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SCIENCE AND INDUSTRIAL DEVELOPMENT

SUMMARY

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Submitted by

The Government of the Union of Soviet Socialist Republics

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1. An important achievement of Socialism is the progress made in economic and cultural development by formerly depressed peoples of the Russian outlying districts. The victory of Socialism is of immense importance to developing countries as it demonstrates the possibility of doing away with, in a brief period of time, ancient backwardness without going through capitalist stages of development to reach the level of economically developed countries.

2. The backwardness of the Central Asian Republics and Kazachistan has been overcome through industrialisation and scientific research and effective application of scientific achievements. Of great interest in this connexion is the Soviet experience in solving the problem of developing infra-structure in the field of science.

Training of national specialists, establishment of scientific institutes

3. The procedures for training national specialists and establishing scientific institutes can be met by any country which embarks on the path of economic development. In Turkestan there was not one scientific institute nor even an institute of higher learning. Only one and a half to two per cent of the population was literate. Educational expenses were as high as two per cent of the total budget. The Soviet Government took measures to develop training systems and now the Central Asian republics are far ahead of many countries, including European ones. In accordance with the character of the local economy, various kinds of scientific and research institutions were created. At present there are 312 of them.

The form and methods of linking science with production

4. The methodological basis and form for linking science with production is in the planned development of an economy in which the State can influence adoption of new methods and technology. The main form of scientific activity is fundamental and applied research for industrial development. Problems in science that arise in the course of industrial development are dealt with by the Republican Academies of Sciences in the Central Asian republics. Academies of Sciences have sixty-seven scientific research institutes with a staff of 13,000 scientific research workers.

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5. The experience of the organization of applied research may be of a great interest to developing countries. About 20 per cent of all industrial research is conducted by educational establishments of higher learning. The main functions of applied research in a country may be as follows:

- to prospect, study and determine ways to utilize natural resources;
- to apply existing technology to local conditions;
- to create new technological processes based on the use of local materials;
- to elaborate on the sciences of locating and developing industry.

6. As a result of prospecting for natural resources in the Central Asian republics, discovery has been made of a number of coal deposits, oil, and various metal ores. The example of Central Asia shows that there are no regions with poor natural resources. A large industry has been created on the basis of the natural resources discovered. To discover deposits, geologists use the whole complex of methods available and have developed a number of new ones for prospecting and extracting mineral resources as well as new technological processes for using local materials and for increasing the effectiveness of existing ones. There have been elaborated schemes for locating industry and for carrying out integrated development in various regions.

The social implications of industrialization

7. For the short period of time of less than the lifetime of one generation, immense changes have taken place. The gross industrial output of the Virgiss SSR has increased 63 times and that of the Usbeck SSR 100 times. Industrialization has helped to improve the national income and the standard of living. The rate of growth of the national income in the Central Asian republics exceeds that of the entire country. There is complete literacy and an abundance of national specialists. Such success is within reach of all people.

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Recommendations

8.
- Application of science and technology for development must be part of the overall task of planning and implementation of programmes of economic and social development,
- Immediate measures should be taken to create infra-structure of science according to local conditions;
- The efforts of scientists should be directed to the solution of problems affecting industrial development (prospecting for natural resources and utilization of these resources to create new technological processes suitable for using local materials, mainly agriculture.)
- United Nations should give special attention to questions of practical application of scientific and technological advances for industrialization of developing countries, to determine problems of first priority whose solution requires concerted effort on the part of developed countries and provides benefit for both developing and developed countries.

