SOVIET INDIAN COOPERATION SERIES

K. V. RAO

PROJECTS FOR PROSPERITY

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Monuments of
Indo-Soviet Friendship and Cooperation

K. V. RAO

1978

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The relations between the Soviet Union and India sealed by the Treaty of Peace, Friendship and Cooperation, are very rich and multifarious. They include cooperation in diverse fields of economy, science, culture and the arts ; this is ramified, strong and mutually-advantageous cooperation. They cover also interaction in international affairs, placed entirely in the service of world peace.

—L.I. Brezhnev
(October, 1977)

From a modest beginning, a wide range of agreements have been concluded, culminating in the Indo-Soviet Treaty of Peace, Friendship and Cooperation. I would like, on behalf of the Government and the people of India, to acknowledge with gratitude the consistent support extended by the Soviet Union to us on questions of vital concern to India. On our part, we have reciprocated our goodwill and offered you our trust and cooperation.

—Morarji Desai
(October, 1977)

INTRODUCTION

The plants and projects in Bhilai and Bokaro, Ranchi and Ankleswar along with dozens of other projects of Indo-Soviet cooperation, have become a practical embodiment and symbol of the selfless friendship between the two great peoples.

—**Alexei Kosygin**
(1975)

On August 15, 1978 India celebrated the 31st anniversary of its independence. During the last 31 years since 1947, independent India has made phenomenal progress in all fields, and particularly in the industrial sector, thereby emerging as one of the top ten industrialised countries of the world.

The Soviet Union has made a significant contribution to the development of Indian economy in the public sector. A diversified solid industrial base has been created and self-reliance achieved.

At this moment, it is quite appropriate to have a look into the colonial past of the country.

* * *

Traders Become Rulers

For more than four centuries India had been the grazing ground for European traders. In 1498 A.D. Vasco Da Gama set foot on India at Kozhikode (Calicut) and managed to get permission from Zamorin, the Ruler of that place, for development of trade. Then the Portuguese East Indian Company was

formed with exclusive rights granted by the Pope for trade in this part of the world. Slowly this Company extended its power and influence. Goa became the capital of Portuguese colony in 1510 A.D. The Protestant countries which did not recognise the exclusive trade rights granted by the Pope to the Portuguese also came to India. Thus, the French East India Company and the British East India Company came into existence.

During the reign of the Mughal Emperor Jehangir, the British East India Company (formed in 1600 A.D.) began its trade with India. The Company built its forts at Madras, Calcutta, Bombay, Surat and Patna. Slowly the Company began to take interest in the internal affairs of the country and began to play one ruler against another to gain supreme authority. The Company stopped paying the taxes and built up its own military power. It fought wars and established presidency areas. In 1773 British Parliament passed a Regulating Act by which its Madras and Bombay Governors became subordinates to the Governor-General at Calcutta. By 1857 the whole of India and Burma came under the sway of the British Company. Those who came as traders, ultimately became the imperialist rulers of the country.

The Other Sort of Trader

A Russian trader named Afanasi Nikitin from the ancient town of Tver, now Kalinin, visited India in 1466 in the company of a group of Russian traders. Luckily for historians, Afanasi Nikitin was an educated, inquiring person and his diary still extant speaks of the adventurous journey to the fabled land of India.

Afanasi Nikitin and his friends started their journey to India in their sailing ships down the Volga to the Caspian Sea. At Astrakhan these ships were looted by pirates, and Nikitin and his fellow-traders lost all their fortune. Even then Nikitin did not give up. He travelled on horseback, by camel and even on foot, crossed Persia and finally reached India. He spent more than one year in India, visiting various places and making friends with the people. On one occasion, a local Raja confisca-

ted his horse and put him in prison. The Raja had even planned to execute Nikitin. But friends saved him. After great hardships Afanasi Nikitin travelled back to Russia and managed to reach Crimea. But before he could get back to his native place, he died in a small monastery near Smolensk. But just before he breathed his last, he called his friend Matvei and handed over to him his manuscript-diary entitled "Journey Beyond the Three Seas" which has become a valuable document of historical importance.

Thus Afanasi Nikitin was the first Russian visitor-friend, and unofficial Ambassador who came to India long before any European colonisers could set their foot on India's soil.

India Plans Progress

After three hundred years of colonial rule which ruined Indian economy, Britain had to bow out finally on August 15, 1947. Independent India inherited from the erstwhile British rulers an impoverished economy, underdeveloped industry and primitive agriculture.

The architects of Indian independence had visualised that industries in a free India shall have to be in the state sector. In a resolution adopted at the Karachi Session (1931) the Indian National Congress declared that all the key industries in free India should be owned or controlled by State, thereby guaranteeing rapid social progress.

The first industrial policy statement of the Government of India was published on April 6, 1948, just eight months after independence. It declared state monopoly in railways and atomic energy and that all new undertakings in coal, iron and steel, aircraft manufacture, mineral oil industries would be started in state sector.

The next policy statement came exactly a year later (April 6, 1949). It dislodged foreign capital from the pedestal of preference.

Later on, the Neogy Commission (1949-50) prescribed industrial priorities and recommended that defence industries,

coal and oil, mining and power industries, and heavy and basic industries should be developed in the public sector.

In 1955 the Indian Parliament adopted a socialist pattern of society as its objective. The industrial policy resolution of April 30, 1956 reiterated the objective of 'Socialist pattern of society' and development of heavy industry.

The emergence of the world's first socialist state in the USSR had been a source of inspiration and support to the Indian freedom struggle, and the successes scored by the Soviet Union in transforming the once-backward Tsarist Russia into a developed socialist society had deeply influenced the Indian leaders to opt for a socialist pattern of society.

The chief architect of independent India, Pandit Jawaharlal Nehru who had a thorough grasp of Soviet economic planning wrote in one of his letters that the "Soviets have put magic into it." He wanted that India also should progress on those lines. But it was not easy to build a national heavy industry base where the Western economic interests still exerted a dominating influence. The first significant attempt in this direction was the launching of the First Five-Year Plan in 1951. It sought Western assistance for industrial development. But the West was in no mood to offer anything concretely. Their diplomatic refusal was as good as saying : 'You need not have it, you don't need it, you can't do it'. It was also as good as suggesting : 'Sell your raw material to us at our prices and we will supply you ready goods at our prices.' They even resorted to blackmail but failed to achieve their ends thanks to the Soviet Union and the other socialist countries which came forward to assist India in its industrial development programme.

The basic difference between Western aid to India and Soviet assistance has been well delineated by no less a person than Mr. John Kenneth Galbraith, the then Ambassador of the USA to India, who wrote in his **Journal** : ...Our past help to private sector plants such as Tatas has evoked comments that Americans help those who are already rich. By contrast, the Soviets... build plants that belong to the people."

In 1951 the state sector in India had only five industries. By the end of 1977 their number rose to 120. Of these, about 80 have been already built or are being built with the active assistance of the Soviet Union. Most of them are in the core sector comprising iron and steel, heavy machinery, oil, power, coal and other industries.

These Soviet-aided projects account for 30 per cent of the total production of steel in India, 16 per cent iron ore, 60 per cent oil, 30 per cent refined oil, 20 per cent power and almost 50 per cent of metallurgical equipment. By May 1977, these projects produced 34.5 million tonnes of pig iron, 28.2 million tons of steel (including 22 million tonnes of saleable steel), 43 million tonnes of oil, 53 million tonnes of refined oil, 20 million tonnes of coal, 600,000 tonnes of metallurgical, mining and other equipment, heavy electrical equipment worth Rs. 2,470 million, and medicines worth Rs. 3,000 million.

In 1975-1976, in these Indo-Soviet projects 100,000 workers were employed. Their output was worth Rs. 19,900 million and the profit was Rs. 980 million, which is really more than 75 per cent of the profit carned by all the public sector projects. The Bhilai Steel Plant alone earned a profit of Rs. 490.5 million during the year 1976-1977.

Indo-Soviet projects have helped the growth of ancillary industries around the main plants. By May 1977 there were 813 small-scale enterprises around ten such main projects.

The Soviet Union has not claimed any dividends or royalties for its projects. According to the answers given in the Parliament in 1975, other countries (than the Soviet Union and socialist countries) received Rs. 1,105 million as dividends and Rs. 165.9 million as royalties.

Indo-Soviet projects are already playing a substantial role in export promotion. In 1974-75 period 43.7 per cent of the total exports of the state sector plants came from Soviet-aided projects. In 1975-1976 fiscal year, out of the gross output worth Rs. 19,900 million the value of import substitution goods amounted to as much as Rs. 11,000 million, i.e., a saving of foreign exchange to the tune of this amount.

BHILAI STEEL PLANT

Our friendship, tempered in the flames of the blast furnaces of Bhilai, obtained a new content as a result of the joint efforts of the Soviet Union and India in the world arena, efforts aimed at the triumph of peace, justice, and freedom of the peoples.

—L.I. Brezhnev
(From his speech at Delhi in November, 1973.)

Free India had to face many problems when it planned to establish its steel plants in the state sector. When approached, Britain gave a short answer : "Not interested." The British were not interested in losing their traditional steel market in India. The FRG group Krupp & Demag was approached for setting up a steel plant at Rourkela. Under stiff terms, they agreed for a half-million-tonne project only with a small, 600-tonne blast furnace and with no provision for expansion. But as soon as the Bhilai agreement was concluded with the Soviet Union on February 2, 1955, FRG came forward for a million-tonne plant with 1000-tonne blast furnaces. Britain also offered a similar plant at Durgapur.

This was a turning point in the industrialisation of India. The Soviet offer to build the Bhilai Steel Plant was on terms quite favourable to India. The credit carried a 2.5 per cent annual interest, to be repaid over a period of 12 years. The payments were to begin only after the last equipment for the project was supplied and there was a grace period of seven years, which in reality made the long-term Soviet credit avail-

able for about 20 years on average. After the Bhilai agreement was concluded the British and FRG firms undertook to build the steel plants of the same capacity but on different terms. Britishers agreed for an interest of 4.75 to 5.5 per cent for 7 to 15 years and the West Germans reduced their interest rate from 12 to 6 per cent, and the period of repayment to 12 years.

The foundation work for Bhilai involved digging up 200,000 cubic feet of earth and using about 18,000 tonnes of steel and 3,300 tonnes of castings for erection of the furnaces. The first coke-oven battery at Bhilai plant was commissioned exactly four years after the first agreement was signed and the first blast furnace was inaugurated two days later on February 4, 1959, by the President of India. The second and third coke oven batteries were commissioned in 1959 and 1960 respectively. The second blast furnace was commissioned at the end of 1959 itself and the third one a year later. Bhilai reached its planned capacity for its first stage in 1962, much ahead of Durgapur (1964) and Rourkela (1965).

Situated about 415 km away from Nagpur, Bhilai was a desolate village of little importance when it was chosen as the site for steel plant on March 14, 1954. The choice was greatly influenced by the easy availability of essential raw materials for steel making, such as iron ore and limestone. The nearby hills of Dalli and Rajhara could provide the iron ore and the Nandini quarry the limestone.

The coke-oven battery generates 57,600 cubic metres of gas every hour and yields a number of by-products like ammonium sulphate, benzol, tar, sulphuric acid, naphthalene, phenol, and various oils.

It is quite interesting to watch iron ore passing through several stages of treatment in the sintering machine, blast furnace, steel-smelting shop, blooming mill, billet mill, rail and structural mill, etc. Iron ore, limestone and coke in the required proportions are hoisted to the top of the blast furnace and dropped into it. Hot air is blown into the furnace to burn coke and generate heat. Hot carbon of coke, carbon bearing gas and the oxygen of the iron ore combine to form gases. Thus molten pig-iron collects at the bottom of the furnace.

In the sintering plant, ores less than 12 mm in size and coke breeze of less than 10 mm are crushed along with limestone and dolomite, and mixed. Then by heating at high temperatures the mixture is fused into lumps which are fed for charging the blast furnace. This sintering process reduces the cost of production as well as reduces the consumption of coke.

In the Bhilai Steel Plant pig-iron is converted into steel by the open-hearth process. Molten pig-iron from the blast furnace is fed into the open-hearth furnace with the required quantities of steel scrap, limestone and iron ore. After about 11 hours of continuous heating, molten steel is poured into different moulds to form ingots of different sizes weighing 5 to 15 tonnes. These huge red-hot steel ingots automatically move to the billet mill where they are cut into thick billets of the required lengths and rejects the odd length automatically to be fed again into the smelting shop. In the merchant mill we see the automatic fast moving red-hot rolled metal resembling the shooting stars and disappearing instantaneously after acquiring the required shape. The wire rod mill produces coils of wire rods automatically.

For the first stage of the Bhilai plant with an annual capacity 1,000,000 tonnes of steel, and for the second stage with a total capacity of 2,500,000 tonnes of steel every year, the equipment was supplied by the Soviet Union. The sixth blast furnace of the plant was designed and fabricated by the Indian engineers for the first time in India at Ranchi and was commissioned in 1971.

On June 3, 1972, an agreement was signed between India and the USSR for the expansion of Bhilai Steel Plant's capacity to 4,000,000 tonnes of steel per annum. Eventually, the capacity of Bhilai Steel Plant is to be raised to 7,000,000 tonnes of steel per annum, in keeping with the agreement signed during L.I. Brezhnev's visit to India in November 1973.

Bhilai has made a significant impact on the economic and social development of India as a whole and particularly in this part of India. Its continuous development and profitable working have heightened the value of Indo-Soviet cooperation and friendship.

BOKARO STEEL PLANT

I am sure this venture of constructing a steel plant at Bokaro is the biggest of its type and will further cement the friendship that already exists between the two countries.

—**N. Sanjiva Reddy**
(1965)

Bokaro, the fourth integrated steel plant in the public sector, is the largest steel complex in India, being built with the cooperation of the Soviet Union. Unlike the previous ones, it is almost a "Swadeshi" plant. Most of its machinery is designed and manufactured in India. It is a symbol of India's industrial progress and incorporates the most modern developments in steel technology.

The history of Bokaro Steel Plant is also interesting. When at the end 1959 the project plan was submitted to the Government of India, it was expected that the USA would assist in its construction. The US circles spent almost one year, in 'studying' the question and then began expressing doubts about the feasibility of the project. Then they demanded that the whole control over the construction of the plant should be given to the American monopolies. It was also made plain that the United States was not interested in strengthening the state sector. But when India insisted that the Bokaro plant will definitely be built in the state sector only, the Americans lost all interest in the project.

It was only then that the Soviet Union was approached. As could be expected, Indo-Soviet agreement for cooperation

in this project was concluded on January 25, 1965, and the actual construction work was started in October 1967. It took the labour of 100,000 people for ten years to complete the construction of this huge plant, the largest in South-East Asia. The plant's first 2000 cubic metre blast furnace produced pig-iron in October 1972.

President Neelam Sanjiva Reddy inaugurated the third blast furnace of the plant on February 28, 1978 marking the completion of the first stage of the plant having an annual capacity of producing 1.7 million tonnes of steel. Now the plant is well on its way towards the second stage of 4 million tonnes. Later, with a few additional units, the capacity could be raised to 5.5 million tonnes.

Now it has four coke-oven batteries of 63 ovens each, two sintering plants and three blast furnaces. In the second stage three more coke-oven batteries, two more sintering plants and two more blast furnaces will be added.

Steel-smelting at Bokaro is done by L.D. process which is different from the open-hearth process at Bhilai. For this purpose four 100-tonne converters have already been installed in the first stage. During the next stage one more converter of 100 tonnes capacity and two more converters each of 300 tonnes capacity will be installed. Slabbing mill, and hot and cold rolling mills are already working smoothly. Within a short span, Bokaro plant has already become a major (45 per cent) supplier of high grade cast iron in the country. Its pig-iron is exported to other countries also.

