TRANSFER OF TECHNOLOGY TO ARAB-ASIAN COUNTRIES : SOVIET EXPERIENCE

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C O N T E N T S

P R E F A C E

International transfer of technology has become a subject of absorbing interest the world over. The emergence of the USSR in the second half of the twentieth century as a potential source of technology posed a serious challenge to the restrictive practices prevalent in the transfer of technology transactions. It brought about considerable changes in the pattern of international transfer of resources and economic relations. Unlike the trans-national corporations, the USSR pursues a specific policy on transfer of technology to developing countries. This policy on transfer of resources is said to have the basic objective of strengthening the technological capability of recipient countries. The existing literature on the subject seems to have given only a cursory treatment on this aspect of Soviet policy. The present study is a modest effort in this direction.

Gratitude, expressed in words, may not be always sufficient to reciprocate the cooperation extended. From the moment the idea of this topic was conceived to its eventual conclusion, my supervisor Prof. Zafar Imam enriched my imagination with valuable insights. I am deeply indebted to Prof. Imam, who was the inspiration behind this study.

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I N T R O D U C T I O N

Science and technology has been considered as an indispensable factor in the industrial and economic growth of nations. In fact, it is the most important productive force capable of not only spurring economic development but also its self-generation and perpetuation. Historically, technology has been an important determinant to the relative and absolute growth of nations and to the concentration and dispersal of economic prosperity. Major technological changes have always been accompanied by, or have led to, significant changes. At the same time, adaptability of the social and economic organisations of the society is a prerequisite for transfer, diffusion and development of new technologies.

The Industrial Revolution made Europe the centre of production. Countries in Asia, Africa and Latin America were integrated as an adjunct to the needs and development of the Centre. These countries were reduced as mere suppliers of cheap raw materials, labour and vast market for manufactured goods. The Centre imposed a growth mechanism in the Periphery countries which altered its pattern and pace of socio-economic development, often creating harmful distortions and perhaps many undesirable and unintended consequences. The benefits of the new

production system tend to be mostly absorbed by a limited section of the society. It resulted in the development of some societies and underdevelopment of many others. The anomalies that have been created by colonial exploitation have proved to be inconsistent with the needs of developing countries. Economic backwardness and poverty, which these countries have inherited from their colonial past, cannot be reduced without the active support of developed countries. Hence, economic aid and technology from industrially advanced countries are essential prerequisites for their further development.

Unfortunately, in the post-War period, technology has become an instrument of domination and control. The relative decline in the overt forms of military and economic power of the major industrialized countries is leading them to turn more and more to technology as a means of maintaining their position in the international economic and political system. Consequently, transfer of technology has become an important factor in international politics.

According to a background paper prepared by the UNESCO, "Science is generally defined as ordered or systematic knowledge, the development of which proceeds by accepted criteria. In practice, it is the systematisation of observed facts, and the strength of its

productive function, which make science a preeminently usable form of knowledge in the service of man and his advancement..... Technology, on the other hand, is not so easy to define or grasp as science. It implies more than sheer knowledge and know-how is one of its essential and intrinsic ingredients."[1] Technology involves the systematic application of scientific and other organised knowledge to practical tasks. It also means social and economic atmosphere in which such application will take place.[2] Furthermore, technology refers not only to ways of producing goods, but also ways of fulfilling needs and deriving satisfaction. The noted Indian economist Amartya Sen rightly points out that "Even the attitudes and values of people in a sense form part of technology since they affect the capabilities of a nation".[3] Technology is critical to development because it is a resource and the creator of new resources, a powerful instrument of social control, and affects

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1. UNESCO, Doc. A/CONF.81/BP/UNESCO, pp. 18-19.

2. Charles Cooper, "Science, Technology and Production in the Underdeveloped Countries: An Introduction," The Journal of Development Studies, October 1972. Vol 9, pp. 1-18.

3. Amartya Sen, "The Concept of Efficiency," cited in UNCTAD Doc. TD/190, Transfer of Technology (Item 12-Main Policy Issues), 1975, p. 5.

decision-making to achieve social change.[4] In the context of the present study, "Technology refers to different types of knowledge which may be embodied in the form of machinery, equipment, or in the form of information-designs, specifications, project reports or in the form of know-how - technical, managerial or marketing skills."

The role of science and technology in the UN concept of development is indicated in the resolution on international development strategy for the Second UN Development Decade. Some of the general points in the document are:[5]

- the expansion of the capability of developing countries to apply science and technology to development and to reduce technology gap (para 60);
- the increase, by developing countries, of their expenditure on research and development averaging 0.5 per cent of their GNP (para 61-63);
- strengthening of mutual cooperation and assistance to promote science and technology in developing countries (para 62-63);
- the establishment of a programme for promoting the transfer of technology to developing countries.

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4. Denis Goulet, The Uncertain Promise: Value Conflicts in Transfer Technology (New York, 1977), pp.7-12.

5. UN Resolution No.2626 (XXV), 25th Session, Supplement No.28 (A/8028), p.39.

Volker summarises the role of science and technology for development in terms of optimism, pessimism and realism.[6] Scientific and technological optimism, as characterised by UN documents, view that the fruits of applying science and technology to development, hitherto enjoyed by a few countries only, should be made available to all countries and regions of the world. Pessimistic approach regards the scientific and technological change as a source of many critical social problems, rather than a means to solve them. Hence, this perspective stands in clear contradiction to the prevailing UN concept. Realist perspective assumes that science and technology play a pervasive role in social dynamics:

- that science and technology can help solve social problems and contribute to development;
- that the appreciation of science and technology to solve social problems frequently entails unintended consequence that may be detrimental to development efforts;
- and that science and technology can be, and have been, used for wasteful and destructive purposes.

One of the most important means of solving the problems of underdevelopment prevailing in the developing

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6. Volker Rittberger (ed.), Science and Technology in a Changing International Order (Westview, Boulder, 1983), UNCTAD, Chapter I, p. 15.

countries is industrialisation. It will solve problems related to unemployment; standard of living of nationals; mobilisation and effective utilisation of national resources, and foreign exchange which is the key element for further industrialization. Developing countries are dependent on developed countries for technology which is an important pre-requisite for industrialisation. Hence the need for a transfer of resources from developed to developing countries.

In the spectrum of industrial technology, developing countries are unequal partners. Developed countries not only possess technologies that developing countries do not, but their technological advantage is sustained by research and development (R & D) efforts.[7] This is evident from the fact that developed countries account for 97 per cent of R & D expenditure and 80 per cent of scientists and engineers. Among the various factors responsible for this limited impact of science and technology in developing countries are:[8]

(i) the weakness of scientific institutions in the developing countries;

(ii) scientific work is of less economic and social relevance to the country;

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7. UNIDO Doc. A/CONF.81/BP/UNIDO, Strengthening of Technological Capabilities of Developing Countries: A Framework for National Action (Vienna, 1979), p.9.

8. UNCTAD Doc. TD/B/C.2/119/Rev.I, Restrictive Business Practices in Relation to the Trade and Development of Developing Countries (New York, 1974), p.26.

(iii) research and development practically does not exist in developing countries;

(iv) the weight and orientation of advanced country science and technology and its impact on the developing countries in three ways:

(a) the internal brain drain resulting from the poor perception of science and technology in developing countries and weakness to make policy decisions;

(b) external brain drain resulting from the incapacity of developing countries to absorb science and technology personnel as well as on the encouragement of the flow of personnel from developing countries to developed countries;

(c) the adverse composition of the stock of knowledge.

Hence, it has been recognised that major structural changes cannot occur without the injection of new techniques appropriate to the requirements of developing countries.

