INFLUENCES OF NATURAL FACTORS ON ECONOMIC DEVELOPMENT OF SIBERIA

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A Dissertation submitted in partial fulfilment of the requirements for the Degree of Master of Philosophy of the Jawaharlal Nehru University

NEW DELHI

1977

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LIST OF ABBREVIATIONS

ASSR	AUTONOMOUS SOVIET SOCIALIST REPUBLIC
BAM	BAYKAL-AMUR MAGISTRAL (TRUNK LINE)
CPSU	COMMUNIST PARTY OF THE SOVIET UNION
NKSSR	NATIONAL ECONOMY OF THE U.S.S.R.
RSFSR	RUSSIAN SOVIET FEDERAL SOCIALIST REPUBLIC
USSR	UNION OF SOVIET SOCIALIST REPUBLIC
YASSR	YAKUT AUTONOMOUS SOVIET SOCIALIST REPUBLIC

... ...

PREFACE

The world's attention is now drawn to the Soviet attempts to develop the Siberian economy. Immense reserves of natural resources in Siberia are likely to provide a firm foundation for the Soviet military might and socialist economic prosperity. This region is expected to become a strong export base for the Soviet Union. It is also to become an area of international co-operation and collaboration at present. Therefore, this study of the economic development of Siberia, particularly of the influences of natural factors on the development process, has both academic and practical significance. Indeed several scholars in the Western world have written on the various aspects of economic development in Siberia. However, very few have focussed their attention on the relationship between natural environment and economic development, especially on how nature, by creating formidable difficulties in the way of utilization of the rich resources it has itself provided for the benefit of society, also influences the very process of development. For this reason I try to investigate how natural environment affects the process of development in Siberia.

In this dissertation, I have made a preliminary attempt to establish the linkage between the natural factors on the one hand and methods of planning, choice of techniques, structure of industries, and evolution of technology. A complete analysis of these linkages could not be undertaken within the limits of an M.Phil. dissertation. I hope to take up a detailed study of this subject for my Ph.D.

I have faced many difficulties in collecting the materials for this study as the material available in English is sparse and inadequate.

I am most grateful to Professor Jayashekar of our Centre for his supervision and guidance. I am equally obliged to Dr. K. P. Dhurander, Centre for Regional Development, School of Social Sciences, Jawaharlal Nehru University, for going through the parts of this dissertation and making valuable suggestions. I wish to express my sincere thanks to Dr. M. K. Bandman, Institute of Economics and Industrial Engineering, Siberian Department, Academy of Sciences of the U.S.S.R. and Visiting Professor at the Jawaharlal Nehru University, for drawing my attention to important materials on this difficult subject.

My thanks are also due to the library staff of the Jawaharlal Nehru University for helping me in the collection of materials. I must also express my appreciation and sincere thanks to Mr. S. T. Rajan for going through the manuscript and helping me in various ways.

V. Velappan

New Delhi — V. VELAPPAN

17.5.1977

CHAPTER I

THE NATURAL SETTING AND ECONOMIC SIGNIFICANCE OF SIBERIA

CHAPTER-I

NATURAL SETTING AND ECONOMIC SIGNIFICANCE OF SIBERIA

(a) Physical Features of Siberia:-

Siberia is one of the largest, but least populated out of the fifteen provinces of the U.S.S.R. The land area is 12,766,000 sq. km., which is larger than that of the Chinese People's Republic, an area of 8.5 million sq. km., or of the U.S.A. with 9.3 million sq. km. It is more than twice as large as European Russia (5.57 million sk. km.). The distances from East to West and from North to South of Siberia are also enormous and with the prevailing harsh climate, the conditions greatly handicap the construction of a well organised communication system. It lies between 60° E and 170° W longitudes and 50° S and 85° N latitudes which covers three-fourth part of the Russian territory. It is separated from the western regions of the Ural mountains which form the western boundary. In the North, the Kara Sea, the Lepta Sea and in the North-east, the Siberian seas of the Arctic north with many islands, make the northern boundary. In the South, it is bounded by the Sayan and the Sajan mountain ranges from Mongolia and in the East, by the Bering Sea and the Kurile Islands.[1]

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1 Violet Conolly, Siberia Today and Tomorrow, Collins Clear Type Press (London 1975), p.15.

This vast Siberia is divided into three major economic regions based on physical and climatic conditions. The regions so divided are:-

(i) West Siberia

(ii) East Siberia

(iii) Far-East Siberia

(i) Western Siberia:-

The vast western Siberian plains which lie to the east of the Ural mountains, extend from north to south from the shores of the Arctic Ocean to the steppes of Kazakhstan and eastward to the Yenisey river. Large areas of swamp in the north gradually give way to the hilly plateaux of Kazakhstan, but as a whole, the western Siberian plains are even flatter than the East-European plains, and constitute the largestarea of level land on the earth.[2]

Western Siberia is the fourth in area amongst the nineteen economic regions of the U.S.S.R., but ranks ninth in population which comes to 1,22,01,000, the figure given for 1970. The western boundary coincides closely with the drainage basin of Ob'-Irtysh rivers. It is bounded in the north-west by the high mountains and the northern Ural ranges. In the north, there is little traffic out into

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2 James S. Gregory, The Geography of the U.S.S.R., (Moscow 1975), p.10.

the Arctic Ocean, and in the east, little movement across into East Siberia. This region mainly lies between 50° S and 70° N latitudes from the high rugged Altay mountain district of the extreme south, which consists of some hilly areas and low mountain ranges like Kuznetsky Altatau. In the great west Siberian low-land, the flatness of which is interrupted by low hills and ridges here and there with a local relative relief. It rarely exceeds a few tens of meters. Much of the area lies roughly through Tyumensk and Tomsk oblasts and there is almost no cultivation at all and the less swampy areas remain covered with coniferous forest. In the extreme north, this thins out to give way to tundra. In the extreme south, however, there is a considerable area of steppe country (Barabinsk and Kulundinsk steppes) with reasonable to good chernozem and associated soils. About 30% of Omsk Oblast and of the Altay Kray are under cultivation. Like the north-west, Western Siberia has abundant supplies of water, most of which drain into the Arctic Ocean.[3]

(ii) East Siberia:-

It lies roughly in the drainage basin of the Yenisey river. Unlike Western Siberia, it generally differs in

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3 J.P. Cole and F.C. Gorman, A Geography of the USSR, Butterworth Co. (Publishers) Limited, 1961, Great Britain, pp. 15-17.

many respects in secondary aspects some of which are mentioned here. East Siberia lies mainly between the Yenisey river and the Lena river. It consists of a series of table-lands, such as the Verkhoyansk and Kolyma table-lands. The southern part of the region is extremely rugged consisting of a number of high ranges, separated by deep valleys. Most of the region is comprised of the mid-Siberian plateau, which is 400 - 500 meters above sea level, dissected by many deep valleys. The platform ends where it overlooks the Yenisey river and the West Siberian low-land. Here the temperatures are very low on account of the long cold winter which is to be expected at these remote northern latitudes as well as in the corresponding regions of the Atlantic and the Pacific. Most of the area is in the zone of continuous or partial "permafrost" (permanent frozen ground).[4]

(iii) Far-East Siberia:-

The Far-East region now includes the Yakut A.S.S.R., which for some decades was thought of as part of the West Siberian region. It is the largest economic region of the U.S.S.R. covering over a quarter of the area, but it is only

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4 L.S. Berg, The Natural Regions of the USSR (Translated from Russian) (New York 1950), pp. 205-7.

the eighteenth in the order of population among the republics. Though it is much farther from the European U.S.S.R. it is very much a world apart, involved in Far-Eastern affairs and is much more difficult to integrate into the national life than even the Baykal area.

The Soviet Far-East is comparatively a narrow strip of land extending from north-east to south-west for practically 4500 km. In the south, the ranges of the Sikhote-Alin system face the Sea of Japan. There are fairly extensive lowlands around the middle and lower reaches of the broad Amur river and its tributaries, the Zeya, the Bureya and the Zussuri.

From the port Vladivostok, the Far-East extends far into the Arctic and the road links in that direction. The Trans-Siberian Railway is the only important land link with the rest of the U.S.S.R. The north coast is ice-bounded for nearly the whole of the year. The long Pacific coast is difficult in physical characteristics to negotiate. The Okhotsk Sea is itself frozen for most of the year. The rugged conditions, the short growing season, marsh, permafrost and the poor soils combine to make farming difficult in even the small favourable localities.[5]

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5 J.P. Cole and F.C. Gorman, The Geography of the USSR, 2nd edition, (Butterworth 1970), pp. 269-72.

The mountains of Kamchatka and Sakhalin, which are geologically comparatively young parts of the Pacific Ocean mountain belt, have numerous extinct and active volcanoes (about 160, of which 23 are active). The highest is the Klyuchevskaya Sopka, which is 4,750 meters high. The mountainous islands of the Kuril Arc are a continuation of the Kamchatka mountains. The mountains are typical not only of the Eastern Siberia, but of the Soviet Far East also. A highland belt stretches for thousands of kilometers along the southern boundary of the Soviet Union.

Part of the Carpathoans lies in the extreme Southwest. This is the Eastern wooded Carpathean, a chain of ranges between 1000 and 2000 meters in height. The relatively low Crimean mountains (reaching to about 1500 meters) on the southern sea-board of the peninsula of the same name are one of the links in the southern mountain belt.[6]

Siberia has four major rivers which have a very large flow of water. They are the Ob', Yenisey, Irtysh and Lena. Most of the rivers in this region are permafrost in character, except the river Ob'. The combined discharge of the Yenisey, Ob' and the Irtysh exceeds by more than five-fold

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6 James S. Gregory, The Geography of the USSR, Moscow 1975), p. 13.

the total discharge of all the rivers of Central Asia and Kazakhstan. It was estimated by the U.S.S.R. team that it would exceed by more than 2000 parts over the other regions of the U.S.S.R.[7]

The Ob'-Irtysh total interfluve contains most of the land of the West Siberia that is suitable for agricultural development. According to estimate, upto 40 - 60 million hectares of water-logged land would be available in the area after the necessary drainage work is done. The lands of North Kazakhstan, Kokchetav, Kustanay, Turgay, Tselinograd and Pavalodar Oblasts, if properly irrigated, would come close in productivity to those of the southern Ukraine and Moldavia and would even surpass the latter in other parts of Kazakhstan and Central Asia, because of the high level of solar radiation and the advantages of the continental climate.[8]

The Yenisey river, the largest water resource in the region flows for more than 4000 kilometers through Siberia. In terms of the amount of water carried into the ocean, the Yenisey occupies the fifth place in the world.

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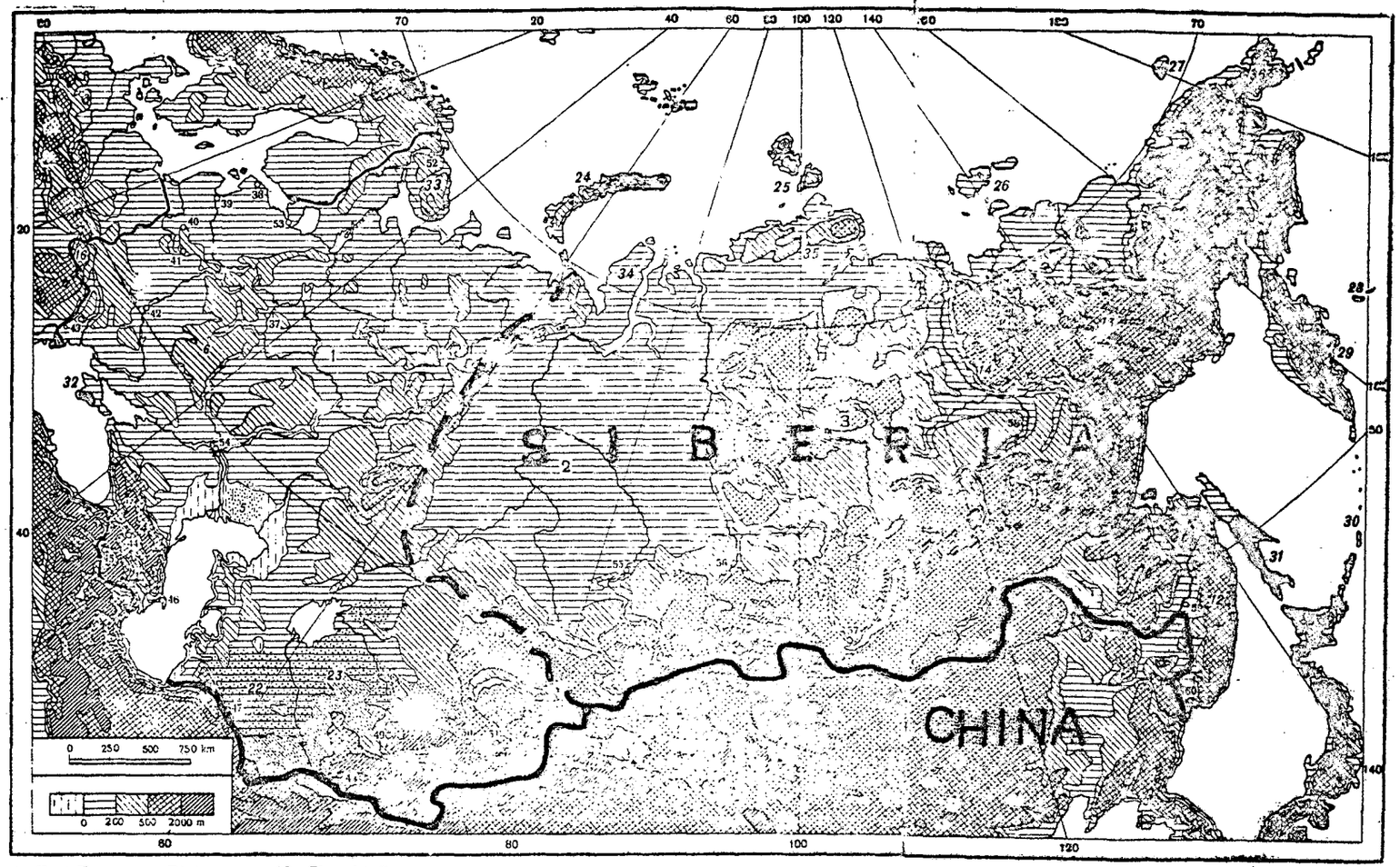
7 M. Ye Gerdetskaya, "The Geo-morphology of the Turgay through in connection with the problem of diverting the water of the west Siberian rivers to Central Asia", Soviet Geography, vol. xiii, no.9, November 1972, pp. 629-30.

8. Shabad Teteo, Soviet Geography, April 1972, p. 261.

RELIEF OF THE U·S·S·R.

Source:- James S. Gregory, The Geography of the U.S.S.R. (Moscow, 1975) pp. 20-21.



1. East-European Plain
2. West-Siberian Plain
3. Central-Siberian Plateau
4. The Caucasus
5. Transcaspian Lowland
6. Central-Russian Upland
7. The Urals
8. Pamir
9. Tien-Shan
10. Altai
11. Sayan Mountains
12. Sikhote-Alin Range
13. Cherski Range
14. Verkhoyansk Range
15. Kazakh Hills
16. Carpathian Mountains
17. Elbrus Mt., 5,642 m
18. Communism Peak, 7,495 m
19. Pobeda Peak, 7,439 m
20. Klyuchevskaya Sopka, 4,750 m
21. Narodnaya Mt., 1,894 m
22. Kara-Kum Desert
23. Kyzyl-Kum Desert
24. Novaya Zemlya
25. Severnaya Zemlya
26. New Siberian Islands
27. Wrangel Island
28. Commander Islands
29. Kamchatka Peninsula
30. Kuril Islands
31. Sakhalin Island
32. Crimean Peninsula
33. Kola Peninsula
34. Yamal Peninsula
35. Taimyr Peninsula
36. Chukchi Peninsula
37. Moscow
38. Tallinn
39. Riga
40. Vilnius
41. Minsk
42. Kiev
43. Kishinev
44. Tbilisi
45. Yerevan
46. Baku
47. Ashkhabad
48. Dushanbe
49. Tashkent
50. Frunze
51. Alma-Ata
52. Murmansk
53. Leningrad
54. Volgograd
55. Novosibirsk
56. Krasnoyarsk
57. Irkutsk
58. Yakutsk
59. Khabarovsk
60. Vladivostok

However, the other Siberian rivers are longer than the Yenisey; these are the Lena and the Ob' (including its tributary, the Irtysh). They also contain a great deal of water-flow and in conjunction with the Yenisey, account for approximately one half of the discharge of all the rivers in the country.