Latest achievements in metallurgy are incorporated in the designing of Bokaro plant. This plant will produce the much needed rolled sheets and galvanised sheets, thereby saving a good deal of foreign exchange.

The indigenous content in the construction of the plant was 65 per cent in the first stage. Its ratio is being raised to about 80 per cent in the second stage and to 85 per cent in the next stage of construction. The main suppliers of machinery to this plant are the Heavy Machine-Building Plant (Ranchi), the

Mining & Allied Machinery Plant (Durgapur), the Heavy Electrical Equipment Plant (Hardwar) and the Precision Instruments Plant (Kota), which are all built with Soviet assistance.

During the last two years Bokaro has exported goods worth Rs. 54.3 million and has earned good profit.

There are about 35,000 people working in the main plant now. About 50,000 people are employed by the ancillary agencies around the plant.

HEAVY MACHINE-BUILDING PLANT

Soviet aid has helped us to set up plants of basic industries which help in making us independent in our requirements for industrial development.

— Fakhruddin Ali Ahmed
(1970)

Just as industrialisation of a country is unthinkable without steel, the creation of a powerful steel industry requires heavy machinery and equipment which, if imported, would involve heavy drain on foreign exchange.

On the advice of the first group of Soviet experts invited to India in 1956 to study the question of setting up heavy industry and draw up concrete proposals, the Government of India decided to establish two large machine-building plants with Soviet assistance: the Heavy Machine-Building Plant at Ranchi and the Mining and Allied Machinery Plant at Durgapur.

For this purpose, on December 31, 1958 the Heavy Engineering Corporation (HEC) was set up with an authorised capital of Rs. 50 crores. It includes Heavy Machine-Building Plant (HMBP) built with Soviet assistance, and also the Foundry Forge Plant and Heavy Machine-Tool Plant built with aid from Czechoslovakia. The construction work at the site was commenced early in 1961. In November 1963 this prestigious HMBP was dedicated to the nation. This plant, which with its annual total capacity to make 80,000 tonnes of heavy machinery was originally meant to supply machinery for equip-

ping the new steel plants, has now become the base of industrial machinery in the country. Its production is adequate to provide coke and chemical, steel-smelting, hoisting and lifting and other basic equipment for a new one-million-tonne steel plant annually. In its five departments, the largest one produces heavy machinery and equipment up to a weight of 150 tonnes (single piece), rolling equipment, crushing and grinding equipment, forging and pressing equipment, excavators, etc.; the medium and small machinery department produces machinery up to 50 tonnes single piece weight; coke-oven by-product and handling equipment department manufactures EOT cranes and coke-oven equipment; the reduction gear department has a special high frequency heat treatment section for hardening gear; and the forging and heat treatment department has a special section for metal coating.

A substantial part of equipment and machinery for the Bokaro Steel Plant—nearly 200,000 tonnes—(including the coke-oven batteries, blast furnaces, casting machines and rolling mills) was produced at the Ranchi plant. Now, for the second stage of Bokaro, about 37,000 tonnes of equipment and machinery will be supplied by this plant. Machinery for the expansion of Bhilai Steel Plant, and two electrolytic shops for the Aluminum Plant at Korba are also being manufactured here. At present, the HMBP produces almost 80 per cent of all the metallurgical equipment manufactured in India.

During the initial years after its establishment, the HMBP used to import highly sophisticated and intricately designed equipment to the tune of 8,000 to 10,000 tonnes. But with the cooperation and help of Soviet experts, Indian engineers at HMBP have acquired the necessary expertise to produce all these equipment indigenously.

Already HEC has produced and supplied heavy equipment to several plants in India. They include rolling mills to Defence department, excavators to National Coal Development Corporation, crushers to Khetri Copper Project, EOT cranes to BHEL, Oil drilling rigs to ONGC, etc., to name just a few.

Besides, the Heavy Engineering Corporation is now exporting many such items. At present, it has orders on

hand from Yugoslavia, Bulgaria, Hungary, Cuba, Egypt, Turkey and other countries. The Soviet Union also has placed orders for about 40,000 tonnes of technological structurals. Presently talks are in progress to produce annually 10 to 12 thousand tonnes of equipment for export. Production of spare-parts for HMBP is also being indigenised.

A number of ancillary industries have come up around this industrial complex also, providing employment to thousands of people.

This unique plant of plants has a great future and it is a shining mounment of Indo-Soviet friendship and cooperation.

MINING AND ALLIED MACHINERY PLANT, DURGAPUR

Large plants have been and are being built in India with Soviet aid. Hundreds of Soviet engineers and technicians have rendered us in India assistance in this work extremely important to us. I am very grateful to the Soviet Government for the aid it has been rendering and continues to render to us.

—Jawaharlal Nehru
(1961)

India is fortunate in possessing huge deposits of coal which is rightly called 'black diamond'. It is estimated that these deposits would be of the order of about 130,000 million tonnes, including about 13,000 million tonnes of coking coal. Besides, new deposits are being found every year.

Coal is essential to keep 'home fires burning' in the cold regions. In recent years its uses are multiplied and it has attained an important position. It is still needed for the railways, despite the introduction of diesel and electric traction. It is necessary for thermal power stations—even its brown variety, lignite, is also made use of for this purpose. It is an essential raw material for steel-making and for the production of chemicals. We get about 200 items from coal including resins, plastics, fertilisers and dyes.

During the British rule, the coal industry in India was in private hands and, in the absence of modernisation, production lagged behind. World War II brought some spurt in pro-

duction of coal and the trend continued for quite some time. In 1951 there were about 380,000 labourers in this industry; but there were only 875 coal cutting machines in 118 coal mines, producing about one-fifth of the total output. There were only nine mechanical loaders and 19 conveyers. The total production of coal was only 34 million tonnes.

During the Second Five-Year Plan, the Government of India gave serious attention to this problem and the National Coal Development Corporation was set up. The need of the hour was comprehensive assistance for expanding Indian coal industry, stepping up production, developing skills and indigenous production of mining equipment. And Soviet assistance was readily available in all these fields.

In July 1956 a group of Soviet experts visited Indian mines and quarries, studied the mining and geological conditions in the country, and submitted their report to the Government of India in January 1957, strongly advocating the setting up of a mining machinery plant with an initial capacity of 30,000 tonnes. The Government accepted this proposal and decided to establish the plant at Durgapur.

In February 1960, a contract was signed for the supply of working drawings for the plant and its ancillaries. Construction was started in 1961 and completed in 1963. The Government of India decided to increase the capacity of the plant to 45,000 tonnes in view of the anticipated higher demand for coal mining machinery in future. Though it was originally a part of the HEC, Ranchi, it was separated in April 1965 forming the Mining and Allied Machinery Corporation, Durgapur.

In November 1963, the plant started production of coal-mining machinery covering all operations including coal-cutting, loading, underground electric locomotive transport, ventilating de-watering, etc. The range of products varies from 150 kg pump-sets to gaint winding machines of 4 metres diameter and weighing 150 tonnes.

The cast iron foundry of the plant is capable of supplying 11,000 tonnes of iron castings per year. There is a non-ferrous

foundry also which can supply 300 tonnes of non-ferrous metal castings.

The steel foundry of this plant produces 9,000 tonnes of steel castings per annum. There are two electric furnaces, one of 5 tonnes capacity and another of 2.5 tonnes capacity. All processes in this foundry are mechanised.

The forging shop is fitted with different sizes of hammers ranging from 150 kg to 3 tonnes. It has an annual capacity of of about 9,850 tonnes of forgings. The furnaces are gas-fired. There are forging presses up to 1,000 tonnes capacity, four horizontal forging machines, etc. The plant is producing conveyer equipment for new industrial projects, ports, etc. It has already supplied more than 14,000 tonnes of equipment for Bokaro Steel Plant. The products of this plant are in great demand for reconstruction and remodelling of Indian coal mines.

CONTINUOUS STEEL CASTING PLANT, ARKONAM

There can be no doubt that it is in steel that we have had the most substantial aid from the Soviet Union and also probably the most decisive assistance in what is a crucial sector of Indian economy.

—S. Mohan Kumaramangalam
(1972)

This plant is the first of its kind in India. Situated in Arkonam near Madras, it is a great boon to small industries which are in need of rolled steel. This produces steel castings out of scrap-iron, steel, etc.

Agreement to set up this plant was signed in January 1966. The main equipment was supplied by the MACHINOEXPORT organisation of the Soviet Union and also by the Heavy Machine-Building Plant of Ranchi. Besides setting up the plant, Soviet engineers also trained Indian personnel at the plant site.

This plant smelts steel scrap in the electric furnace and casts billets in another machine. These billets are then rolled in the small merchant mills to the required shapes. The novel method of steel rolling used here has resulted in a saving of about Rs. 70 to 80 per tonne of steel when compared with the conventional method.

The complete mechanisation and automation of the entire process of steel casting and rolling has made it possible to increase production up to 20 per cent. The rolled metal obtained is of superior quality.

The Arkonam plant has four strand continuous casting installation. Its present capacity is 50,000 tonnes of square steel billets a year during the first stage. This can be raised to 200,000 tonnes a year by adding some more electric furnaces to the plant.

There are 14 rolling shops and four forges in the plant. These also can be extended. And there is provision to start a wire mill also.

This plant produces 75 mm malleable squares for supplying to the small rollers. It also produces carbon steel, manganese steel and ferrous metal for small industries.

METALLURGICAL & ENGINEERING CONSULTANTS (INDIA) LTD.

The cooperation extended by the Soviet Union has helped India to make progress towards economic self-reliance and emerge amongst the more important industrial nations of the world.

—Morarji Desai,
(October 2, 1977)

The Metallurgical and Engineering Consultants (MECON) located at Ranchi is the biggest organisation in India which designs metallurgical projects. It was set up in cooperation with GIPROMEZ, which is the Soviet Union's foremost metallurgical institute. Two hundred Indian specialists were trained in the USSR, besides sending Soviet specialists and equipment to set up the MECON. Moreover, the USSR has provided the necessary know-how and documentation, designs for whole plant and workshop. As a result, the MECON has emerged as an important designing complex during the last 15 years. It employs about 2,000 people including more than 900 engineers and plans the growth of ferrous and non-ferrous metallurgy in the country. The institute has undertaken the designing and engineering aspects of expansion of Bhilai and Bokaro plants and also the new steel plants and the Korba aluminium plant. It offers cheap consultancy service also in technical matters.

NON-FERROUS METALLURGY

We appreciate the help that the Soviet Union has given to us to industrialise our country and to make us self-reliant. We are also grateful for the consistent and principled support in our difficult times.

—**A.B. Vajpayee**
(1977)

Considerable amount of foreign exchange are being spent by India for importing aluminium, copper, zinc and other non-ferrous metals. For instance, during 1969-70, India imported non-ferrous metals worth Rs. 745 million. Four years later, i.e., in the year 1973-74, the value of such imports was almost double, Rs. 1,397 million. The demand for these metals keeps increasing along with the development of engineering industries.

During the past few years, the non-ferrous metal industry has been making a steady headway and the production of aluminium, copper, zinc and lead in the country has increased. In fact, for the present there is an export surplus in aluminium and there is almost self-sufficiency in copper. But more production of non-ferrous metals is absolutely necessary for further industrialisation in the country. Happily India has abundant deposits—in fact about 10 per cent of the world's reserves—of bauxite (aluminium ore), and also of copper, lead, zinc, nickel, fluorite, etc.

a) Aluminium

A decision to set up aluminium industry in the public sector was taken in the sixties. There was a very negligible aluminium

industry in India before 1960. But during the last 15 years it has made steady progress. The demand for aluminium is also growing for electrical industry, for aircraft frames, for manufacturing cheap utensils, for packaging, transport equipment, building materials and also for various defence requirements. The export possibilities are also very bright.

Between 1951 and 1960 the consumption of aluminium in India rose from 15,000 tonnes to 54,000 tonnes. During the same period the production of aluminium in the country rose from 3,840 tonnes to 18,000 tonnes and the deficit was regularly imported. In later years the domestic consumption of aluminium had grown gradually from 130,000 tonnes in 1967 to 170,000 tonnes in 1973. During the year 1978-79 the demand for aluminium is estimated to rise to about 370,000 tonnes.

There are already seven enterprises in private sector in India and they produce more than 300,000 tonnes of aluminium. They are expanding their production by about 70,000 tonnes.

The public sector Bharat Aluminium Company (BALCO) is building two aluminium complexes out at Korba (M.P.) which is already working and will eventually produce every year 100,000 tonnes of aluminium and rolled products. It is proposed to build another at Ratnagiri (Maharashtra) with a capacity of 50,000 tonnes.

It is proposed to establish a major aluminium plant in Andhra Pradesh. A delegation of Soviet experts led by S.G. Starodubrovsky, Deputy Director of the USSR Aluminium Research Institute (VAMI) of Leningrad, made a study of the East Coast bauxite deposits and the site of this proposed largest 600,000 tonnes alumina plant there. They collected the initial plant data and samples of raw materials, after processing of which a feasibility report will be prepared and submitted. The report is expected to be ready in about a year. Eventually this new plant will have a capacity of 1.2 million tonnes of alumina. They had discussions with BALCO authorities about the setting up of a research and development centre for aluminium with facilities for testing and treatment of new bauxite deposits. A

captive power plant also is proposed to be built here. This centre will have a Reserch and Design Institute, and a pilot plant to test alumina and aluminium technologies for future projects in India. The quality of alumina in the Andhra Pradesh plant will meet world standard, and half of the output of the new proposed plant in the Andhra Coast will be purchased by the USSR in compensation for its assistance and supply of equipment for the new plant. An Indian team will visit Leningrad to finalise the feasibility report in July 1979.

The first phase of Korba Aluminium Plant in public sector was ready by May 1975, with the commissioning of smelter for production of 25,000 tonnes of aluminium. With three more smelters of the same capacity construction work of this complex is almost completed.

The alumina plant of this complex built with Hungarian assistance was ready in 1973 with a production capacity of 200,000 tonnes of alumina per year. The bauxite deposits for this plant are situated at Amarkantak and Rhutka Pahar in Madhya Pradesh. Electricity is obtained from Korba Thermal Plant which is also built with Soviet assistance.

The Korba Aluminium Plant will produce rolled aluminium, aluminium sheet, pipes, rods for electrical conductors, various aluminium sections, etc. It will supply aluminium ingots to other aluminium units also. It provides employment to 8,000 people and will serve as a base for further research and development of this industry.

A training centre is also established here for aluminium technology and about 100 specialists are trained every year.

b) Copper

Copper and its alloys are in great demand. India used to have all small coins in copper. They are nowhere to be seen now, because they were all smelted and used for other requirements. During 1973-74 the demand was for about 83,000 tonnes of copper. It may go up to 105,000 tonnes in a few years. As the production of copper in the country is not adequate, India

has to spend several millions of rupees to import it. The world market price of copper is very high in recent years.

The Khetri (Rajasthan) and Ghatsila (Bihar) smelters, together having a capacity of 57.000 tonnes per annum, are expected to contribute at least 45,000 tonnes copper in 1978-1979. Attempts are being made to increase this capacity by extracting at least 10,000 tonnes more ore per day at Khetri Kolihan and by development of other mines including Rakha and Surda in Bihar.

The project report for extracting copper ore by using the method of massive explosion in open-cast process and establishing a copper ore dressing complex at Malanjkhand (Madhya Pradesh) is already prepared by the Soviet design institute with the participation of Indian engineers and experts. This is one of the largest copper deposits discovered in 1968 by Indian geologists trained in the USSR by using Soviet geochemical prospecting methods. It is estimated that 850,000 tonnes of copper can be extracted from the deposits here. Soviet experts have already visited India in 1974 and inspected deposits, existing plants and the proposed plant site.