Thus, it is amply clear that international transfer of resources has a specific role to play in the restructuring of international economy. The process of international diffusion of technology from one country to another is known as transfer of technology. "Transfer of technology involves transfer of skills embodied in products, processes and

persons. It often also involves patents, designs, trade marks and other technical data.[9]

Today, about 90 per cent of world trade in technology takes place within the industrial world, and of this, more than half is through trans-national corporations based in the developed countries. The transfer of technology as a part of international trade and sometimes aid, occurs for various reasons, which involve either the requirement of the recipient country or those of the supplier country or both.[10] Technology as a product, artefact, process, technique, patents, designs and its knowhow can be imported or bought to augment or improve the production capacity and efficiency in terms of its social, economic or political cost-benefit calculations, to effect import substitution, or still, to exploit new natural resources. At the same time technology can be sold either to increase the share of a particular market and its profits to combat a potential competitor, to ensure future market dominance or simply to get rid of surplus and obsolete technologies. Hence the logic of demand does not always correspond with the logic of supply.

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9. UNIDO Doc. A/CONF.81/RP/UNIDO, n.6, p.32.

10. UNCSTD Doc. A/CONF.81/5/ADD.2/ITEM No.7, Science and Technology and Future, (New York, 1979), p.37.

Typology of international transfer of technology can be generally classified into four categories:

(1) Transfer of technology among developed countries;

(2) Transfer of technology from developed to developing countries;

(3) Transfer of technology among developing countries;

(4) Transfer of technology within a country among various enterprises.

Transfer of technology can be either vertical or horizontal.[11] Vertical transfer is generally internal to the enterprise and takes place by the incorporation of new scientific knowledge from the idea stage to its final development. Horizontal transfer involves the transfer of proven and tested technology - from one country to be adopted, modified and applied in another country.

Trans-national Corporations are the important carriers of technology in the world. The method of their operation and mechanisms involved in the transfer process have unleashed many controversial issues. Most often it has become detrimental to the development needs of newly independent countries. Hence, an evaluation of existing

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11. Mascarenhas, R.C., Transfer and Development: India's HMT Company (Westview, Colorado, 1982), p. 13.

mechanisms and major issues will give an insight for a better appreciation of Soviet policy and experience on transfer of technology to developing countries.

Capital goods sector is either very backward or practically non-existent in most of the developing countries. Hence, at least, in the initial stage of industrialization, they have to import technology and equipments from developed countries. Import of technology to this vital sector of national economy perpetuates dependence on developed countries. Contrary to their interests, the exploitative policies and discriminatory practices thwart all efforts towards development in developing countries. In this context, the USSR, that has built a modern and competent capital goods sector, is highly important to developing countries. Emergence of Soviet Union as a source of technology has gone a long way in reducing the monopoly practices of trans-national corporations. In fact, it has restructured the post-War international economic relations. Hence, the evaluation of Soviet experience, in the light of the activities of multinational corporations, in transfering technology to developing countries will be interesting as an academic exercise and relevant to national requirements.

In the present study it is proposed to assess the Soviet experience in transfer of technology to select developing countries, viz., India, Iran and the Arab Republic of Egypt. These countries are selected for the following reasons:

(i) The socio-economic, scientific and technological infrastructure and environment are appreciably comparable.

(ii) Among the developing countries these are recipients of Soviet technology in the capital goods sector.

(iii) Barring variations in degrees, the absorptive level of the society as a whole, scientific and technological manpower, the markets and administrative setup in these countries are also comparable.

(iv) The level of socio-economic development and the dependence on foreign technology is also comparable.

(v) All these countries were liberated from colonialism after the Second World War and therefore, the impact of the legacy of colonialism is manifest more or less comparably.

(vi) In addition, all the three countries pursue the policy of non-alignment in the conduct of their foreign policy.

The nature of the present study may, thus, be seen as an enquiry into the Soviet policy on transfer of technology to developing countries, with a view to understanding its features. Due to paucity of data and relevant documents, it has not been possible to lay adequate emphasis on the Soviet experience vis-a-vis Iran and the Arab Republic of Egypt, and hence the emphasis on India.

Chapter I

INTERNATIONAL TRANSFER OF TECHNOLOGY: MECHANISMS, MAJOR ISSUES AND TECHNOLOGICAL DEPENDENCE

In spite of the accelerating pace of scientific and technological development in the twentieth century, the majority of developing countries, though in varying degrees are in a state of technological dependence. This is accounted for by a series of asymmetries in the structure of commodity patterns, ownership of means of production including technical knowledge and skills, the share of world trade, access and control over financial capital resources and initiative.[1]

Technological dependence of developing countries has its origin in the restrictive practices prevalent in transfer of technology transactions. Trans-national corporations, with their monopoly power and superior bargaining capacity, transfer technology selectively through such channels and mechanisms that serve their interests best. Consequently, it may be inconsistent with the interests of recipient developing countries. It has led to several major issues in the transfer of technology. An enquiry into the channels and mechanisms

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1. UNCTAD, IV Doc. TD/190, Transfer of Technology (Item 12- Main Issues), 1975, pp. 6-8.

and the major issues will enable us to assess transfer of Soviet technology to developing countries on the proper perspective.

1.1 Mechanisms and Channels for the Transfer of Technology

"Mechanism for the transfer of technology is, any means for making available to a production enterprise, those elements of technical knowledge, which may be unavailable in the domestic economy, required to set up or operate production facilities."[2] Each of the elements of technical knowledge may be transferred in a variety of ways and even the transfer of one element by itself may involve a number of mechanisms.[3]

The range of alternatives for a particular project includes at one extreme, not acquiring the foreign technology at all through any vehicle or acquiring it through a spectrum of mechanisms ranging from direct investment to various cooperation agreements. Before World War II, foreign investment was almost the exclusive form of arrangement for transfer of resources to developing countries.

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2. UNCTAD Doc. TD/B/AC.11/5, The Channels and Mechanisms for the Transfer of Technology from Developed Countries to Developing Countries, (New York, 1971), p. 12.

3. Ibid., p. 5.

Most often, it has accelerated economic and technological dependence. This tendency started changing in the post-War years and continue to change, mainly due to three factors, including the capability of Socialist countries to supply technology to developing countries.

The choice of mechanisms in the transfer process is conditioned by various factors such as government legislation in the host country; political and economic uncertainties; the extent and nature of control the supplier wants to exercise; nature of distinctive capabilities in terms of process technology, marketing advantage or managerial and organizational monopoly/quasi-monopoly position of the technology possessed by the supplier.

Overseas enterprises prefer transfer of technology to exports because of:[4]

(a) the international differences in relative factor prices;

(b) transfer takes place because of restriction on trade imposed by the host country governments;

(c) transport and labour costs are a high proportion of the value of the produce, hence incentive to produce abroad.

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4. Ibid., pp. 37-40.

Proprietary technology held by multi-national corporations is normally made available to developing countries on unfavourable terms. They often transfer technology through such channels which maximise their profit and reduce the risk factor. For example, some firms are unwilling to enter into minority joint ventures whereas they are quite willing to transfer technology through wholly owned or controlled subsidiaries, as the case may be. Some firms are not prepared to license patented knowhow without receiving a substantial minority share in the capital of the enterprise, while others prefer only to act as licensers, provided the terms of licence are satisfactory.[5] Experience suggests that the availability of alternatives to developing countries depends on the structure of industry and the strategy of individual suppliers.