There is quite a lot of water in the Kolyma and Khatanga, which are Siberian rivers, and also in the northern Dvina and the Pechora, which are in the European regions of the country and flows into the Arctic Ocean.[9]

There are more than 250,000 lakes in the Soviet Union. Most of them are small, but fifteen including the Caspian and the Aral seas, each has an area of more than 1000 sq. km. The deepest lake is Baikal. Balkhash and Ladoga are located in Siberia. The Baikal, which reaches a depth of 1620 meters, is particularly capacious. Most of the lakes are also having the characteristic of being frozen in the winter season.[10]

(b) Climatic conditions of Siberia:

A classification and regionalisation of the harsh cold climate of Siberia is in relation to problems of cold

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9 James S. Gregory, The Geography of the USSR, (Moscow 1975), p. 22.

10 Ibid., p. 23.

resistance of machines. The harsh cold climate in Siberia is broken down into four sub-types -- low, medium, high and very high harshness -- on the basis of four harshness indicators, numbers of days with mean daily temperature of less than - 30° C, January temperature. Siberia has continental climate which temperature variation from 38° C in summer to -70° C in the winters. Most of the region is typified by "Permafrost" (permanent frozen ground) with depth varying from 15 feet to 35 foot in the south and 650 feet or more in other places. According to the "Bodman" scale, in certain regions, the climate is of "weather severity".[11]

Based on the classification of the cold climate, a zone is formed, the zone of "Northern specification", extending from the north-eastward to the Soviet frontier in the Altay mountains. The southern boundary of the zone then follows the state frontiers eastward excluding the area around Vladivostok and the adjoining coast of the Sea of Japan and the tatar strait, southern Sakhalin, the Kurile chain and the South coast of Kamchatka. In the first zone, with the low level of harshness, comes the tundra, wooded steppe and steppe (Western Siberia, nearby

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11 V.A. Kolyego, "Materials of an economic analysis of the use of machines in outdoor work in the northern region", (Novosibirsk 1964, Translated from Russian), Soviet Geography, vol. xi, no.1, January 1970, p. 43.

Kyakhta). It is distinguished by the following harshness indicators: mean daily temperature below -30° C and possible absolute minimum temperature of -40° C to -50° C. It covers the western Siberia, mostly between the Yenisey and the Ob' basins and the south-east part of Biryusinsk included in the region.

The second zone of medium harshness lies mainly in the tundra and taiga and it extends up to the cold wooded steppe and steppe, only in eastern Trans-Baykalia. The mean temperature is -40° C and it covers east of the Yenisey river and west of the Kotuy river and extends up to the south of lake Baykal.

The third zone of harshness has possible absolute minimum temperatures -44° C to 55° C. It covers east of Kotuy river up to the Lena river, and it extends to the south of Primorsky Kray, Sakhalin and major portion of Khabarovsky Kray.

The fourth, very high level harshness zone, has mean daily temperature minimum of -50° C to -64° C and the central sections of the zone are traversed by the January terms of -36° C and it covers the north-eastern part of Siberia that is beyond the Lena river and Kamchatka.[12]

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12 V.A. Kolyago, "A classification and Regionalisation of high cold climate of Siberia and the Far-East in relation to problems of cold resistance of machines", Soviet Geography, Vol.XX, no.1, January 1970, pp. 45-48.

(c) Economic Potentials in Siberia:

The consideration of physical factors in determining the course of economic development of the Soviet Union and of individual economic sectors and regions is an essential part of economic geography research and practical territorial planning. The following set of resources is available in Siberia, which is important for the national economic development. They are: (1) Coal (bituminous and lignite); (2) Oil; (3) Natural gas; (4) Iron ore; (5) Hydro-electric resources; (6) Timber resources; (7) Arable land; and (8) other major resources (this group includes, when necessary, such resources as chemical and mineral, non-ferrous metals, if they were particularly significant).

The comparison of the resources of the region with the other regions of the U.S.S.R. has been given in terms of the totals in Table No.1.[13]

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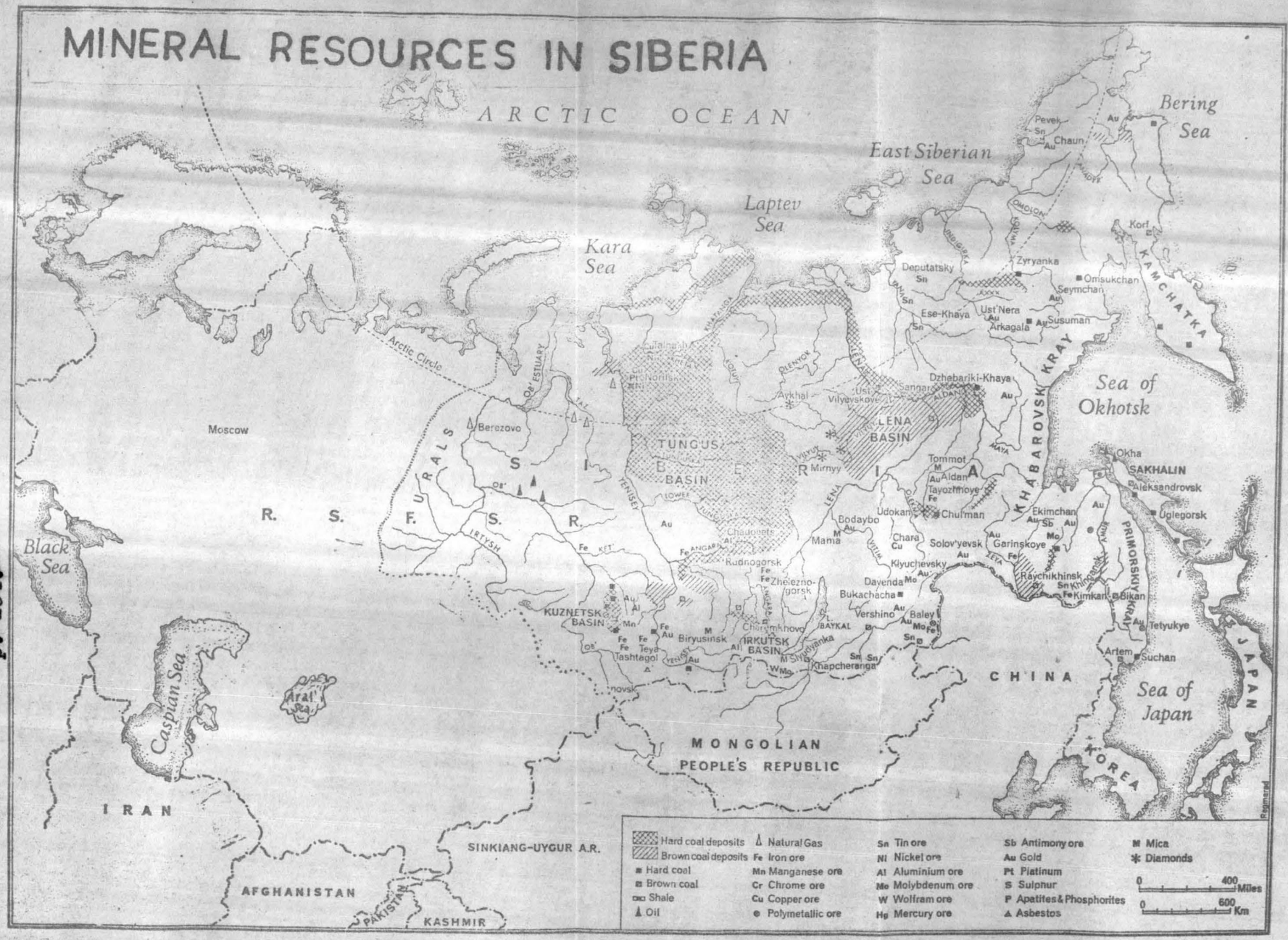
13 The table is compiled from the Soviet press reports on the fulfilment of the 1971 economic plan, the plan for 1972 and additional data on the goals set for the five-year plan 1971-75. Theodore Shabad Notes, Soviet Geography, Vol. XIII, No.5, May 1972, pp.322-30

Source:- Violet Conolly, Beyond the Urals (London, 1965) p. 294.



(i) Total Resources compared with other Regions:-

TABLE 1

NATURAL RESOURCE POTENTIAL BY ECONOMIC REGIONS OF THE U.S.S.R.

(Percentage)

	Economic Regions	Total potential of USSR in %	Coal	Oil Gas	Iron ore	Hydro-Electric.	Timber.	Arable land	Forage	OTHERS	Total
1	North-West	3.2	14.0	4.3	3.5	10.5	30.5	11.3	5.6	20.3	100
2	Central	2.6	3.1	-	0.4	1.4	10.6	73.9	10.6	-	100
3	Volga Vyatka	1.3				5.2	18.5	69.5	6.8	-	100
4	Central Chermozem	3.1			28.6	0.1	6.4	67.8	3.1		100
5	Volga	7.0	0.3	37.9	0.0	5.3	2.5	52.4	3.6		100
6	North Caucasus	4.8	8.3	14.2		7.4	0.6	55.1	4.4		100
7	Urals	5.4	5.3	27.8	5.1	1.6	9.5	35.7	4.3	10.7	100
8	West Siberia	18.5	18.5	49.8	0.4	5.3	6.3	16.8	2.9		100
9	East Siberia	10.1	28.8	0.1	1.7	29.2	15.4	10.4	2.8	11.6	100
10	Far-East	5.1	13.7	3.9	1.4	40.3	18.8	5.6	3.3	13.0	100
11	Donetz Dneiper	7.2	39.1	3.1	12.3	0.9	0.0	43.3	1.3		100
12	South-West	3.6	1.6	4.8		1.8	1.3	86.7	3.8		100
13	South	1.5		0.7	5.9	2.1	0.1	89.1	2.1		100
14	Baltic	1.0				6.2	6.0	75.8	12.0		100
15	Trans-Caucasia	1.7	1.1	26.1	1.1	30.4	0.8	30.1	10.4		100
16	Central Asia	10.1	2.1	14.5	0.0	19.6	0.0	47.6	14.0	2.2	100
17	Kazakhstan	14.7	9.9	3.8	3.2	3.0	0.2	27.5	41.6	10.8	100
18	Bylo-Russia	1.2		5.5		1.8	4.0	78.0	10.7		100
19	Moldavia	0.6		0.1		1.2	0.3	96.7	1.7		100
	TOTAL U.S.S.R.	100	12.4	15.9	3.1	10.2	6.0	37.0	10.6	4.9	100

Source: The Soviet press has published reports on the fulfilment of the 1971 economic plan for 1972 and additional data on the goals of the 1971-75 five-year plan. From Theodore Shabad Notes, Soviet Geography, Vol. XIII, No.5, May 1972, pp.322-30.

(ii) Fuel and Energy:

The Soviet Union's fuel and energy complex can be divided by a certain degree of approximation into three zones: the European part of the U.S.S.R. (including the Urals), Kazakhstan and Central Asia, Siberia and the Far-East. The first zone consumes more than 70% of the fuel resources used in the Soviet Union, but has limited supply possibilities of its own. The second zone is distinguished by a relatively low consumption of fuel and energy, compared to the first zone, and is able to cover its needs from its own resources, natural gas, oil, coal and hydro-electric power.

The third zone contains most of the fuel and energy resources of the U.S.S.R. Siberia alone accounts for about one half of the nation's water power resources, over one half of the known geological resources of oil and gas, and above 85% of the geological reserves of coal. Some of these resources can be used at costs lower than elsewhere in the Soviet Union, if the technological problems arising from the climatic conditions are solved in Siberia.

The best find was the discovery of the unique oil and gas fields of West Siberia, making Siberia a highly promising region for the development of the oil and natural gas industry. Ways and means were found to reduce the cost of construction of hydro-electric stations.

It used to be said that Eastern Siberia had a unique position relative to Western Siberia in fuel and energy potential. The proceedings of the Conference on the Development of Productive Forces in Eastern Siberia made a point that "the regions of Eastern Siberia represent an energy and mineral resource potential that is unique in the world."[14]

In the scale of fuel and energy resources and the degree to which the region is endowed with them, Eastern Siberia is in the first rank in the U.S.S.R., ten or more times over the other regions of the country.[15] The same view was supported by a group of authorities who wrote, - "Eastern Siberia contains almost one-half of all the fuel and energy resources of the U.S.S.R., including about one-half of the natural resources of coal and more than one - fourth of the hydro-electric potential."[16]

The degree to which Eastern Siberia is supplied with its own fuel and energy resources (in terms of 1965 consumption levels) is seven times greater than the U.S.S.R. as a whole and 50 times greater than the European part of

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14 Forces of Eastern Siberia, Energy Volume, Moscow Academy of Sciences, USSR, 1960, p.6.

15. A.Y. Probst, Ed., Razvitiye toplivnoy bazy rayonov SSR (Development of Regional Fuel Bases in the USSR) Moscow (Nedrom 1968), p. 1975.

16 Trudy, op.cit., p.85. The Yenisey and Khatanga basins have been included in Eastern Siberia; Soviet Geography Vol.XVI, November 1974, p.558.

the country. In the scale of fuel and energy resources and the degree to which the region is supplied with them, Eastern Siberia is in first rank among all the regions of the U.S.S.R." The distribution of Siberian total coal and hydro-power resources (in tonnes) is: (1) Hydro-power resources of West Siberia amount to 15.0 million tonnes, and (2) of Eastern Siberia, 85.0 million tonnes. The coal reserves in Western Siberia are 19.4 million tonnes and in Eastern Siberia, 80.6 million tonnes. The southern basin of Siberia accounts for 10% of the total U.S.S.R. coal resources. In terms of reserves: the Kuznetsk Basin contains 36.5% of the U.S.S.R. resources, including more than 65% of the coking coal. In 1975, coal production plan for Kuznetsk Basin was 135 million tonnes. Estimate for 1990 is 200m. to 220m. tonnes with further growth level of 400 to 500 million tonnes, which would be equivalent to 350 to 450 million tonnes of conventional fuel units of 7000 kilo-coal.[17]

The Kuzbas offers excellent opportunities for strip mining coal reserves suitable for surface mining which has risen to 15.3 million tonnes compared to 7 million tonnes eight or ten years ago. In 1972, 32 million tonnes were strip-mined. By 1990, this share may rise to 100 million tonnes, and further to 200 to 220 million tonnes.

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17 According to the 24th Party Congress, output in 1975 was about 125 million tonnes. Ed. Soviet Geography, see Note No.(3), p.634.

Most of the power stations within the Novosibirsk, Tomsk and Kemerovo and other Siberian cities might be converted to natural gas and fuel oil to reduce air pollution. Siberia now uses about 40 million tonnes of Kuznetsk coals, this coal consumption should be reduced to 20 to 25 million tonnes or even less. The southern portion of Krasnoyarsk Kray and possibly for Kemerovo oblast might be raised to 35 million tonnes by 1990 (it was 4.7 million tonnes in 1965).

