed the coordination of the activities of seven territorial-geological administrations, five academy institutes, a number of higher educational institutions, and scientific research institutes of various branches of the economy. The agreement with the USSR Ministry of Nonferrous Metallurgy, in which 25 enterprises and scientific organizations from the industrial side participate, provides the possibility to introduce the results of joint developments not only with participation by ministerial scientific research institutes, but also by direct ties between academy institutes and industrial enterprises. The huge effectiveness of this latter type of relationship is illustrated also by another fresh example.

On the initiative of USSR Academy of Sciences President A. P. Aleksandrov, the Institute of the Physics of Metals of the Ural Scientific Center was entrusted with the development of a special magnetic system for feeding yarn in a spinning machine (the absence of an appropriate device is one of the most serious shortcomings of modern spinning technology, which leads to machine breakdowns, to large losses of yarn, and to a large waste in the physical labor of spinners). Within the framework of the agreement between the Ural Scientific Center and the RSFSR Ministry of the Textile Industry, a large project was undertaken in which participants included the Institute of the Physics of Metals, the Yakovlevskiy Linen Combine, and the Special Design Bureau for Textile Machine Building. Special magnetic systems were developed and created in which magnets with very high energy were used that were previously developed at the Institute of the Physics of Metals. These systems were installed in the spinning machines of the Combine.

Experiments and subsequent industrial trial on a broad basis demonstrated the high effectiveness and reliability of the devices developed. During 1979 the Institute prepared around 30,000 magnetic systems that were handed over to the Yakovlevskiy Linen Combine to be fitted to operating spinning machines. After these devices were put into operation, labor productivity of spinners increased by 30 percent and, according to assertions by the Combine management, will in time approach 100 percent. It is saving more than 10 percent of the raw material. The annual economic effect for the whole Combine is over 1 million rubles and the amortization time for the magnetic devices is 7 months. No less important is the social effect of the sharp unburdening of the labor of spinners. There is an urgent need to diffuse this means to the whole textile industry of the Soviet Union.

The July (1979) decree of the CPSU Central Committee and USSR Council of Ministers again stressed the necessity for concentrating efforts and resources on the development and realization of the most improtant national technical, economic, and social programs and also programs for the development of individual regions and territorial production complexes.

The Ural Scientific Center of the USSR Academy of Sciences has developed a long-term program directed toward the complex and effective utilization of the natural riches of the Urals. This program is the result of a large amount of research which is embodied in the prognostic report of the Ural Scientific Center, "The Development of the Productive Forces of the Ural Economic Region for the Period up to 1990 and 2000 (with Consideration of Adjacent Regions)." It reflects the chief scientific results of Ural scientists' research and outlines proposals for the development of the productive forces of the Urals.

During the period of prognosis, the Ural Economic Region first of all must develop as an important economic complex which includes fuel-energy and raw-material sectors, sectors for the production of the means of production and for consumer products, and also the development of agriculture. As scientific research has shown, the further development of the economy of the Urals depends to a significant degree on the solution of a number of practical problems. Included among these, for example, are improvement in the base of raw-material sectors and development of fuel-energy and water resources. In particular, the Urals are experiencing a sharp deficit in hard fuel. In connection with this, it is important to spend some time on the question of the possibility of delivering high quality coking coal from the Pechora basin to this area.

One of the most important scientific problems of our economic and social development is the problem of reproduction and regional utilization of labor resources. For the Urals the problem is particularly complicated and many faceted. Thus, while during the period from 1966 to 1970 the population of the country increased by 5.2 percent, the population of the Urals decreased by more than 0.5 percent. And this tendency continues.

The further increase in effectiveness of all branches of civil production also must be put in the category of urgent scientific and practical tasks.

For each problem, the above-mentioned report provides an economic analysis and introduces considerations of the basic lines of development, the priority tasks, and the sequential steps for their solution.

The most essential contribution to the generalizing materials of the report and in the substantiation of proposals for the development of the economy and culture of the Urals was made by the Institute of Economics of the Ural Scientific Center of the USSR Academy of Science. This work was led by the Institute's director, M. A. Sergeyev, a corresponding member of the USSR Academy of Sciences.

An important landmark in the scientific substantiation of the economic and social problems of the Ural region and in the development of the "Ural" program was the All-union Scientific Practical Conference on the Development of the Productive Forces of the Urals, which took place in Sverdlovsk. Participants included the Ural Scientific Center of the USSR Academy of Sciences, the Commission for the Study of the Productive Forces and Natural Resources of the Presidium of the USSR Academy of Sciences, the Council for the Study of the Productive Forces of USSR Gosplan, and the Central Economic Scientific Research Institute of RSFSR Gosplan.

What chief problems are reflected in the "Ural" program?

First of all we must speak about the question pertaining to the intensification of industrial production in the Urals--the reconstruction of operating enterprises, industrial centers, and settlements. In the Ural region this problem is sharper, perhaps, than in other regions of the country, because the Urals have been developing as an industrial region for more than 250 years. Here, old factories with lagging technology sit side-by-side with modern giants of industry, and old cities and towns side-by-side with modern industrial centers.