Mechanism for the transfer of technology assumes two dimensions - direct and indirect. The former includes direct contracting of individual experts and consultant companies, engaging them in engineering, design and plant construction responsibilities, training individuals for specific production projects, and for acquiring technical

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5. U.N. (Department of Economic and Social Affairs), Doc. E.74.11.A.7, Acquisition of Technology from MNCs by Developing Countries (New York, 1974), p.25.

information and transfer of process technology embodied in capital goods, by importation of equipments purchased directly from machine manufacturers.[6] Direct mechanism is generally possible when there are no restrictions on the availability of process technology through patents or proprietorship. Direct purchase of plants and equipments plays the most important aspect of direct transfer of technology. It presupposes an amount of technological capability on the side of developing countries.

Mechanisms for indirect transfer of technology is defined as "those where an enterprise in the advanced country is interposed between various individuals, groups and enterprises which can supply technical knowledge, and the recipient in developing countries".[7] Indirect mechanisms are more prevalent in sectors where technology is highly sophisticated and changes rapidly. There are various mechanisms for the transfer of proprietary technology. An UNCTAD study classifies the mechanism for transfer of technology as follows:[8]

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6. UNCTAD, n.2, p.25.

7. Ibid., p.25.

8. UNCTAD, Doc.No.E.72.11.D.79, Guidelines for the Study of Transfer of Technology to Developing Countries (New York, 1972), p.8.

(1) The flow of books, journals, and published informations;

(2) The movement of persons from one country to another;

(3) Education and training;

(4) Exchange of information and personnel through technical cooperation programmes;

(5) Employment of foreign experts and Consultancy Arrangements;

(6) Import of machinery and equipment and related literature;

(7) Licence agreements for production process, use of trade marks, patents, etc.

(8) Direct foreign investment.

M.A. Chudson, an expert on the subject, lists the channels and mechanisms for transfer of technology in a coherent and systematic manner as follows:[9]

(1) Direct investment

(2) Joint Ventures/Minority Joint Ventures

(3) Licensing

(4) Management contracts

(5) Turnkey projects

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9. For a detailed discussion see UNITAR R.R.No. 13/1971, The International Transfer of Commercial Technology to Developing Countries (New York, 1971)

(6) Equipment suppliers

(7) Consultancy services.

Many projects transferred may involve a combination of two or more of the mechanisms mentioned above. Technology can be acquired through any of the mechanisms, depending on the technological capability of the recipient and monopolistic position of the supplier.

(i) Direct Investment:- Direct investment by a foreign firm in a wholly, or majority-owned subsidiary is a predominant form of transfer of technology to developing countries. Foreign direct investment refers to "investment abroad, mostly an element of control by the investor over the corporation in which the investment is made".[10] A study conducted by the UN Centre for Trans-national Corporations on direct foreign investment in developing countries concludes that direct investment was the most important channel for transferring technology from developed market economy countries. There was an upward growth in direct investment to developing countries in the sixties and seventies, mainly in the consumer and service sectors of economy. The purpose of foreign direct investment by trans-national corporations is primarily to take advantage

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10. UN Centre on Trans-national Corporations, Doc.ST/CTC/114/ Salient Features and Trend in Foreign Direct Investment (New York, 1983), p.1.

of availability of raw materials and relatively low factor costs, particularly of labour.

During the period 1960-79, about 90 per cent of the net flow of direct investment to developing countries from developed market economy countries continued to originate in Canada, France, Italy, Japan, the Netherlands, the U.K., and the U.S.A. The main source of direct investment in developing countries was the U.S.A. which accounted increasingly for more than half of the total, especially in the late seventies. Foreign direct investment has largely taken place in relatively few developing countries, many of which have a comparatively high per capita Gross National Product (GNP). In 1971, twenty developing countries accounted for almost two-thirds of the total stock of direct investment in developing countries. This share increased to nearly three-quarters in 1978.[11]

International firms prefer direct investment to licencing where;[12]

(a) the financial and human resources are available;

(b) control over present and future market development is desirable;

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11. Ibid., para 50, p.16.

12. Jack Baranson, "Transfer of Technology Through International Firms," American Economic Review (May 1970), p.435 cited in UNCTAD Doc.n.8, p.21.

(c) the firm fears licensing will result in the give away of valuable know-how or will threaten its position in established markets;

(d) the transfer involves a broad line of products or an integrated part of marketing and financial management;

(e) the technology is highly complex or the foreign affiliate lacks industrial sophistication and the transfer requires a prolonged and sustained relationship to effect the transfer; or

(f) there is concern over protecting product standards or trade name.

The total flow of foreign direct investment to developing countries from the developed market economies increased at current prices and exchange rate from $1.8 billion in 1960 to $3.7 billion in 1970.[13]

Technology, at times, will not be available through any other channel other than direct investment. Direct investment is primarily meant to maximise returns and monopolise profit. It provides absolute control to the investor, which shall be misused in such a manner that impedes the transfer process and the development of the recipient countries.

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13. UN (Centre on Trans-national Corporations), n.10, para 43, p.15.

(ii) Joint Ventures/Minority Joint Ventures:- In this case, a company from the developed country establishes an organization in developing countries with a partner from the latter. An accepted precise definition of joint venture is lacking, as the percentage of foreign-held equity declines a parallel contract is concluded defining with more or less precision the rights and obligations of the parties, thus establishing a sub-category, often referred to as a "contractual joint ventures."[14] Normally, in joint venture, the local government/enterprise owns a majority share of capital, to ensure greater local control, sharing of profits, training and sharing of management skills and information, which may be otherwise inaccessible.

Voluntary joint venture represents voluntary combination of complementary skills and resources, whereas mandatory joint venture implies that the foreign partner has the necessary cooperant capital, technology and other inputs. Eventhough royalty payments will be a bit higher for joint ventures in comparison with wholly-owned subsidiary, the price of intermediate goods will be much favourable to the recipient. Joint ventures are considered to be better for developing the technological capability of developing

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14. UN (Department of Economic and Social Affairs), n.5, p.23.

countries, as considerable element of control will lie with the host country.

(iii) Management Contracts:- Pugh defines management contract as "arrangements where operational control of the enterprise is vested by contract in a separate enterprise, which performs the necessary managerial functions in return for a fee."[15]

Management contracts offer another alternative to direct investment. It eliminates from the package provided by the multi-national corporation the equity and possibly the loan capital, and the basic control that this affords, but leaves in tact the package of technology and management needed to produce and market a product.[16]

A management contract can include a wide range of functions and responsibilities and a variety of formulae for compensation. Generally, compensation formula depends on the bargaining position of both sides as well as alternatives available to the recipient country. The managing firm normally will not accept the uncertainty of profit-based formula and insist a guarantee of minimum remuneration in the form of a lump-sum payment or a percentage of sales. Management contract assures the recipient country

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15. UNCTAD, n.2, p.39.

16. UN (Department of Economic and Social Affairs), n.5, p. 24.

efficiency and continuity of management, uninterrupted supply of technology and training of local personnel, combined with an element of local control.

(iv) Turnkey Project Agreements:- The distinguishing characteristic of the Turnkey project Agreements is that the supplier of technology 'carries out' the full range of technical and managerial operations needed to establish an enterprise, and turns over the management of the enterprise in full operating condition to the local owner as soon as he is prepared to assume it.[17] The important feature of turnkey project agreement is that all the skills required to marshal and organise market consultants, engineering designs, machinery supplier, plant construction and the like are provided by the supplier and the recipient country pays for the services and supplies as stipulated in the agreement.

Turnkey project agreements will help the developing countries in the initial stages of industrialisation to establish infrastructural and basic facilities required for technological capability. Turnkey project agreement on a government-to-government basis is one of the important features of Transfer of Technology from socialist countries to developing countries.

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17. UNCTAD, n.2, p.38.