The central portion of Siberia contains most of the hydro-electric resources. Most significant are Yenisey, the lower Angara and other streams of Yenisey basin, Sayan and Ust-Ilimsk stations. The capacity is 17.22 million kilo-watt hours. The production of the middle Yenisey hydro-electric stations is 25 to 26 billion kilowatt hours.[18]

The main fuel is coal for heat and power in the Siberian stations of Kansk-Achinsk which produce 601 billion metric tonnes and Kranyask Kray 38% in Kemerovo oblast with 70% of all the strip-mines in the region. The service of the Irkutsk coal basin is estimated at 76.2 billion tonnes. Annual output was 22 million tonnes in 1970 and it would rise to 57 million tonnes in the future. Excepting this,

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18 The Ust-Ilimsk station was already included in the Central zone. Shabad Notes, Soviet Geography, Vol. XIII, no.5, May 1972, p.335.

Karantsay produces 30 million tonnes bituminous and brown coals from Trans-Baykalia Gusinoozersk, Tvgnery, Kharanor and other reserves of 24 billion tonnes. The annual output was 5.6 billion tonnes in 1970 and would rise upto 16 billion tonnes by 1990.[19]

(d) Rate of growth of resources:

(i) Iron and Steel:- The rate of growth of iron and steel industry was 4% in 1971, down from the rate of increase of 5 to 6% in 1970. Total iron production rose from 195.5 million metric tonnes in 1970 to 203 million tonnes in 1971. Pig iron output rose from 65.9 million tonnes to 89.3 million tonnes in 1971 as ore mining. Steel production rose from 116 million tonnes in 1970 to 121 million tonnes in 1971 making Soviet Union a largest steel producer in the world. Siberian contribution to the U.S.S.R. is given in the table below:-

TABLE 2

No.	Resources	In million metric tonnes			
		1965	1970	1972	1975 Plan
1	Iron Ore	8.2	12.8	14.0	
2	Pig Iron	4.8	7.3	9.0	
3	Crude Steel	...	9.4	10.5	
4	Crude Oil	6.7	34.0	65.2	
5	Petroleum	4.4	64.4	...	
6	Natural Gas	0.6	11.0	14.7	44 million cubic meters
7	Coal	172.0	199.0	215.0	
8	Electric power*	87.0*	132.0*	156.0*	*in billion kilo-watt hrs.

Source: Theodore Shabad Notes, Soviet Geography, Vol.XIII, No.5, May 1972, p.322 and Vol.XV, No.6, June 1974, pp.377-87.

19 Shahabad Notes, Soviet Geography, 1971, pp.615-34.

(ii) Crude Oil: The crude oil output increased at the rate of 7%, the same as in 1970, and reached to 372 million tonnes in 1971. In 1972, the goal was 395 million tonnes and in 1975 it rose to 496 million tonnes in the U.S.S.R. The achievement in West Siberian fields was that the production rose from 31.4 million tonnes in 1970 to 44.2 million tonnes in 1972. The output in Samotlov field rose from 3.5 to 9.5 million tonnes. The second largest production achieved in West Siberian fields is 127.3 million tonnes in 1975.

(iii) Natural Gas: Natural gas production in 1971 rose by 7%, i.e. 198 billion cubic meters in 1970 to 212 billion cubic meters and in 1975 it was 320 billion cubic meters. The principal increases are to be achieved in West Siberia where production rose from the giant field of Medvezhk was to start in 1972.

(iv) Coal: The coal mining additional capacity of 17.4 million tonnes was inaugurated in 1971, and production rose from 624 million tonnes in 1970 to 641 million tonnes in 1971. The output of 169 million tonnes was coking coal and 472 million tonnes was steam coal. Siberia's output increased by 172 million tonnes in 1960 to 199 million tonnes in 1970.

(v) Electric Power: The electric power generation rose from 740 billion kilowatt hours in 1970 to 800 billion

kilowatt hours in 1971. In 1972, thermal power was 850 billion kilowatt hours and in 1975 it was 1065 billion kilowatt hours in the U.S.S.R. The total generating capacity of 123 million kilowatt hours installed in 1971, rose by the year-end to 190 million kilowatt hours. The increase in Siberia was from 87 million kilowatt hours in 1965 to 132 billion kilowatt hours in 1970.[20]

(e) Siberian Contribution to National Economy:-

The largest and most economical reserves of mineral raw materials, fuel and energy, forest and water resources, have been found in the Eastern region, especially in Siberia and the Far-East. Russia's future lies in the Siberian region. Every five-year plan, Siberia has been given an important position.

The total investment in economic development of the East (excluding the Urals) amounted almost to 205 billion rubles during the Soviet period. As a result of heavy investment, industrial output in the Eastern Region rose by 12.7 times from 1940 to 1960 compared with the total national increase of 11 times during 1941-1969. Gross industrial output increased by 14 times in Siberia and the Far-East, compared to 10.8 times in Central Asia and Kazakhstan.[21]

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20 Shabad Notes, Soviet Geography, Vol.XIII,No.5, May 1972, p.322.

21 Party and Government decision on economic questions, ibid., No.10, p.337.

TABLE 3

PERCENTAGE OF REGIONAL DISTRIBUTION OF CAPITAL INVESTMENT
(in million rubles - 1918-1970)

No.	Regions	1918-40	1941-50	1951-60	1960-70
1	European Region	70.7	67.7	65.4	63.3
2	Urals	7.9	10.5	9.1	7.2
3	Eastern Regions	21.4	22.3	25.5	29.5
4(a)	Siberian Far-East	14.1	14.5	15.8	16.2
(b)	Central Asia and Kazakhstan	7.5	7.5	9.7	13.3

Source: Theodore Shabad Notes, Soviet Geography, Vol.XIII, No.10, December 1972. Collection of the whole data has been rearranged here.

The following are some of the savings that can be achieved in annual development and production costs if energy intensive industries are located in central Siberia even if it is based on long-haul raw materials. Electrically smelted nickel costs 154 rubles a ton, aluminium 29.50 rubles, synthetic rubber 80.50 rubles, artificial fibre 78 rubles and synthetic resins and plastics 26 rubles a tonne.[22]

Economic development of Siberia, which was promoted in the 1930's and particularly during the emergency of World War II lastly slowed for two basic reasons: (1) The tradi-

22 V.A. Shelest, Ikonomika Razmasheneniya elektronergatiki USSR (The economics of location of electric power generation in the USSR), Moscow Nauka, 1965, p.70, (Translation).

tional Siberian resource industries (coal and timbers) were out of step with the new emphasis on oil, gas, chemicals and electronics; (2) The difficulties of including a a nearly mobile labour force to settle permanently in Siberia. Siberia is given essentially an increasingly important role in the combined output of Soviet industry and agriculture and has increased at least four-fold over this period, according to the Russian statistical calculations.

The Trans-Siberian rail-road is distinguished by the highest freight-traffic intensity of any rail-road in the U.S.S.R. Industries in which Siberia specialized contribute heavily to the formation of the Soviet Union's material resources balance. Western Siberia, for example, ships to other regions of the country more than half of the substantial plan of its market grain and meat. Siberia was given priority over Kazakhstan and Central Asia in resource development. Siberia's share in the total capital investment during the 30 years since the start of the first five-year plan (1928-32) was one to two percentage points higher than the share of Kazakhstan and Central Asia.[23] TH-4371

In 1940, the fuel industry, electric power, ferrous and non-ferrous metallurgy, logging and wood-processing,

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23 V.A. Kratov, I.T. Borovsky, YU. F. Mikhaylov, V.O. Shatsky: "The role of the Eastern Siberia in solving some of the economic problems of the Pacific basin", Soviet Geography, Vol.IX, No.2, February 1968, p.86.

accounted for 30% of Siberian gross industrial output, higher than the average for the Soviet Union as a whole. Firstly, the abundance of natural resources in raw materials in favourable locations served by the Trans-Siberian rail-road, favourable geological mining conditions and the availability of large fuel and energy materials made possible the development of resources at a rapid rate. Secondly, industrial complexes have been set up in areas with advantages to extract the natural resources for transhipment. Siberia's share in the gross industrial output rose from 1.5% in 1913 to 5% in 1940. In 1945, 12% of the Soviet industrial output was shared by Siberia. In 1970, Siberian industrial output rose to 15% of the total industrial output of the U.S.S.R.[24]

Siberia continued to play an increasing role in supplying coal and timber. Its share in the use of coal rose from 21% in 1959 to 25% in 1965. Oil and gas resources combinedly along with the availability cheap coal from 1946 to 1960 helped in the increase of gross industrial output of Western Siberia by 3.3 times, Eastern Siberia by 4.7 times and the U.S.S.R. as a whole by 5.5 times. Siberia's share in the national output of industry was 7% by 1960.

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24 Ibid. (see f.n.37), p.08.

Mean annual rate of growth in industrial output during the seven-year plan 1959-65 was 9.4% compared with the national average of 9%. In 1961-65, the traditional Siberian industries (coal, iron and steel, tin) had an average annual rate of growth that was a little more than half of the average for all industry, and 30% to 40% in the rate of growth of electric power, chemicals and machine-building.[25]

A point that clearly emerges from our discussion is that Siberia is significant not only because of its substantial contributions to the national economy but also because of its immense potentials in this area. Nature has bestowed Siberia with rich natural resources. These resources provide the basis for realisation of all the aspirations of the Soviet Union. But the nature which has endowed the region with such enormous natural resources has also created formidable obstacles to their utilisation. What are the problems the natural environment of Siberia poses to the speedy development of this rich region and how these problems influence the development processes in Siberia are some of the issues which will be explored in the remaining chapters.

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25 Ibid. (see f.n.37), pp.89-90.

CHAPTER II

THE INFLUENCES OF THE CLIMATE ON LABOUR SUPPLY

CHAPTER-II

INFLUENCE OF CLIMATE ON LABOUR SUPPLY

The creation of the material and technological basis of communism in the U.S.S.R. requires the fullest possible use of the country's productive forces, particularly those in the easter areas which possess incalculable natural wealth. A large-scale exploitation of the inexhaustible natural resources of Siberia for the benefit of the national economy requires the supply of massive labour force, both skilled and unskilled. This is because as Lenin put it, "The first productive force of all mankind is the worker, the labouring man".[26]

Improvement of the technological and scientific organisation of the industrial production in Siberia requires more labour power, particularly the auxiliary industries need near about 50% of the labour power. The scientific improvement and specially skilled management reduces the labour power in big industries but in Siberia, for maintenance of industrial complexes with various equipment and machinery, a specialized labour force is essential to be permanently deployed in the locations.[27]

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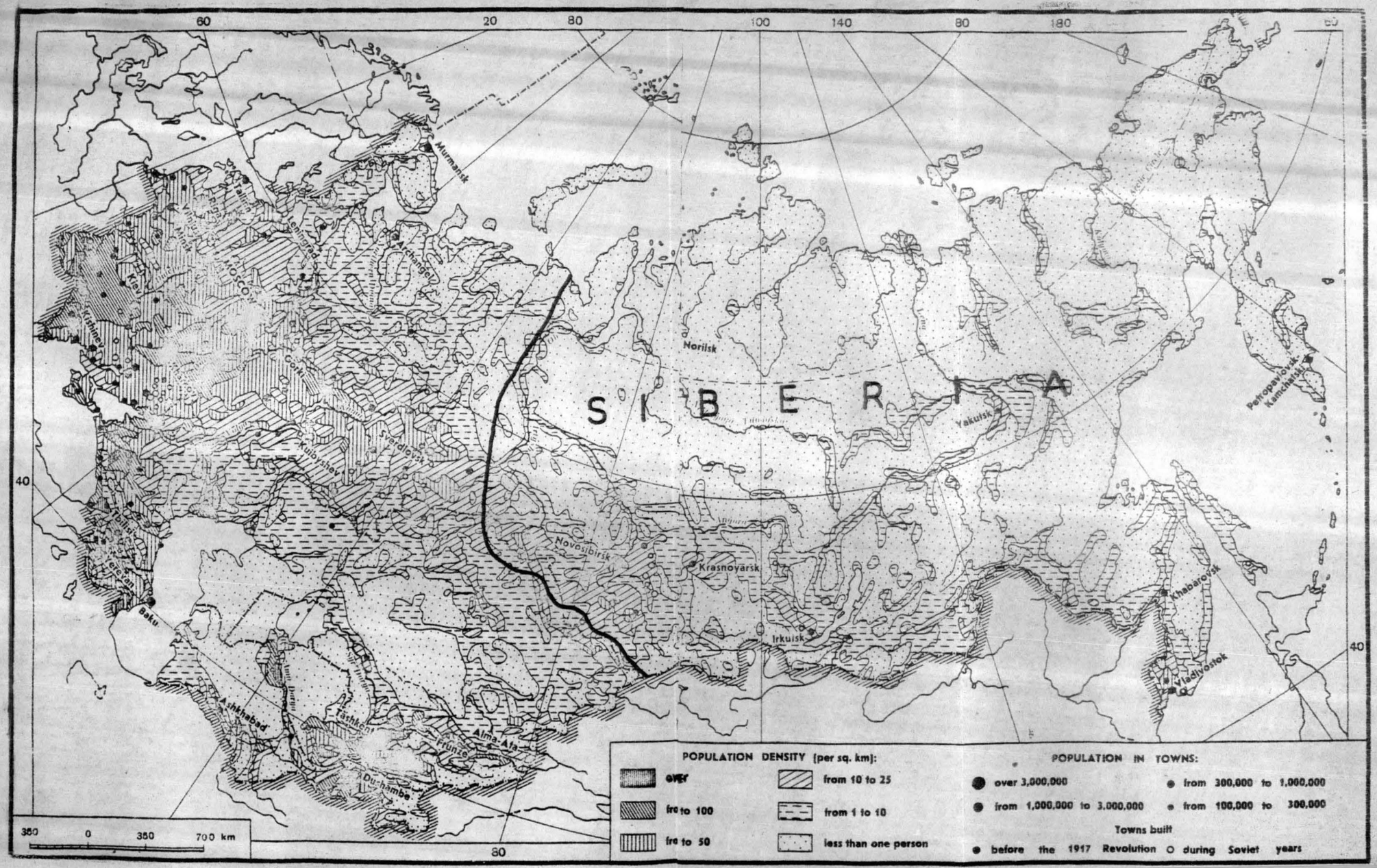
26 Quoted in G. Pondengki, "The Problems of Utilising the Manpower of Siberia and the Far East", Problems of Economics, Vol. V, No.6, October 1962, p.25.

27 Ibid., p.27.

The demands for labour in Siberia have been problematical. Firstly, the demand is very large and growing. Owing to the harsh climatic conditions in the different regions of Siberia differing only in the degree of harshness and because of the peculiar character of the natural resources distribution in Siberia, individual industrial projects are unprofitable. Therefore, it is necessary to plan the development of a number of integrated industrial and possibly agricultural projects. This gives rise to demands for enormous labour force in varied terrain and selected locations with harsh climatic conditions where natural settlements for indigenous population could not arise. Secondly, the development of Siberian industry and also of agriculture has to be highly capital intensive as of inevitability. This is partly because the processes employed in Siberian industry require a large force of picked and specially skilled labour. Thirdly, the prevailing harsh climate in Siberia necessitates the deployment and devotion of relatively young and energetic labour force capable of putting in sustained work in adverse environment. Lack of living facilities within the region would also make it desirable for attracting workers without family encumbrances. While successful development of Siberian resources require a very large, young and dedicated skilled labour force, the deterrent climatic conditions act as a damper and

DENSITY OF THE POPULATION IN THE U·S·S·R. [1975]



Source:- James S. Gregory, The Geography of the U.S.S.R. (Moscow, 1975) pp. 36-37.

the most adverse factor upsetting the plan progress in the economic development of this vital region.