This circumstance calls for the development here of fundamental and applied research and development related to the creation of conceptually new technological processes for the complex reconstruction of enterprises and related to mechanization and automation. This is one of the most important directions of scientific and technical progress in the Urals. Related also to reconstruction are solutions to social tasks of the future Urals region.

A leading link in our regional programs is also the problem of providing Ural industries with mineral and raw-material resources. Earth resources here have been intensively worked for more than 2 1/2 centuries. The processing capacity grows uninterruptedly, but the extraction of ores is falling. Thus, from 1965 to 1975, the production of pig iron grew by a factor of 1.5, but the extraction of commercial ores fell by 5 percent. At present, the metallurgical enterprises of the Urals are working on the basis of imported raw materials. The complex scientific research program of the Ural Scientific Center, "Ural Mineral Resources," foresees large joint geological-geophysical and economic research projects directed toward raising the effectiveness of exploration and toward the accumulation in the Urals of ores of ferrous and nonferrous metals and other useful minerals. The geological-economic evaluation of the mineral and raw material bases of the Urals will be the basis for the development of the mining industry and for determination of the main directions of geological exploration work up to the year 2000. Geophysicists from the Moscow area are developing scientific bases and technical means for locating deposits at depths of more than 1 kilometer, as ore deposits in the Urals have been worked only from the surface or to depths of not more than 500 meters.

The program "Ural Mineral Resources" gives special attention to launching the industrial assimilation of useful minerals from the North Urals, as the undeveloped region closest to the industrial Urals, and a region which has many types of natural riches. In recent years, the volume of research done by the Ural Scientific Center and other scientific institutions of the region that relates to the North Urals has sharply increased and will continue to increase. Moscow geophysicists have discovered very large anomolies there that promise, if their ore content is confirmed, to provide rich deposits of iron ores. Geologists have found a large barite deposit (Khoyvinskoye). We think that it would be advisable to establish a Far North Territorial Production Complex to develop the Vorkuta coking and fuel coals, the iron ore of the Shchuchinskoye Synclinorium, the water resources of the Ob', and so forth.

Scientists of the Ural Scientific Center consider that the riches of this huge area will bring new fame to the Urals, no less than the fame of the ore stores of the Central and Southern Urlas. In this connection, a "North" program has been created that envisages the systematic economic development of the North Urals.

The Urals, as before, will remain the rich storehouse of useful minerals, including iron ore. But these ores are complex; they contain, along with the iron, other components which, on the one hand, raise the value of the ore and, on the other hand, complicate its utilization by traditional methods. Billions of tons of iron-titanium ore in the Medvedevskoye and Kopanskoye deposits lie untouched because none of the existing structures can recognize the expediency of their development. Only the titanomagnetites of the Kachkanar type are being exploited, but in the process, some hundreds of thousands of tons of titanium are lost each year in "tails" and slags.

The complex processing of ores continues to be impeded by persistent administrative barriers. Thus, the ores of the Vysokogorskaya mine, which is under the USSR Ministry for Ferrous Metallurgy, contain much copper. It could be recovered as a by-product, and thus more cheaply also, than at working enterprises of nonferrous metallurgy. However, it is sent to dumps. The managers of the dumps themselves do nothing with it.

During the existence of the North Ural bauxite mine, many tens of millions of tons of iron were mined together with the bauxite. Where is it now? In the sludge of aluminum production. But the iron contained in it is no less than in industrial ores.

Workers of industrial enterprises clearly understand that it is unprofitable to limit the extraction of basic components of ores with great losses of other components. They are in favor of production without waste. But for this they need well-developed technological processes, finished projects, and allocations for their realization. Is it that these developments do not exist? But they do exist. The Institute of Metallurgy of the Ural Scientific Center has created more than 10 new technological processes with equipment designs that foresee practically complete processing of ore without waste. But all this requires experimental-production trials. The enterprises themselves have no experimental bases, and the ministries are not rushing to create them.

We are acquainted with the opinion of party and soviet workers of the Urals: they all agree in the opinion that the solution of the problem is hampered by inertia, and at times deep opposition, on the part of ministries in attempts to organize complex production of intersector significance. But the ores of the Urals, because of their content, cannot be put within the framework of any one sector and their processing must be undertaken from a nonagency position. A way must be found to boldly transform enterprises that process multicomponent raw materials into intersector non-waste complexes. In the Urals this applies to the overwhelming majority of non-ferrous and ferrous metallurgical plants. It is necessary that the ministries responsible for scientific and technical progress actively promote such progress, that they case to divide products into "ours" and "theirs," and that they manifest real state concern for the processing of raw materials.

USSR Gosplan and USSR State Committee for Science and Technology have an important role in this. Long ago it was time to plan the development of all facilities necessary for full utilization of raw materials without waste, for those enterprises that process multicomponent ores. It is also very important to attract the economic interests of collectives in obtaining a larger number of elements and to raise the level of their extraction. It is extremely desirable to hasten the development of the experimental base for experimental-production testing as recommended by scientists.