The copper ore lies deep under surface and protrudes 75 metres above ground. Most of this protruding part is not rich. So, if it is agreeable to the Governmet of India, 1,400 tonnes of explosives will be blasted here to break up 1,200,000 cubic metres of rock. It will mean a saving of time, labour and also about Rs. 1,300,000 to slide the hill nearly 50 metres off to enable the engineers to start extraction. Advanced Soviet technology of obtaining pure metal ensures high quality of metal output. By-products like sulphuric acid and other metallic dusts are also obtained.

This project is expected to yield about 30,000 tonnes of copper every year. The benefication plant at Malanjkhand will be the most advanced, and designed according to the latest Soviet technology. It will be completed in 4.5 years. It will yield twice as much copper as is produced in India today.

c) **Nickel**

So far, India has been fully importing this metal because there was no production in the country. Now construction of

a plant is undertaken with Soviet cooperation. Indian geologists discovered a rich deposit of nickel ores in Sukinda (Orissa). But these ores are of composite type and most effective technology becomes necessary to extract nickel from these ores. The Soviet research and design organisations are making a thorough study and elaborating the suitable mining technology for this purpose. They are making the feasibility study and also working out cost analysis.

d) Zinc, Lead

India has rich reserves of polymetallic ores which contain zinc, lead, copper, etc. These ores are difficult to process. The Soviet Union will help India to develop special technology for these composite ores. Joint research will be undertaken and if necessary, Soviet technical assistance will be rendered for the development of these deposits.

Prospecting

The Soviet Union will provide India assistance in prospecting for non-ferrous metals. Geologists of both the countries will cooperate in developing and applying latest method of survey and prospecting.

The vast programme includes elaboration of new technological processes for production of non-ferrous metals and also for ore mining and dressing. Soviet and Indian specialists meet regularly and exchange opinions and coordinate their work as per the decision of the fourth session of Inter-Governmental Soviet-Indian Commission for Economic, Scientific and Technical Cooperation.

Soviet cooperation in this field will enable India to develop its non-ferrous metallurgy and attain self-sufficiency.

DEVELOPMENT OF MINING ENTERPRISES

Soviet assistance to India's coal development has become significant...It will not only help to increase production, but also improve India's coal technology as also the production of coal-mining machinery.

—**J. G. Kumarmangalam**
(1974)

India has vast resources of minerals. But there was not any appreciable development of mining industry. The British colonial power was interested only in lucrative precious metal mining as at the Kolar Gold Fields in the South making huge profits for themselves and impoverishing the country. They carried away almost all the available valuables from the country during their regime.

Even coal industry was not well developed. For example, India produced only 320,000 tonnes of coal in 1950, three years after independence, mainly for railways and domestic use.

Only after independence India developed its coal production. For example in 1973-74 its production was about 79,000,000 tonnes. The target for the Fifth Plan was set at 135 million tonnes in 1978-79 and much of this progress is due to the Soviet economic cooperation,

An agreement was signed between the National Coal Development Corporation and Soviet TIAZHPROMEXPORT organisation in 1958 for the development of coal basin at Korba.

Now we have Manikpur (capacity one million tonnes) and two pits of Banki (6,000,000 tonnes) and Surakachar (one million tonnes). A Central Electrical & Mechanical Workshop is also established here with Soviet help to carry out repairs to the mining equipment and dump trucks. Soviet aid for these projects was about Rs. 600 million.

The Soviet-aided mines are highly mechanised automatically run with complete safety.

Near Bokaro, the new steel giant in Bihar, there are deposits of coking coal with an ash content of 13 to 39 per cent and this coal was formerly mainly used for railways. Now with the new coal washery at Kathara, built with the aid of the Soviet Union, this coal output can be used for the steel plant also. This washery is one of the biggest projects of its kind with an annual capacity of processing three million tonnes of raw coal. The high quality concentrate is supplied to the steel plants and the middlings to thermal stations. This flourishing washery is another testimony of Indo-Soviet cooperation.

Open-cast quarries in Bihar with a combined output of 6.5 million tonnes of coking coal at Ramgarh, Pundi, Taping, Kedla are being developed to supply coal to Bokaro and Bihar. An agreement for this development was signed in December 1966. Soviet credits of Rs. 2,500 million were granted for this purpose.

Under a protocol signed in 1973, the Soviet Union agreed to develop three coal fields in Singrauli (Madhya Pradesh) and in in Raniganj (West Bengal). In May 1975 under a new protocol the Soviet Union offered a credit of five million roubles for these projects. Singrauli is expected to yield 45 million tonnes by 1990-1991. Raniganj is expected to have an annual capacity of 5.3 million tonnes of coal.

The Soviet Union offered its aid to survey the coal deposits in Mirzapur area (Uttar Pradesh).

The Soviet Union has provided further training to Indian engineers in the Soviet open-cast and deep mines and research stations.

In this connection, it is appropriate to state that mining machinery is built to meet India's needs at Durgapur (West Bengal) in the plant built with economic and technical aid of the Soviet Union.

The Soviet Union has given aid to Rajhara and Dalli iron ore mines and Nandini limestone mines for Bhilai Steel Plant. It is giving financial and technical aid for the development of copper, aluminium, nickel, zinc and other mines also.

The discovery and development of these deposits, extraction and processing of ores are contributing more and more to the harmonious development and economic stability of the country.

ELECTRIC POWER PRODUCTION

The essential basis for development of industry is power—electric power. The progress made by a country can be judged by the electric power it has. That is a good test for the development of any country.

—Jawaharlal Nehru

An independent nation has to fortify its political freedom with economic independence through industrialisation for which electricity is absolutely essential. Electricity provides light and heat for home. But its usefulness in industry is far more important. For example, it is estimated that one kilowatt of electricity is enough to produce any of the following : 10 metres of cloth, 5 kg of steel, 40 kg of coal, 33 kg of mineral oil. India with its vast untapped natural resources—long perennial rivers which could be harnessed to supply about 40,000 MW hydro-power and huge deposits of coal estimated at about 130,000 million tonnes—was left power hungry when the colonial rulers had to retreat finally.

An idea of what wonders a flourishing power industry can accomplish in a country like India can be had from the experience of the USSR. Uuder the able guidance of the great V.I. Lenin Soviet Russia gave first priority to electrification. It had to start absolutely from scratch. Today the Soviet Union has attained the top level of industrialisation with more than 500 electric power stations to boast of, producing about 136,000 MW of electricity, thereby setting an example to the newly-independent developing countries.

Independent India also took to the road of industrialisation through electrification. At first it took up some hydro-electric projects like Damodar Valley, Bhakra-Nangal, Tungabhadra, etc.

In this connection it is worthwhile to recall that the first power station in India was built at Darjeeling Hill Station in 1897 by the local municipality by utilising the waters of the hill stream.

Even the first big Indian hydro-electric project was of a mere 4.5 MW capacity, which was built in 1902 A.D. at Shivasamudra in the erstwhile Mysore State (now Karnataka) for providing electricity to British gold-mining company at Kolar (South India) and to the British cantonment at Bangalore. Then, the Tata Hydro-power projects of a total capacity of 50 MW were built in 1914 to provide electricity to Bombay and its industries. Power generation went on at a snail's pace during the British regime in India mainly for lighting purposes in about 4,000 large towns, as it was considered a luxury for the rich.

At the beginning of the First Five-Year Plan, the aggregate installed generating capacity in India was 2,300 MW only, and most of it was produced in private sector. State-owned public utility projects were producing just 630 MW at that time.

Today the power generating capacity in the country has grown ten-fold and most of it is in the public sector, out of which about 20 per cent is obtained from the power plants built in India with Soviet assistance. But even then the per capita consumption of electricity is about 100 KWH as compared to 2,000-7,000 KWH in developed countries.

The Soviet Union has rendered economic and technical assistance to India in the construction and commissioning of the following major power stations in the different states :

Thermal Stations

600 MW	Neyveli Thermal	Power Station	Tamilnadu
200 MW	Korba	-do-	Madhya Pradesh

250 MW	Obra	-do-	Uttar Pradesh
300 MW	Harduaganj	-do-	Uttar Pradesh
400 MW	Patratu	-do-	Bihar

Hydel Stations

600 MW	Bhakra Right-Bank Hydro-Electric Station		Punjab
200 MW	Mettur	-do-	Tamilnadu
25 MW	Hirakud	-do-	Orissa
360 MW	Balimela	-do-	Orissa
200 MW	Lower Sileru	-do-	Andhra Pradesh

In addition to the above major stations, several captive thermal electric stations at Bhilai, Barauni, Bokaro, Koyali, Hardwar, etc., have also been built. Natural gas discovered in Gujarat is being used to produce power in Dhuvran Power Station.

The **Neyveli** Thermal Power Station is the biggest in India with a capacity of 620 MW. The fuel used here is lignite, an inferior variety of coal. After careful prospecting, this site was chosen because the deposit is fairly near the ground level. At a depth of 44 metres just below the seams of lignite very powerful artesian aquifers had to be tackled first, before obtaining the lignite. Only when 50 powerful pump-sets were installed around the mining area, and when they incessantly pumped out 50,000 gallons of water every minute, this aquifer thrust problem was solved and lignite mining became possible. More than 60 per cent of the extracted lignite is used for thermal power production.

The preliminary plans for this thermal power station were ready in 1956. Some Western countries were approached to help in setting up this station; but they demanded high rates of interest on long-term credits. Only the Soviet Union was ready to build, at the low rate of 2.5 per cent interest on credits for the project. An agreement was signed in November 1957. In 1958 a team of Indian engineers went to the USSR to participate in the preparation of detailed project report. Machinery and equipment began arriving from the Soviet Union in 1960. Transport of heavy equipment created some problems. A new

steel bridge across Buckingham canal was built specially for this purpose at Madras. The first 50 MW unit erection was started in 1961. The last (fifth) such unit for the first stage was commissioned in April 1964. In the second stage, the seventh and last unit of 100 MW capacity was commissioned in March 1967. In the third stage two more such units were built and the station attained its full capacity of 600 megawatts.

The Neyveli Thermal Power Station is a beehive of activity. This is the biggest thermal station in India employing more than 1,500 people. In the initial stage a batch of Indian engineers was trained in the USSR. During the construction of the plant about 40 Soviet specialists trained Indians on the site in different stages of erection. Now many of them are engaged in the new plants under construction.

There is a training institute established by the Government of India which has already trained several batches of engineers deputed by the Electricity Boards of different states.

The **Korba** Thermal Power Station, the biggest in Madhya Pradesh, was completed with four 50 MW units in 1968. It runs on low-grade coal from the nearby Manikpur quarry and supplies cheap electricity to the major industries of Madhya Pradesh including the Korba Aluminium Plant, Bhilai Steel Plant, and several other coal and iron ore mines. It will supply power to the Malanjkhand copper complex also.

The **Obra** Thermal Power Station is playing a very important role in the integrated operation of power systems in the northern and eastern regions of Uttar Pradesh. Its first stage of five 50 MW units with a total capacity of 250 MW was ready in 1970. Though initially designed for 750 MW during the third stage, this plant will attain the full capacity of over 1,500 MW and eventually will become India's biggest thermal power station. It is getting coal from Singrauli area.

The **Harduaganj** Thermal Power Station is situated in Western U.P. Neyveli sent a batch of 11 technicians to work there for six months. The station was inaugurated in 1968.

Its initial capacity was only 100 MW; but its installed capacity of 300 MW can eventually be extended to 800 MW.

The **Patratu** Thermal Power Station, situated just outside the coal belt of Bihar, is the first to be built for India by the Soviet Union. It was commissioned in 1972. It has an installed capacity of 400 MW and will be increased in future. It supplies power to Bokaro Steel Plant, the Ranchi Industrial Complex, Barauni Refinery, etc.

The **Bhakra** Right-Bank Hydro-Electric Station is built near Bhakra Dam in the Punjab with Soviet assistance to be the biggest in this country with a capacity of 600 MW. It was completed in 1962, It has five tunnels of 6.1 metre diameter totalling 609.6 metres in length on a very steep slope, joined with penstack pipes of 1,067 metres. There is a separate 533.5 metre tunnel to carry underground cables from power plant to switchyard. Construction work was fully mechanised and about 4,600 tonnes of reinforced steel and about 92,000 cubic metres of concrete were used.

Bhakra power has helped the growth of industry in the Punjab, Haryana and Delhi areas.

Highly sensitive electronic governors are installed in this plant for the first time in India to facilitate quick synchronisation and automatic starting or stopping in a matter of one minute and 35 seconds. The station has central control which ensures equal distribution of load over all the five generating sets.

The **Mettur** Hydro-Power Station on the river Cauvery on the Mettur Dam near Salem has four 50 MW generating sets. The dam is about 159 metres in height.

Under Indo-Soviet Agreement all the required pieces of machinery for the plant including two 200-ton EOT cranes were supplied by the USSR and about a dozen Soviet engineers helped the Indian engineers to erect the machinery at the site. The first unit was commissioned in 1965 and the fourth, the last one, in 1967. The power generated here enables to irrigate about 56,650 hectares of fertile land in Tamilnadu.

The **Hirakud** and **Balimela** Hydro-Power Stations are built with Soviet assistance in Orissa. Hirakud is a small station of 25 MW capacity and was commissioned in 1963. It has the same kind of equipment supplied to the other Soviet-aided stations. The Balimela station has an installed capacity of 360 MW for the first stage which could be raised to 480 MW in the second stage. This is across the river Sileru, a tributary of Sabari river which flows in the Andhra Pradesh. Both these plants supply electricity for further development of industry and agriculture in Orissa.

The **Lower Sileru** Hydro-Power Station is a recent project. It is also on the river Sileru but in Andhra Pradesh near the Dam of Donkarayi. It has a capacity of 230 MW.

HEAVY ELECTRICAL MACHINERY

Hardwar Heavy Electrical Equipment Plant built with Soviet technical assistance is the largest enterprise of its kind in South-East Asia. The equipment it manufactures is successfully operating in many power stations of India.

—V. Borushko

When the Britishers finally quit India in 1947, the total power generating capacity of all the stations in India was about 1,700 MW only.

Therefore India had to plan new power stations with imported machinery to meet the immediate requirements of industrialisation and to start indigenous manufacture of heavy electrical machinery.

The Bharat Heavy Electricals (BHEL) was originally set up in Bhopal in 1955 to manufacture turbines, generators, transformers, etc. But this plant alone could not meet the fast increasing demand in the country. Therefore it was decided to start the manufacture of power generation equipment at Hardwar and Hyderabad and a high pressure boiler plant at Tiruchirapalli. All these four units are now working very well and have achieved a substantial measure of success. Already, both the Bhopal and Hardwar plants have bagged several international tenders.

The Hardwar Heavy Electrical Equipment Plant, the largest in India, has been built with Soviet assistance. It accounts for about 60 per cent of the total capacity of hydro and turbo

generators produced in the country. Fifty per cent of the planned power targets can be achieved with the help of this plant. It has the capacity to manufacture power generation equipment up to 2.7 million kilowatts every year. The Hardwar plant produces most sophisticated power equipment. Its 200 MW unit can provide light to a million homes. It can produce turbo-generators of 1,500 MW aggregate capacity, hydro-power generating units of 1,200 MW aggregate capacity and also other generators of 500 MW aggregate capacity.

Agreement for project report of the plant was signed in 1962. The Government of Uttar Pradesh allotted about 2,670 hectares of land for this project at Ranipur near Hardwar. The main factory extends to about 65 hectares at present. Following the signing of an agreement in 1963 between India and the USSR, 150 Indian engineers were trained in Soviet plants. The Soviet Union supplied about 575 machines and 9,700 pieces of equipment for the plant—those which were not available in the country.