(a) General inadequacy of labour in Siberia:

The labour problem confronting the Soviet planners in Siberia is the result of certain historical and natural factors. Throughout the past centuries, the harsh climatic conditions with freezing temperature and the sweeping cold biting winds have inhibited the spread of even a sparse population over this great land mass with climate identified with the Arctic region and frosty winds blowing from there. The problem is of creating conditions for human habitation by applying modern technological and scientific means and human biological and living science research in the areas chosen for agricultural and industrial activity to exploit the natural resources.

East Siberia and the Far-East together occupy half of the total area of the whole of the Soviet Union's territory. But the region holds only 10% of the total population of the entire country. Even this percentage is confined to a few locations here and there found habitable and where human settlements grew in the normal evolutionary process and with some impetus to population growth in this region after the birth of the Soviet Union.

In the northern parts of Siberia, there are vast expanses of lands with hardly any human habitation. The population of Siberia is distributed with concentration in and around towns and cities sprung along the Trans-Siberian rail-road in the south. According to the 1970 census (official sources), the population of the various regions of Siberia and the U.S.S.R. was as given in the table below.

TABLE 4

POPULATION OF SIBERIA - 1959 & 1970.

Region	Year	
	1959	1970
West Siberia	11,252,000	12,110,000
East Siberia	4,473,000	7,464,000
Soviet Far-East	4,834,000	5,760,000
U.S.S.R.	208,827,000	241,748,000

Source: Violet Conolly, Siberia Today and Tomorrow, (London 1975), p.176.

In the historical background of evolution, the nature of population distribution in Siberia has been determined by the climatic factors prevailing in the region. Because of harsh climatic conditions and impossibility of cultivation of land, people have not settled in large numbers in

Siberia. For the same reason the growth of population in the region has been slow even after the founding of the towns and cities along the Trans-Siberian rail-road stretching upto Vladivostok, in spite of the great demand for labour for bringing the outlying areas into habitation and economic development and exploitation of the natural resources.

In the West Siberia, the natural or normal increase of population declined from 20.9 per 1000 in 1950 to 7.6 per 1000 in 1967. During the same period, the birth rate in East Siberia declined from 32 per 1000 to 14.8 per 1000. The fall in birth rate in Soviet Far-Eastern Region is from 42.5 per 1000 in 1950 to 16.7 per 1000 in 1967. This fall represents the lowest birth rate in the far-eastern region recorded for the whole of the Soviet Union.

The growth of population in percentage in respect of previous years, 1960 to 1969, is given in the table below.

TABLE 5

Year	USSR	RSFSR	WEST SIBERIA	EAST SIBERIA
1960	1.7	1.3	2.0	2.2
1961	1.9	1.4	1.3	1.3
1962	1.7	1.3	1.8	1.8
1963	1.6	1.1	1.3	1.6
1964	1.4	1.0	0.3	1.8
1965	1.3	0.9	0.4	1.5
1966	1.1	0.9	0.4	1.5
1967	1.1	0.5	0.2	0.5
1968	1.0	0.5	0.2	0.5
1969	1.0	0.5	0.63	0.5
1959 - 70	15.8	10.7	7.6	15.3

Source: D. M. Zakharin: "Problems of Providing Siberia with Manpower", Soviet Geography, Vol. XIII, No.10, December 1972, p.672.

The rate of growth of population in West Siberia has declined sharply from 2% to 0.03% and in East Siberia from 2.2% to 0.5% between 1959 and 1969. If we compare the average annual rate of growth of population in Siberia with the overall growth of population for the U.S.S.R. for the period 1959 to 1970, the following picture emerges: 15.0% for the entire country, 10.7% for RSFSR, 7.6% for West Siberia and 15.3% for East Siberia. What is interesting is that much of this growth in Siberian population has taken place in urban centers and not in the rural sector. This accentuated the uneven distribution of population in Siberia.

Due to the very low density of population and slow rate of growth, Siberia has always depended on other regions like central Russia, the Volga region and Belo-Russia for injection of labour and other men to work in the areas of Siberia taken up for development. This dependence on outside regions for the supply of labour to sustain Siberian development has created its own problem which has assumed much more difficult character. The problem is known in the Soviet Union as "labour turnover" and sometimes called the "flight of labour".

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23 D.V. Belorovaov: "The effectiveness of integrated development of productive forces in the new pioneering areas of Western Siberia", Soviet Geography, Vol. XIII, No.10, December,1972, p.684.

The pattern of departing migrants in numbers and length of stay in cities (in percentage of departures) is described in the figures given in the accompanying table.

TABLE 6

Length of stay (in years)	Cities					
	Barnaul	Zasarovo	Divo-gorsk	Boro-tsk	Kasa-insk	Aver-age
1 year	22	33	47	29	31	31
1 to 2 years	15	17	23	24	16	16
2 to 3 years	10	9	12	13	7	10
Less than 3 years	47	59	82	66	54	59
3 to 4 years	..	4	6	7	5	5
4 to 5 years	53	2	..	..	..	..
More than 5 years with activities of the cities		35	12	27	41	36

Source: D.M. Zakhariga, "Problems of Providing Siberia with Manpower", Soviet Geography, Vol. XIII, No.10, December 1972, p.679.

(b) Labour Turnover:

The heavy outflow of individual migrations from Siberia has tended to cancel the benefits of organised in-migration. The out-migration from both Western and Eastern Siberia exceeds the in-migration and is giving negative migration balance in Siberia. During the period from 1959 to 1969,

the population of Western Siberia declined by 788,000. The net out-migration had the effect of slowing the growth of population in Siberia. So that on percentage basis, the share of Eastern Siberia in the national total remained steady over the last decade and that of West Siberia declined. This out-migration lost 18 persons per 1000 population, and from 1961 to 1969, the rate was 40 persons to a 1000. Eastern Siberia had in fact a net in-migration of 50 per 1000 population from 1951 to 1958, turning into a net migration of 21 per 1000 during the 1960's. In Altay Kray, Kemerovo and Chita Oblasts, the total population had begun to decline, result being that in 1963 the population growth in West Siberia had been significantly slower than in the RSFSR or in the U.S.S.R. as a whole and in 1969, virtually no growth was recorded despite the intensive development programme of the oil and natural gas recources of Tyumen Oblast. A sharp natural decline in the rate of population growth has also been recorded in the last four years in East Siberia.[29]

Excepting Tyumen oblast, not a single Siberian oblast has had a steady positive migration balance. Only in some years, there has been no in-migration into Irkutsk

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29 Zh. A. Zayonchkovskaya and D.E. Zaschariga, "Problems of Providing Siberia with Manpower", Soviet Geography, Vol. XIII, No.10, December 1972, p.674.

Oblast, Krasnoyarsk Kray and Tuva ASSR. The balance can be seen in the table given below.

TABLE 7

MIGRATION BALANCE DURING THE PERIOD 1959-60
(in 1000s)

Krays and Oblasts	Urban	Rural	Total
Altay Kray	+ 149	- 358	- 209
Kemerovo Oblast	+ 87	- 136	- 49
Novosibirsk Oblast	+ 133	- 201	- 68
Omsk Oblast	+ 120	- 171	- 57
Tomsk Oblast	+ 62	- 99	- 37
Tyumen Oblast	+ ..	..	+ 65
West Siberia	+ 551	- 965	- 349
Krasnoyarsk Kray	+ 259	- 249	+ 10
Irkutsk Oblast	+ 103	- 154	+ 29
Chita Oblast	- 4	- 72	- 76
Buryat ASSR	+ 24	- 25	- 1
Tuva ASSR	+ 21	- 16	+ 5
Eastern Siberia	+ 483	- 516	- 33
WESTERN SIBERIA and EASTERN SIBERIA	+1034*	-1481*	- 382

* not including Tyumen Oblast.

Source: IMKRSSSR 1967-P-902-4 from D.M. Zkhariga, "Problems of Providing Siberia with Manpower", Soviet Geography, Vol. XIII, No.10, December 1972, p.672.

Rural migration resulting in decline of rural population is common in most of the regions of the U.S.S.R. but it is most intensive in Siberia. This decline of rural population has been measured by several techniques on the farm labour supply of Siberia. In all of them, there had been significant labour shortage, although it varied from region to region. In 1965, during the most active farming season, the collective farms of Siberia could meet only 65% of their manpower requirements, and in Eastern Siberia, 74%. V.Ye. Churokov and L.I. Surverova by comparing the potential total working time and the aggregate labour needs of collective farms in Eastern and Western Siberia, found that the requirements were being filled at 76% and on an average, during the year the total available labour was only 57% to 58% in the peak summer season.[30]

T.I. Zaslavskaya and L.D. Arvtrosenkova, who compared the actual and normative labour inputs in agriculture found that 76% of farm labour needs was being fulfilled in West Siberia and to the extent of 84% in East Siberia.[31]

The majority of the Soviet migrants to Siberia are motivated by normal considerations of appeals for migration to new areas with the usual initial enthusiasm. The number

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30 Labour Resources of the U.S.S.R., (Moscow 1967), p.103.

31 L.A. Shishkina, "The Impact of Certain Conditions and Factors on Labour in Industry", Soviet Geography, Vol. VIII, No.10, December 1972, p.673.

of those who are eager to go to new construction projects, no matter how remote or under-developed, does not mean that living conditions are irrelevant. Due to lack of facilities even for a modicum of living comfort, they return very soon or at the most within 3 - 5 years.

The biggest single problem that the Soviet planners are unable to solve is in finding skilled labour to recruit for the work in the Siberian areas. For instance, the Nara-vorsk Savanor Coast was able to get only 876 college-trained specialists against 2100 which it had asked Moscow to provide. Of these 876, 767 arrived at their place of work and 50% of them had left their jobs in the project within three years of arrival. In 1969, in Primorary, 400 doctors arrived, but as many as 300 left in the same period.

The problem of "labour turnover" in Siberia results in loss of millions of rubles annually, disturbs the planned development of the region and ties down enormous capital investment in advances and unfinished projects.

(c) <u>Causes of "the Labour Turnover"</u>:

The problem of shortage of labour in general and intense "labour turnover" in particular (by out-migration) rests on the following factors: (1) the great contrast in Siberian environment requires a serious process and arduous life expe-

rience for adaptation to the great difference in living conditions involving adjustments to deprival of daily living needs and the difficulties in basic amenities like housing. Although initially the wage enhancement attracted many workers to Siberia, once they arrived in the region, they find the rigors of the environment too much to cope with. Outdoor working conditions are often impossible and sometimes even dangerous when the temperature falls below -20° C and there is danger of frost-bite. The long winters with lack of sunlight is psychologically depressing. Therefore, many who come to work in Siberia do not find it easy to adapt themselves to the extremely inhospitable natural conditions and environments without adequate basic facilities which have yet to be devised and introduced with technological and scientific research means. But for a variety of reasons, including the peculiar geographical and geophysical factors, the daily needs and basic living amenities are yet difficult to provide in Siberia.

The harsh climatic conditions of the region necessitate huge extra expenditure on food, clothing, housing and heating if the workers have to keep good health and put in hard work. In these climes, the daily needs of vegetables, fruits and meat are hard to obtain. The frigid climate does not permit production of these necessities on any scale to

satisfy the local demand. The long and rigorous winters make it impossible to grow any domestic vegetation, except perhaps in hot-houses which is a matter of stupendous costs and experimentation. Therefore, most of the daily consumption needs have to be imported from distant regions and sometimes from foreign countries. Total inadequacy of transport network in Siberia is a big barrier in ensuring regular supplies of the daily living needs of the workers brought here for project works in these remote areas.

(d) Supply of daily needs and high living costs:

The daily needs of food, clothing and even bare living comforts of housing present significant problems in Siberia. The Times' correspondent who visited Eastern Siberia and Soviet Far-East four times in 1970 reports, "I saw no meat in any official shops, for frozen meat and sometimes for sausages, there were long queues. There was meat in the market, but it was very expensive and there, too, were queues. The food and other necessities were much more expensive than in European Russia".[32]

The difficult working conditions for the same type of work in the north as in normal climes, call for more food calories and special clothing outfit, fuel and light

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32 The Times, (London, 18 December 1970), quoted by Violet Connolly, "Siberia Today and Tomorrow", p.179.

which can be provided only at gigantic costs. A family budget, taking everything into account, would be 70% higher, it is estimated, in the far north than in the temperate areas of European Russia.[33]

Dr. Ferance Armstrong gave a first-hand description of the problems created in housing when he visited Yakutsk in 1967: "One resident in Yakutsk told me that the extra pay he received was virtually all spent on the high cost of living. But this meant not only more fuel, heavier clothing and higher prices on the Kolkhoz market but also the increased price of "bread" items in the shops. I had thought that these items were sold at the same price throughout the country. But he told me that there was about a 10% increase in Yakutsk. As a result, many would-be imigrants had either left or never come." This was especially true of of skilled people. Clearly, no major progress has been made in improving amenities for the northern workers. (This was to have been the compensation for the 1960 at an extra pay). In 1973, new conditions had been introduced. According to the calculations made by N.P. Kalinovsky regarding real and nominal wages in Siberia and the Far-East, a person would have to spend 4% more on food, 47% more on clothes, 16 times as much on heating outlays and more than twice on

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33 P. Hayenkov, "Living and Working Conditions at the New Construction Sites in Siberia and Far-East", Studies on Soviet Union, (Institute for the Study of the USSR), (Munich 1965), p.66.

transportation, including holiday trips to European resorts, to attain the same level of material comfort as in the center. The climatic conditions of the regions are so bad.[34]

Workers constructing a timber haulage railway through the taiga in the Irkutsk oblast described their working conditions as follows: "We work hard but nobody bothers about us, food is bad in the eating houses, summer is ending but we have seen no fresh vegetables, there is no meat, sausages, or cheese in the shops. You have to go more than 100 km. for a hair-cut. There are only cold meals although hot meals could be sent by bus. The mechanized bakery is out of order for the second year and bread is baked in a primitive stove. An old woman travelled here with two boxes of tomatoes to sell but why cannot our own supply organization do as much? Everything is available in Tayshet. We can't get our boots repaired. Fulfilment of the plan at any cost is an sin."[35]

Another correspondent wrote in October 1965, "For ten years now I have been visiting the Tyumen Taiga and the prospectors for natural wealth; much has changed there. They have received hundreds of tractor machines capable of going across any kind of country, new types of drilling rigs, seismic stations; the drillings are served by helicopters and a powerful technology has been used for a river flotilla.

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34 Violet Conolly, "Siberia Today and Tomorrow", op.cit. p.181.

35 Pravda, 22 November 1965, quoted from Violet Conolly, Beyond the Urals, p.255.

The black gold diggers are constantly getting improved technical equipment. But in their living conditions, practically nothing has changed. The state has provided compensation, a bonus on wages, and the local heads have countered that by a system of complete indifference to the human beings. That appears to be the only possible explanation for the living conditions in the settlement of the Tyumen Taiga."[36]

The basic factors causing large scale "labour turnover" in Siberia are mostly concerned with housing comforts. According to the various reports, the largest number of worker-flights from Siberia was due to lack of housing facilities. For instance, over a seven-year period from 1963, it has been estimated that 80% of incoming migrants left the Tyumen oblast primarily on account of the shortage of housing facilities. There have been many reports in the Soviet press on how factories built at enormous cost are unable to start production because of the absence of housing facilities for the workers. It is true that in any newly developing region which is either partially populated or virtually uninhabited previously, the problem of housing is encountered; but in the Siberian situation, the problem of housing assumes a special character because of the extreme inhospitability of the climatic conditions. It is impossible to expect any worker or

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36 Violet Conolly, op. cit. p.256.

groups of workers to sustain themselves for a long period without adequate housing and protection of their physical condition in such harsh climatic conditions.