Ural treasures need to be taken into account. And if this account is justified and is fully borne out in production, it will certainly yield great advantages both to enterprises and to the state.

The Urals are a great machine-building area. We have therefore given a large amount of attention to its development. The program "Ural Machine Building," developed at the Ural Scientific Center of the USSR Academy of Sciences, is directed toward the optimization of the process for creating unique mechanisms, machines, and complex machines for leading sectors of the country's economy. An example of a large scientific and technical problem being solved in a complex way within the framework of this program is the development of a conceptually new metallurgical line which combines smelting, casting, and rolling of metal. The organizer of this work was the Department of Machine Building, which was recently created at the Ural Scientific Center and is directed by Corresponding Member G. L. Chimich of the USSR Academy of Sciences. The solution of the task involved scientists from the Institute of Metallurgy, the Institute of the Physics of Metals, the Institute of Mathematics and Mechanics, and also specialists from a number of metallurgical and machine-building enterprises. The concept lying at the base of the new metallurgical complex is profoundly changing established technology and promises a huge economic effect on a country-wide scale. Sufficient to say, the output of rolled metal per year will increase by a factor of 1.5. We seriously need assistance in strengthening this machine building-cell, the only one of its kind in the USSR Academy of Sciences system.

Unfortunately, such examples, where academy science participates from the very beginning shoulder to shoulder with production specialists in solving important practical tasks, are still few. One should think that it will not cause an argument to state that initiative here must largely come from producers. Managers of enterprises are supposed to know thoroughly the status of their sectors and to quickly react to economic inquiries.

For many enterprises this requirement for technical progress has still not become an organic necessity. It is obvious that the economic mechanism is still insufficiently effective from the point of view of industrial assimilation of scientific and technical innovations, and therefore the fate of innovation frequently depends on the personal qualities of the economic manager and on his desire or lack of desire to take on himself the "unnecessary" dickering. Unfortunately, this is not a rare phenomenon. Here is a characteristic example. We have intended, in contact with practical metallurgists, to engage in the solution of a number of powder metallurgy problems and in the development of technology for producing iron without blast furnaces, using the Alapayevsk Metallurgical Combine as a base. But, unfortunately, we received no support from the managers of the "Uralchermet" association. It was not that they rejected it. No, they did not doubt the importance of the task and all of them, at least in words, were "in favor." But no practical steps ever ensued. Meanwhile, the Alapayevsk Metallurgical Combine badly needs renovation; participation in this matter by scientists obviously would be very useful. And moreover, the Ural Scientific Center would gain a good scientific-production base.

A large amount of attention in the "Ural" program is given to the utilization, preservation, and renewal of natural resources. Thus, the complex scientific research program "Ural Biosphere" is devoted to the development of ecological bases for rational utilization of natural resources in the Urals and is one of the most important regional research programs. The results of projects in this program have great meaning not only for bringing about other programs devoted to problems of the Ural region, but also for the development of plans and forecasts for the development of the productive forces of the Ural economic region.

The study of natural resource utilization in the Urals has enormous interest both from the scientific point of view (inasmuch as we are involved with a complicated, unique combination of natural conditions and anthropogenic influences) and from the practical point of view, inasmuch as the Ural region is one of the basic industrial regions of the country. The high level of urbanization and industrial concentration, the high degree of natural resource utilization, the pollution of the environment, and the negative balance of labor force migration make research on nature, habitation, and natural resource utilization especially urgent not only in relation to the regional problems of the Urals, but also within the framework of man's relationship to the biosphere as a whole.

Unfortunately, time does not permit addressing a number of other programs developed by scientists of the Urals such as "New Materials," "The Physics and Chemistry of Condensed Matter," "The Physical Chemistry of Surfaces," "The Material and Spiritual Culture of the Urals," and others. Incidentally, the latter is a joint program of the Ural Scientific Center and the RSFSR Ministry of Higher and Secondary Specialized Education, with which we recently concluded a general agreement on joint scientific research and training.

It is obvious that the successful fulfillment of such large-scale programs as the "Ural" program decisively depends on the realization of the whole complex of measures foreseen in the recent decree by the party and government on the futher improvement of planning and management. Required particularly are new forms for coordinating the activities of all ministries and agencies and the optimum combination of sector and territorial management, including disassociation from ministries and agencies.

Another topic pertains to the status of the coordination council that stands at the head of the program. At present, this council is an authoritative nongovernment body. Although this authority is large, it nevertheless is clearly insufficient for managing such a complicated and large-scale matter. The council should have all the necessary rights, including the right to distribute financing. We must think about the future sources of financing and how to bring facilities together. It should also be essential to find ways of overcoming the administrative barriers in this matter. The future lies precisely in such forms of work.

In conclusion, I would like to stress again that "pure" science and science for the sake of science do not exist today and cannot exist. Scientific work is closely interwoven with organizational work. And to develop science means to improve all of the mechanisms of its relationship with practice and with production. This is the principle that determines all of the activity of the Ural Scientific Center of the USSR Academy of Sciences.

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