(v) Equipment Suppliers:- Equipment suppliers are a very important source of technology to developing countries. In this case, technology is unpackaged. The cost of technology is included in the purchase price of the plant/ machinery.[18] The conditions for transfer through machinery/ equipment supplies are most favourable in manufacturing sectors, which are already well established in many developing countries.[19]

(vi) Licensing:- Licensing is a favourable alternative to direct investment for developing countries. Licence is looked upon as a means of acquiring a given element of technology quickly in order to develop the technological capability of the recipient country. Technology in the licensing terminology refers to 'proprietary and non-proprietary information and skills, the use of which gives its owner a competitive or superior technological position.[20] The basic idea of licensing is the granting of a legal right. To the licensor, licensing appears as a marketing alternative, the essence of which is to move production to the market, but in the hands of a licensee. To the licensee, licence appears as a

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18. U.N. (Department of Economic and Social Affairs), n.5, pp.25-27

19. UNCTAD, n.2, p.20.

20. UNIDO Development and Transfer of Technology Series No.12, Guidelines for the Evaluation of Transfer of Technology Arrangements (Vienna, 1979), p.1.

suitable means of increasing his share of the market through diversification or improvement of his range of production, based on the use of licensers' R & D activities. Licensing seems to be highly attractive because the technical element being transferred is clearly identified, the business risks of both parties are less than those involved in direct investment, and the commercial arrangements are straight-forward normally. On the payment side of licensing agreement the recipient pays a stream of fees that are generally based on sales over a limited period.

An UNIDO study classifies various licensing agreements, commonly used in developing countries in six categories.[21] It includes (a) Franchise agreements; (b) two service agreements (Technical Assistance Agreement and Engineering Contracts), and (c) three types of agreements concerning industrial property in patents, trade marks and know-how.

The Franchise Agreements- Franchising is a system of distributing goods or services that is often associated with high reputation trade and service marks in which the franchiser supports, trains and to some extent,

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21. Ibid., p. 3.

controls the franchisee in selling the goods or in rendering the services.

The simplest system of Franchising is the product distributism franchise, where the dealer works only with one company's product. The franchiser may supervise the location and constructism of site, advertisement, training of management practices etc.

The Technical Assistance Agreement:- Technical assistance refers to the components of technical information and services that lie outside know-how and patents. In this case, the recipient gets manufacturing and marketing services either directly or through sub-contracts. Generally, supplier inputs are basically informational and managerial, except when the firm supplies materials and machinery. Informational inputs include lay-outs, designs, specifications, literature, etc. Technical assistance agreement can be either 'short term service agreement' or 'continuing service agreement'.

The Engineering Services Agreement:- 'Engineering services agreement is a short-term contract that lists the technical work, the supplier of engineering service is required to perform'. The most common situation is for the engineering firm to design the basic plant, with the licensee disclosing to the engineering firm the process know-how acquired from

its licensor. In this case, inter-relationship between the engineering firm, the licensor and the client is desired. Division of responsibility among the three parties will lead to 'interface problems' related to know-how.*

Patent Agreements:- Patent system is not very well-developed in many developing countries. Licensors insist on the inclusion of patent** clauses - thus obtaining legal rights - when technology is transferred through patent agreements to developing countries.

Misuse of patent agreements are quite common in the international transfer of technology in various forms as follows:[22]

(1) require the licensee to licence patents that he does not want in the package with those he does;

(2) require the licensee to purchase the licensor's unpatented products;

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*Know-how comprises of two parts: (a) information ordering the design and construction of the plant and (b) information relating to plant operation. In the first instance, interface is mostly between the engineering firms and know-how supplier, whereas in the second case, interface is mostly between the client and know-how supplier.

**Under patent statutes, the patentee has property rights over his invention, thereby prohibiting unauthorised use of inventions. In socialist countries, the state is the sole owner of patents.

22. Ibid., p.8.

(3) royalty payments even after the expiry of patent rights.

Many developed countries have developed various measures to prevent the abuse of patent system, such as 'Anti-trust laws' in the USA and the EEC or the 'US doctrine of patent-use'.

The Trade Mark Agreement:- Trade mark is distinctive visual and sometimes oral symbols, emblems or words that a firm applies to the goods it trades in or to the services it performs, to trace its source of origin. Trade mark is a very important aspect in the marketing and sales of products. Trade mark constitutes proprietary rights to its owner, but unlike patents, it does not have any statutory limitation to its life. The concept of licensing of trade marks is relatively new in the international scene.

Trans-national corporations charge exhorbitant rates for the use of trade mark in developing countries. Licenser tends to prolong the life of the agreement by licensing a trade mark that is otherwise of secondary value to the licensee or the sale of the product.

Composite arrangements for trade mark and know-how rights are made by certain licensors while the applicable fee is charged for the use of trade mark; hence if the

know-how fails to perform as warranted, the licensor can be absolved of any financial liability.

Trade mark agreements may carry clauses for compulsory approval of product quality by the licensor for using the trade mark; it leads to several problems such as:[23]

- compulsory purchase of raw materials and other items which are otherwise available on favourable terms;
- restraints on the volume of sales;
- restriction on the sale of products outside the purview of trade mark use.

Know-How Agreements:- Know-how lies between technical assistance agreements and patents. Like technical assistance, know-how is a package of technical information, but unlike it, substantial part of the information is kept secret.

Know-how has four characteristic elements such as utility, novelty, confidentiality and value - the latter two imposing a complex of obligations on the licensee.[24] Licensee's obligations, when know-how is transferred are related to exclusivity of use; territory and field of use;

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23. Ibid., p.34.

24. Ibid., p.12.

site of manufacture; volume of production; use only by persons concerned; secrecy period; cease-use provisions, process improvements etc. which will be discussed in the next section. On the payment side, licensor's expectations include profits from sales of components and intermediate items, apart from royalties, through tying of purchases of intermediates to know-how agreements.

These excessive obligations place heavy limitations on the technological development of the recipient country. Most of the obligations are discussed in the next section on major issues.

1.2 Major Issues in the Transfer of Technology

The practice of trans-national corporations in the transfer of technology to developing countries has led to several major issues. The origin of most of these issues can be traced to cost and control factors. Profit has been and continues to be, the motivating factor in the technology transactions of these corporations. Maximisation of profit presupposes maximum control over the transfer process. Explicit clauses and implicit practices in contractual agreements increase direct and indirect costs of transfer of technology. It is evident from the fact that the net value added by all trans-national corporations was estimated to be $500 billion

in 1971, or over one-and-a-half times the Gross Domestic Product (GDP) of all developing countries.[25]

The nature of these restrictive practices prevalent in the technology transactions varies from country to country and sector to sector. It hinders the development of domestic technological capability of recipient countries at various levels of selection, acquisition, absorption, adaptation and innovation of technology. Moreover, it affects the growth of economy through adverse effects on skill formation and diffusion of the transferred technology. It should be noted that some restrictions are inherently bound up with the commercial character of technology transfer and the proprietary interest in technology. Unfortunately, most restrictive practices seem to be abusive and unfair even in the light of commercial interests.[26] The first part of the proposed code of conduct formulated by the UN deals with general and political issues.[27]

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25. UNCTAD Doc. TD/B/C.2/119/Rev. I, Restrictive Business Practices in Relation to the Trade and Development of Developing Countries (New York, 1974), p. 4.

26. Oscar Schachter, "Transfer of Technology and Developing Countries," in Kamal Hussain (ed.), Legal Aspects of the New International Economic Order, (Nicholas Publishing House, New York, 1980), p. 157.

27. Samuel K.B. Asante, "Code of Conduct on Trans-National Corporations," in Kamal Hussain (ed.), Legal Aspects of the New International Economic Order (Nicholas Publishing House, 1980), p. 12.

An evaluation of the restrictive practices employed by the trans-national corporations in developing countries will highlight major issues in the transfer of technology. It can be broadly categorized into restrictive practices related to control factors and cost factors.