Many western and Soviet scholars attribute the shortage of housing and other amenities in Siberia to wrong investment policies. It is argued that the lack of amenities in Siberia is due to neglect of non-productive spheres of Siberian economy in investment policy. Another reason is the diversion of resources meant for construction of houses, hospitals and schools towards building productible facilities in order to meet the plan targets. While these factors no doubt contribute to the housing problem, one cannot ignore the influences of geographical factors on the difficult housing problem. The geographical factors worsen the situation created by inadequate investment in providing basic amenities to the thousands of workers required to be deployed in the project areas of Siberia. This does involve stupendous cost to build houses, schools and hospitals in the region. The pattern of houses to be built in Siberia to suit human living in these climatic conditions must be different from those in relatively favourable climatic conditions.

In the eastern regions, the houses must be built with very thick walls, double or treble the normal thickness, with

specially improvised or designed windows that could resist frosty and forceful winds and with heating system inside every house. The conditions of permafrost make house-buildings very costly affair. About two-thirds of Siberia is affected by permafrost. In those areas, any construction of buildingrequires costly precautionary measures in the preparation of the ground, because a major structure may cause the soil temperature to change with destructive effects on the foundation and to the building itself. This means that with the limited available resources, only very few houses can be built. This is one of the very important reasons why the Soviet planners have been unable to solve the housing problem for Siberian workers.

The general shortage of labour and acute "labour turnover" in Siberia are attributed to other factors, also, like insufficient wage differentials. From our analysis, it is clear that the difficult labour problem in Siberia is to a very large extent associated directly with the natural environment of the region in which human endeavour is dwarfed although the struggle typifies human endeavour against the gigantic forces of nature in adversity. Since climate is an immutable factor, it is easy to anticipate that the Siberian labour problem is not likely to be solved in the near future. This will have far-reaching effect on the pattern of economic

development to be designed for Siberia. It will force the Soviet planners to opt for highly capital intensive techniques of production in order to save scarce labour. In this sense, it is to be expected that the pattern of economic development in Siberia will be characterised by highly capital intensive techniques to much higher degree than heretofore and in the rest of the country.

CHAPTER III

THE GEOGRAPHICAL FACTORS AND TRANSPORT PROBLEMS

CHAPTER-III

GEOGRAPHIC FACTORS AND TRANSPORT PROBLEMS IN SIBERIA

Transport plays a very important part in the national and regional economic development. It affects the multifarious connections between production and consumption, between agriculture and industry, between the extractive and manufacturing industries. It ensures the production relations with economic areas and the various branches of the economy. It exerts considerable influence on the development and distribution of social production and in turn reflects the developments and distribution of the productive forces over the territory of the country. For these reasons, economists always stress the development of transport and communications as a precondition for the accelerated growth of whether national or regional economies.

In order to maintain a high rate of growth of the national economy and to bring about a more uniform distribution of the productive forces, the Soviet planners have been envisaging speedy exploitation of the rich natural resources of Siberia in the recent years. The success of the planned programme of development of Siberian economy is, to a large extent, dependent on the further development

of the transport system in the region. V.A. Krotov rightly points out, "The transport problem is .... of the highest importance in Siberia and determines the order of priorities, the scale and the rate of industrial development of any region".[37]

The significant role of transport in Siberian development is illustrated by the following example: prior to 1967, in the most important oil and gas fields of Tyumen', the production of crude oil had to be limited to the capacity of water transportation in the shipping season. It was only after the construction of the oil pipe-lines, Shaim-Tyumen' and Ust-Balyk Omsk (1967), that the production of crude oil could be increased.[38]

There are two very important factors which make the transport problem a crucial one in the economic development of Siberia. (1) The size of the region with all its peculiar geographical features; (2) the dependence of Siberia on distant European parts of the country for the supply of labour, capital equipment and the market. It is self-evident that a continental size region like Siberia

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37 V.A. Krotov, "Geography Series, Academy of Sciences, USSR", translated in Soviet Geography, No.9, 1964, p.53.

38 V.G. Krashaninnikov, "The role of River Transport in the development and location of productive forces in the eastern regions of the USSR", Soviet Geography, Vol. XIV, No.5, May 1973, p.298.

with widely dispersed natural resources requires very extensive transport network for its faster development. Often it may be necessary to build lengthy transport facilities just to utilize the resources of a single deposit. The construction of modern means of transport becomes all the more important due to the absence or severe limitations of natural transport facilities. Severe limitations on natural transport facilities arise from the fact that large parts of Siberia are under permafrost. Moreover, due to the under-development of Siberian economy, most of the inputs including labour and heavy capital equipmentneeded for the extractive and manufacturing industries will have to be brought from long distances - from the well developed European parts of the country. Even to ensure regular supply of food for the workers in dispersed Siberian industries, it is necessary to have extensive transport facilities.

But an intensive development of transport in Siberia is confronted with very formidable difficulties and involves very huge investment of scarce resources. Large-scale investment is necessary not only because of the difficulties posed by the natural environments of the region, but also because of the nature of modern transport technology needed for construction of transport network in the region. Before considering the effects of natural factors on the development and maintenance of transport system, it would be worth-

while to give a brief description of the existing modes of transport in Siberia.

(a) Present Development:

(i) Rail-roads: The transport of Siberian region may be classified into five main ways including gas and oil pipe-lines. They are: (i) Railways; (ii) Roads; (iii) Rivers and sea routes; (iv) Airways; and (v) Gas and oil pipe-lines.

The first step taken to solve this problem in Siberia was the construction of the Trans-Siberian Railway of about 6000 miles, a few decades ago. It links Chelyabinsk in the Urals with Vladivostok on the Pacific via the Chinese Eastern Railway and Harbin. It was completed in 1904. In the northern side of the Trans-Siberian, the Amur Railway linking Kuenga to Khabarovskvas was completed in 1916. This line is continued south through the Usuri railway to Vladivostok. It is now completely double-tracked and electrified up to the Baykal region. This line also connects Lugavoy in south Kazakhstan with Novosibirsk, a distance of about 1442 km. length. Kuzbas and Altay metallurgical developments have led to the construction of other small rail links. Other links also built between Karaganda coal fields with the Trans-Siberian lines and with Balkash copper smelter

works make some 504 km. of railway further to the south in Kazakhstan.[39]

The trans-Siberian line is very laden, carrying 9% of the total U.S.S.R. rail freight, and this line is playing a major role in the Soviet economy. Of the total freight, 34% is dispatched outside the area and a further 15% in transit. There is only 15% inward traffic and the remaining 37% is outward traffic. The main exports are coal and coke from the Kuzbas, oil products from Omsk, ferrous metals, timber and grain. The imports into Siberia through the lines are fuel oil from the Urals, metals and building materials. The stretch between Omsk and Novosibirsk, it is claimed, is the busiest rail-freight traffic in the world.[40]

Further north, a narrow-gauge railway of 70 miles was built in 1933 to link Norilsk with Dudinka on the Yenisey and connect the metallurgical centers. Another line was built between Norilsk and Talnakh mines in 1965. The Second World War gave the impetus to build further links with outer Mongolia and China and strengthen the Trans-Siberian railway system. The important line was built in order to connect Outer Mongolia and Soviet Union and Borzya, the big junction, was completed in 1939. The above line also com-

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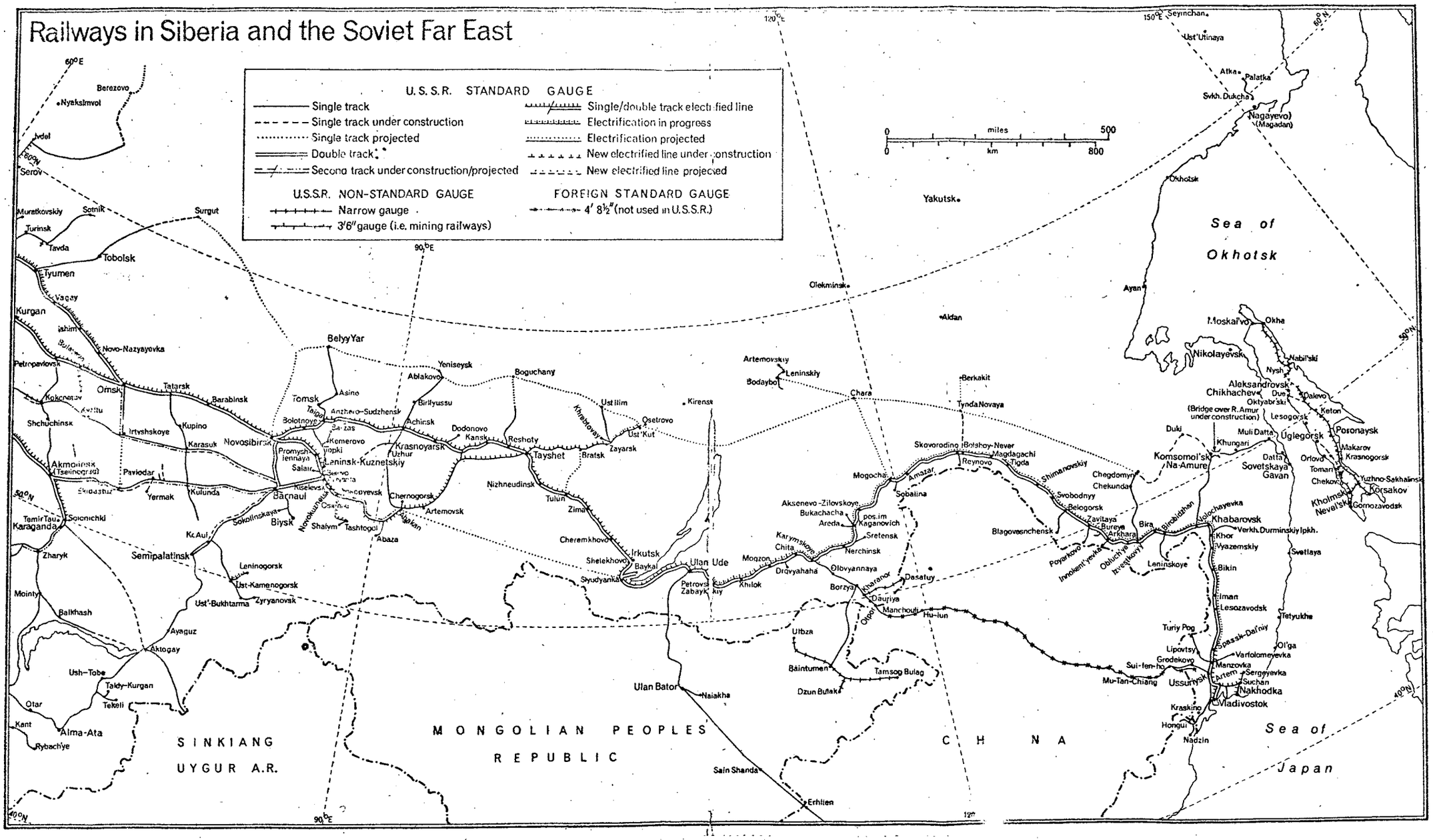
39 Violet Conolly, "Beyond the Urals: Economic Development in Soviet Asia", Oxford University Press (New York - Toronto 1967), p.281.

40 Ibid., p.283.

Railways in Siberia and the Soviet Far East



Source:- Violet Conolly, Siberia Today and Tomorrow, (London, 1975) pp. 168-69.

nects Chita and Choybalsan, the chief towns of Mongolia. The Buryat-Mongolian capital of Ulan-Ude was connected by a new railway line about 213 miles long with the frontier town of Naushki. These lines were of strategic importance to the U.S.S.R. in the wars of 1938-39 and 1944-45 conflicts in Manchuria between Russia and Japan. The Naushki line was later on extended to Ulan Bator in 1950. The Ulan Trans-Mongolian Railway connecting the Chinese territory was opened in 1954, running to a distance of 1115 km. It was intended to reduce by 700 miles the rail distance between the Chinese and the U.S.S.R. capitals.[41]

In 1933-35, about 1687 miles stretch of the Trans-Siberian railway further east between Ulan-Ude Khabarovsk, was double-tracked. In 1940, Khabarovsk was linked by Komsomolsk'na-Amure about 213 miles north. The importance of the major combined transport routes of Taysket-ust'kut-Kirensk-Vitimyakutsk was to link the Yakut ASSR and the north-eastern part of the Irkutsk oblast with the rest of the country.[42]

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41 Violet Connolly, "Siberia Today and Tomorrow: A Study of Economic Resources, Problems and Achievements" Collins Clear Type Press (London 1975), p.157.

42 A.A. Vorobyev, "Problems in the Location of Transportation in the Southern Part of Eastern Siberia", Soviet Geography, Vol. V, No.5, May 1964, p.12.

After the Second World War, considerable rail links have been developed making up what is called the B. A. M. (Baykal-Amur-Magistral) from Tayshet on the Trans-Siberian Railway about 1200 miles long. Another important line of the Amur Railway linked Komsomol'skna-Amure with the Pacific port of Sovetskaya Gavan, the best natural harbour on the Gulf of Tartary, in July 1945. This was extremely helpful in 1945 for the Soviet seizure of Sakhalin and the Kurile Islands from Japan in the Second World War.[43]

Besides these major lines, other small lines were also constructed in Siberia to link industrial plants to the main line. The most important lines were the Central and Southern Siberian lines of the Abakan-Tayshet railway, Tayshet-Ust, Yakut trans-Siberian up to the Lena river part of Usetsova. The South Siberian line stretches up to Kazakhstan and it was completed in 1953 by forced labour. Another line starting from Tselinograd, the heart of the virgin land of Magnitogorsk-Karagand, is bout 700 miles, now double tracked and electrified. In the middle of Central Siberia, the projected line of about 745 miles was partly done in 1966 and then completed by 1972. It starts from Kustenany and runs through Kochetav-Irtyshskoye. Some other southern

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43 Cf. H. Tupper, "To the Great Ocean", p.442, and Violet Conolly, Siberia Today and Tomorrow, p.158.

lines are the Tartarak-Karasuk-Kalunda and the connections to Kuzbas and Kemerovo oblasts. Another important line of Asino with its extension towards north to Balyyyer and South to the Trans-Siberian by a branch line from Omsk, is notable for feeding the ore processing center. Ust'kut via Bratsk was completed in 1954 and it connects the Lena river port of Osetrovo and the heart of the Yakutiya and Tayshet-Ust'kut line is playing a major role in the Soviet economy. The Korshunovo iron ore project has been developed with the help of this line.[44]

Industrial development has led to connection by new lines from Noril'sk metallurgical combine to the Talnakh ore deposits and the mining town twenty miles north of Noril'sk by a short new line of considerable importance.[45] The line was comissioned in April 1966.[46] The public announcement in January 1966 about the construction of the northern Siberian line was significant.[47] The double-tracked line between Bratsk and Ust'kut as a new line was opened in 1973. The manamica deposits and the Bodaybo gold-fields to the east of the Ust'kut are also linked with this Lena railway through the Vistina-Lena waterway.

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44 J.P. Cole, F.C.German, "Geography of the USSR, (London 1961), p.199.

45 Moscow Home Science, 2 April 1966.

46 Novosti Information Service Bulletin, 7 March 1966.

47 Violet Conolly, Beyond the Urals, op.cit., p.284.

In 1965, another line in the north from Abakan crossing the Trans-Siberian through the Abaken Tayshet was completed to play a major role for the Sayan electric project. One more line completed in the region was of the Salakhand, the trans-Siberian link to the copper mines of Udokan and the B.A.M. - Chul'man extension of the Amur trunk. It runs to the distance of about 200 miles through Arctic Siberia to Igarka on the Yenisey river. This line was first abandoned after the death of Stalin in 1953. It was called "The Road to Death", but now it has been reopened to become important for the oil and natural gas resources of the Nadyma.

In spite of substantial extension, electrification and dieselisation of railways, the density of railway lines in Siberia remains the lowest in the country. It is far from adequate to meet the requirements of massive movement of men and materials necessary for accelerated development of Siberian economy. Further development of railways in Siberia is beset with many difficulties such as extraordinarily high cost of construction arising from unfavourable natural environment. Some of these problems will be discussed in detail in the next chapter.