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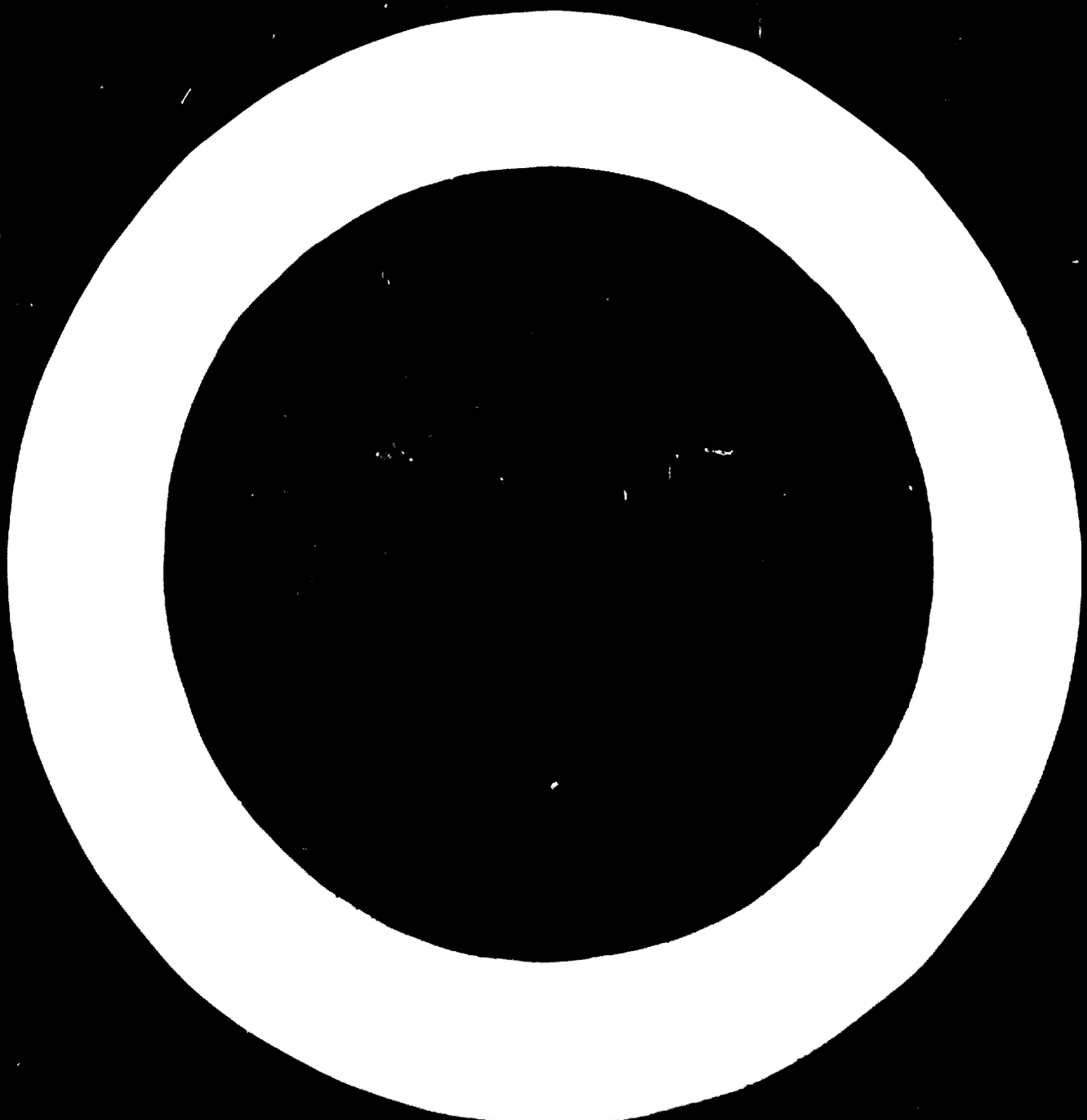