The plant was inaugurated in 1967, and has already attained its capacity. With a little readjustment the plant can manufacture steam turbines and generators of 300 MW capacity.

Equipment manufactured here is being used in Subernarekha, Bhatgar, Vaitarna, Lower Sileru, Giribata and other stations. It has supplied steam turbine to Kuradi Power Station in Maharashtra and hydro turbine to Kulhal station in U.P. Even at Badarpur Plant (Delhi) Hardwar unit is in use. The Kalpakkam Atomic Power Plant is provided with a 235 MW generator produced at the Hardwar plant. For the expansion of Neyveli and Obra power plants also Hardwar will supply new units. This plant has produced already 24 sets of 200 MW capacity by 1977-78.

Hardwar Heavy Electrical Equipment Plant of BHEL is a standing monument of Indo-Soviet friendship successfully helping India to carry out the plan of electrification of the country.

ELECTRONIC INSTRUMENTATION

Russia today literally teems with scientists and engineers. The age of science seems to have reached its apogee in this country, which a few decades back was one of the most backward regions of the world.

—**Sardar Hukam Singh.**
Ex-Speaker, Lok Sabha.

In our age of cybernetics and automation, every industrial complex needs precision instruments which are like 'sensory organs'—comparable to human eyes, nerves and brain. These instruments are very essential in all major industries like power, steel, fertiliser, oil-refining etc., where an automatic control and measurement of different operations and adjustment of technical processes, etc., are, necessary. Defence establishments in India are also using them. There is a growing foreign market too.

The Precision Instrumentation Plant at Kota started production in September 1968. In the first year of its full production in 1969-70, this plant made a net profit of Rs. 2 million and in the next year the profit went up to Rs. 15.5 million. This progress is continuously maintained all through.

This plant, built with Soviet aid, has an annual capacity for producing over 70 different types of 138,000 instruments and 400,000 transmitting elements of measuring devices including automatic electronic devices for controlling temperature, pressure and level of liquids, etc. The construction work was taken up in November 1965 and its mechanical shops were commission-

ed in December 1966. The commercial production of precision instruments began in September 1968.

A protocol for further Soviet assistance to diversification of production and manufacture of pneumatic instruments of different types, was signed in 1970 between the USSR and India.

Many power houses and processing industries in India are using the sensitive control boards produced in Kota. The Tunku Jafar Power Station of Malaysia imported one such board from Kota at a cost of Rs. 15 million. The plant could successfully get this order in spite of stiff international competition.

The plant produced Rs. 53 million worth of precision instruments in its second year of complete production in 1970-71 and its products were well received at the International Exhibition of Automation and Instrumentation held in Dusseldorf in the summer of 1971. With diversified production, the plant has drastically reduced its import content and has become totally self-reliant, thereby increasing its profits and expanding the range of production.

The plant has contributed to the setting up of at least 16 power stations by 1974, by supplying automatic controls. Oil refinery at Haldia also received Kota instruments. In the metallurgical field, instrumentation worth of Rs. 160 million had been supplied to Bokaro by 1974. Out of orders worth Rs. 450 million received by the plant by 1974, Rs. 250 million worth has been fulfilled, resulting in the earning of foreign exchange of several millions. It is estimated that the annual output of Kota Instrumentation Plant will be worth Rs. 180-200 million by 1980.

The Kota plant employs 1,700 workers in different categories. Over a hundred technicians of the plant were trained in the USSR. The plant has already achieved import substitution and self-reliance in the field of instrumentation.

SPACE RESEARCH

The Governments of our countries have agreed to launch an Indian satellite by means of a Soviet carrier-rocket. This agreement is symbolic in many ways. It shows, above all, ...how great are the prospects for our relations.

—L.I. Brezhnev

India's first agreement with the Soviet Union for space exploration was concluded in 1964. The Soviet Union has provided a computer, equipment and a helicopter for the Thumba Equatorial Rocket Launching Station (TERLS) near Trivandrum in Kerala. The station located on the geomagnetic equator, offers best conditions for studying "equatorial electrojet", a fascinating phenomenon in the equatorial ionosphere. This is a narrow but intense band of electric current centred at the geomagnetic equator and flowing at a height of 105 kilometres.

Soviet-made two-stage solid fuel sounding rocket M-100 is launched every Wednesday from Thumba station at 85 degrees West. Its 65 kg. payload consisting of sensors and other instruments attains an altitude of 80 to 90 km. in just 8 to 10 seconds and then makes a slow descent during which data on atmospheric pressure, temperature, wind velocity, etc., are transmitted to the ground. Very valuable data have been collected over the past few years on the wind and temperature structure of atmosphere up to mesospheric heights.

Aryabhata

An agreement was signed on May 10, 1972 between the USSR Academy of Sciences and the Indian Space Research Organisation for the launching of a research satellite made in India. Accordingly, the satellite **Aryabhata** was launched on April 19, 1975 by a Soviet Intercosmos rocket into a near-circular orbit 600 km above.

The Soviet Union has supplied India, for this satellite, silicon solar cells, nickel-cadmium batteries, sensors spin-up systems, on-board tape-recorders, thermal coatings, etc.

Just eight months after the agreement a new laboratory came up at Peenya on the outskirts of Bangalore and it became a beehive of activity with several auxiliary establishments all around. 300 young Indian engineers and technicians were engaged in this task of building a sophisticated artificial earth satellite for the first time in India. Enthusiastic cooperation of Soviet experts was available from time to time and their advice was useful for the work. At last the satellite was orbited on April 19, 1975. Several successful scientific experiments have been carried out and valuable data collected since.

The Second Satellite

Encouraged by the success of **Aryabhata**, Indian scientists decided to build another scientific satellite, to study the resources of the earth. For this an agreement was signed with the USSR shortly after the launching of the **Aryabhata**. The Satellite for Earth Observation (SEO) will be more sophisticated and will weigh 420 kg. Natural resources and environment can be studied through the photographs, which will be taken by this satellite. Its pictures will be of interest to different scientists connected with oil industry, cartography, geological survey, soil amelioration, land reclamation, agriculture, etc.

An engineering model of the SEO has already been made and flight tests are conducted successfully in a helicopter, for on-board and ground communications.

As in the case of the first Indian satellite, solar batteries, on-board tape-recorders, stabilisation system, thermal coating, etc., are provided by the USSR. All the necessary preparations for launching the satellite are being made. And, if everything goes well, the satellite will be launched by early 1979.

"MONEX" EXPERIMENTS

The Indo-Soviet scientific cooperation in the field of meteorology has helped to improve considerably the standards of weather forecasting.

—**Dr. P. Koteshwaran**
(1974)

In 1973 Soviet Union and India launched the Monsoon Experiment Programme (MONEX) to study monsoon conditions in Indian Ocean and Arabian Sea, and probing of near space, the birth place of cyclones which cause sudden severe damages in coastal areas.

MONEX-1977 Programme was carried out from May to August in the Bay of Bengal and the Arabian Sea. In this joint project four Soviet ships and two Indian ships participated. They studied pressure of winds both in the atmosphere and in the Ocean, in three phases each with a definite purpose. The second phase during furious monsoon season in June-July is important. When spring sets in early in the European part of the USSR, and delayed in the Central Asia, then the monsoon in India is also delayed. When there is early spring in Central Asia there is early monsoon in India. This helps to forecast monsoon two months in advance.

Indian and Soviet meteorologists will jointly carry out MONEX Programme in 1979 as well.

OIL INDUSTRY

The importance of oil and petrol grows and affects the imperialist policies. Indeed modern imperialism has sometimes been called 'Oil Imperialism'.

—Jawaharlal Nehru

For ages the God-fearing Hindus of India burnt ghee and edible oils before Gods and Goddesses in temples and homes. There was no dearth of oil seeds. Mineral oil was unknown in India till the foreign rulers introduced it.

Slowly mineral oil began to be used in every nook and corner of the country for lighting hurricane lamps, gas lamps and for cooking. Engines using diesel oil and cars using petrol became common.

Mineral oil is really treasure from the soil. It is a dark coloured liquid, sometimes in jelly form, and has acquired the name 'black gold' to signify its value. From the crude (oil) to its various refined varieties of oil, and to its various products, every one of them has become essential to the modern man.

Kitchen stoves are run by kerosene and liquid petroleum gas. Lamps use kerosene. Cars use petrol. Buses, lorries, tractors and other heavy vehicles use diesel oil. The aeroplane uses high octane petrol. Machines are lubricated with grease. Linoleum, terrene and plastics are products from oil. Fertilisers and DDT are also of the same origin. There are thousands of such items.

Oil was discovered only in the beginning of this century in Persia, then in Middle East countries around the Gulf.

Britishers and Germans had the monopoly in the beginning. After the defeat of Germany in World War I, Americans penetrated and expanded their monopoly.

During the British rule in India attempts to find oil reserves in India were not encouraged. In 1933 Sultan Chinoy, a wealthy automobile dealer of Bombay, wanted to start prospecting for gas at Bhavnagar, where it had seeped to the surface. But he failed to secure government patronage and his project remained on paper. On the eve of World War II the Geological Survey of India had only 27 specialists, and amongst them not a single petroleum geologist.

After World War II, the British regime declared a ban on oil prospecting and prohibited any exploratory digging in Assam. This did not apply to Digboi and the refinery there.

The Digboi Oilfield in Assam is the first oilfield in India. It was discovered just by chance. An elephant fell into a ditch in a jungle and got smeared all over the body with sticky mud oozing oil. When the Britishers saw it, their order was "Dig Boy !"

The first oil well was drilled in Digboi in 1890. Assam Oil Company, and the Burma Oil Company explored the area, drilled about a thousand wells, but kept their discoveries a closely guarded secret, with the deliberate intention of using them for their own profit at a future date. They were making huge profits from their wells in other countries and they did not want to develop this area. They spread the idea that India is poor in oil deposits.

When India became independent in 1947, they lost all their interest in the project because they knew that the national oil industry would cut down their super-profits.

Free India faced the problem of oil. Only about 500,000 tonnes of oil were available mainly from the Assam oil wells.

Search for oil was confined to Assam. Two more oil deposits were found at Naharkatia in 1953 and at Moran in 1956.

The American Standard Vacuum Company secured a concession and searched for oil in West Bengal, in vain.

In 1956, the Government of India decided to build a national oil industry in pursuance of its decision to establish and strengthen a public sector of key industries.

The Soviet Union began helping India in every way to make the latter achieve economic self-reliance. In 1955 it signed the first agreement for setting up the Bhilai Steel Plant. In the same year, a delegation of three Soviet oil experts led by the famous geologist, N.A. Kalinin, visited India at the request of the Government of India to assess the oil resources of the country and to determine the lines along which the prospecting for oil should proceed. They made an exhaustive study of all the data available then and visited various sedimentary basins in India. N.A. Kalinin gave a very optimistic and encouraging report saying that India has considerable potential reserves of oil (4,000 million tonnes) and natural gas (2,000,000 million cubic metres), and advised that carefully planned prospecting activities should be undertaken in right earnest to locate the actual resources.

In 1956, the Oil and Natural Gas Directorate (later on called in 1959 statutory Commission) was set up for this purpose with its headquarters at Dehra Dun. In the next year Soviet gravimetric and seismic parties started geophysical surveys in India. In May 1958, gas was struck at Jwalamukhi (Punjab) at a depth of 886 metres and three months later oil was struck at Cambay (Gujarat) with the help of Soviet drilling rig "Uralmash-3D". In 1960, the Ankleshwar (Gujarat) deposit was discovered, a major oilfield with superior crude. Its daily output in 1962 was 1,200 tonnes, which meant a saving of Rs. 75,000 in foreign exchange every day. Jawaharlal Nehru called it "**Vasudhara**" (the fountain of prosperity). Later on, several oil deposits were discovered in Gujarat, viz., Kalol, Navagam, Kosamba, Kadi, Dholka and others. In 1960, oil was struck in the eastern part of the country at Rudrasagar (Assam) where also the Indian team worked under the guidance of Soviet experts. Success followed success. Several teams of

Soviet experts—over one hundred specialists—came to India to carry out oil exploration in the different areas of the country. Meanwhile the Soviet seismic survey ship **Academician Arkhangelsky** carried out detailed seismic survey along the Coramandel Coast, along the Kerala Coast and in the Arabian Sea adjoining the Gulf of Cambay and Gulf of Kutch in 1964-66, and the "Bombay High" structure was discovered. The Soviet Union provided the design of the fixed platform for Aliabet and helped its fabrication and erection.

The discovery of Bombay High as a result of off-shore prospecting by the Soviet marine and seismic expedition has proved to be most beneficial to India. This discovery marked a turning point in the history of the country's petrochemical industry. Now the Bombay High gives the biggest yield and only very recently the oil pipeline connection to this off-shore project was completed to ensure the flow of oil to the refinery.

Discovery of oil deposits was not enough. There should be the facilities to refine the crude oil. Before independence in India there was only one small refinery and that belonged to the Burma Oil Company. Later on, between 1954 and 57 three more refineries of bigger capacities were established, by the oil monopolies—Burmah Shell, Stanvac (later on ESSO) and Caltex. These three refineries refused to oblige the Government of India, to refine the Indian crude, though they had raised their annual refining capacities from the initial 3.9 million tonnes to 7.75 million tonnes. They used to get crude for their refineries from their own foreign sources and went on raising the price of their imported crude from time to time on some pretext in 1970-71. Again in 1972 the price of crude was raised for the fifth time, on account of the expected devaluation of dollar.

Having no refining facilities of its own, the Government of India had to grant special concessions and privileges like duty protection, etc., to these foreign monopoly companies during the fifties. Yet, they refused to cooperate with the Government to set up a public sector refinery.

Thus, the Government of India was forced to enter the field and set up its own oil refineries. Consequently, the Indian

Refineries Ltd., was set up in 1958, and the Indian Oil Company in 1959. Both of them were merged into the Indian Oil Corporation in 1964. Rumania agreed to help India for building a refinery at Gauhati. The Soviet Union offered its cooperation for setting up a refinery at Barauni in Bihar, and later another at Koyali in Gujarat.

Barauni Refinery

The construction work of Barauni refinery was started in 1959 and it went on stream in 1962. It attained its planned initial capacity of 2 million tonnes in 1964. The refinery was formally inaugurated in 1965. Kerosene Treatment Unit was commissioned in 1966. Later on, Atmospheric Unit was commissioned in 1969 when the capacity of the refinery was expanded to three million tonnes per annum.

The crude oil is processed in the Atmospheric and Vacuum Unit (AVU). Here motor gas, naphtha, liquid petroleum gas (LPG), aviation fuel, diesel oil, etc., are manufactured. In the Kerosene Treating Unit, the inferior Kerosene from AVU is refined. Aviation turbine fuel and mineral turpentine oil are also refined here. In the coking unit—it is the tallest here—crude residue, slack wax, etc., are subjected to thermal cracking. In the Lube Oil Complex, the Phenol Extraction Unit (PEU) refines vacuum distillates from AVU to remove heavy aromatics and resins, the Dewaxing Unit removes waxy substances from the refinate coming from PEU, and in the Contact Filtration Unit the dewaxed oil is subjected to absorption with natural clay. The Bitumen Unit produces various grades of bitumen (asphalt). There is a coke calcination plant which calcines petroleum coke to meet the market demand.

Barauni Refinery receives oil from Naharakatiya and Moran Oilfields in Assam. There is a 1,150 km pipeline for this purpose. Up to 1976, in a period of 12 years, it has refined about 20 million tonnes of oil, thereby saving a considerable amount of foreign exchange for the country.