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48 The conditions under which this line was first built and later abandoned were described in detail in an article in Novy-Mir, No.8, 1964; op. cit. Violet Conolly, Siberia Today and Tomorrow, p.164.

(ii) Road Transport: Next to the railways, the roads come in importance for bringing about economic development in this region. The first road was started, according to the Dal Story during the 25 years of police administration. About 7000 km. of roads were constructed by forced labour in terrible hardship in Magadan and the East. The chief trunk roads in these two areas are between Never-Yakutsk and through the Magadan-Irkutsk-Kachung; and Minusinskkyaya, the capital of Tuva ASSR. This was also linked with AkDovurak Abaza; Lansk-mirryy and the Turkinskye trakt-Mongolia at Mondy and leading beyond Mondy. The Magadan-Never Road is playing an important role for exchanging cattle from Mongolia and it traverses both the Kolyma and Aldan gold fields. It is now providing facilities to the Yakutia gold fields and the trans-Siberian railways and other important rail links to Nakhodha, Vladivostok and Khabarovsk, along the Amur river in the east.[49]

The most important highway from Sokolichi in Primorye follows the railway to Nakhoda, Vladivostok and Khaborovsk into East Siberia. The nodal point of Ust'Nera on the Magadan-Yakutsk road is now being connected with Khandyga on the Aldan river by a new road. The other Chuyskiy track of about 617 km. long motor road connects Biysk with Outer Mongolia and it traverses the mountain rivers and many other obstacles in the Gorno Altay'Skaya autonomous oblast.[50]

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49 Violet Conolly, Siberia Today and Tomorrow, op.cit. p.165.

50 Violet Conolly, Beyond the Urals, op.cit., p.332.

However, the network of roads in Siberia is negligible compared to the vast size of the region. One can say that Siberia is almost roadless. This is because of the high cost of constructing and maintaining roads in conditions of permafrost. It has been estimated that the cost of constructing a mile of road is higher than the cost of building a mile of railway line. The maintenance cost is even higher.

(iii) River Transportation: Siberia is a vast area with many rivers capable of being used as waterways for internal and external transportation. In the northern regions, neither roads nor railways existed and because of their absence, the linkages to the sea and inland through these rivers could be looked upon as an important means of transportation. The problems of the Siberian rivers, excepting Yenisey, are that none of the great rivers like the Amur, the Lena, or the Kolyma, is capable of being used for navigation upstream for ocean-going vessels. According to the ninth five-year plan, Soviet river transport was to increase by 24% by 1975 and in the northern Siberia it was probably to be higher. The use of oil-gas, timber and industries of Western Siberia, the port of Novosibirsk has been modernized and other new ports are also being established in the region. The new

river depots are being constructed at Surget, Tobl'sk and Nizhnevartovsk as also at Novosibirsk. Novosibirsk is the second river port in dealing with increasing volume of river freight.[51]

The more powerful rivers, with the exception of the Amur, run northwards from the inhabited centers. Supplies to many districts in the taiga-tundra zone are largely provided through the rivers during the short navigable season. The rivers of Yenisey and Lena connect with the rail links.[52] The main drawback to river transport is its seasonal character.

In the farther south oil fields, although the wells are being drilled along the Ob' and near the river, to carry out the pipe-line work and also the transport is very difficult for nearly seven months of the year when the ground is frozen which incidentally makes the work in the fields almost impossible. Navigation in the Ob' is, however, feasible for about six months. Within these six months, heavy equipment is brought in (a port is being constructed at Surget) and the oil sent out from this part was about 850,000

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51 Violet Conolly, Siberia Today and Tomorrow, op. cit., p.166.

52 G.S. Krasheninovikov, "The Role of River Transport in the Development and Location of Productive Forces in Eastern Regions of the USSR", Soviet Geography, Vol. XIV, No.5, May 1973, p.64.

tonnes in 1965 and the same amount was planned for 1966.[53]

River transportation is extremely important in the north-eastern regions and the far-eastern Siberia. Formerly roads were few and railroads were non-existent. So, the Amur river is important for navigation with the use of its streams also and transportation has been going on through this river for some time. There is also an Amur naval force with base at Khabarosk consisting of river gun-boats for frontier patrol. The Amur delta is too shallow to allow sea-going ships to sail for inland during the last few years. Freight has to be transhipped to smaller craft at Nikolayvsk. At the present time, there is a rail-link ferry over the Amur river between the towns of Komsomol'sk and Pivan. In the near future a rail bridge is to be built to replace the ferry, so that it will be possible for traffic to continue throughout the winter months.[54]

In East Siberia, Osetrovo, the busy Lena port at the Ust'kut rail terminal, as a new port has been built in the recent years to serve as the trans-Siberian shipment point for supplies passing some 700 miles down stream to the new Lena port of Lensk. The materials are transported through

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53 Violet Conolly, Beyond the Urals, op. cit., p.333.

54 Pravda, 25 July 1965 - quoted - ibid., p.334.

road to the Yakutsk diamond centers, the Vilyuy and further east to the heart of Central Yakutiya. Ship-building has also been established at Osetrovo. The Lena river transport is increasing in recent years and equipment has been installed at Osetrovo and Yakutsk to improve loading and loading freight. About 80% of the machinery and clothing, oil, construction materials and vegetables from Yakutia is transported along the coastal Lena river transport.[55]

An amalgamated Far-Eastern shipping corporation (directorate) now controls all shipping along the Soviet Pacific coast and around the islands. Formed in 1964 from the Sakhalin Far-Eastern and Kamachatkan shipping directorates, the corporation has been subsequently acting and increasing the volume and range of its operations. The main imports and exports were taken in Kamachatka. In 1970, the ports of Petropavrovsk and Ust-Kamachatsk handled the timber from the eastern regions. According to the local plan, all these corporation ships were to have been converted into oil-firing by the end of 1965. According to Soviet sources, the port of Kamachatska will act as a main port in this region.[56]

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55 Andrei Lebed Boris Yakovlev, Soviet Water Ways, Institute for Study of the USSR, Series 1, No.30, December 1956, (Germany), p.120.

56 Violet Conolly, Siberia Today and Tomorrow, op. cit., p.162.

The discovery of oil in Markovo in the valley of Lena river below Usk'kut and of alluminium areas in the Vitim river basin, as well as the prospect of developing a large working complex at the mounth of the Kiege river, have increased the freightage. The northern part of Lena-Chara railroad through Kireek and Bodaydo is also proposed in the future. The systematic resource development in the eastern region of the U.S.S.R. proceeding gradually from the economically developed regions, the central parts of the country towards the far-east, the western and central Siberia, and in the best parts of Eastern Siberia, needs great improvement of river transport.[57]

The north-south dignment of the Angara, Lena Biryuga, Chuna, Oka, Ilum and other rivers in the western part of the Baykal region makes them suitable as speeder routes for delivering timer, minerals, agricultural and other goods to the west and east railways. In the south-eastern part of the Baykal region, parts of the Angara, Khilka, Ingoda, and Onons rivers run parallel to the railroads. These rivers can be used for transportation of minerals, building materials, wood and farm products to reduce the transport costs and reduce the traffic load on parallel sections of the Trans-Siberian railroad.[58]

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57 V.I. Koldomasov, Kompleesnoya razmittiya Transporta SSSR (integrated development of transportation of the USSR), Moscow Transzheldor: Zolat, 1961) from A.A. Varob'yev, "Problems in the Location of Transportation in the Southern Part of Siberia", Soviet Geography, Vol.V, No.5, May 1964, p.11.

58 Ibid., p.12.

Although river transport plays considerable role in the Siberian economy, it suffers from many defects. Apart from the slowness of this transport system, its usefulness is reduced by seasonal character. Navigation is hindered by freezing of rivers in winter and flooding in summer. A more severe restriction on river transport system arises from the direction in which rivers flow. Most of the rivers in Siberia flow in south - north direction. But the transport facilities are required to connect Siberia with the western parts of the country.

(iv) Sea Routes: The sea routes to Siberia is of significant importance for the economic development of the U.S.S.R. The improvement of exports and imports to and from the east Asian countries, India, Singapore and Australia have the key ports of Vladivostok and Novosibirsk in the eastern coastal lines of Siberia which play a major role in the Soviet national economy. The new relations with America would enhance the activities of these Siberian ports. A delegation of American officials from Seattle and California Beach visited Nakhodka in 1973 to examine its docking facilities and discuss the loading of Soviet vessels at Seattle for the Far Eastern shipping line.[59] The citrus

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59 Violet Conolly, Siberia Today and Tomorrow, op. cit., p.170.

fruit imports from America and exports of Yakutsk natural gas should considerably increase the activities of these Siberian eastern ports of the Soviet Union. In competion with Britain for shipping to Singapore since 1968, the Siberian ports have improved. The far-eastern maritime programme has activised Nakhodka, Vrangel, Sovetskaya Gavan, Vanino and Sivyaska, Posyev and Magayovo in various measures.

The port of Nokhodka, about 120 km. north of Vladivostok is rapidly improving. Its turnover in 1973 was 800,000 tonnes. Vladivostok accommodates vessels upto 120,000 tonne capacity. The other three deep water quays are under construction since 1972, with berths for large vessels. The port of Nakhodka, when construction is completed, will accommodate tankers of 40,000 tonne displacement. Since 1968, the storage capacity has increased. Supplies for Vietnam were shipped from Vladivostok to Hyphong by the sea lane as well as along the Chinese railways to Vietnam and the frontiers.

The port of Vrangel on the opposite side of the bay of Nakhodha is being constructed as a large deep water port with equipment supplied by the Japanese, at an estimated cost of $ 45 million. This port is to be connected with Suchan mines by the first road and rail bridge in the far-

east, being constructed over the lower reaches of the Suchan river. On completion, this port will handle exports and imports of hay.

The port of Sovetskaya Gavan is fast improving and has repairing facilities in the port itself. The port of Sakhalin I has a special four track railway derrick which operates at 15 knots speed. Sakhalin conveys passengers, tractors and other vehicles. It does only coastal shipping and conducts some foreign cargo business. The other line of Vanino-Kholmsk will operate very soon and its exports may reach up to 2,500,000 cubic million tonnes of timber. This port is also linked with the Amur railway from the branch line of Vladivostok and Sovetskaya Gavan. Other small ports like Posyet, Slavyanka or Nagayeva and Primorye in the Northern Pacific coast are also developing, but these have poor repair facilities.[60]

(v) Air Transportation: The expansion of air transport has become significant to the development of all the areas of Siberia, which are not directly served by railroads, roads or river and sea transports. Air transport has been used to a large extent for geographical surveys and preliminary prospecting of mineral resources. It has the advan-

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60 Andrei Lebed Boris Yakovlov: Soviet Water Ways, op.cit., p.30.

tage over railway communication in the wild areas which can be easily covered by air for planning the construction works.

The southern half of Siberia is well served with air-ports and services. Krasnoyarsk has become a non-stop service port for flights to and from Moscow and for communications within Yakutia. The airport of Irkutsk is the main link within the Far-East between Khabarovsk, Sakhalin, Kamachatka and for the traffic east-west - to the Urals and to Leningrad in the West. Another port of Novosibirsk is the main link with Alma Ata and coastal centers of Asia, while from Omsk, regular services go to the various centers in Kasakhstan, the Southern Urals, Leningrad and Moscow.[61]

The aircrafts have improved the supplies urgently required for the rapid development of the oil and gas fields of the lower Ob' basin. A large number of helicopters delivered the passengers with drilling equipments and stores from the airports of Yakutia and Norilsk or from the Ob' estuary ports. This is the only way of delivery to the gas fields. In order to link up the enormous roadless, rail-less expanses of the east, air-transport was introduced early in the 1930's. Air transportation is the

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61 Violet Conolly, Beyond the Urals, op. cit., p.259.

popular means of personnel transportation in the far-eastern region. The main route connects Moscow with Vladivostok via Skovendinov, Birobidzhan, Khabarovsk, Ussuribsk (formerly Voroshilov) and other intermediate stations. From Sakhalin to Kamachatka, there is regular service because of the improving gold fields, and it makes personnel transportation comfortable in the Eastern Siberia.[62]

Giant planes carry tractors, motors, vehicles and spare parts and assemblies to the eastern region. In the more remote areas, the planes fitted with ski's make landings on snow and ice. The main center for such flights to the region is Khabarovsk. In 1960, from Irkutsk to Yakutsk, 8-hour flights were introduced with only two stops and in 1964, non-stop flights were introduced with three-hour run from Irkutsk to Bakutsk. In 1965, the turbo-prop aircrafts were introduced and the fare became relatively lower. There are also airports in Chutkota at Uolan and Andryiv where people who have never seen trains are familiar with planes. In 1964, a direct flight between Anadyr-Magadan-Krasnoyarsk-Moscow was also established.[63]

(vi) Oil and Gas pipe-lines:

Oil pipe-lines: The pipe lines are the most viable

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62 J.P. Cole and F.C. German, Geography of the USSR, op. cit., p.99.

63 Violet Conolly, Beyond the Urals, op. cit., p.261.

means of transportation for oil. It is most vital to Siberia since through the pipe-lines, oil and gas can be piped from one place to another through long distances at low cost. The problem is of the construction of the pipe lines. The first line from Surgot and Tyumen' deposits to Omsk was started in 1965, through which 850,000 tonnes of crude were pumped for refining. Another pipe line from Shain to Tyumen' oil-field, about 436 km. was also completed in 1965. Yet another line from Tyumen' at Ust' to Balyk which is about 1300 km. and the Omsk oil refinery were completed in 1967.[64]

In 1964, from western Urals to Irkutsk, the line was completed. The other line from Omsk to the Urals and a new pipe line from the lower Ob' westward to European Russia are planned for the future. At present, 2 to 3.5 million tonnes of oil are piped from the Okha to the petroleum port of Moskalvo on the west coast of the island and through Tartary strait to the refineries at Vladivostok, Khabarovsk and Komsomolsk. The second line is built in Sakhalin and it is regularly pumping oil to Japan and this export of oil from Yakutia was estimated only 10% of the total export to Japan. It was also reported that some 2,70,000 tonnes of oil was dispatched from Tyumen' oblast for processing in

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64 Violet Conolly, Beyond the Urals, op. cit., p.263.

1966, and it was three times more than in 1965 and the target for 1967 was to exceed 6,000,000 tonnes.[65]

Gas Pipe Lines: Gas pipe lines are equally important means of fuel transportation in Siberia, as elsewhere. The first line from Tazovskaya to supply the mining towns of Norilsk and nother from Berezovo westward through Igrim to Serovo and Nishniy tagil in the northern Urals of the industrial regions had been completed in 1967. It was proposed to link the Berezovonishiniy Tagil line with the Bukhara Urals pipe line and continue it to Leningrad and Minsk in 1970. In Okha, the oil deposits also produce natural gas, but no refining is done in Sakhalin. The other proposal was to build gas lines from Okha to Komsomol'sk within two years. The Lena-Vilyuy area of central Yakututin has 5 to 7 billion cubic meters of gas resources. There is also a plan to link Usk-Vilyuskoya about 300 km. north of Yakutsk to Pokrovsk being constructed which will run on the permafrost areas.[66]

(b) Inadequacy and effects of Geographical factors on Transportation:

The above discussion clearly shos two major characteristic features of the transport problem in Siberia: (1)

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65 J.P. Cole & F.C. German, The Geography of the USSR, op. cit., pp.207-10.

66 Thiel, The Soviet Far-East (London 1957), p.178.

Compared to the vast size of the region, the existing transport arrangement is totally inadequate; (2) the limited available transport network is very unevenly distributed with concentration in some parts like southern Siberia having earlier developed, and leaving enormous expanses of Siberian lands unserved by modern means of transport. Since most of the needed Siberian natural resources are located in places far distant from the main lines of communication, it is imperative that further exploitation of the resources is impossible without multiplying the communication and transportation system by several times over what has been done so far. But large scale construction and maintenance of transport and communication system is both difficult and costly in the geographic and climatic conditions of the Siberian northern regions.