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USSR ACADEMY OF SCIENCES

COUNCIL FOR CO-ORDINATION OF RESEARCH OF THE ACADEMIES
OF SCIENCES OF THE UNION REPUBLICS

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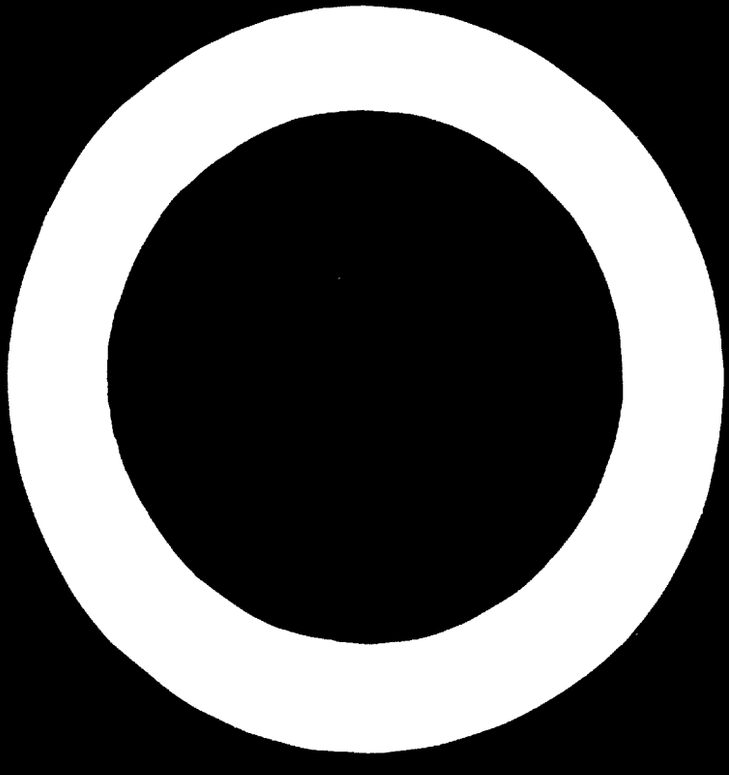
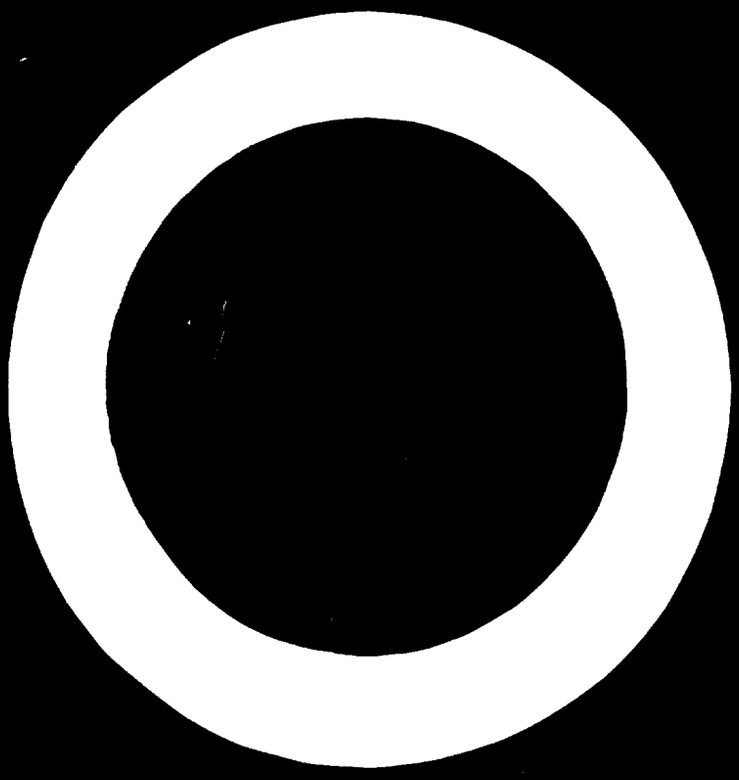
SCIENCE AND INDUSTRIAL DEVELOPMENT

(Central Asian Soviet Republics: A Practical Experience)

This paper has been distributed by the United Nations in its original language, Russian, as document number ID/Conf. 1/G. 37 for the International Symposium on Industrial Development.

MOSCOW 1967





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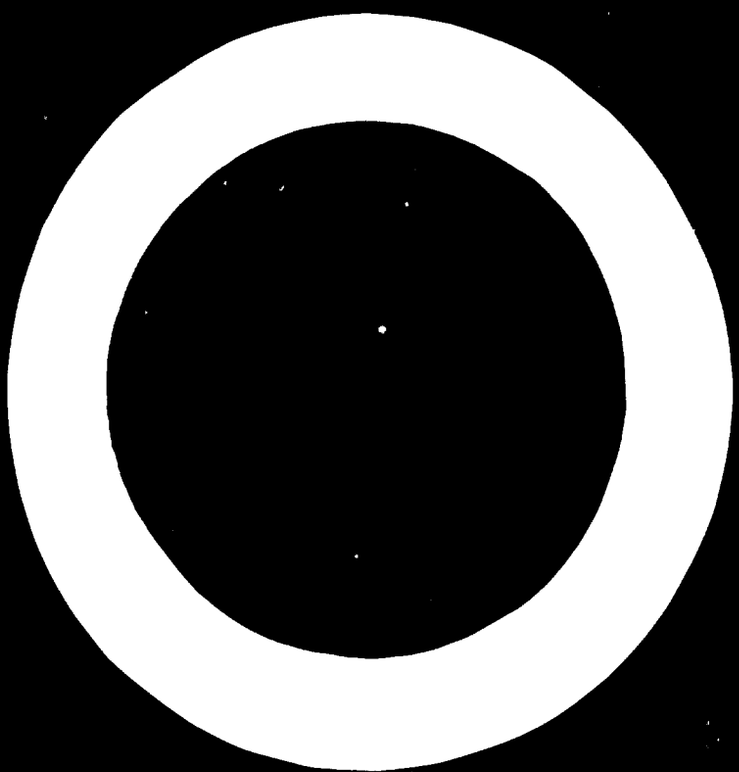

1. Economic and cultural progress of formerly oppressed peoples of the outlying areas of Russia, but recently at the semi-feudal or patriarchal-tribal stage, is a major achievement of socialism and Soviet national policy. The triumph of socialism in Central Asia and Kazakhstan is of immense significance to the developing countries, for it has demonstrated in practice that formerly backward nations can overcome centuries-long stagnation in a historically short time bypassing the capitalist development and not only catch up with advanced countries but even outstrip them in some respects.