(a) Restrictive Practices Related to Control of Technology

(i) Restrictions on Field of Use, Volume or Territory:- Field of use restrictions limit the area in which the recipient may use the technology and ban him from extending his production to other goods, which might be of greater use for local needs or might have a greater chance of being exported.[28] Restrictions on volume of production occur in the form of maximum and/or minimum production quotas, restriction of production facilities or prohibitions of technology in other plants. Restrictions on production quota will be at disadvantage of export possibilities and consumers.[29] The treatement of volume and territory restrictions in national legislation differs considerably in developing countries. The legislation of certain

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28. UNCTAD Doc. TD/B/C.6/AC.I/2/Supp.I, Preparation of Draft Outlines of an International Code of Conduct on Transfer of Technology (New York, 1975), p.40.

29. Ibid., p.41.

countries consider volume and territory restriction as a part of the rights conferred by the industrial property right.

(ii) Restrictions After Expiration of Industrial Property Rights of Loss of Secrecy or Secret Technical Know-how:- Normally, restrictions or payment obligation based on an industrial property right must terminate when the industrial property right expires. But in many transfer of technology transactions, restrictions or payment obligations are artificially prolonged beyond the life-time of the main patent by referring to the expiry of the last improvement patent or basing restrictions on patents actually not exploited by the licensee. It is much common in 'package licensing'.*

Transfer of technology arrangements, especially the secret know-how agreements, may contain restrictions imposed upon the technology recipient which continue even after the expiry of the arrangement such as prohibition to compete, restrictions on R & D activities and in particular the obligation to keep secret and not to make use of the confidential information after the expiration of arrangements.[30]

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*'Package Licensing' is a method employed by multi-national corporations to force the recipient to acquire technologies that the latter neither wants nor needs.

30. UNCTAD Doc. TD/B/C.6/72, Control of Restrictive Practices in Transfer of Technology Transactions (New York, 1982), p. 15.

Many transfer of technology arrangements contain clauses relating to the duration of the contract and the obligations even after the expiry of the contract, such as continuing payment of royalties, or the obligation not to use or not to pass on the technology after the expiration of contract.[31]

If the duration is too long, it may mean that technology will be outdated or inadequate to the new requirements of the recipient country.

(iii) Challenge to Validity:- 'No challenge' or 'Non-contestation' clauses in the transfer of technology agreements require the technology recipient not to challenge the validity of the rights granted under a transfer agreement.[32] It is based on the argument that since payment obligations and restriction on the validity of rights transferred, the non-contestation clause has the effect of safeguarding the basic conditions for payment.

(iv) Quality Control:- Transfer of technology agreements may contain quality control clauses, obliging the technology recipient to comply with certain quality standards. But multi-national corporations abuse these clauses on quality

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31. UNCTAD, n.28, p.46.

32. UNCTAD, n.30, p.20.

control and product standard requirements to ensure control over the recipient with respect to decision making and access to foreign personnel. Quality control provisions are used as a means to tie in improperly, products sold by the licenser or otherwise to ensure the dependence of the licencee.[33] These restrictive requirements, in turn, prevent adaptation of technology to local needs.

(v) Restrictions on Research and Development (R & D) and Grant-Back Provisions:-

Restrictions on R & D may be concerned with either further research, improvements and adaptations to the technology transferred or related to R & D of competing technologies. The total/partial limitations on the recipients freedom to introduce changes in the acquired technology always affect the development of scientific and technological capability of developing countries.

Grant-back provisions constitute another form of limitation on the recipients ability to benefit from the R & D activities. Transfer of Technology agreements with 'Grant-back clauses' provide that the recipient is obliged to 'Grant back' or pass on to the licencor, often free of charge, any inventions or improvements that are or might be made to the imported technology at some future date.[34]

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33. Ibid., p. 22.

34. UNCTAD, n. 28, p. 72.

Most of the developing countries prohibit unilateral grant-back obligations, especially those imposed on the licensee as it adversely affects the adaptability and innovation capability of the recipient.

(vi) Non-Competition Clauses:- Transfer of Technology contain non-competition clauses designed to protect the interests and markets of the supplier. Prohibition on competition restricts the freedom of the technology recipient to enter into arrangements related to competing or other technologies or products not furnished or designated by the supplier.[35] Direct forms of prohibitions on competition are the obligation of the recipient not to manufacture or sell competing products, not to acquire competing technologies, or even to terminate the further use of technology and products developed by the recipient himself. Indirect forms of non-competition clauses may oblige the recipient not to cooperate with competing enterprises or to pay royalties if he sells or manufactures competing products.[36]

(vii) Tying:- Tying clauses are provisions, which impose upon the acquiring party the obligation to acquire, apart from the technology wanted, additional inputs such

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35. UNCTAD, n.30, p.32.

36. Ibid., p.32.

as raw materials, intermediate products, machines or additional technology from the supplier, or from a source designated by him.[37] The acquisition of the additional goods may be the condition for obtaining the technology itself. Empirical studies show that tied purchase provisions are used as a source of additional income for the supplier and often as a means of overpricing the inputs. It limits the recipient's choice from alternative channels for other elements of technology on favourable conditions. Tied purchase clauses connected with transfer of technology transactions not only affect production cost, through overpricing of inputs, but also may have important effects on the import substitution, export diversification and growth efforts of developing countries.[38]

(viii) Restrictions on Distribution Channels - Exclusive sales or representation arrangements limit the freedom of the recipient to organize its distribution system independent of the supplier. Such agreements may not only increase the dependence of the recipients, but also deny access to the suppliers distribution system. Some transfer of

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37. Ibid., p. 36.

38. UNCTAD Doc. TD/B/AC. 11/10/Rev. 2, Major Issues Arising from the Transfer of Technology to Developing Countries (New York, 1975), p. 17.

agreements contain provisions reserving the supplier the right to fix resale prices or other resale conditions.

(ix) Export Restrictions:- Export restrictions are quite common in the transfer of technology agreements concluded by developing countries with multi-national corporations. An export restriction can either be a restraint on exports from other countries into the country of the recipient or a restraint on exports from the recipient country.[39] Export restrictions can take a variety of direct and indirect forms. Direct explicit restrictions such as global ban on exports, export restrictions or export permission for specified countries only and higher royalties for exported products, etc. Direct implicit restrictions are usually related to the operation of multinational corporations by virtue of their equity and management control over subsidiaries and affiliates.

Indirect explicit export restrictions can take a wide variety of forms, chief among them being requirements of prior approval for exports, additional higher royalties on output designated for export, quality requirements for exports, exclusive sales rights of the supplier or through his agents, etc.[40]

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39. UNCTAD, n.30, p.45.

40. UNCTAD, n.28, p.51.

These export restrictions may block the potential export facilities of developing countries, prevent the acquisition of market skills, limit benefits and hinder overall development. An UNCTAD study indicates that explicit restriction on exports, in over 2000 contracts entered into with ten different developing countries ranged as much as 99 per cent in Peru to 6 per cent in Israel.[41]

(x) Cartels, Patent Pool and Cross Licensing Arrangements- A cartel is an agreement of enterprises designed, inter alia, to allocate markets, fix prices, or promote the exchange of knowledge resulting from scientific and technical research, exchange patent rights and standardisation of products. More specific arrangements of this type deal with cross-licensing, patent pooling and multiple licensing.[42]

Cartel-like arrangements among suppliers may involve different types, chiefly: import cartels, export cartels, international cartels controlling imports, exports and marketing, exchange of technical information cartels, including cross-licensing and patent-pooling.