The sparcity of transport network in Siberia can be attributed partly to low density of population and the relative under-development of the economy. However, the environmental factors are no less significant in creating the present transport problems.[67] The significance of environmental conditions for the development of transport is little recognized in economic literature. Yet it is on the provision of transport facilities that future development of Siberia rests, among other factors already pointed out.

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67 For further discussion on the effects of environment on transportation, see also Chapter IV, pp. 77.

A basic geographical factor that has very important influence on transportation in a region is the distance to be covered. In Siberia, distances are phenomenal. Moreover, Siberia suffers from disadvantages of being farther away from the main populated industrial centers of the U.S.S.R. This means both industrial units that supply the inputs to Siberian industry and the market for the latter are located at considerable distances away. The long distances result in long haulage. For instance, the average length of the haul for the Far East is 1234 miles. The long haulage leads to high transport costs which out-weigh the value of the product itself, and which in turn influences the pattern of development in the region.

The relative cost of haul by railway, road and river in the Far East is between 42% and 47% more expensive than the average for the U.S.S.R. A good example of the limiting effect of distance is that of transportation of grain from surplus from relatively low cost farming in Kazakhstan to deficit high-cost agricultural center in the Far East. The cost of producing a tonne of grain in Kazakhstan is about 60 rubles, whereas in the Far East it is over 80 rubles. But the transport costs between the two regions add up to more than 22 rubles and so equate the CIF cost at Kabarovsk.

Environmental factors are of considerable significance

in determining the suitability and efficiency of different modes of transport in Siberia. In planning and developing transport in Siberia, it is necessary to take into account the natural conditions within which various means transport can be operated, if at all. A Soviet geographer, V. B. Nefedovo has shown the relationship between natural environment and transport development with reference to Tyumen' oblast. Here, we can do no better than give a brief summary of her work to highlight the problems related to modes of transport.

In summer, the difficulties of transport would be due to the physical and mechanical properties of the ground (particularly the carrying capacity depending upon the state of the permafrost), land-form characteristics (density and depth of terrain dissection, slope angles), climate (the wetting impact of precipitation), the degree of plant cover and areas covered by water bodies.

In winter, the key obstacles to transport development are harsh climatic conditions, such as low temperatures, strong winds, the duration of the Arctic night, snowstorms, fog, and snow-drifting. In the absence of data on the physical and mechanical properties of frozen ground, Nefedova used some generalized characteristics of permafrost conditions that seemed adequate, in establishing the carrying

capacity of the ground and distinguished two basic classes, the clay ground noted for cohesion and plasticity; and the sandy ground. Other properties of the ground relevant to transport requirements are density and wetness. The density of water-saturated clay ground may change as a result of frost heaving. However, the most dynamic factor in the strength of the ground is its wetness. Clay ground, for example, is highly resistant when dry. But any precipitation of more than 5 millimeters tends to soak the ground and deprives it of cohesion. As a result, the use of wheeled vehicles may become difficult or altogether impossible. Any evaluation of passability of ground types requires an objective index of the limiting carrying capacity.[68]

Unfortunately, many parameters of the physical and mechanical properties of frozen ground could not be calculated by Nefedova because of the lack of data. The textual description, therefore, contains highly generalized data on the state of the permafrost. Ice content, soil temperature regimen, thickness of the active layer and the extent of permafrost processes are beyond calculation without firm data.

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68. V.B. Nefedova, "Methods of Evaluating the Natural Environment for Transport Development", Soviet Geography, Vol. XIV, No.4, April 1973, p.245.

Ice content of permafrost sediment is one of the most important engineering geography parameters in permafrost areas. It usually depends on the character of the cryogenic texture and the ice content is closely relayed to lithology. Particular lithologic genetic complexes are usually distinguished by a given type of cryogenic texture and the ice content. The ice content is also an indirect indicator of the moisture content of the active layer in the absence of direct data.

The thickness of the active layer and its moisture content are also important parameters of passability. Pulverized sandy loams with a high moisture content tend to become thixotropic (becoming fluid when stirred or disturbed). Peaty ground has a low carrying capacity. The temperature of permafrost ground is also used as an index of carrying capacity, the lower the temperature, the greater is the carrying capacity. The least favourable in this sense are ground types in the zone with temperature close to the freezing point; their carrying capacity is extremely low.

The transport development of any territory also depends on land form characterization. Therefore, their description of natural complexes in the study area also contains morpho-metric parameters used in engineering -

designs. Surface slope angles and the density and depth of terrain dissection have to come for calculation. The harsh climate in the study region also affects the costs of transport development. In this connection, they have considered the number of days with temperatures below -40°C, the number of days with gale-force winds with speeds of more than 15 meters a second, and the number of days with a snow cover of more than 40 centimeters.

Data on plant covers also presented factors for the particular purpose of the study. The absence or presence of trees, distances of 7 to 8 meters between the trees, which is the minimum necessary for wheeled vehicles, and the thickness and height of the tree trunks come into reckoning. In addition, the tabulated natural complexes also include fog and lack coverage.

The basic criteria for transport accessibility were established on the basis of the engineering specifications of the particular means of transportation; the clearance of the vehicle, the unit pressure transmitted to the ground, maximum grade that can be overcome. The clearance, for example, was taken as 40 to 50 centimeters, the unit pressure transmitted to the ground as 1.5 to 1.6 kg./km^{2}*, the minimum grade for road design 5°43' and the maximum grade that might be overcome in wet ground was taken as 10-12°.[69]

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69 Ibid., p.246.

Applying the above criteria, Nefedova came to the conclusion that environmental differences affecting the use of ground transportation are most pronounced at the level of landscape type. The results of her investigation are given in the following table, annexed in the next page.

Harsh climatic conditions in Siberia thus makes planning difficult and construction and maintenance of transport systems exhorbitantly costly. Permafrost areas greatly increase the problems of construction of railways and roads. In permafrost zone, roads are cheaper to build than railways, but annual maintenance of roads are more expensive. Consequently, roads can be used to suppliment the river transport or link railheads. Thiel refers to the significance of permafrost conditions to transportation when only the shallow layer of top soil thaws each summer the building and maintenance of fixed capital like bridges and buildings associated with transport are difficult and expensive. The expansion of ground moisture as it freshes crostes breaks in the surface that seriously damage lines of communication. Deep cracks occur in the roads. With the summer thaws, the surface layers subside into a sea of slush and mud. The building of all-weather roads in the permafrost zone is slow and costly and annual expenditure is very high.

TABLE 8

REGIONAL EVALUATION OF ENVIRONMENT OF NORTHERN TYUMEN' OBLAST FOR TRANSPORT DEVELOPMENT PURPOSES

Regional Group	Region	Wheeled ground Transportation	Water Transportation	Air Transportation
I	Yamal (1)	Relatively easy in winter	Relatively easy in coastal inlet	Hard
	Gyde (2)	Very hard in summer	Very hard on small streams	
	Taz (3)			
II	Ob'-Taz (11)	Winter traffic possible along fixed routes, very hard in summer.	Relatively easy.	Hard
III	Sos'Va-Synya (5) Ob'Kazya(9) Upper Taz(13)	Hard all the year round with traffic possible along fixed routes after opening preparation.	Relatively easy on large streams and only in flood stage in small streams.	Hard
IV	Polny Taz(12)	Winter traffic possible along fixed routes after special preparation, very hard in summer.	Relatively easy, on large streams. Only in flood stage in small streams.	Hard
V	Ob' left Bank (6) Ob' Right Bank (10)	Hard all the year round, with traffic possible along fixed routes after special preparation.	Relatively easy.	Hard
VI	Surgut (14) Konda (7) Pre-Urals(4)	Winter traffic possible along fixed routes after special preparation; very hard in summer.	Relatively easy.	Hard
VII	Urals (8)	Hard all the year round.	Unsuitable	Hard
VIII	Lower Ob'(16) Middle Ob' (15)	Relatively easy in winter, very hard in summer.	Relatively easy	Hard.

Source: V.B. Nefedova, Ibid., p.248.

These problems are magnified for the more demanding task of running the railways. The cost of building railway lines is extraordinarily high. For instance, in Amur region, the construction of one verst of railway line costs about 1,58,000 rubles compared to only 67,737 rubles for the trans-Siberian railway as far as Sretensk in Trans-Baykalia. The Siberian climate also creates problems associated with the efficient operation of transportation machinery and equipment in the long Siberian winters. Some of the difficult technical problems posed by environment in the development of transport network will be discussed further in the next Chapter.

The inadequacy of existing transport facilities and the economic and technical problems (arising from natural factors) in the further development of transport in Siberia are decisive in influencing the pattern of economic development in this vital area. Because of shortage of transport facilities, it has become necessary to plan the development of territorial industrial production complexes in Siberian regions. The development of such territorial production complexes are expected to minimize transport requirements and thus remove an important bottleneck in the speedy development of Siberian natural resources.

CHAPTER IV

THE PROBLEM OF BRITTLENESS

CHAPTER-IV

THE PROBLEM OF BRITTLENESS

The territory of Siberia varies greatly with respect to natural and economic conditions. It is even more heterogeneous in regard to technological problems from region to region. The vast expanse of the Siberian economy begins from "zero" level. In order to execute projects costing many millions of rubles, it calls for substantial investment in the local construction base from the preliminaries. In building a factory or in setting up an industrial centre, numerous technological and constructional problems relating to the special conditions of the region have to be faced. This chapter deals mainly with the technological problems relating to construction works in Siberia.[70]

Man at the present stage is typically interacting with the environments through applying a wide range of engineering structures. As these structures increase in numbers and diverse applications, the problems continue with specific and technological progress made with the positive and negative changes effected by the environmental conditions in the region. Here, we are confronted with acute need for optimizing the processes of interaction between engineering structures and environments. The deve-

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70 V.N. Bogachev, "Problems of Development of the Construction Industry in Siberia", Problems of Economics, Vol. XVII, No.4, 1974, p.77.

lopment of a theory and methodological approaches evolved for dealing with complex problems has become one of the key theoretical and practical tasks of modern science. This brief chapter attempts to make a general characterization of the technology and natural relationship, with particular attention to the prospects of controlling physical and geographical problems that can be seen in Siberia.

(a) Engineering Systems and Natural Complexes:

Any kind of investigation of 'Man - Nature' relationship requires a special means of classifying the engineering systems employed to meet the conditions presented by nature. In order to analyse the classification of engineering systems suited to the conditions of nature, the criteria should suggest the most significant factors which determine the character of other factors. They are those relating to the position of energy and information on energy resources in the natural environment and in the society established in a given region.

In this context, the engineering technology applicable to Siberian conditions and the breaking characteristics of machines brought to work in the region can be analysed here on the basis of certain facts. Oil being one of the first and foremost items of industrial development in Siberia, the prime problem to be taken up is of the pipe lines

without which no working operation is possible.[71] Unlike in areas of normal climatic and environmental conditions, in Siberia, the pipe lines have to be laid with adoption of entirely different engineering system of skill, material and construction. In climatic conditions having temperature far below the freezing point for most of the year, the requirements of efficient working of the pipe lines involve (1) that the pipe lines should be provided with a whole-time heating system with the use of special heating equipment and instrumentation by which the pipes and their contents of oil are kept in permanent warmth for the regulated and continuous flow; (2) that the pipe lines should be strong enough to stabilise the heat and the material should withstand the subjection to permanent heating.

The harsh climatic condition (in the northern regions of Siberia, the temperature goes down to -70° C) of this region, the ground is mostly of permafrost which causes the problems not only in laying the pipe lines but also in keeping them heated. The means of heating being electrical, any defect, leakage or break-down in the heating system may prove even totally destructive, the least being the freezing of the oil, stopping of the flow and leading to the breakage of the pipes. This may happen in a matter of minutes or hours. If the pipes are not strong

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71. For brief description of existing pipelines and other modes of transport refer to Chapter III, pp. 46-65.

enough in material, construction or joinings to stabilise the heat or to withstand permanent heating, the lines will give way soon resulting in huge and irretrievable losses. Quick repairs cannot be contemplated in such conditions, and there is no way of giving temporary flow of oil till repairs are completed. A break-down in the pipe lines leads to a chain of difficulties, dislocation and disasters resulting in stoppage of works all round from oil extraction to the refineries. For such break-downs of pipe lines, there could be no short-term remedies and repairs. Long lay-off to the works and maintenance of the work-force with all living amenities until the lines are restored which will inevitably take a long time is unmanageable and it brings about total wastage of the national economy.

Another critical problem involving specialised technology applied to the region is transportation. The heavy and costly machines and equipment have to be brought to the field of installation and operation without damage and mechanical derangement in transit. The only transportation for the region is through the railways and through shipping over these vast areas of ice-laden region. The loaded ships have to be helped on their way by employing ice-breakers. This speaks for the magnitude of the problem

of transportation by shipping in this region. The transit hazards and delays expose the machines and equipment to both external and internal damages under perpetual snowfall conditions. The electronic equipments are the worst to suffer and the consequences can well be understood for operations in regions which depend on electrical energy as the basic means for carrying out all other activities.

For repairs of the ships, all the required facilities have to be brought from the western parts of the country. Often, it takes a long time to get the ships repaired and going and sometimes, the equipment may reach the industrial site after a delay of one year or more, making every work in the site to wait until the essential machinery and the stores arrive.

In such conditions, the overlay of expenditure for the maintenance of the work-force at the industrial site in idle time for long durations and the cost of transportation of machinery and equipment through hazardous shipping is colossal. It cannot come within any economy of scale, and constitutes the heaviest burden on the national economy.

The other means of transportation by railways in this region is also beset with formidable problems for evolving a technology to deal with them. The abundant coal available in the region cannot be used to run the engines. In the

harsh icy environmental conditions, steam engine locomotives are not workable. Electrically run engines are the only practicable for removing the snow from the tracks and for providing central heating inside the trains and the carriages to make travel possible in this region. Even in industrial complexes already built up, it is difficult to use coal driven locomotives. Electric trains are comparatively easy to equip, provided the lines are maintained in spite of many difficulties. There are, of course, very difficult problems faced by road transport in this region as we have already described the ground and climatic conditions.[72]

Air-transport at present plays an important part with natural limitations and technological problems. All the industrial sites are not served by ships or by railways. Airways alone provide the links between the industrial centres for transportation of personnel and limited material supplies in these uneven physical and environmental conditions. In some places, near the industrial centres, it is very difficult to prepare the landing grounds. Even where small planes and helicopters are used, the fog, the snowy winds and snow-storms make their operations dangerous and most difficult. In the face of these obstacles, even work-

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72 Thiel, The Soviet Far East (London 1957), p.180.

ing personnel or badly needed equipment, stores or supplies cannot be brought to the site on a time schedule. The planes and helicopters run the risk of total damage or mechanical break-down involving the lives of the personnel and the safety of costly stores and equipment carried by them.

The basic engineering system is of the extraction of energy from the various available resources, to derive energy by different methods suited to the resource. The principal role of generating energy in the region is played by hydel power stations. The operation of these stations involve intensive mass and energy exchange with the environments. For setting up a hydel power station, a reservoir has to be raised by heating a river stretch of 12 - 13 kilometers and melting an area of 3000 hectares into water. A new environmental condition has to be created to produce electricity. A break-down to the electrical machines and equipment in the process of installation or in operation even for a short duration of a few hours will result in the whole reservoir becoming frozen again. In the freeze, the remaining equipment also may lose working condition. A whole hydel plant may stop due to defects in the parts, big or small, dislocating the whole system which depends on vital instrumentation. Repairs take a lot of time and expenditure.