2. As soon as Soviet power was established in Central Asia, the Soviet state set out to abolish backwardness through industrialising the entire area and providing conditions for its economic and cultural upsurge. It was part of the sweeping programme for rebuilding the country and turning it into an industrial-agrarian power.

3. Extensive development of research and an effective use of scientific achievements went a long way in implementing this policy.

4. Today, science and technology have become potent instruments, on whose efficient employment the economic and social progress of the human community depends. To ensure the speediest practical introduction of scientific know-how, a country needs, among other things, to adopt a clearly outlined attitude towards science, setting up an

institutional structure which would take care of scientific research and information. Unless this is done, developing countries cannot successfully advance towards economic and social independence.[1]

5. It is of interest in this respect to consider the development of the scientific infrastructure in the Soviet Union, especially in its formerly backward Republics. Although marked by specific historical features due to the difference in national and economic characteristics, the development of science in Soviet Republics has many features which may be of interest to other countries striving to end economic backwardness.

Training and Research Programmes

6. A problem which confronts every developing country is that of raising a local professional force. It was the case of the Central Asian Republics too. There was not a single institution of higher learning, let alone a research centre, in the whole of Turkistan Territory. Ninety-eight per cent of the population were illiterate. There were only 160 schools with a total of 17,000 pupils. Education accounted for a mere two per cent of Turkistan's budget. A series of measures effected

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[1]Consultative Committee on the Employment of Scientific and Technological Achievements for Development Purposes; 41st Session, Third Report E/4178 (1966), 22.

under Soviet government did however help to achieve the goal in less than twenty years' time. There emerged a national force of engineers, scientists and ancillary trained personnel.

7. Elimination of illiteracy was a priority target of the Soviet state. Numerous schools were launched and allocations for public education were sharply increased, amounting to 30 and more per cent of the local budgets. Numerous teacher training courses, schools and colleges were set up. In 1930, compulsory universal primary education (later extended to 8-year compulsory education) was introduced. A vigorous campaign with the participation of numerous volunteers was staged to end illiteracy among adults. Education in local languages, the development of a national system of writing for Kirghizia and free tuition greatly contributed to the training of local skilled personnel. Rapid elimination of illiteracy paved the way for the inauguration of a system of secondary specialist as well as higher education.

As early as 1918, Turkistan People's University (subsequently renamed Central Asian University) was organised with the aid of Moscow and Leningrad Universities. It became an important centre for training skilled personnel for the Central Asian Republics. As the economy developed, more specialists had to be provided for work in particular branches, which necessitated the organisation of specialised colleges. Among the first to be opened were the Central Asian College of Irrigation Engineering, the Central Asian Industrial Polytechnical College, the Tashkent College of

Irrigation and Mechanisation of Agriculture, etc. They supplied specialists in cotton growing and processing and irrigation engineers to meet the need of the main economic branches of the Uzbek and other republics. Extensive facilities were provided for training specialists to meet the needs of industry and other branches of the economy. During six years (1927-33), 24 colleges with a student body of 10,800 were opened in Uzbekistan alone. Besides, large groups were regularly sent to study at colleges and universities of Moscow, Leningrad, Kiev and other major centres of the USSR.[2]

Today the Central Asian Republics have more university and college students and college-trained engineers than many other countries, including advanced European countries. In 1966 there were 157 university and junior college stuients per 10,000 of population in Uzbekistan; 122 in Kirghizia, 118 in Tajikistan and 104 in Turkmenistan.[3] Most college students are native-born. And since women enjoy equal rights to education and job opportunities, they form a considerable proportion of the student population.

8. Systematic research activities began in the twenties. Prominent at that time were surveying expeditions of the USSR Academy of Sciences, in which the leading scientists of the country took part; the parties regularly included local

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[2] Kh. M. Abdullayev, Forty Years of Soviet Science in Uzbekistan. Published by the Uzbek SSR Academy of Sciences (1958).

[3] USSR Economy in 1965. Statistics (1966), 693.

personnel as well. The emergence of a national force of engineers and scientists and the advance of economy favoured the rapid growth of research bodies and centres, which were to promote the development of industry and agriculture. As concerns their economic standards, surveyed natural wealth and available trained personnel, Central Asian Republics were at rather different levels. Then as now each of them had a definite place both in the national and regional division of labour. Accordingly, besides the light, food and building industries, indispensable in any economic region, specialised engineering, chemical and mining projects were also constructed. Specific features of the economy determined the pattern of research institutions in different Republics. The research centres mainly concerned themselves with the development of cotton processing techniques and irrigation systems, both typically regional problems. Among them were the Central Asian Research Institute of Irrigation, which played a leading role in the construction of big canals, the All-Union Research Institute for Cotton Growing and other important research centres. Later on research institutes of geology, chemistry and biology were organised to examine the natural wealth and work out efficient ways for its exploitation. As research centres thus increased in number, government Science Committees were set up to co-ordinate their efforts. On the basis of these Committees local branches of the USSR Academy of Sciences were organised.