The Barauni Refinery is manufacturing naphtha, motor gas, 'high speed' and 'light' diesel oils, aviation turbine fuel, mineral

turpentine oil, furnace oil, superior and inferior kerosene, liquid petroleum gas, lubricating oil, petroleum coke, etc.

Not far from Barauni Refinery, a fertiliser project has been built, based on the feedstock from the refinery.

The Barauni Refinery has led to a rapid industrialisation of North Bihar. It is indeed the first shining monument of Indo-Soviet cooperation in oil refining. The experience gained in building this refinery was very helpful for setting up another refinery at Koyali (Gujarat).

Gujarat (Koyali) Refinery

The Gujarat Refinery (formerly called Koyali Refinery) with a tall chimney, rising 30 metres above the Kutub Minar of Delhi, stands at the place where the former village Koyali existed. Situated not far away from Baroda the Koyali township, now Jawaharnagar, has a road called Indo-Soviet Friendship Avenue with a 6.2 metre monument. The refinery complex is spread over an area of 547 hectares. Ankleshwar and Kalol supply oil to this refinery. Ankleshwar Oilfields are at a distance of 96 km from here.

Foundation for this refinery was laid by Jawaharlal Nehru in May 1963. Originally it was built for a capacity of 2 million tonnes, just like Barauni, as per agreement with the USSR in 1961. Later on, by another protocol signed on May 25, 1963, the capacity was raised to 3 million tonnes for both Koyali and Barauni refineries.

The first million-tonnes plant was commissioned in October 1965 and a month later it was taken over by the Indian engineers. The refinery was inaugurated by the President Dr. S. Radhakrishnan on October 18, 1966.

The Gujarat Refinery is the first of its kind in India with which Indian specialists were associated in the designing and construction stages. It has a good proportion of indigenous equipment also. It is the first public sector refinery which began producing fuel for jet planes. Its products include motor spirit, superior kerosene for domestic use, high-speed diesel oil for diesel

engines, light diesel for irrigation pump-sets, liquid petroleum gas (Indane) for the kitchen, aviation turbine fuel for planes, benzene, toulene, LSHS for the thermal power stations, naphtha as raw material for fertiliser, petro-chemical and caprolactum industries.

There is a plant for production of protein from oil, the first such plant in India. This protein produced here is good] as animal feed, and research is on for producing nutrient useful for human consumption.

In 1968, a plant to produce benzene and toulene was commissioned. Benzene is used for making caprolactum for manufacturing nylon yarn and other products. There is another plant to produce polyester fibres, filament yarn, etc. These are the biggest and the most diversified petro-chemical plants in the country.

There is a very large fertiliser plant also in this complex, based on the feed-stock from the refinery.

A 420-km oil pipeline from Salayi Shore Terminal to the Gujarat Refinery has also been completed.

The annual output of Gujarat Refinery has reached 4.3 million tonnes already and is to be raised to 7.3 million tonnes shortly. As a result of the recent development, it is being considered that the capacity should be raised to 10 million tonnes in the next few years.

This refinery has contributed to the establishment of huge petro-chemical complex. Gujarat has become the largest industrial centre of oil and chemical projects in India, providing great stimulus to the national economy.

Mathura Refinery

Now the country's total refining capacity is 27 million tonnes. The requirements of petroleum products is about 28.5 million tonnes. Therefore, now India's biggest and the third Soviet-aided oil refinery is being built at Mathura (Uttar Pradesh) in order to raise the production of petroleum products

and make them available to the people of the northern regions of India, particularly to the people of Uttar Pradesh, the Punjab, Haryana, Rajasthan, Jammu & Kashmir and the capital city Delhi. Protocol for Soviet cooperation for this refinery was signed in 1973. Mathura project is specifically mentioned in the Agreement of Cooperation signed in New Delhi on November 29, 1973 during the visit of L.I. Brezhnev to India.

The 6-million-tonne Mathura Refinery will process a mixture of light Arab oil and Iraqi oil from the Nothern Rumaila Oil-fields and also India's share of Rostansh Rakh crude oils. A 1,200 km pipe-line from Salayi Shore Terminal on the Gulf of Kutch to Mathura will convey the oil to the refinery.

This project is unique. There are very few refineries of this size. Even France has purchased machinery from the USSR for such a refinery.

This plant is more indigenous than the Gujarat Refinery. More and more Indian specialists are participating in its construction work. Technically one of the most modern and advanced refinery projects, the refinery is expected to start production in 1979. It will produce all the petroleum products which are produced at Barauni and Gujarat Refineries, but in larger quantities. It will provide naphtha to the fertiliser plants of Kanpur, Kota and Nangal.

When the Mathura Refinery is completed, it will be the biggest in India with a refining capacity of 6 million tonnes a year. The output of all these Soviet-aided refineries after the current expansion will be 16 million tonnes.

* * *

Out of 41 oil and gas deposits explored in India so far, 36 deposits were discovered with the assistance of Soviet specialists. Since the discovery of Ankleshwar (1961) over 300 oil wells were drilled in different areas. Half of them were found productive, yielding 8,300 tonnes of high grade oil daily. The Soviet Union sent 1,200 engineers and skilled workers for joint work in this field.

A programme for development of oil industry in India was drawn up for a period of up to 1981 by the participation of Soviet and Indian specialists. At present, the major forms of Soviet assistance include : (1) assistance to boost oil extraction from the existing wells, (2) organising an institute of oil engineering, and (3) provision of deep-drilling rigs and special pipes.

* * *

The Soviet Union will continue to supply India with crude oil. The volume of deliveries increased from one million tonnes in 1977 to 1.5 million tonnes in 1978. There is already an agreement to supply 5.5 million tonnes of crude between 1977 and 1980. There has been further growth in deliveries of kerosene, diesel fuel, etc.

In conformity with the Joint Soviet-Indian Declaration of October 20, 1977, the Soviet Union has agreed to drill the first exploratory deep well up to a depth of 4,500 metres of Gojabia and Baramura in the State of Tripura. It has also agreed to set up a Research Institute for Drilling Technology at Dehra Dun.

Soviet specialists were associated with the training of Indian personnel for national oil industry ever since it started over 20 years ago. An oil institute was started at Baroda with Soviet assistance. In addition to this, the Hind Oil Design Institute and Research and Training Institute were established at Dehra Dun with Soviet help.

MEDICINE FOR THE MILLIONS

India spends tens of millions of rupees on importing medicinal preparations including antibiotics, although it is India which possesses enormous resources of the most important medicinal herbs and grasses, almost all varieties from which world pharmacology produces medicines.

—**A. Natrazde**
(1959)

For ages the indigenous Ayurvedic medical system has been popular in India. Later it was supplemented by the Unani system brought by the Muslim rulers and both these systems continue to retain their popularity especially among the common people in the rural areas.

Modern medicine came to India during the foreign domination. These foreigners came to India for trade. They took away raw materials from India and brought back their manufactured goods to India for sale. In the same way, they took away medicinal plants and brought back their pills and mixtures for every simple disease and sold them in India. They built up a big market for their goods and medicinal preparations in India through their publicity schemes.

Folk medicine could not face this onslaught and languished. It became a prestigious fashion for the urban dwellers to purchase foreign salts and pills.

Hospitals in Indian cities and towns were built with people's money and the names of foreign and local kings, queens, vice-

roys, governors, etc., were given to them. They were furnished with foreign equipment and medicines. The control was in the hands of foreigners and their yes-men.

India possesses enormous resources of medicinal plants, herbs and grasses required for world pharmacology. Despite this, millions of rupees in foreign exchange were spent for imports of medicinal preparations until recently.

In 1860 a beginning was made by starting cinchona plantations in Nilgiris in the South and Darjeeling in the north, for the manufacture of quinine. Then it was Acharya P.C. Ray of Bengal who took up to the productions of galenicals, i.e., medicines extracted from vegetables and plants.

The First Russian Medic in India

Vladimir Haffkine, a native of Russia and a painstaking medical researcher who was at Pasteur Institute, developed a vaccine against cholera and wanted to popularise it, to eliminate the epidemic. Then cholera was raging in Bengal and Haffkine came to India from Paris. His vaccine made him famous in India. Then he heard about plague rampant in Bombay and after carrying on research for about three months in a small laboratory in Central Medical College there, he succeeded in evolving a vaccine against that deadly disease. In 1896 he established an institute at Bombay on the model of Pasteur Institute which came to be known later as Haffkine Institute. It has been famous for more than four score years now.

During World War I, as a result of the curtailment of drug imports, local pharmaceutical industry increased its production, various vaccines and sera were produced: caffeine from tea dust, ether from alcohol, etc. Again during World War II, some new products like ephedrine, morphine, liver extracts, etc., were manufactured indigenously. After the war, indigenous drug industry languished as a result of stiff competition by foreign products.

Such was the situation when India achieved independence. Indigenous pharmaceutical industry was almost non-existent

when compared with the industry in the West—most of them —more than 1,500—were small-scale establishments manufacturing tinctures, ointments, etc. There were some 82 bigger enterprises too in 1952. Among them 28 firms processed mainly imported bulk pharmaceuticals into compound preparations, tablets, ointments, injectibles, etc. The rest of them (54) were mostly working in collaboration with or under licence from foreign firms for which they had to pay a royalty of 12.5 per cent not for any teehnical know-how, but just to repack the imporied stuff after mixing and blending it into tablets, capsules, powders, mixtures and then to sell them. For this India had to pay Rs. 156 million in 1951-52 in foreign exchange. The foreign firms charged the highest prices for these supplies. For instance, the US drug industry charged about 20 times the cost of production. In the early forties sulphathiazole was imported into India at Rs. 400 per pound and sold at Rs. 800 per pound (1 kg=2.2 pounds).

The Haffkine Institute at Bombay developed its own process under Dr. Ganpathi to manufacture sulphathiazole in semi-commercial quantities of 500 pound at a time at Rs. 17 per pound and sold it to hospitals and public at Rs. 20 per pound. The anti-malarial drug paludrin also was manufactured at low cost.

Then, for the first time, the government realised how India was being fleeced by the foreigners for the modern life-saving drugs and agreed with the suggestion of Major General (then Col.) S.S. Sokhey, that such drugs should be manufactured in the public sector. In 1946, on persistent demand, Major General Sokhey and Dr. Ganapathi were sent abroad to study the feasibility of drug manufacture and find out what assistance India could get from the West. They visited Denmark, Belgium, France, England, Canada and the USA. The United States of America was the most important country for them because it had by then a well-developed antibiotics industry. But they had to face a different music there. They were not even allowed to visit the drug factories. They got some training in the pencillin plant at Toronto University later on, through the courtesy of the firm which had supplied equipment

for antibiotic plants. They were permitted to visit a few plants. They met the director of the famous Massachusetts Institute of Technology. The director told them that he had no information to give them and they should go to private firms to get the technical know-how! When they approached a few firms recommended by him, they quoted very heavy charges, which amounted to ten times the estimate which these Indian scientists themselves had prepared on the basis of what they had learnt at Toronto and seen in the USA.

Later on, American firms showed an inclination to establish some drug plants in India on partnership basis with private Indian firms and insisted that the prices of finished products should remain the same as their current import prices in India.

Then in 1950 Major General S.S. Sokhey, as the Assistant Director General of WHO in-charge of Technical Services, was able to get scholars trained to run such plants through collaboration of a plant connected with the Belgian University. Major General Sokhey spent some months there and got full details of the methods of production of pencillin, streptomycin, and auremycin (chlorotetracycline) and obtained the cultures for these antibiotics. The Hiudustan Antibiotics was established at Pimpri near Poona.

In 1953 after retirement from WHO Major General Sokhey went to the Soviet Union and explained to the authorities there about the drug position in India and found out that they were ready to help India to put up plants. When Major General Sokhey reported the matter to Jawaharlal Nehru, he deputed Sokhey back to the Soviet Union with two more scientists, to prepare a detailed project report for the manufacture of drugs and antibiotics in India. To their surprise, these scientists found that all the drug plants were open to them and production methods were explained.

Then the Soviet drug experts came to India in February 1956 to make an on-the-spot survey and made their own recommendations. That report was ready in a very few months, in May 1956.

The Soviet Government offered free technical aid to put up the required plants. But India could not immediately proceed with the work for lack of foreign exchange. On further negotiations, the Soviet Union offered the credit required for this purpose.

In 1958 a second team of Soviet experts visited India and after a careful study of the conditions and resources available in the country, advised the establishment of a pharmaceutical industry in the public sector to manufacture synthetic drugs, antibiotics, and also surgical instruments.

Subsequently the Soviet Union built there medical plants in India ; Antibiotics Plant at Rishikesh (U.P.) (not far from the Soviet-aided Heavy Electrical Equipment Plant at Hardwar); Synthetic Drugs Plant at Hyderabad (Andhra Pradesh) and the Surgical Instruments Plant at Madras (Tamilnadu). An Ophthalmic Glass Plant was also built at Durgapur (West Bengal).

Antibiotics Plant

The Antibiotics Plant is one of the projects of the Indian Drugs and Pharmaceuticals Ltd., and is situated at Virbhadra near Rishikesh, a place of pilgrimage in Hardwar, at the foot of the Himalayas. It is the biggest antibiotics plant in India and in South-East Asia and is built with the assistance of the Soviet Union. Under an agreement signed in 1959, the construction work was started in 1963, and the plant was commissioned in 1967.

The project area extends to about 365 hectares and many types of medicinal plants are available nearby.

Antibiotics are life-saving drugs. Pencillin is effective against many serious diseases like pneumonia, diphtheria, meningitis, etc., and is available in many forms—pills, capsules, powder, lotions, pastes and injections for different diseases. Streptomycin can combat tuberculosis and tubercular meningitis. It is also very effective against plague, leprosy, diarrhoea, urinary infection, etc. Tetracycline is used against respiratory and urinary infections, etc. All these antibiotics and many more are now manufactured at the Rishikesh plant.

Antibiotics are used against pests in plants, and even for improving agricultural yields. They are very useful in animal husbandry because small doses of penicillin stimulate the growth of young animals.

India's need for antibiotics was exploited by the foreign drug firms which manipulated the prices and controlled markets by introducing brand names, advertising them, employing marketing network, and also influencing the doctors to use these medicines in their practice. It was in this context that the public sector antibiotics plant entered the scene.

The pilot plant at Rishikesh was commissioned in November 1965. After the purification and recovery blocks were built and production was started in 1967, the Central Research Laboratory carried out a number of quality control experiments. Starting with penicillin in non-sterile form, the production of sodium penicillin, procaine penicillin, streptomycin sulphate, etc., was undertaken by June 1968.

No less than 70 different kinds of raw materials are needed here and some of them are regularly imported from the USSR. Scientists at the plant succeeded in substituting some locally available raw materials for the imported ones in the manufacture of some antibiotics (sugarcane for lactose and so on), after successfully carrying out the experiments.

Production of antibiotics involves the knowledge of different composite disciplines like mycology, microbiology, biochemistry, organic chemistry, pharmacology and engineering. The Soviet Union has trained many Indian scientists for specialised work in this field. Some of the top officers and senior technical personnel were trained in the Soviet Union. Some brilliant scientists have studied in the Soviet Research Institutes and obtained Doctorate degrees there.

Designed for a total production capacity of 290 tonnes of antibiotics of different sorts, this plant has already put on the market several low priced life-saving medicines which play a crucial role in bringing down the price line.

It is expected that the capacity of the plant will be raised by another 171 tonnes by adding two or more units.

Synthetic Drugs Plant

The Synthetic Drugs Plant at Hyderabad is also built with the assistance of the Soviet Union. It was designed to produce 850 tonnes of basic bulk drugs every year and it is already playing a major role in the development of the pharmaceutical industry in India. It produces about 90 tonnes of marketable semi-products and also about 4,500 tonnes of chemical intermediates from indigenous herbs.