Besides the above problem of operating a hydel power station based on reservoir in permafrost river source, we can draw attention to further examples of technological problems in the generation of energy in the region. The problems were highlighted in the case of Bratsk energy and hydro-electric industrial complex. In course of time, the construction of the power station failed to withstand the harsh climatic conditions and the construction gave way by bursting. New research technology has to deal with the problems arising from the effects on materials and machinery, as well as on the materials of construction from snow-winds, frozen ground, etc.[73]

In order to protect machinery as well as the building constructions, paints are indispensable for the various items needing protection. The paints manufactured in the factories in the west to the normal standard requirements are not suitable for use in Siberian conditions. Paints suited to withstand the onslaught of Siberian climatic conditions have not been developed as yet. Paints are most essential for the protection of machines and various materials of diverse equipment and without proper paints being applied, the risk of damage and loss is enormous and a high cost industrial plant has no life.

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73 N.A. Krotov, "Geographical Effects and Problems of Industrialisation in Siberia", Soviet Geography, Vol V, No.9, November 1974, p.53.

PAPERS TO BE PRESENTED IN DIFFERENT SESSIONS

July 24, 1977

SESSIONS I: INDO-EAST EUROPEAN TRADE AND ECONOMIC COOPERATION - AN OVERALL APPRAISAL

- India's Trade with East Europe - An overall view.
  Sumitra Chishti

- India's Exports to East European countries - Issues and Prospects.
  O.P. Sharma

SESSION II: PRODUCTION AND TRADE COOPERATION OPPORTUNITIES

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- Engineering Goods Exports to East Europe - Engineering EPC

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- Trading Opportunities and Practices in East European countries - State Trading Corporation of India.

SESSION IV: EMERGING CHALLENGES AND OPPORTUNITIES - BROAD CONCLUSIONS

- Foreign Trade Outlook of East European Countries
  - V. Vithal Babu

BROAD CONCLUSIONS

(b) Constructional problems:

Next to engineering, in the electrical and mechanical systems, the problems of construction engineering in the construction of industrial buildings, the base and other structures, housing, educational facilities, etc., come up in magnitude for handling by new technology in Siberian conditions.

Under the present conditions, construction in Siberia is characterized by more consumption of time and very high costs because of the harsh climate and environmental conditions of the region. The Siberian industries are not in agglomeration and the distances between industrial plants vary from 200 to 300 kilometers in a given area. It is not easy to link all those plants and centers with railways or water-ways. The construction works are beset with many difficult problems.

If we take the basic need of construction for getting a cement mix or a cement concrete mix, an entirely different process of material handling has to be adopted in these conditions of frozen ground, wetness and extreme precipitation. It is impossible to do the mixing in the open air or on open frozen ground. The mixing of the materials has to be done in the required volumes in adequately heated places and since the mixed materials do not flow and will

got frozen in transit, they have to be conveyed to construction sites by means of conveyers in specially fabricated vessels with heating arrangements to keep the mix in condition for application and pouring to make the required structures. The additional problem in conveying the material to the construction sites is of the uneven physical features of the area in ground conditions, environments and distances. So, the problem of construction work is to have the materials prepared in convenient places with arrangements made beforehand for handling and mixing the materials and conveying them to the place of construction of buildings and structures. The work has to be done and carried on continuously without break as there can be no time lag between mixing the cement concrete in various grades and using the mix in the construction work.

The other modern methods thought of are to have ready-made structures of walls, pillars, beams, etc. prefabricated in factories elsewhere and lifted to the construction sites in the region. But these methods are found impracticable because of uneven physical features and inaccessibility of the areas where it is very difficult to carry the ready-made structures to the sites. In some regions, even for personnel and for small stores and equipment supply, only air transportation is possible. It is

impossible to transport the heavy pre-fabricated structures except to places served by ships through rivers and seas, where also numerous problems of cost and handling have reduced the feasibility of those means or cancelled any advantage to be derived in adopting them.

In order to overcome time delays obstacles of distances, it was proposed in 1965 to build a bridge across the Amur river planned to be completed in 1970. This bridge proved to be a most difficult task to construct owing to the great depth of the river at the place projected and also due to the very steep flow of water. The sharp fluctuations in the water level, the fierce frosts and winds and the winter ice created many difficult problems in the way of construction. Moreover, the labour force employed was inexperienced in this kind of work. The result of all these difficulties has been that the construction period is now projected to the ninth five-year plan period (1971-75).[74]

Like the North-Eastern branch, the second connection with Trans-Siberian through the Abakan-Tayshet railway was completed after a long delay with many stoppages of work because of the many technological problems involved in construction work in 1965. This line traverses some of the

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74 P. Krotov and I. Prostiakiv, "Concerning the Participation of Scientific Organisations in the Elaboration of National Economic Plan", Problems of Economics, Vol. XVIII, No.3, July 1974, p.79.

most difficult and inaccessible terrain in Siberia with many rivers and high mountains to cross. The projects of Abakan-Tayshet and the Achinsk-Abalakova railway lines were subjected to criticism by the Krasnoyarsk party secretary in 1966 because the highly technical machines failed to work in the harsh climate and environmental and uneven physical conditions and a lot of excess money over what was provided in the plan was spent to complete the construction works in this region.[75]

This state of construction technology problems could be illustrated in cases of many parts of Siberia. The blockage to mining development in the north-west Buryatiya for lack of constructions needed for transport is as good an example as any other. One other illustration of the problem is of the Sayan - Tunkinskiy area, the arc of high qualitative asbestos, bauxite, graphite and many rare and non-ferrous metal area. Admittedly, it is extremely difficult to link this place with transport constructional work and it looks like a primaeval lining. Any work is beset with much delay because of certain problems involved in handling the technical procedures and technical equipment. Most of the area is covered with permafrost which creates umpteen problems for machines and more men, money and time are required for constructing the railway lines. The great

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75 Ibid., p. 78.

distances between the industrial sites also created many problems in carrying specialized technical equipment in the areas.[76]

In the Tyumen' middle Ob' fields, for example, the needs of strong constructions were beset with problems of completing them through marshy forested terrain, menaced by floods, while the gas-fields further north, permafrost and foggy tundra presented impracticable obstacles to machinery and construction works. Similar difficulties were encountered in all northern areas of Siberia. With these complicated physical and environmental features, the technological shortcomings make the position acute for maintaining the machinery and for constructing the buildings and structures.

The great Lena river is entirely un-navigable, blocked by islands and numerous tributaries. Siberian river navigation is, of course, seasonal and only during the summer months when the rivers are free of ice. When frozen, it is hard to negotiate without the use of ice-breakers, which, as already pointed out, is full of technical difficulties. Another example is that of Nadym port on the Nadym river, now confronted with immense construction hazards. The problem is to collect the gas from the Medu-shiya fields some 50 km. from the north of Nadym. The

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76 Violet Conolly, "Siberia Today and Tomorrow", Collins Clear Type Press (London 1975), p.165.

nature of the terrain in the northern and far-eastern regions where there are many valuable mines, makes transport construction development extremely difficult. The expensive road journey involves sending supplies from Yakutsk to the mining regions of Esekhya, on the Lena river. This is another example where the construction problem is highlighted in Siberia.[77]

There is good reason to assume that there is intimate relationship between labour power and problems of brittleness in the region. We have already noted that those workers and technicians and engineers who were trained in the western part of the U.S.S.R. have to face many problems in putting up the machinery and equipment in the Siberian region, because of the effects of harsh climatic conditions on the machines and the materials. Parts and machines for repair have to be sent to the western regions and got back for fitting again in the Siberian sites. The problems can be resolved only by creating a specialised training based on research within the climatic and environmental conditions of Siberia rather than bringing trainers from the other parts of the country who themselves have to learn to work and know the effects of Siberian conditions. But at present it is not easy to set up training centers in Siberia, although in a few places small repairing faci-

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77 V.N. Bogachev, "Problems of Development of the Construction Industry in Siberia", Problems of Economics, Vol. XVIII, No.4, 1974, p.110.

lities have been set up, even these by facing numerous problems and difficulties related to the climatic and environmental conditions of the region.

In dealing with the effects of environment on labour and technology, much investment and time are consumed here. On the average, the actual cost of construction and installation work in Siberia exceeds the estimates by 30% - 40% over standard costs of construction. In eastern Siberia, construction cost exceeds by up to 85% while in the northern polar regions of the Tyumen', Norilsk industrial locations, the unit of physical volume of construction is 60% - 90% more in cost than stipulated estimate. The figures are compiled for normal climatic and geographical situations for constructions on the basis of national data. In the above regions, the construction costs would be 3 - 4 times as for similar objects of construction in western regions of the country. Therefore, even with the same growth rate of capital investment as in the national case, the cost of construction in Siberia would be 20 to 50 points higher than the U.S.S.R. average. This high cost of construction is directly or indirectly attributable to the adverse natural environment.[73]

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73 Ibid., p.80.

The permafrost covers 80% of the Siberian regions. Even in a comparatively settled areas - the Chita region, for example - additional expenditures to reinforce buildings and structures built on frozen ground comprise at least 20% of the estimated cost. At the same time, the harmful effects of permafrost on the operating conditions of the structures have not been overcome so far. The service life of the structures built on frozen ground is below normal. The correlation of various types of deformations that arises in the course of operation requires additional expenditure as high as 50% of the initial cost. Since the construction work in permafrost region is possible only in certain seasons of the year, the factor which disrupts the rhythm of construction and the organization of construction work on a flow line basis is an indirect factor underlying higher construction costs.

CHAPTER V

CONCLUSION

CHAPTER-V

C O N C L U S I O N

In the preceding chapters, we have described the extent and physical features of Siberia, the climatic and environmental conditions, and the natural factors that hinder the Soviet Union's endeavours in tapping the natural wealth of Siberia in any workable measure for the benefit of the country. Siberia, occupying more than three-fourth of the territory of the Soviet Union, is the largest land mass in the world less hospitable for normal human habitation and spread of human civilization with economic activities of cultivation and industry except in negligible locations in the normal course.

For a land area of nearly 12.8 million sq. km., after a long period of history, the population confined to inhabitable areas of West Siberia close to the Urals is only 12 million, in the East Siberian economic centres about 7.0 million and in the Far-East ports and town settlements about 5.8 million against the total of 242 million for the whole of the Soviet Union (according to 1970 census figures). Eighty per cent of the entire region being covered by permafrost with Arctic climate, the question is of how to make men and machines not only to go to the areas which attract attention for economic development and extraction of the

natural resources, but of how to make the men and the machines work in those intolerable conditions. In the earlier chapters, we have highlighted the problems of providing amenities for the men with food, clothing and shelter, the cost of inventives to make people, both skilled and unskilled, to go, stay and work there for the planned period, the in-migration and out-migration problems. We have inevitably dealt with the basic problems of transportation through roads, rail, river and sea-routes over vast ice-laden regions and phenomenal distances with hazards and risks to life, material and machines; with the limitations of air-transportation even for personnel and stores at stupendous costs; with the impassability of the terrain for wheeled vehicles; and with the most basic of all problems - the construction of buildings and multifarious structures including the pipe lines for oil and gas.

The resources which have come in for handling in Siberia in the first instance are of considerable importance. The foremost are oil and natural gas, the estimated resources being three-fourth of the total resources of the whole of the Soviet Union. In the same way, Siberian coal deposits are estimated at nine-tenth, and timber at four-fifth of the total resources of the country. There are large deposits of iron ore, and the largest scope for mining non-ferrous and rare metals. A few gold fields and one of world's largest diamond fields in Yakutia are in hand for development.

The energy problem is sought to be met with the biggest resource of hydro-electric power as the water resource is gigantic and perennial, subject to the technological problems of handling and installation of power stations on the basis of the ice-laden and heavily flooded rivers in permafrost conditions and most of them having course from south to north towards the Arctic.

The Soviet Union having its multiplied world trade since the Second World War and emerged as the second super power in the world balance, is hungering for material resources. Its national pride and the need to sustain its economy on any commensurate scale with standards of living comparable to the advanced western countries and Japan, spurs the Soviet planners on the ventures into Siberia. Any appreciable success can come only if the natural factors of harsh climatic conditions, the Siberian terrain and environments, the horrors of permafrost and arctic winds, could be overcome with evolution of new technology and scientific research in man management, transportation, production of materials and machinery and equipment and the ability to put up the required constructions and structures suited to withstand Siberian conditions.

A large number of big projects like petro-chemical complexes, metallurgical industries, timber and wood working establishments are either under construction or in partial

operation. The costs have been heavy and progress very slow with results nowhere near any economy of scale. The need is for a new technology based on new scientific research on men, materials and machinery yet to be evolved for Siberian conditions overcoming the natural factors.

The increase in industrial output in Siberia has not kept pace with the scale of investment. From the ninth to the tenth five-year plan, the investment increased from 10 per cent to 11 percent of the total for the Soviet Union and it will be further stepped up in the future five-year plans. Nevertheless, there has been steady increase in the quantum of output of various items between 1965 and 1972; iron ore from 8.2 million metric tonnes to 14 million metric tonnes; pig iron from 4.8 million metric tonnes to 9 million metric ronnes. The crude oil extraction rose from 6.7 million tonnes in 1965 to 65.2 million tonnes in 1972; petroleum from 4.4 million metric tonnes in 1965 to 64.4 million metric tonnes in 1970; natural gas from 0.6 million cubic meters in 1965 to 44 million cubic meters in 1972; Coal from 172 million metric tonnes in 1965 to 215 million metric tonnes in 1972. Electric power, the key industry to run all other industrial operations, produced 156 billion kilo-watt hours in 1972 as against 87 billion in 1965. As already stated in earlier chapter, the fuel industry, electric power, ferrous and non-ferrous metallurgy, logging of timber and wood processing gave 30 per cent of Siberian gross industrial output in 1940

which was higher than the average for the whole of the Soviet Union. The Siberian share in the gross Soviet industrial output was only 1.50 per cent in 1913 and 5 per cent in 1940; 12 per cent in 1945, it rose to 15 percent in 1970.

Keeping the political, military and economic goals of the country, the Soviet planners are making concerted efforts to step up at an accelerated rate the contributions of Siberia to National product. In the present situation of the Soviet Union, the speedy development of rich resources of Siberia has become a paramount necessity, but the economic development of Siberia within the natural environment described earlier is a matter of adventure and gamble. The natural environment is one of the most decisive influences on the planners' efforts. Even the limited scope of facts presented in this dissertation has clearly shown that natural factors influence almost all aspects of economic development of Siberia beginning from techniques of planning to even minute things like the use of paints on machinery. Some of the major influences of the natural factors on the pattern of economic development in Siberia can be summarised in the following ways.

1. Peculiar geographic conditions and the dispersal of natural resources in Siberia put severe limitations on the use oof planned techniques developed in the European parts of the country as the first party secretary of Kemerovo obkon expressed at the 24th Congress, "The development of Siberia

has its own special features and difficulties. In order to extract and place the riches of this region more effectively at the service of the people a more profoundly thought, thorough, specific approach isnecessary as well as a complete plan of development of this extremely rich region. This plan must take into account local natural climatic and mining geological conditions and the special need. . . . ."[78]

2. The problem of "vanishing man power" largely attributed to the environmental conditions makes its imperative that the pattern of economic development in Siberia should be characterized by high capital intensive technology.

3. The Natural limitations on transportation in Siberia necessitate the development of the region based on territorial production complex principles.

4. An investigation of the engineering technology applicable to Siberian conditions and the brittleness in permafrost conditions shows that the machinery and equipment evolved to suit different conditions are not suitable for Siberian environment. From this it follows that the economic development of Siberia requires substantial investment on research and development.

The above conclusions are tentative in nature, because they are based on a preliminary study of the impact of natural

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78 Pravda, 6 April 1971.

environment on the processes of economic development. Further the various issues raised in this dissertation require a far more in-depth study which is a time consuming proposition. However, the above study has established the relationship between the natural environments and the pattern of development in Siberia.

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