9. At present there are 312 research centres in Central Asia which constitute a solid basis of economic development. In 1966 there were 53,000 workers of science in Uzbekistan, 29,000 in the Kirghiz Soviet Socialist Republic and

15,000 in the Tajik and Turkmen SSR respectively.[4]

10. Having practically solved the problem of personnel training, the Central Asian Republics are now able to aid developing countries in this respect. College teachers and qualified specialists are sent from Uzbekistan to developing countries to render assistance on the spot. Students from foreign countries come to study at various Central Asian colleges. Over 350 students from 22 Asian and African countries are now studying in Uzbekistan, 250 of them at higher schools.

Linking Science with Production

11. In the Soviet Union state economic planning, which takes care of the more important branches of science and technology, furnishes the methodological basis for translating their achievements into economic progress. The state economic plan makes special provisions for the development of new technology, advanced methods, equipment of new design, automation, etc. The state is in a position to ensure the speedy introduction of advanced technology and constant improvement of existing technological standards and increase the efficiency of social production.

12. In the course of scientific progress in the Central Asian Republics--as in the entire Soviet Union--various forms of scientific activity have taken shape. The most

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[4] USSR Economy in 1965. Statistics (1966), 562-3.

important of them are fundamental and applied research to develop new progressive technology and processes; advance scheduling of both the development and siting of industries and individual projects; socio-economic research, etc. The results of these activities materialise in new industries, higher efficiency and national income. A definite contribution is also made by scientists giving well-informed advice to production engineers, introducing them to the latest achievements of science and technology and supervising the work of volunteer research and designing bodies at enterprises.

13. Applied research and research connected with the development of new technology and processes naturally play by far the most important part. Research and development work is carried out by scientific organisations of various ministries and departments, the main of them (for the areas under consideration) being as follows:

a) research institutes and special designing offices of all-Union and Republican ministries;

b) scientific organisations of Academies of Sciences of Union Republics;

c) research laboratories and centres at colleges and college departments;

d) research laboratories at industrial enterprises;

e) factory laboratories and designing offices run on a non-paid basis.

14. It is characteristic of the Central Asian Republics that current practical problems posed by their economies were handled both by specialised institutes and branches of the USSR Academy of Sciences, which subsequently developed

into independent national Academies of Sciences. Many of the present-day specialised institutes have originated under their auspices. For example, the Uzbek Research Institute of the Oil Processing Industry, the Research Institute of Cotton Cellulose Chemistry and Technology and other specialised institutes have branched off from the Uzbek SSR Academy of Sciences. Republic Academies of Sciences planned their work and built up the network of their organisations mainly with the purpose of contributing as much as they could to the economic and cultural progress of their republics. Therefore applied problems received much attention. The Kirghiz SSR Academy of Sciences, for example, has set up the Automation Institute, the Institute of Rock Physics and Mechanics and other research bodies which deal with problems related to the Republic's mining and ore-processing industries. Today the Academies of Sciences of the Central Asian Republics have 67 scientific institutions with unique, up-to-date equipment and installations and an aggregate membership of over 13,000, including nearly 200 Ph.D.s and over 1,700 Masters of Science. The East's first laboratory nuclear reactor was constructed in 1959, at the Uzbek SSR Academy of Sciences. Besides conducting theoretical research, the scientific centres of Republic Academies of Sciences are tackling problems of importance to the industries.

15. The organisation of applied research within the state university system may be of especial interest to the developing countries, since most of their specialist force sufficiently qualified to conduct serious research is concentrated at colleges. It is part of Soviet government policy in the sphere of science to build up college research

programmes and encourage contacts with industry. Compared with 1963, the value of research and development work done under contract to ministries and other Government offices increased 21, 44 and 50.7 per cent in three successive years. About 70 per cent of the contracts are filled by colleges.[5]

16. The specialised laboratory, at which college teachers conduct research and experiments commissioned by economic management bodies in a particular field has proved very suitable for solving current production problems. The benefit is mutual. The ministries, which make the necessary outlays, obtain the services of the very best specialists and their findings are then applied at numerous enterprises; the colleges get the opportunity to conduct large-scale research at laboratories that leave nothing to be desired. Students, whose services are also enlisted, gain invaluable laboratory experience and, staying on after graduation, quickly develop into competent researchers. Central Asian university colleges have more than thirty specialised applied and theoretical research laboratories.