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41. UNCTAD, n.38, p.50

42. UNCTAD, n.30, p.54.

(b) Restrictive Practices Related to the Cost of Technology

The price of technology is a dominant factor in the entire transfer process and the major problem area affecting both the recipient and the supplier. The imperfect nature of market, coupled with the abusive practices of the supplier, adversely affect the price and cost of technology.

The use of overseas technology and proprietary rights has direct and indirect implications to the recipient - the direct implications concern the size of foreign exchange outflow and the sharing of business gains; indirect implications concern value added, its influence on royalty remittances and the social cost of technology. The basic areas of concern are direct and indirect costs of transfer, the level of payments and the pricing of different items, and the time period during which payments are affected.[43]

(i) Direct and indirect costs of transfer refer to:

(a) straightforward payments for technology

(b) charges in excess of prices prevailing elsewhere for the same technology

(c) changes through restrictive practices in the arrangements of transfer.

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43. UNCTAD, n.28, pp.62-68.

(ii) The level of payments in the pricing of different items:

The level of pricing is a combination of all prices charged directly or indirectly for the transfer of technology. Explicit payments are generally a small part of the total payments. An UNCTAD study indicates that the level of overpricing is much greater for foreign-owned enterprise than for nationally-owned one, suggesting that foreign suppliers of capital and technology have preferred to obtain return on their investment through 'hidden costs' to the receiving countries rather than explicitly through receipts of royalties and/or profit remittances.[44] The more 'packaged' the transfer, the greater the scope to the supplier for apportioning charges to one or other technological elements, for interchanging such charges, for curtailing potential benefits of recipients and for prolonging the duration of payments with a view to maximise overall returns on the sale of technology.[45]

In some transfer of technology transactions, the supplier stipulates that intangible assets should be registered as capital contribution or charged with equity holdings in the recipient country.[46] In the intra-corporate

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44. UNCTAD, n.30, para 44-52.

45. UNCTAD, n.28, p.63.

46. Ibid., p.63.

transactions, trans-national corporations evade taxation or substantially reduce tax base in violation of national laws and regulations of the host country. Arbitrary nature of transfer prices for goods and services transferred, intra-company loans, allocation of central overheads for R & D and other accounting charges by the parent firms are problem areas in direct investment and intra-enterprises transactions.

(iii) Royalty and Lump-Sum Payments:

Royalties are the main form of payments for the use of patented technology and other industrial property rights and for licensing secret know-how. The percentage rate, the base on which payments are calculated, the period during which payments have to be affected and the tax treatment of such payments affect the level of costs to the recipients and the returns of the supplier. Royalties - the recurring payments - are usually formulated against the sales prices or sales value of production.[47]

Trans-national corporations calculate royalty rates on sales, on the basis of 'licensors share of licensee's profit and licensee's profit on sales'. Licensee's profit on sales will be calculated on the tacit assumptions that:[48]

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47. UNIDO Doc. On Development and Transfer of Technology Series, No. 15, Guidelines for Evaluation of Transfer of Technology Arrangements, 1979, pp. 39-45.

48. Ibid., p. 40.

- royalty payments will be forthcoming over a reasonably long period;
- plant capacity and forecasted profitability are reached quickly;
- plant capacity is rated for maximum exploitation of the market over the period of contract.

These assumptions which are tenable in developed countries, may not be true for developing countries. If and when regulatory mechanisms are incorporated in national legislation to restrict abusive practices in royalty payments, licensor look for alternative payments like lump-sum royalty payments or cumulative royalty payments.

'Lump-Sum and Cumulative' Royalty Payments:- In licensing industrial property, a lump-sum royalty is a payment made in lieu of running royalties.[49] This method of payment is quite usual in high technology. Licensors prefer lump-sum royalties as it does not risk income from the recipient. It decreases the interest of the licensor in the licensee's enterprise as well as hinders the market expansion through process improvements with the help of licensor. In the case of cumulative royalty payments, royalty rates change with the total accumulated sales from the date of commencement of production.

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49. Ibid., p.46.

These restrictive practices in the transfer of technology transactions have adversely affected the technological self-reliance and endogenous capacity for scientific and technological development of almost all developing countries. Technological self-reliance should be conceived in terms of the capacity to identify national technological needs, to select and apply domestic and foreign technology and to enhance national technological capacity.[50] "Technological autonomy/self-reliance is merely a short-hand way of referring to the autonomous capacity to select, acquire, absorb, adapt and develop technologies necessary to meet country's economic and social needs. It involves an increasing capacity for autonomous decision-making on the choice and use of foreign technologies and generation of indigenous technological solution to a country's urgent economic and social problems, especially those relating to meeting the minimum material needs of the people".[51]

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50. UNIDO. Doc. Development and Transfer of Technology Series No. 15, Technological Self-reliance of the Developing Countries Towards Operational Strategies, 1981, p. 11.

51. For a detailed discussion, see Syed Noro Hasan, Technological Autonomy and Dissociation in International System

Problem areas in the endogenous technological capability can be better expressed through the dimension of technological self-reliance/endogenous technological capability - choice, information, acquisition, adaptation, absorption, innovation and development.

Choice of Technology:- Choice of technology is one of the most difficult tasks that the developing countries are required to make in their efforts to accelerate technological development and yet retain their cultural values and economic and political identity.[52] The concept of choice of technology covers the whole spectrum of technologies from the most labour intensive to the most capital intensive.

Information:- Information and communication process is a very important aspect of transfer of technology transactions. Most of the developing countries do not have sufficient mechanisms to guide technology choice. International information available from developed countries seem to be highly expensive. Developing countries do not have access to information banks and documentation services operating between the source and the user.[53]

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52. UNCSTD Doc. (A/CONF.81/8/ADD-I), Science and Technology and Future (Vienna, 1979), p.26.

53. Edward Haythrone, The Transfer of Technology (OECD, Istanbul, 1970), pp.93-98.

Acquisition:- Acquisition of technology presupposes adequate specifications of technological services and negotiating capacity.[54] Lack of such capacities weaken the bargaining power of the recipient country.

Adaptation:- Adaptation is the process of matching alien technologies to local factor endowments, social customs, values and national development objectives. Adaptation also refers to linking imported technology with domestic research and development.

Consultation and technological service capabilities are highly essential for the adaptation of the technology. Lack of technological service and consultation capabilities make disaggregation of technology packages extremely difficult in developing countries, leading to a critical lack of infrastructure and perpetuate undue dependence on foreign design and engineering services, with their consequential impact on the pattern of investment for particular projects and on the requirements of capital goods and equipment as well as on the subsequent plant operations and management.[55]

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54. UNIDO Doc. A/CONF. 81/BP/Vienna, Strengthening of technological Capability of Developing Countries: A Framework for National Action (Vienna, 1979), p. 10.

55. Ibid., p. 12.

Absorption:- Absorption is very much a function of the 'Critical Mass' in terms of qualified and experienced national personnel. Problems of absorption tend to be high when an alien technology is transplanted to a totally different sociological environment.

The concept of social carriers of technology developed by Dequist and Riqvist identifies problem areas in absorption. Transferred technology can be absorbed through training national personnel of the recipient country.

Innovation and Development:- Innovation capacity is the outcome of a complex relationship between available capital skills, information, communication, infrastructural facilities, etc. It is also the consequences of socio-economic and cultural interactions. Innovation and development of the technology transferred can be ensured through:[56]

- the linkage between education, research, production and development process;
- well-directed programmes to promote R & D activity;
- removal of manpower and financial constraints;
- commercialisation of R & D findings; and
- institutional changes in the society.

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56. UNIDO, n.50, pp. 17-18.