This plant is situated in a village called Kukkatpalli, about 11 km from Hyderabad. Now it is called Sanatnagar (Industrial Town) and has a number of metallurgical and other industries including the Synthetic Drugs Plant, which is one of the units of the Indian Drugs and Pharmaceuticals Ltd. It is the biggest such plant in Asia and covers an area of about 44 hectares.

As in the Antibiotics Plant of Rishikesh there is a pilot plant and a laboratory also here, which are of pivotal importance in ensuring quality control of in-coming raw materials as well as out-going finished products. New synthetic drugs are also developed here.

There are eight separate blocks of the plant which are assigned to the manufacture of different drugs, viz., sulpha drugs; vitamin B_1, vitamin B_2, and folic acid; anti-tubercular drugs and anti-pyretics; compounds based on metallic sodium; phosgenation and chloriation; liquid ammonia and sodium disulphate; and intermediaries. Each production block has a process control laboratory.

This Rs. 220-million plant has a central laboratory, auxiliary service agencies for maintenance, oxygen-nitrogen plant, boiler house, refrigeration, and gas plants, water storage, etc., besides administrative and other sectors. About 11,000 tonnes of machinery are installed here of which 55 per cent were imported, mainly from the Soviet Union.

According to the agreement of 1959 between the Governments of the USSR and India, foundation for the plant was laid in 1963. About 5,100 tonnes of Soviet equipment for the major and basic units were received in 1964 and assembled here. The

pilot plant was commissioned in 1965. In December 1966, it started producing phenacitin, a white crystalline compound which is used for easing pain and fever. Stage by stage the production programme covered all the 15 drugs planned for production, viz., analgesics and prophylactic drugs like phenacitine, amidopegrine and metamizole; standard sulpha drugs like sulphanilamide, sulphadimidine, sulphaguanidine, sulphacatamide sodium for bacterial infections like dysentery, diarrhoea, colds, sore throat, etc.; vitamins B_1 and B_2, nicotinamide (vitamin B complex) which are essential for nutrition as well as curing polynuritis, beriberi, etc., and folic acid (crystalline vitamin B complex) used for radiation and post-cancer treatment. Isonicotinic Acid Hydrazide (INH) for treatment of tuberculosis; Anthelmintics like sliprazine adipate, Diethylcarbamazine citrate for curing stomach, intestinal and liver diseases, epilepsy, etc., and hypnotic and sleep inducing phenabarbitone, etc.

The manufacture of many of these medicines involves complicated technology. The Synthetic Drugs Plant uses more than 30,000 tonnes of raw materials of about 160 varieties. Many are of mineral, vegetable and animal origin. The bulk of raw materials is obtained in the country itself.

The intermediaries manufactured from indigenous medicinal herbs here are partly used in the plant itself for its final products and the balance sold in bulk quantities to other pharmaceutical concerns. The plant attained its full production capacity by 1970.

In the earlier stages of construction and manufacture, about 400 Soviet experts were cooperating on the spot. They guided and trained the local talent unhesitatingly and made them capable of running plants by themselves. About 70 Indian technicians were trained in the USSR for this plant. Some of these Indian scientists were able to further improve some of the production processes, resulting in substantial savings. A number of risky processes involving chemical reaction are completely mechanised. For some processes hermitically sealed chambers are provided.

At the training centre in the plant, the Soviet experts trained hundreds of specialists, at the rate of 100-150 Indian specialists every year.

The plant employs about 4,000 people. It is to increase its output capacity to 3,500 tonnes a years to meet the country's increasing drug requirements.

Surgical Instruments Plant

The Surgical Instruments Plant is located at Nandambakkam, Madras (Tamilnadu) in an area of about 85 hectares. The Indo-Soviet Agreement for the Surgical Instruments Plant was signed in 1961 and the foundation laid in 1962. Commissioned in 1965, it is the first major plant in India to manufacture the much-needed surgical instruments of reliable quality. It has a capacity of producing in a year 2.5 milllon pieces of 166 kinds of surgical instruments. These include scalpels and surgical knives of different kinds; forceps of different types, surgical scissors, needle-holders, clamps, different kinds of speculums, surgical hooks; different kinds of curettes and bone scoops; guages, surgical saws; probes; pelyimeters; bracers, reamers and drills; teeth filling instruments; tracheal tubes, etc., which are used in the field of general, gynaecological, ophthalmic, ENT, and dental and neuro surgery. It is capable of meeting the country's demand for most of the sophisticated medical instruments.

The production of diverisified wide range of instruments is undertaken to meet the needs of the country. The quality instruments of the plant have found a market in European countries also.

The Soviet Union itself purchased 611,285 pieces of surgical instruments valued at Rs. 5,072 million by 1972-73. Orders for more instruments of the total value of Rs. 6.5 million were pending in April 1973.

* * *

Ancillary industries are growing fast round these plants at Rishikesh, Hyderabad and Madras. They supply various materials to the main plants which give them the necessary technical guidance and testing facilities.

As a result of the Soviet collaboration, the monopoly control of foreign companies is broken and much of foreign exchange saved. These public sector plants have brought about radical changes in the drugs and pharmaceuticals industry.

Ophthalmic Glass Plant

India was importing ophthalmic glass from Western countries by spending valuable foreign exchange. The Government of India sought Soviet help early in 1960 for manufacturing ophthalmic glass in India. The Soviet Government responded to this request favourably and sent a highly-qualified team to India to explore the possibilities. These specialists submitted a detailed project report and selected Durgapur, West Bengal, as the site for this proposed plant. The Soviet Union rendered all technical and financial assistance for this project. Commissioned in 1968, the plant has a designed capacity of producing 300 tonnes of parts for spectacles and also 10.3 million lenses every year.

Ophthalmic glass is produced by melting a mixture of sand, soda, calcium, potassium nitrate, potassium corbonate and 15 different chemicals. Earthen pots are made of ceramic clay, dried and baked in electric furnaces. These pots are made to resist temperatures up to 1450°C. They are put into a separate furnace with the glass mixture. The mixture melts into liquid glass. This molten glass is then poured into dies to make solid blocks. The blocks are then cut into cubes and heated again to make them into egg-shaped glass plates. Then these plates are ground and cut into small rectangular glass pieces. They are again heated and pressed into blocks and after quality control test sent for further processing to the lens manufacturing department.

This plant is equipped with Soviet machinery which produces lenses of high precision and quality, based on the latest technological achievements. The Soviet experts who were associated with the plant have trained Indian engineers, technicians and workers. Besides several Indian engineers had a good training in the Soviet Union. At present this plant produces high quality lenses from 0 to 10 dioptrics and -11 to -20 dioptrics. All

the raw material for producing lenses for this plant are locally available.

The plant is increasing its output every year. The assortment of articles is being expanded. Smoky lenses, protection glasses for atomic power plants, lenses for photographic cameras and other optical scientific instruments will be manufactured.

The products of this plant satisfy domestic needs and are even exported. The Soviet Union alone is receiving several hundred thousands of lenses every year from this plant.

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Other Medical Projects

A Research and Practical Paediatric Centre was set up with Soviet assistance at the Kalavati Saran Hospital for children in New Delhi from 1956 to 1972. This Research Centre trained several Indian doctors in this field. Many Indian doctors were sent to the Soviet Union and trained in the paediatric hospitals there.

The Soviet doctors at this centre, who were specialists in the treatment of children's diseases, have cured a good many children at New Delhi of the dreaded ailments like polio, etc.

The Soviet vaccine for poliomyelitis immunised children in almost all the urban areas in India.

From 1960 onwards, the Soviet Union supplied to India over 1,000,000 million doses of small-pox vaccine and it has been used all over India, so much so that small-pox is almost eradicated from the country.

INDO-SOVIET COOPERATION IN AGRICULTURE

Cooperation with the Soviet Union facilitates diversification of our agriculture, and stimulates the development of such rare branches of fine-fleece sheep-breeding, cotton growing, cultivation of sugar-beet and sunflower seeds.

—Dr. M.S. Swaminathan

India has been an agricultural country for ages and with the present growth of population has to depend upon its agriculture for its need of food to the millions even in future. Mechanisation and chemicalisation and large-scale farming are absolutely necessary for attaining self-sufficiency in food and commercial crops.

According to statistical data, in 1959 India had 39.3 million hectares of uncultivated land, owned by the state. If about a hundred agricultural farms are established on just about a million hectares of this land reclaimed for this purpose, with 10,125 hectares for each farm, then according to a Soviet economist A. Tubipnikov's estimate made at that time, these proposed state farms, with properly planned cultivation of grain and double crops every year, will be producing over 3 million tonnes of wheat at the rate of 0.325 tonne per hectare which could solve the food problem of the country.

The leaders of new India had been watching with great interest the transformation brought about in the agriculture of the Soviet Union. They wanted to take up agricultural development seriously and set up big farms in the public sector, to set up seed farms, and provide the farmers with fertilisers and

agricultural machines, and thus boost up farm yields and attain self-sufficieney in foodstuffs.

Suratgarh Central Mechanised Farm

If India could have a hundred such farms, the food problem-will be solved.

—**Jawaharlal Nehru**
(1959)

An Agricultural Exhibition was held in Delhi in the year 1955. The Soviet Union brought and exhibited there 70 tractors, 60 grain harvesters, trucks, bull-dozers, a mobile workshop, etc. All these are normally used in the Soviet collective farms.

The Soviet Union presented all this agricultural machinery it had brought for the exhibition, worth about Rs. 7.5 million, to the Government of India and offered the services of Soviet specialists to organise a state farm and train people. India decided to use this gift for setting up an experimental state farm at Suratgarh, a semi-desert area in the Ganganagar District of Rajasthan. This first 12,000-hectare farm in the public sector was established on Independence Day (August 15) in 1956. Soon it became the biggest state farm not only in India, but in the whole of South-East Asia as well.

The main objectives of this new farm were the following :

1. to produce good quality seeds for distribution among farmers and to demonstrate better methods of cultivation.
2. to develop a citrus orchard and nursery for supply of selected stocks ;
3. to produee pedigree bulls and distribute them in order to upgrade livestock ;
4. to develop the famous Bikaner breed of sheep which yields one of the best varieties of carpet-wool in the world ; and
5. to establish poultry farms for improving the stock of poultry.

This farm is 37 km long and its width varies from two to six kilometres. The entire farm land was brought under cultivation in about 3 years after making a 30-mile long shelter-belt and wind-breakers to check sand-dunes. Gram, mustard, wheat, cotton, paddy ('Jaya' variety) moong, sugar-beet, and sugarcane, etc., are the important crops grown here with a high yield. Total cultivated area in 1973-74 was about 8,846 hectares. The farm has been earning profits year after year. Its profit in 1972-73 was Rs. 57,000,000 and in 1973-74 was about Rs. 10 million.

Three years after the farm was set up the Soviet Union made another gift of equipment worth Rs. 400,000 to set up a repair workshop here. India has also brought some Soviet farm machinery for cotton and maize sowing and for harvesting potatoes.

Jetsar State Farm

Encouraged by the successful working of the Suratgarh Farm, the Government of India decided to set up a new farm at Jetsar nearby for which the Soviet Union offered a credit of Rs. 2.53 million for the purchase of agricultural machinery. In 1964, the Jetsar Farm was established on 12,150 hectares of land allotted for it. The subsoil water is very deep (200 ft. below) here and it is highly brackish. Wheat, gram, rapeseed, mustard, moong, bajra, jowar, etc., are the main crops here. There is a sheep farm set up with 100 'noli' breed sheep. Total area under crops in the year 1973-1974 was about 3,565 hectares.

Indian farm machine-operators were trained by Soviet specialists and they are skilfully handling the Soviet agricultural machinery and equipment which are easy to operate and have been working very well for over 20 years. They have proved their reliability, efficiency and versatility.

Suratgarh and Jetsar Farms are now included in the State Farms Corporation of India, incorporated in 1969.

In spite of numerous hurdles like shortage of water supply, the Corporation has been able to establish more farms in different parts of the country. In November 1966, an agreement was

signed by India and the USSR under which the Soviet Union gifted agricultural machinery worth Rs. 15 million for setting up five more state farms. It also agreed to sell machinery required for ten more state farms. The five farms were at Hissar (Haryana), Ladhewal (the Punjub), Raichur (Karnataka), Aralam (Kerala) and Chengum (Tamilnadu). They are 3,000 to 4,000 hectares each in area.

Hissar Central State Farm

A state farm was established at Hissar district in Haryana with Soviet assistance in 1968. The farm is situated on the Hissar-Sirsa road at a distance of 16 km from Hissar railway station. The farm was a thick jungle. Soviet bulldozers cleared the jungle, levelled the land and a network of roads and irrigation channels was laid.

Cotton, arhar, moong, bajra, wheat, gram, toria, mustard, sunflower, etc., are the main crops grown here. In 1973-74 its crop area was about 1,620 hectares.

In 1971-72 the farm made a net profit of Rs. 0.629 million and in 1972-73 Rs. 0.961 million.

Ladhewal Central State Farm

This state farm was set up in August 1968. It is situated in Ludhiana district of the Punjab. It is near Ladhewal railway station and about 12 km from Ludhiana toward Sutlej river.

This has also been set up with Soviet agricultural machinery and equipment. Grown on its fields are paddy, maize, wheat and potato. Its total area under cultivation in 1973-74 was 2,637 hectares.

Raichur Central State Farm

The Raichur State Farm extends to about 2,875 hectares. This farm is situated in the Raichur district of Karnataka about 10 km from Jawalagere village. This is a compact block on both sides of the Tungabhadra canal.

The Raichur Farm was set up with Soviet assistance in October 1968. It is also one of the five farms which received the

Soviet gift of agricultural machinery and equipment under the 1966 agreement.

The total area brought under cultivation in 1972-73 was about 1,003 hectares for both Kharif and Rabi crops. In 1973-74 a total area of about 1,725 hectares was cultivated.

The farm has been growing quality seeds for the farmers. The Soviet varieties of sunflower are grown here since 1970, according to the crash programme of intensifying sunflower cultivation. The oil content of sunflower is about 45-60 per cent compared to 20-25 per cent of groundnut seeds. The large-scale cultivation of Soviet varieties of sunflower will go a long way in meeting the growing need of India for edible oils.

The Raichur State Farm has a record cultivation of new variety of high yield cotton called 'Varalakshmi', which was evolved by Indian scientists and which is yielding about 37 metric centners of cotton per hectare (usual varieties give only about 25 centners). This is extra-long-staple cotton. With an investment of Rs. 607.50 per hectare, the farm had a profit of Rs. 5,000-6,000.

Aralam Central State Farm

The 4,800-hectare Aralam Central State Farm is in Cannanore district in Kerala. It was set up in 1970 with the aid of and equipped with Soviet agricultural machinery.

This farm is a little different from other farms. It started working in 1970-71 on 1,520 hectares of land. Initially only 305 hectares were utilised for Kharif and Rabi crops. About 400 hectares were used for nursery and plant breeding.

This farm was mainly started for tapioca and pineapple cultivation. With a bumper crop of both these, it began to run a cannery to pack pineapple, and a starch factory. The farm produces coconut seedlings also. It is expected to produce about 15 to 20 lakhs of hybrid seed units.

Chengam Central State Farm

The Chengam State Farm is situated in Chengam taluk (tehsil) in North Arcot district of Tamilnadu. It is near Jolarpet

on the main road to Bangalore. The farm extends to 3,970 hectares and it was inaugurated on October 2, 1971. This is also equipped with the Soviet gifted agricultural machinery and equipment.

Chengam was formerly part of protected forest area of Anandwadi and Mel Changam. The land was very uneven and it took some time to make it cultivable. This area being dry and barren, about 80 wells were sunk by 1975 and the plan is to dig some 70 more to provide adequate water supply.