Functions of Applied Research in the Process of Industrial Development

17. Applied research plays a key role in promoting industrial development. Its main functions in accelerating development from any level are as follows:

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[5] V.V. Maloshuk, N.T. Pribytovskaya, The College Laboratory and Industry. Vestnik vysshei shkoly (Higher School Journal), No. 12, 11-13 (1966).

a) to explore and examine the natural wealth and see how it can be developed;

b) to adapt processes to local conditions;

c) to develop new processes for working local materials;

d) to devise methods of obtaining new products and utilising the output;

e) to raise the efficiency of the operating enterprises;

f) to improve quality; to devise suitable methods of quality control;

g) to elaborate adequate siting and development patterns both for separate projects and entire economic areas;

h) to ensure standardisation, provide relevant information, etc.

The relative importance of any of these functions may vary depending on the level of development, the available scientific force and natural resources, and government policy. In the case of the Central Asian Republics each of the functions referred to has come into its own. Each line of research has yielded results of great economic and social significance and sped up industrial development by supplying the answers needed.

Exploration and Exploitation of the Natural Resources

18. To ensure further development of an economic area it is necessary to find out what natural resources it has. In Central Asia surveys were conducted first by expeditions of the USSR Academy of Sciences and later by special local bodies. The discovery of numerous deposits of coal, oil

and metal ores made it possible to create a considerable extracting and processing industry. In recent years enormous deposits of natural gas and gold were discovered in Uzbekistan; oil-extracting and refining industry appeared in Turkmenistan; Kirghizia is the main supplier of mercury, antimony and other metals.

19. This shows that there is no place without its share of natural wealth. It was believed forty years ago that these areas would never be able to supply anything but farm produce. Perseverant research, however, helped to discover enough mineral wealth to launch and develop large-scale diversified industry.

20. Central Asian geologists, physicists and geochemists set out in the first place to perfect the accepted methods of prospecting and develop new ones, like aerial photography, geophysical, geochemical and magnetic methods, employment of isotopes and nuclear radiation, which allowed considerable territory to be surveyed in a very short space of time and so made possible the discovery of rich raw material deposits. Metallogenic maps had been prepared that enabled industrial organisations to discover rich deposits of non-ferrous and rare metals in many areas. Increasing use is being made of activation analysis methods, which help to identify the rare-earth and some other elements, gold., etc., more quickly and much more accurately.

21. The discovery of industrial deposits of valuable minerals led to the creation of the extracting and processing industries, which in turn faced the scientists with the task of working out adequate methods of mineral extraction,

concentration and processing. Specialised scientific bodies together with relevant departments organised at the institutes of energetics, mechanics, chemistry and physics were to meet the need. In Kazakhstan—which was in the lead—essentially novel methods (cycline method, amalgam method, etc. were developed for recovering non-ferrous and rare metals. A new complete set of self-propelling equipment was designed and is being successfully used at many mines in the Central Asian Republics. Introduction of these and other innovations saved millions of rubles, and resulted in a higher productivity and a more extensive utilisation of labour resources in new project construction and operation. The Republics of the former Turkistan Territory have become chief suppliers of some commodities on the home as well as foreign market. It should be noted that the first stage of research was to adjust the standard technology of ore extraction and processing to local conditions. Having solved this task, the scientists were able to perfect the old processes and create essentially new ones.

Elaboration of New Processes Adapted to Local Materials

22. It is the most important task of research to develop commercial exploitation of local raw material. We shall mention only a few examples in connection with the chemical industry, which, incidentally, did not appear in Central Asia until after the revolution. During the first Five-Year Plans fertiliser, hydrolysis, oil-refining, cement and other plants were constructed. This created a host of problems, which arose in connection with the processing of

different kinds of local raw materials. Accordingly, chemists suggested processes for producing new kinds of fertilisers, like non-caking potassium nitrate, mixed fertiliser, etc., for producing cement, recovering antimony from lean oxidised ores, obtaining metallurgical coke from some coal deposits, etc.

23. Much has been done towards utilising pentosan-containing material. This problem faces many developing countries, especially those poor in minerals. Waste products like corncobs, cotton hulls, rice husks can be turned into furfural, furan and alcohols, which can be used to obtain polymeric materials, physiologically active compounds and other chemicals needed by many branches of the economy. Uzbekistan has enterprises for processing pentosan-containing material. Processes have been developed for extracting malic and citric acids from the leaves of the cotton plant. The Chimkent Pharmaceutical Factory in South Kazakhstan produces effective drugs from local alkaloid plants, etc.