In the light of the restrictive practices prevailing in transfer of technology transactions and its impact on the developmental activities of developing countries, it can be concluded that development of endogenous technological capability and technological self-reliance is the task before developing countries. Self-reliance is more than production of goods and services and building up of scientific and technological institutions. Self-reliant development with its emphasis on local, rather than imported institutions and technologies, is thus a means whereby a nation can reduce its vulnerability to events and decisions that fall outside its control.[57] Endogenous technological capability and self-reliance can be developed through various measures to promote R & D activities, management and training and institutional mechanisms.

1.3 Transfer of Technology and Technological Dependence

Although science and technology has contributed perceptibly to the boosting of economic activities and welfare of many societies, it has not been successful in solving major socio-economic problems in developing countries adequately. In fact, it has done little to

57. Ibid., pp. 17-20.

alleviate inequities among and within nations. It is not the technology, but rather the policy of the developed countries, who have monopolised it that is responsible for the technological backwardness of developing countries. The pattern and character of technology flow have been inadequate for meeting the global inequity crisis affecting a sizeable portion of population - inequity crisis is manifest through income inequality, unemployment and underemployment.

The activities of trans-national corporations are conditioned by their corporate interests. It has resulted in various restrictive practices in technology transactions. Moreover, these monopoly corporations transfer technology to developing countries through such channels and mechanisms that ensure maximum profit and control of the former. These activities are often at variance with policies and priorities of developing countries. Developing countries, as a group, suffer from an inherently weak bargaining position, compounded by inadequate knowledge and skill levels to select, acquire, adopt and absorb technologies. In the final analysis, it leads to technological dependence that distorts industrialisation and development of newly independent countries.

Ward More House refers to technological dependence in terms of "the unholy alliance of power, privilege and technology emanating from the consumption pattern in developing countries".[58] The present system of affairs have created a small percentage of population in developing countries which have opted for rich country consumption patterns. These groups wield economic and political power in developing countries and are not in favour of breaking existing linkages which are inconsistent with the requirements of developing countries. The alliance of these groups with similar groups in developed countries perpetuates technological dependence.

The best strategy for development is selective technological and economic delinking or dissociation from the global production system.[59] Selective dissociation does not mean technological isolation of the third world, but does mean, carefully targeted selective technology acquisition, on the initiative of developing countries rather than the indiscriminate north-south flow of technology. As Denis Goulet observed, while commenting

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58. Ward More House, n.51, p.69.

59. Ibid., p.54.

on Guinea Bissau's development experience, "the lesson of greatest importance is that the best model of development is the one that any society forges for itself on the anvil of its own specific conditions".[60]

1.4 Transfer of Technology and International Relations

During the post-war period, technology has become an important determinant in shaping the relations among nations. Emergence of Socialist countries, particularly the USSR as a source of technology, has radically restructured international economic relations.

Transfer of technology across national boundaries is an essential factor in the development. Developmental problems in developing countries being what it is, successful transfer of resources calls for international cooperation of developed countries and developing countries. Unfortunately, as other forms of military and economic power of the major industrialized countries decline, technology is emerging as a significant and forceful instrument for maintaining the dominance in the international economic and political system.

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60. Denis Goulet, The Uncertain Promise: Value Conflicts in Transfer of Technology (New York, 1977), p.52.

Trans-national corporations, principal carriers of industrial technology, are concerned not only with maximising profit, but also minimising risk. Risk can be minimised by keeping as many elements in the production process as firmly under one's own control as possible. In the process, it adversely affects the economic, political and social affairs of the developing countries.

International transfer of technology, an issue that was taken up thirty years ago, has not ceased to appear on the agenda or work programme of the UN bodies. International norms for transfer of resources is based on the UN General Assembly Resolution 2626 (XXV) on international development strategy for the Second Development Decade (1970s). Para 42 of the above resolution, adopted on the reports of the second committee, agreed that by 1972, each economically advanced country should endeavour to provide annually to developing countries financial resource transfer of a minimum net amount of one per cent of their GNP at market prices in terms of actual disbursements (not later than by 1975).

In the declaration of the establishment of a 'New International Economic Order' adopted at its sixth special

session, the UN General Assembly included the following as one of the principles-"Giving to the developing countries access to the achievements of modern science and technology and promoting the Transfer of Technology and the creation of indigenous technology for the benefit of developing countries in forms and in accordance with procedures which are suited to their economies".[61] Pugwash Conference on science and world affairs held during the same period, as that of sixth General Assembly special session, adopted principles of an international code of conduct for the consideration of world bodies.

The basic objective of the draft code states that it shall "establish general equitable rules for the international transfer of technology taking into consideration particularly the needs of the developing countries and the legitimate interests of technology supplier and recipients."[62] The aim of the international code of conduct in the field of transfer of technology is to define certain internationally acceptable standards of transfer of technology transactions among countries and to lay down ground rules governing trade

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61. UNCTAD, n.28, p.5.

62. UN Department of Economic and Social Affairs, n.5, p.25.

practices of technology transactions of individuals or enterprises in various countries, with a view to achieving a certain order, fairness and predictability in the field of technology trade operations.[63]

In drawing up the programme of action on the establishment of the New International Economic Order (NIEO), the General Assembly emphasised that "all efforts should be made to formulate, adopt and implement an international code of conduct for trans-national corporations[64] in order:

(a) to prevent interference in the internal affairs of the countries when they operate and their collaboration with racist regimes and colonial administration;

(b) to regulate their activities in host country to eliminate restrictive practices and to conform to the national development plans and objectives of developing countries and in this context facilitate, as necessary, the review and revision of previously concluded agreements;

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63. UNCTAD, n. 2, p. 15.

64. Kamal Hussain (ed.), Legal Aspects of the New International Economic Order (Nichols Publishing Company, New York, 1980), p. 124.

(c) to bring about assistance, transfer of technology and management skills to be on equitable and favourable terms;

(d) to regulate the repatriation of the profits accruing from the operations, taking into account the legitimate interests of all parties concerned;

(e) to promote reinvestment of their profits in developing countries.

The problems created by the operation of transnational corporations are echoed in various inter-governmental and international forums like the Decision 24 of Andean group, established under the Cartagena Agreement in December 1970, the OECD Code of Conduct in 1976, Preliminary work of OAS regarding code of conduct, and various other organizations like UNCTAD, ILO, etc. Whatever be the legal nature and form of the code of conduct, it speaks volumes about the issues involved in international transfer of technology and relations among nations.

The emergence of socialist countries in the technology transfer transactions has influenced the course of international relations considerably. The basic motivation behind the transfer of technology policy of socialist

countries is to break the monopoly of trans-national corporations in technology thus to put an end to the exploitation of developing countries. The socialist countries, particularly the USSR, embarked upon the transfer of resources to economically backward developing countries though intergovernmental agreements. Another important feature of the transfer of socialist technology is that it was primarily transferred to the public sector, with the intention of promoting the capability of developing countries. Referring to transfer of technology from socialist bloc countries, an UNCTAD study comments that certain state entities have introduced concessional terms in their agreements covering transfer of technology, for example, low credit, and interest charges, longer payment periods, facilities for the repayment of loans through sales of materials or goods to the foreign partner, coupled with guaranteed markets for their goods and the possibility of credit payments in local currency, thus cushioning the foreign exchange effects of such transactions. Along with these, the agreements also include very elaborate training and development of local skills.[65] These new features of the transfer of Soviet technology will be examined in detail in the subsequent chapters.

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65. UNCTAD, n.40, p.33.

1.5 Transfer of Technology and International Law

The relationship between technology and law is that technology creates additional means for states to pursue their policies and exert influence on international law. At the same time, technological development and changes in inter-state relations enrich the rules of international law which, in turn, influence technological progress. Technology and its transfer has established new types of inter-state relations.