In 1973-1974 about 1,245 hectares of land was cultivated. The main crops were groundnut, jowar, black gram (urad), red gram (arhar), ragi, horsegram, moong, sunflower and maize.

The farm has about 500 employees and in the rainy season some 2,000 work here. It is already yielding good profit.

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In addition to those Soviet-aided farms, the Central State Farm Corporation has already set up 14 Central State Farms in all by 1973-74 : Ashwaraopet, Khammam district (Andhra Pradesh); Kokila Bari Farm (Assam); Bahraich and Rae-Barelli Farm (Uttar Pradesh); Lushichera and Lokichera farms (Mizoram), There will be farms in Bihar, Gujarat, Madhya Pradesh and Nagaland.

The Soviet Union has already delivered equipment worth Rs. 18.8 million for these state farms and India has purchased additional machinery worth Rs. 3.8 million.

The Corporation has undertaken to fabricate spare parts of tractors and other agricultural machinery at Suratgarh to cater to the needs of other farms.

SHEEP DEVELOPMENT

India is lacking in fine wool sheep. Hence India has imported from the Soviet Union 8,000 Merino sheep for cross-breeding purposes. Since 1970 Groznenski and Stavropol breeds have been imported. They have shown that they can adapt themselves easily to the Indian climatic conditions.

Daksun Sheep-Breeding Farm

This pilot sheep-breeding farm was set up in 1971 at Daksun at a high altitude in Kashmir and has an area of 5,200 hectares. Initially 500 ewes and 15 rams of Soviet Merino variety were supplied to this farm. They soon acclimatised and grew well. In 1972 again 700 ewes and 30 rams were added. In 1971 alone, about 99 lambs were born per 100 ewes and the rate of birth improved after acclimatisation. In 1971 the Merino gave an average 4.7 kg of wool. The cross-breeds in the farm gave 2-2.5 times more than the pure native variety.

The scientists of the USSR Sheep- and- Goat-Breeding Research Institute are rendering valuable help to the Indian sheep-breeders for developing the Soviet breeds in India.

Gujarat Sheep and Wool Development

In 1965 cross-breeding experiment was carried out with 18 imported Soviet Merino sheep. It was found that they could very well adjust themselves to the climate of Gujarat. Encouraged by this experiment, the department of animal husbandry decided to set up two large-scale sheep-breeding farms in Gujarat.

Rajasthan Sheep Development

The first lot of 20 ewes and 5 rams of the Merino breed arrived in Rajasthan in 1966. The Merino sheep were found to be more adaptable than other foreign breeds. The multiplied ewes and rams have given more wool—double the quantity of yield of the pure breeds.

Rajasthan's wool production is already almost half of India's total output. It is expected that with the help of the Soviet Union it would become possible to evolve a cheap method of improving the sheep stock.

In 1974, Soviet-Indian protocol was signed envisaging the establishment and organisation of two sheep-breeding farms and one goat-breeding farm. In the course of time it is planned to set up eight big sheep farms, 85 state sheep farms and 800

sheep and wool centres in different parts of India including Tamilnadu, Karnataka, Maharashtra and Himachal Pradesh.

Soviet Farm Machinery

About 40,000 Soviet tractors are working on Indian farms and their number is eonsiderably higher than others.

Harsha Tractors Ltd., set up a plant for the assembly of T-25 (Vladimirets) tractors with the cooperation of the USSR. A group of Soviet engineers came to India to assist in setting up the assembly plant. Indian mechanics and engineers took an apprenticeship course in the USSR for repair and maintenance of tractors. The design of the T-25 was modified to suit the Indian conditions. The operation of the tractor was simplified and the number of attachable implements was increased.

In November 1970 under an agreement with the State Trading Corporation of India, 3,000 Soviet-made T-25 tractors were imported. Shortly, Indian farmers got well acquainted with the T-25 tractors, scheduled to be manufactured in India.

To meet the growing demand for Soviet tractors, the Government of India allowed the Ghaziabad Engineering Company Ltd., to set up a tractor plant with Soviet technical assistance at Loni in U.P., in the private sector. The Loni plant is the biggest in northern India and Soviet experts of the Central Institute of Designing Tractor and Farm Machinery Enterprises of Kharkov prepared the project report for the plant.

Starting with the manufacture of 1,850 tractors with only 20 per cent indigenous content in 1973-74, the content was raised to 42.5 per cent in 1974-75. In accordance with the new contract this will be raised to 49.5 per cent for the next 4,000 tractors. The first tractor rolled out of the factory in 1972 and the plant has a rated capacity of 10,000 tractors per year.

Fertilisers

In 1974 there was an acute shortage of fertilisers in India. The prices were high even in the world market. None of the Western countries was prepared to sell fertilisers in large

quantities. But the Soviet Union came forward to assist India, and a contract was signed for the delivery of 325,000 tonnes of fertilisers to India. Again in 1975 an agreement for supply of 267,000 tonnes of Soviet fertilisers was signed.

Helicopters for Agriculture

"Mathur Aviation" has purchased a number of KA-26 multipurpose helicopters for spraying pesticides to protect plants from pests and weeds.

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In 1973, when India was facing a very critical period in food situation the Soviet Union had no hesitation in diverting ships carrying wheat to help India tide over the difficulty. The Soviet Union sent two million tonnes of wheat and other foodgrains as a loan, to be returned later when Indian food situation improved. The charming feature of the offer was that it was made by our Soviet friends entirely on their own initiative. It was returned after a few years.

Likewise the Soviet Union has supplied to India in the past in time of acute scarcity huge stocks of kerosene, furnace oil, sunflower oil, cotton, fertilisers, etc.

The Soviet and Indian agricultural specialists are working in close collaboration in fishery, horticulture and other fields to apply the latest technological knowledge for agricultural development in India.

COOPERATION IN TECHNICAL EDUCATION

A significant feature of our international relations since Indian independence has been the close cooperation between India and the USSR. This has been specially important for the development of science and technology.

—Dr. D.S. Kothari
President, Indian National Science Academy (1974)

Industrial development in India lagged behind in the days of colonial domination and the urgent task after attaining independence was to bring about rapid industrial and technological development in the country. This task is being accomplished largely thanks to the friendly assistance of the Soviet Union and other socialist countries. Today, India has risen up to the position of one of the top ten industrialised nations of the world.

But industrialisation can be effective only with a well-qualified, determined and patriotic force of engineers, technologists and other technical personnel. To train these cadres, the government of independent India established a network of higher institutions of engineering and technology.

The first of these institutions was started at Kharagpur near Calcutta in 1951 with international assistance, and foreign specialists arranged through the good offices of UNESCO under the UN expanded technical assistance programme.

The Indian Institute of Technology at Powai, Bombay, was set up in 1958. The talks for setting up the Institute were

initiated by the then Minister of Scientific Research and Cultural Affairs, Prof. Humayun Kabir with UNESCO and its Soviet representatives when the former attended the UNESCO General Conference at Monte Video in 1954. UNESCO agreed to set up the institute with Soviet assistance. After further discussions at Moscow, Paris and New Delhi, UNESCO agreed to provide in the form of equipment and technical experts from the USSR an assistance of Rs. 10 million roubles. A bilateral agreement with the Soviet Union was signed in 1958 for a further assistance of 3 million roubles. The assistance was extended from time to time.

The Soviet Union sent Prof. Vladimir Martinovsky in December 1956 with three other scientists to study the situation in India. They spent eight months in India visiting different places and finally chose a plot of land measuring about 222.75 hectares near Powai lake which was donated by the Government of Maharashtra. As the building work proceeded, classes were formally started in a building temporarily loaned by the Silk and Art Silk Mills Associations at Worli, Bombay, and Prof. Kabir inaugurated the Institute on July 25, 1958, and the foundation was laid for the Institute by Prime Minister Jawaharlal Nehru on March 3, 1959. By an Act of Parliament passed in 1961, the Institute got the right to award degrees and other academic distinctions.

The President of India is the Visitor of the Institute. There are four more IITs in India, and the Council of the Indian Institute of Technology under the Ministry of Education coordinates the activities of all the five institutes at Khargapur, Bombay, Madras, Kanpur and New Delhi.

The fiast batch of graduates from the Powai Institute came out in December 1962. This institute is one of the biggest in South-East Asia and has on its rolls more than 2,500 students and post-graduates. It has engineering faculties, viz., civil, mechanical, metallurgical, electrical and chemical, with five-year courses for B. Tech. In 1963-64 special three-year degree courses in chemical and electrical engineering were started for graduates of physics, chemistry and mathematics. Another

faculty, in aeronautical engineering was added in 1968. The Institute has four scientific departments, viz., mathematics, physics, chemistry and physiology.

Though initially planned for 200 post-graduate students, and 320 undergraduates, their number has increased, with more provisions for undergraduates in 1963. In 1958 the Institute took only 121 students. But now the total student strength is more than 2,500 including more than 50 girls. There was only one student for Doctorate (Ph. D. in mechanical engineering) in 1962. But by the end of 1966 there were 135 Ph. D. candidates. Every year some 500 students pass out from the Institute.

There are more than 150 Soviet professors and teachers on the staff of the Institute. It has the largest collection of Soviet technical books in its library. There is an industrial design centre and a computing centre equipped with two advanced Minsk computers and a third generation ES-1030 computer. The Institute has good laboratory facilities and its latest aircraft and engine department of the autonomous aircraft building faculty is a unique one, according to Dr. H.N. Sethna, the famous Indian scientist.

Bombay IIT is really a great and valuable contribution to India's science and technology.

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At the **Khargapur Technological Institute** an autonomous metallurgical faculty has been set up by the Soviet Union under an agreement signed on December 10, 1966.

Osmania University, Hyderabad

An autonomous geophysical faculty was set up by the Soviet Union as per the above agreement. It trains specialists in geophysical mineral prospecting techniques.

Measurement data are processed here and are compared with data available for Soviet territories.

Every year these faculties train some 200 specialists for various public sector enterprises in India.

Indian Institute of Science, Bangalore

An autonomous computing technology faculty was established in the Indian Institute of Science, Bangalore. It is now converted into a scientific centre of the Bangalore Institute of Science to meet the pressing need of India to have a specialised establishment for conducting research in this field and to develop relevant equipment. This centre plays an important part in the national scientific and economic progress. The Soviet agencies are making extra equipment deliveries and further methodological assistance to the centre.

The **Hind Oil Design and Research & Training Institute** is established at Dehra Dun for training in research and design work in the oil industry. The students are taught different aspects of designing, including feasibility and economic studies, surveys, site planning, mechanical design, instrumentation, steam generation, electric power generation, distribution etc. It trains students in refinery technology too.

Information Centre for Soviet Scientific and Technological Literature is set up in New Delhi. More than 10,000 monographs and more than 250 titles of magazines were sent in 1971 and 1972 alone. Special bulletins are issued with lists of Soviet books and summaries of Soviet magazines. Photo-copying and micro-filming of articles is done here. English translations of technical books are produced and an inter-library service is also established.

Soviet Computers in India

Indian and Soviet scientists are cooperating in the development of computer technology also.

A giant Soviet computer BESM-6 was installed at the Bhabha Atomic Research Centre in May 1973. It is capable of performing a million operations per second, possesses very strong memory and stores a vast amount of information. It is useful for scientific research as well as for practical work connected with automatisation of industrial and other planning

and management process. A number of specialists were trained in the USSR for the operation and maintenance of this complex machine.

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The first Soviet computer installed in India was "Urals". In the mid-'50s this computer was installed at the Indian Statistical Institute, Calcutta. Some printing equipment also was presented to this Institute.

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Another Soviet computer is working at the Equatorial Rocket Launching Station at Thumba for nearly a decade and a half.

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Two Minsk type computers are already working at the Bombay IIT. A third generation computer ES-1030 is also provided. They are manufactured in accordance with world standards and can work in combination with the computers of other countries, including those now in use in India.

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The Soviet Union has offered a third generation computer, equivalent to the latest American models, to the Administrative Staff College of India at Hyderabad. It is capable of 1.5 million operations per second.

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Besides, the Soviet Union is also providing assistance to the development of computer technology.

Technical Training

The assistance rendered by the Soviet Union for the training of technical personnel for Indian industries has developed in several directions. In the enterprises built with Soviet cooperation, specialists impart the necessary training to the personnel on the spot. More than 40,000 have acquired new technical know-how and experience during the time of their work with

the Soviet experts in the plants. Thousands of mechanics and technicians have been trained at the special training centres organised at the Soviet-aided projects. More than 2,000 Indian specialists got their training in the leading industrial enterprises and design institutes in the USSR. Hundreds of Indian students are studying in the higher educational establishments in the Soviet Union.

The Soviet Union has helped India in establishing special schools of technical education in India.

Secondary Technical Institutions

With Soviet assistance a Specialised Secondary School for Metallurgy has been built at Bhilai, a Specialised Secondary School for Machine-Building at Ranchi; a Specialised Secondary School for Oil and Gas Industry at Baroda; a Specialised Training Centre for Electrical Engineering at Bhopal; and a Specialised Training Centre for Radio and Electronics at Hyderabad.

A special Training Centre at Korba trains 100 specialists for aluminium industry every year.

The main aim of these schools is to train technical cadre for Indian industrial enterprises built with Soviet economic and technical cooperation. All these schools are located mostly at or near such enterprises and are equipped with Soviet facilities. Soviet teachers participate in the training programme. About 200 people with higher technical education and about 600 with secondary technical education are trained every year in these schools.

Institute of Russian Studies

The Institute of Russian Studies was inaugurated in New Delhi on November 14, 1965. It was organised with Soviet assistance, and was later transformed into the Centre for Russian Studies at the Jawaharlal Nehru University. It trains specialists in Russian language and literature, particularly teachers and translators, and imparts education about the cul-

ture, economy, history and geography of the Soviet Union. The graduates from this Institute work at many other educational establishments. There is a post-graduate school also in the institution.

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It is worthwhile remembering that more than 4,000 Indians have been to the Soviet Union for improving their technical qualification. They studied or got training in the various technical institutes and industrial enterprises there.

In this connection Mr. M.S. Lal, Director-General of Construction at Bokaro Plant, had said a few years ago in an interview to the correspondent of a Soviet newspaper like this: "Soviet specialists help India in every way, giving all the best in the field of technology and production engineering. Former coolies, semi-proletarians and peasants from nearby villages have acquired trades and specialities to become regular workers. Over 70,000 skilled workers and foremen have been trained at Soviet-Indian joint projects, including training centres which exist at these centres." It is needless to add that the number of such trained workers has increased greatly in the past few years, with the establishment of new projects and also extensions of the existing ones.

The Union Minister for Education, Social Welfare and Culture Dr. P.C. Chunder inaugurating the Joint Indo-Soviet Commission for Cooperation in Soviet Sciences on April 16, 1977, said amongst other things: "Indo-Soviet friendship has acquired a national consensus cutting across party lines and other considerations. Largely our experience has been that the Soviet Union has always been a good and understanding friend for the last three decades of our independence."

INDO-SOVIET SHIPPING AND TRADE

We have seen phenomenal expansion of trade between India and the USSR since India attained independence. From a mere ten million in early 1950, the two-way trade rose to Rs. 8,000 million in 1977. In 1980 we hope to cross Rs. 10,000-million mark.

—Mohan Dharia,
Minister of Commerce

More than two decades ago, on April 6, 1956, an agreement between the Governments of USSR and India was signed to establish shipping relation between the two countries. In fact it was the Bhilai agreement of February 2, 1955 which cleared the way for cooperation between the two countries.