Making Production More Efficient

24. We shall quote but one example to show how scientific research can make production more efficient. When working on the mechanisation of cotton processing, Uzbek scientists developed a method for removing linters at the rate of two tons of cottonseed an hour. The residual lint does not exceed 0.5–1 per cent. This makes cottonseed much more convenient for use in the cotton, chemical and food industries. Also, such seed is a more economical sowing material than ordinary seed. Delinted seed not only crushes

more easily but also provides large additional reserves of cellulose. Carboxyl-methyl cellulose obtained from the latter has replaced the food starch used in the oil-and-gas, textile, chemical and some other industries. Thanks to this development, the Central Asian Republics, which had to be supplied with cellulose from other places, now are producing it themselves at a rate of 200,000 tons a year. It is an illustration of the versatile use of a staple crop.[6]

Project Siting and Comprehensive Regional Development Patterns

25. Republican scientific bodies under the respective Academies of Sciences systematically develop scientific principles of comprehensive study and development of major industrial and agricultural economic regions in their Republics. The results of research help define the most suitable lines on which to develop major economic areas so that the productive forces of each should be used to the full. Uzbek scientists have presented long-term suggestions for the development of the Ferghana Valley, the Angren mining district, the Hungry Steppe, the industrial district of Almalyk, etc. Of great importance was the solution of the problems of the ore-mining district in the North of the Kirghiz SSR. Research results serve as initial data for drafting scientifically-grounded plans of comprehensive development

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[6] U.A. Arifov, An Important Reserve of the Cotton, Chemical and Food Industries. Vestnik AN SSR (The USSR Academy of Sciences Journal), 1966, No. 4, 108-10.

of the regions examined, project siting, specialisation and co-operation, etc. Aside from its economic value, such research provides a wealth of scientific data which can be used in establishing the regularities of the geological structure and in studying the plant and animal world, the labour resources and local culture and life.

26. We cannot deal here with each function of research for reasons of space. As industry develops and professional and scientific personnel increase in number, a considerable part of these functions come to be fulfilled by factory Research and Development departments and specialised institutes. Leading research institutes under ministries concentrate their efforts on long-term problems facing the particular industry. Institutes of Academies of Sciences, on the other hand, increasingly undertake fundamental and theoretical research, of common import to groups of industries.

Social Effects of Industrialisation

27. In a historically short period, less than the life span of a single generation, economic and cultural conditions have undergone a stupendous change. A socialist society has been built bypassing the capitalist stage. In the space of forty years the gross industrial output of the Uzbek SSR increased 63 times, in Kirghizia it increased over a hundred times, etc. The share of industry in the gross national product increased more than tenfold. Huge masses of people were drawn into industrial production. In 1965, the operating factory personnel numbered 485,000 in the Uzbek SSR, 148,000 in the Kirghiz SSR, 104,000 in the Tajik SSR,

and 79,000 in the Turkmen SSR.

Industrialisation has resulted in a significant increase of the national income and greatly improved living conditions for the entire population. It is worth noting that the growth rate of the Uzbek, Kirghiz and Tajik Union Republics is higher than the country's average. During 1958-65 it was 167, 174 and 181 per cent respectively against the USSR growth rate of 159 per cent. Illiteracy has been stamped out and a national force of intellectuals created. In 1965, there were 6,700 scientists of the Uzbek nationality, 1,000 Kirghiz, 1,400 Tajiks and 1,300 Turkmenians.[7]

Recommendations and Conclusion

28. At the present level of knowledge it has become possible in principle to apply extensively the achievements of science and technology as a means of accelerating industrial development anywhere in the world. There exist, however, obstacles of an economic and social nature. Insufficient economic resources and an acute shortage of local trained personnel are the two circumstances that put the developing countries at a disadvantage. To cope with these impediments to progress, the developing countries should exert every effort themselves and aid should be provided by the more advanced countries. Unless definite measures are taken promptly, the rapid progress of science and technology will make the economic gap still wider.

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[7] USSR Economy in 1965. Statistics, 562, 590, 708, 711-3 (1966).

29. Practice has shown that to promote the progress of science and make efficient use of its achievements to further the economic development of backward Central Asian regions it was necessary:

to effect socio-economic reforms abolishing the aftermath of the regime of oppression and national inequality;

to introduce economic planning;

to end illiteracy, develop a system of public education and provide for the training of skilled workers, engineers and scientists from the local population;

to rely on the support of the industrially developed areas of the Soviet Union and turn to account their superior know-how;

to ensure a priority development of a network of scientific bodies and institutions of higher education able to meet the needs of the developing economies;

to launch and expand a system of scientific centres for both applied and fundamental research;

to provide for relatively higher growth rates both for industry and science so as to ensure uniform development with the rest of the country;

to stimulate the interest of broad strata in the widest possible introduction of the fruits of science as a means towards better working conditions, higher efficiency, and more material and cultural amenities.

30. A study of the experience of the Central Asian Republics enables the following recommendations to be made:

a) Application of science and technology for purposes of development should be made an indispensable part of all planning and economic and social development programmes;

b) It is imperatively necessary to create an infrastructure of science by consistently increasing the force of scientists and technologists and ensuring their correct placement; by defining the main spheres in which science and technology should be applied; and by creating and building up a network of scientific organisations strictly in keeping with specific local conditions;

c) Scientists of most developing countries should concentrate on problems material to industrial development (cf. par. 17), paying particular attention to the prospecting, examination and proper utilisation of the natural resources, adaptation of processes to local conditions and development of new processes suitable for local materials (agricultural in the first place);

d) The United Nations Industrial Development Organisation should give full attention to practical applications of science and technology in the developing countries and define priority targets requiring co-operated action and promising certain benefits to developing and advanced countries alike.

31. The example of the Central Asian Republics testifies beyond all doubt that stopping the economic gap is a real possibility. Social reform and progress of science and technology place this task completely within the reach of human society.

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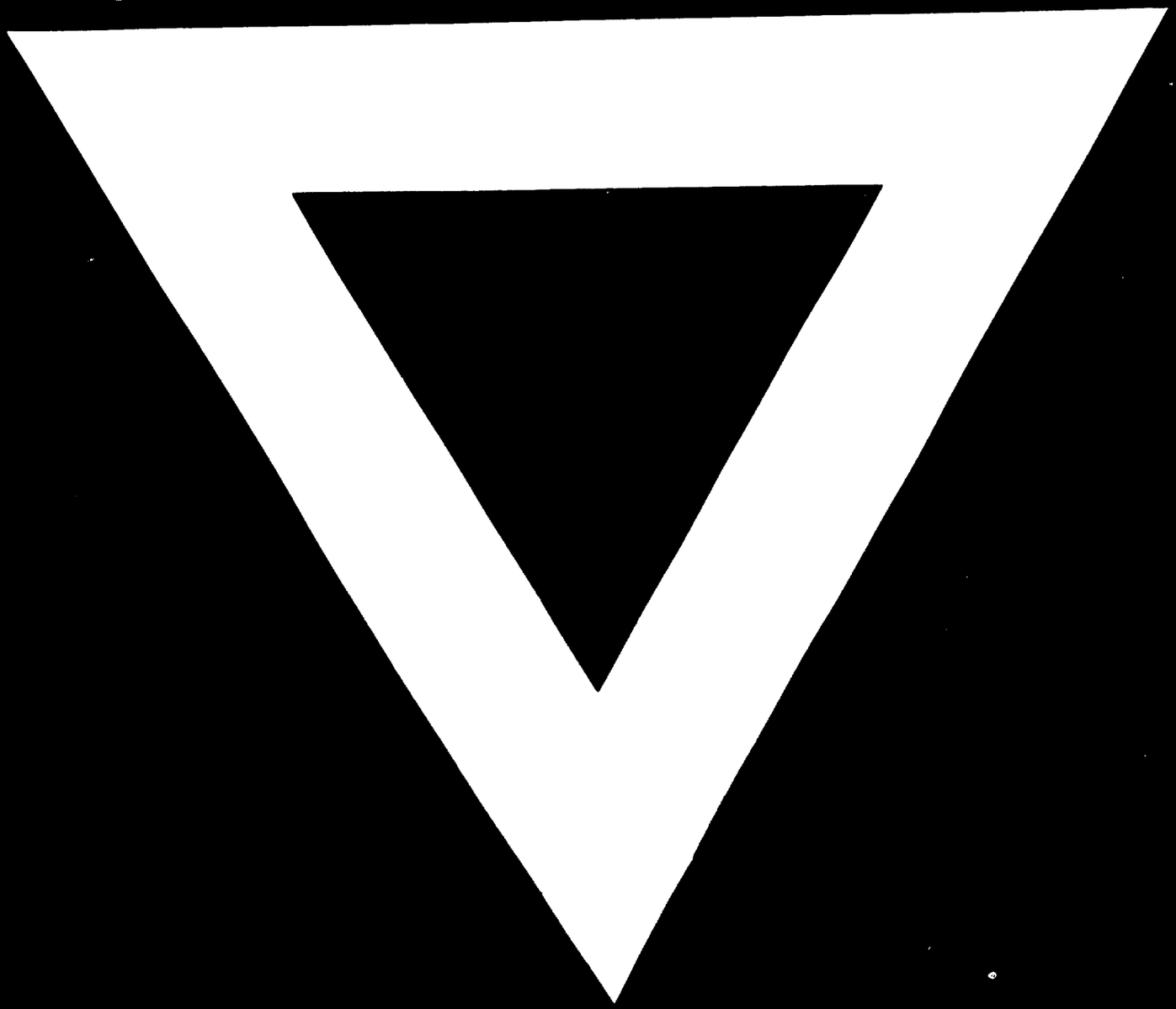

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