Indo-Soviet shipping service started with a total complement of just a dozen ships, the Soviet and Indian ships being equal in number, 6-6 each. As trade expanded the number of ships was raised to 14 in 1962, and then to 20 in 1963. The tonnage carried in 1962 was 0.35 million and in 1963 it was 0.5 million tonnes both ways. In 1969 there were 72 sailings in each direction, shared equally by the Soviet Union and India. The freight turnover in 1956 was just 150,000 tonnes. By 1974 the freight turnover rose to more than one million tonnes.

The first Indo-Soviet trade agreement was signed in 1952. Since then the trade turnover has been continuously increasing. In 1953-54 the trade turnover was only of the value of Rs. 18 million. It went up to Rs. 431 million in 1958-59 and gradually it has risen to Rs. 7,870 million in 1977.

The multinational shipping services operating under the Shipping 'Conferences' had a closed shop policy. These international shipping cartels had actually come into existence as a result of rate wars. They had their monopoly tariff, and were making huge profits at the cost of small nations. Between 1946 and 1957 the freight rates were increased by nearly 60 per cent. Afterwards, the freight rates had gone up by about 70 per cent for UK and by about 55 per cent for the USA during the period from 1957 to 1971 ! This freight explosion was a source of worry for both India and the Soviet Union. In addition, the foreign shipping companies would dictate their own terms. Their freight rates were not fixed for the Black Sea ports of the Soviet Union. They agreed to carry freight only up to Red Sea or Mediterranean ports and insisted on transhipment at these ports for further shipment to Baltic ports. It was precisely in this complicated situation that the Indo-Soviet Shipping Agreement was concluded in 1956 covering shipments between Black Sea ports and India. In 1972 further discussions took place to extend the Indo-Soviet shipping services to the Soviet ports in the Baltic Sea and in the Far East also. At that time Soviet Union ranked second in the total volume of the foreign trade of India. The freight rates are constant and are cheaper in comparison to the rates of the foreign cartels.

In 1961 the Shipping Corporation of India was founded. Its carriage has been steadily growing since then and today it is one of the first ten leading shipping companies in the world. It has bilateral shipping arrangements with different countries on the basis of equal tonnage.

The Soviet Union has 47,000 km of maritime borders and had 1,400 ships with 11 million tonnes deadweight in 1972. Soviet ships touch about 900 ports in almost all countries of the world. Most of the Soviet ships were built in recent years and are of different types and standards.

India has built up its tonnage during the last 30 years, thanks to the help of the socialist countries. Over 40 per cent of the deadweight of 1,800,000 owned by the Shipping Corporation of India has come from the GDR, Poland, Rumania, Yugoslavia and the USSR.

An agreement for 3 tankers to be built for India in the Soviet shipyards was signed in March 1971. A new agreement for four dry cargo ships was concluded in the same year. The payments were to be made in rupees for all these transactions. The dry cargo vessels are **Vishwa Umang, Vishwa Tarang, Vishwa Asha** and **Vishwa Abha** of 13,600 tonnes each with a cruising speed of 17 knots. They can carry all types of cargo including 50 tonnes of refrigerated cargo. They are all-weather vessels with modern sophisticated equipment, and are built at Kherson near Odessa. The tanker **Vishweshvariyya** was launched in 1973 and the other two subsequently. These have a displacement of 22,100 tonnes and a cruising speed of 16 knots. These ships are made specially for the Indian tropical weather conditions. The Soviet Union is helping India to set up a ship designing bureau and to build fishing trawlers.

Indo-Soviet Trade

Indo-Soviet trade has a long history. A Russian trader visited India more than 500 years ago. Indian traders had dealings with Russia and had set up their own centres of trade in different parts of Russia. It is interesting to note that during the time of Napoleon's invasion of Russia in 1812 Indian traders of Astrakhan donated a sum of 10,000 roubles in gold to the Government of Russia for the struggle against invaders.

During the British colonial rule in India the first trade relation between the Soviet Union and India began after the 1921 Soviet-British agreement. In the mid-'20s spices, tea, raw jute and other goods from India were sent to the Soviet Union. Some individual Indian traders also visited the USSR. At the end of 1926 India received the first big consignment of Soviet sugar (7,000 tonnes).

In 1925 cheap Soviet oil products—kerosene and petrol—entered Indian market and competed with British companies, which had to reduce their prices by about 30 per cent. Then they started a fierce anti-Soviet campaign and asked for boycott of Soviet oil products. In 1929-30 India imported 34 per cent of its kerosene requirements from the Soviet Union. In 1932

two Indian companies Western India Distributing Company and the National Petroleum Company marketed the Soviet oil products. After 1930, Soviet cotton textiles also made their appearance in India and competed with textiles of England and Japan. All this was reduced to almost zero level by the unilateral efforts of the British ruling by 1940. However, in spite of the limitations imposed by the British rulers, the first Soviet Trading Agency was established in Calcutta in 1943.

After India was proclaimed a Republic in 1950 the two countries took steps to establish regular trade relations. In 1951 a barter agreement was signed to supply wheat in exehange for tea and jute, when food problem was acute in India. In 1952 the Soviet Union participated in an International Industrial Exhibition at Bombay.

In December 1963 the first Indc-Soviet Trade Agreement was signed. This first long-term agreement stipulated settlements of trade transactions in Indian rupees and at the end of the five-year period, the balance could be converted into sterling. It was also agreed to use as far as possible only Soviet and Indian ships for mutual supplies. It was during this period that supplies for Bhilai and Bombay's Powai Institute started arriving from the USSR. The second trade agreement which was signed in 1958 did not contain the clause on the conversion of balance inlo sterling. The payments were to be made only by mutual deliveries of goods.

The third trade agreement was signed in 1962. That was the period of India's intensive industrialisation. By 1967, Soviet supplies of machinery and equipment to India was about 82 per cent of the total exports, but afterwards, when Bhilai was built, the ferrous imports from the Soviet Union fell to 2.3 per cent at the end of the same year. In the same year the USSR began purchasing Bhilai steel and from 1970 surgical instruments from Madras plant too. In 1970 the trade between the two countries amounted to Rs. 3,269 million. The fourth trade agreement was signed in 1970 for the period 1971-75. It contained a new clause about the possible joint undertakings in third countries. The Soviet Union agreed to supply raw cotton to

India and to purchase textiles from India. Also it agreed to supply equipment for processing bauxite and subsequently to purchase 50,000 tonnes of alumina. In 1974 the Soviet-Indian trade amounted to Rs. 4,300 million. In 1977 it rose to Rs. 7,870 million. Starting with just 4 items of trade in 1953, it rose to 40 items in 1964 and to 100 items by 1975.

Main Indian exports to the Soviet Union are : jute, tea, cotton textiles, iron ore, tanned and finished leather, leather goods, footwear, oil cakes, cashewnuts, spices, iron and steel, tobacco, coffee, mica, manganese ore, aluminium cables and other products.

Exports to the Soviet Union have developed whole areas in India. Andhra Pradesh specialises in the sale of tobacco, Kerala and Karnataka supply cashewnuts and coffee. Ludhiana (Punjab) specialises in the export of woollen hosiery. In fact the Soviet Union is the only big foreign buyer for this knitwear. Tamilnadu exports hides and skins, U.P. and the Punjab export footwear.

Main imports to India from the Soviet Union are : zinc, copper, mercury, asbestos, tin, cellulose, platinum, fertilisers, newsprint, petroleum products, ferrous metals, sophisticated equipment like computers, electronic items, heavy duty dump trucks, heavy excavators, etc.

Trade Agreement		Turnover at the end
I. 2-12-1953	1954-1959	Rs. 431.1 million
II. 16-11-1958	1959-1963	Rs. 1,205.6 ,,
III. 1- 1-1964	1964-1968-1970	Rs. 2,996.0 ,,
IV. 26-12-1970	1971-1975	Rs. 7,500 ,,
V. April 1976	1976-1980	Rs. 15,000 ,,

The Soviet Union is now the biggest market for Indian commodities. For the supply of equipment, know-how and

other services for more than 70 projects in India built with the cooperation of the Soviet Union, the payments are made throughout by export of commodities. Therefore it is difficult to assess the value of Indo-Soviet cooperation in terms of money.

The barometer of trade between the Soviet Union and India always shows "fair" position. It is beneficial for both the countries. The commodity circulation continues to expand.

Recently, the working group of Indo-Soviet Joint Commission signed in Moscow a protocol on July 17, 1978, under which the sides agreed to exchange proposals on development of trade during 1981-1985 and on the main trends of trade cooperation up to 1990 in order to include them in a long-term programme.

OTHER SOVIET-AIDED PROJECTS

The Calcutta Metro

A protocol was signed between India and the USSR in 1970 for the construction of an underground railway at Calcutta. A project report was prepared by Soviet specialists and it was accepted by the Government of India. The foundation was laid for the Metro on December 17, 1972.

Calcutta has the unique distinction of becoming the first city in India to have the underground rapid transit system. It is one of the most complex engineering projects.

This underground railway is being built between Dum Dum and Tollygunj. It is a Metro railway line of 17.5 kilometres with about 10 stations. The building work has already started at Dum Dum. It is a project worth Rs. 1,400 million.

According to a protocol signed in 1974, the Soviet Union will supply 4.5 metre tunnel shields and 5 muckers, 12,500 tonnes of steel sheet piles and 12 diesel hammers for pile driving. Tunnel shields are provided with full complex of machines.

The projeet is expected to be completed in 1979. When completed, the trains will run in the tube here at a speed of

80 km per hour and there will be a train every two minutes during peak hours, stopping at all stations and covering in just 34 minutes the distance between Dum Dum and Tollygunj.

The trains will clear 60,000 passengers per hour and 2,500,000 passengers per day. The Metropolitan Transport Project has already placed orders for air-cooled Metro coaches with a seating capacity of 40 and standing capacity of 400 passengers. Integral Coach Factory at Madras is producing them.

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Refractory Plant for Kerala

An agreement was signed on May 28, 1974 at New Delhi between the Heavy Industry Export (Tiazpromexport) Organisation of the USSR and the Kerala State Industrial Development Corporation for Soviet assistance to establish a highly specialised Refractory Plant in Kerala. The plant is to have a capacity of 31,000 tonnes.

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Other Projects

In 1960 the Soviet Union agreed to provide India supply—dropping planes and helicopters. In August 1962 the Soviet Union agreed to provide India with MIG-21 fighter planes and also to set up plants in India to manufacture these planes. In 1964 this MIG agreement was broadened considerably. Large Soviet transport planes, naval and other equipment were also provided India.

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Agreement on Cooperation Between APN & PTI

An agreement on cooperation between the Novosti Press Agency of the USSR and the Press Trust of India was signed on September 11, 1973 at Moscow.

Under this agreement APN granted the PTI the right to receive and disseminate APN materials specially prepared for the PTI. The APN also receives PTI materials specially prepared for the APN for dissemination. Both the parties will use the

material in such a way as to indicate the source and also as not to distort the content and meaning of the information supplied.

The PTI will give preference to APN commentaries in respect of events in the Soviet Union and received in good time. In the same way the APN will also give preference to PTI commentaries in respect of similar materials, related to events in India and received in good time.

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Air India & Aeroflot Agreement

On April 2, 1970, **Air India** and **Aeroflot**, civil aviation organisations of India and the Soviet Union, signed an agreement to operate 4 flights per week between New Delhi and Moscow.

Film Production and Exchange

Soviet films were unknown in India for a long time, though the Indian film-makers and specialists got inspiration from the books by Pudovkin and Sergei Eisenstein. In later years Pudovkin and Cherkassov visited India in the fifties.

During the years of the Second World War India had the opportunity to see many Soviet films of heroic exploits of Soviet soldiers' inspiring patriotism.

After India became independent, many Soviet films have been exhibited in India and appreciated. For a period, these were mainly exhibited by the friendship organisations in private shows, and commercial shows of Soviet films were not many.

An outstanding Soviet production on India was a documentary made by the Soviet film director Roman Karman. Later on, a joint Indo-Soviet film was produced about Afanasi Nikitin, the first Russian trader who visited India much before any European traveller. This picture "Pardesi" (in Hindi) was produced with Soviet-Indian artistes in the cast in Russian and Hindi versions. This joint film venture was a tremendous success.

Another joint venture was the "Black Mountain", about an Indian elephant.

Every year the Soviet Union is purchasing the popular Indian films of different languages.

FRIENDSHIP TREATY

The Indo-Soviet Treaty of Peace, Friendship and Cooperation is a very important link in the chain of Indo-Soviet cooperation in the interest of the peoples of both India and the Soviet Union...I am sure the future will find them marching forward together and forging further links for the good of mankind.

—Jagjivan Ram
(1973)

It was just a little over seven years ago that the historic Treaty of Peace, Friendship and Cooperation was signed between the Soviet Union and India on August 9, 1971.

The Soviet Union and India have always been propagating peace among all nations. Peace—'Shanti'—is a household word in India. In this connection it is worthwhile to remember that the first decree of the Soviet Union, after the victorious October Revolution, was on peace. It never had any territorial ambitions and never attacked any one. The Soviet Union has been a strong advocate of peace and detente all over the world.

The Soviet Union wants friendship with all countries. There are several non-official friendship organisations having friendly ties with similar organisations in all the countries of the world. The friendship between our two countries has been an example to all other countries. Our governments have always been friendly to each other. In India on the popular side, there is the Indo-Soviet Cultural Society with over 1,000 branches and 200

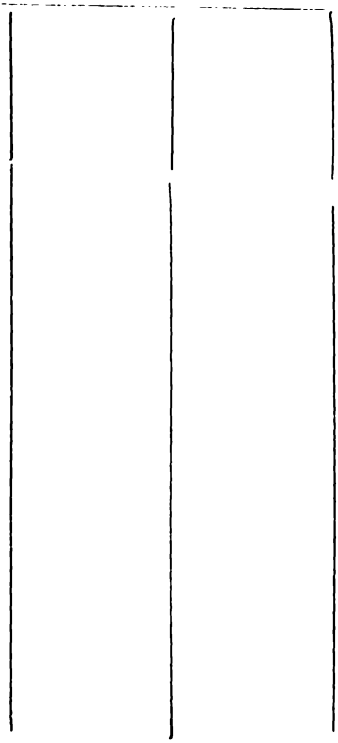
collective members all over the country. There have been mutual visits of friendly delegations of people from all walks of life between our countries. At the governmental level also friendly visits of official delegations take place often.

There has been a phenomenal growth of cooperation between our countries in the political, economic, scientific and cultural fields. There is a significant cooperation in the field of trade relations also.

Therefore, it is quite natural that our two countries signed the Indo-Soviet Treaty of Peace, Friendship and Cooperation. This Treaty was signed at a time when the situation was not quite normal for India. Indeed it was only the Soviet Union which came to the aid of India in its hour of need.

That only highlights the extraordinary nature of Soviet people's friendship for India.

Change of government in India has not affected these friendly relations, because the fundamental interests of our peoples remain the same and coincide with each other. The friendly official visits of the Prime Minister, Defence Minister and Foreign Minister of India to the Soviet Union during the last several months are testimony for our firm friendly solidarity in the interests of peace, friendship and cooperation of all the countries of the world.



Independent India inherited a ruined economy and a quiescent industry, and the enthusiasm of the people and the national leaders to revive the economy and rebuild the basic industries was dampened by the cool, apathetic response of the Western industrialised nations.

A ray of hope came from the socialist world, with first the Soviet Union and then the other socialist countries coming forward to help India build the basic industries like steel, oil, power and mining, with big investments in the public sector on soft terms.

The author, Mr. K.V. Rao, a well-known Indian Journalist, tells the saga of the projects built in India with the Soviet technical collaboration and financial assistance and their general impact on Indian industry and economy, resulting in the development of anciliary industrial units, generation of employment potentials and improvement of the well-being of the people.