At the 1964 UNCTAD conference, the poor nations and a great majority of the industrialized countries signified their agreement with the principle that developed countries should assist the industrial development of developing countries. Before UNCTAD II in 1968, there had been "Unanimous agreement in favour of the early establishment of a mutually acceptable system of generalized non-reciprocal and non-discriminatory preference which would be beneficial to (poor) countries and the conference established machinery for its implementation." This agreement was reflected in conference resolution 21.[66]

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66. Charles C. Okolie, Legal Aspects of the International Transfer of Technology to Developing Countries (Praeger, N.Y. 1977), p.33.

The claims of developing countries for additional resources for development from developed countries are based on the principle and spirit of international law. Two arguments summarize the claims of developing countries from the angle of international law.[67] One such argument is based on the concept of 'Estoppel', which has been described as "the requirement that a state ought to be consistent in its attitude to a given factual or legal situation". As normally applied, the doctrine precludes the estopped party from adopting a position in an adjudication different from the one taken prior to the adjudication, when another party has relied on the first position to his potential detriment. This concept of estoppel could be applied to the UNCTAD preference claim to international transfer of resources and technology for developing the poor nations. International law experts can argue that developed countries have already conceded the claim.

The estoppel concept may be seen, within the International Court of Justice (ICJ) framework, as a "general principle of law recognised by civilized nations". The estoppel concept may also be seen as 'general principle of international law,' that is, a principle, that independent of its municipal law development, has been extensively

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67. Ibid., pp.34-38.

explored and developed in international adjudication and arbitration. In this latter aspect, estoppel straddles the general principles and customary international law headings of the ICJ statute.

The second argument, drawing entirely on the 'general principles,' heading and probably on more difficult traditional ground, suggests that there may be a general principle of welfare that dictates minimum resource sharing norms. The general welfare argument with regard to international transfer of resources for development is undoubtedly strengthened by the international commitment to such norms as those of economic, social and cultural rights of the UN. Framing the legal enquiry into transfer of resources and technology, it is suggested that the Estoppel doctrine should be strengthened and international norms for the transfer of resources and technology must be mutually accepted by the participating states. It is suggested that suppliers of technology should be consistent with their domestic behaviour in their international conduct in terms of commercial transactions with the poor nations. Thus, by doing so, they may contribute to mutual international understanding on transfer of technology.

Chapter II

SOVIET POLICY ON TRANSFER OF TECHNOLOGY: AN OVERVIEW

In the second half of twentieth century, the USSR emerged as a potential source of technology to developing countries. Unlike many other industrialised countries, it pursues a specific policy on the transfer of technology. Transfer of resources is a characteristic feature of the USSR's economic relations with developing countries and hence a major aspect of Soviet foreign policy. The major features and the mechanisms through which technology is transferred from the USSR has been emphasised in various studies. This section of the present study will enquire into various aspects of Soviet policy on transfer of technology to developing countries so as to facilitate our understanding of Soviet experience in the specific context discussed in the final chapter.

2.1 Transfer of Technology and Soviet Foreign Policy

Transfer of technology is an integral part of Soviet aid and trade with the Third World, which is the most important aspect of Soviet foreign policy towards the developing countries. The foreign trade policy of the USSR, says the great Soviet Encyclopaedia, "is part of the

overall foreign policy of the USSR.[1] The evolution of Soviet economic aid and trade programme coincides in many ways with the evolution of Soviet foreign policy towards the underdeveloped countries.[2]

Soviet foreign policy is based on the Leninist principles of 'Peace Coexistence' and 'Proletarian Internationalism'. It is directed towards ensuring the most favourable peaceful conditions for the building of communism in the USSR, strengthening the unity and cohesion of socialist countries, supporting the liberation and revolutionary movements, 'promoting solidarity and cooperation with the independent states of Asia, Africa and Latin America and consolidating peaceful coexistence in international relations.'[3]

'Peaceful co-existence' does not rule out, but presupposes determined opposition to imperialist aggression and support for people defending their revolutionary gains or fighting foreign oppression.[4] 'Proletarian Internationalism' spells out fraternal friendship, unity, mutual

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1. Joseph S. Berliner, Soviet Economic Aid: The New Aid and Trade Policy in Underdeveloped Countries (FREGER, New York, 1958), p.8.

2. Ibid.

3. Progress Publishers, A Study of Soviet Foreign Policy (Moscow 1975), p.15.

4. Ibid., p.15.

assistance, and cooperation in building socialism. "International economic relations and trade, stressed Lenin, were wanted not only by the Socialist, but also by the capitalist countries, that gave peaceful co-existence its real foundation."[5]

Lenin's sound insight into the relationship of socialist countries, particularly the USSR, with developing countries is manifest in his writings. Fight against imperialism and neo-colonialism is the cardinal point of the foreign policy of Socialist countries. On the basis of the principles of internationalism and solidarity in the common struggle against imperialism, Lenin substantiated the specifics of Soviet foreign policy towards countries oppressed by imperialism. Developing countries with an anti-imperialist foreign policy and domestic socialist orientation are seen by the USSR to be of primary importance in their struggle against imperialism. Lenin considered economic cooperation between the socialist and developing countries as a powerful weapon to combat imperialist expansion. He believed that aid from countries of the victorious proletariat to the working people of the East in surmounting backwardness was historically inevitable and

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5. Ibid., p. 15.

justified, stressing that, "the backward countries can emerge from their present stage of development when the victorious proletariat of the Soviet republics extends a helping hand to these masses and is in a position to give them support."[6]

It was in the mid-fifties that the 'Soviet Union' emerged from comparative economic isolation in the arena of international economic cooperation, particularly in third world countries.[7] Prior to 1950s, the USSR pursued a policy of isolation from the rest of the world, particularly in economic relations. The Soviet foreign policy since 1950s has been based on the assumption that the present era is that of transition from capitalism to socialism and that the relation of forces between the capitalist and socialist systems is changing increasingly in favour of the latter.[8]

The post-Stalin policy towards the Third World countries has been heavily conditioned by what is known as the 'Major Contradiction' of the present era - the contradiction between the capitalist and socialist systems.

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6. V.I. Lenin, Collected Works, Vol.31, p.244.

7. J.R. Carter, Net Cost of Foreign Aid (Praeger, New York, 1969), p.vii.

8. Report of the Central Committee of CPSU, 20th Congress, (Moscow, 1956), p.1.

As a consequence, the nature of political and economic development in the third world is seen as a transitory character - the non-capitalist path of development. In this major contradiction, the former colonial and semi-colonial countries, in other words developing countries, are an important world social force, which is regarded by the Soviets as potentially in harmony with them.[9] The change in Soviet policy stems from the belief that the 'task of consolidating peace, strengthening the anti-imperialist forces and establishing a just order in the international economic relations cannot be accomplished without the participation of developing countries and without their having achieved economic independence.'[10]

Among the notable changes in Soviet foreign policy in the latter half of the century is the promotion of economic relations. It is manifest in the bilateral agreements between the USSR and developing countries and in the Soviet support to the principles of the UN programme of technical assistance to developing countries. The new shift in Soviet policy started with the technical assistance agreement with Afghanistan in 1953, the first such agreement to be signed by the Soviet Union with a

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9. For a detailed discussion, see Zafar Imam, Ideology and Reality in Soviet Policy in Asia: Indo-Soviet Relations 1947-60 (New Delhi, 1975).

10. Andrei Chekhutov, "Socialist and Newly Free Countries, Monetary Relations," Social Sciences, USSR Academy of Sciences, No. 2, 1982, p. 154.

developing country. Since then, economic and technical cooperation of the USSR with developing countries increased 12.7-fold in the next 25 years. The number of countries the Soviet Union is cooperating with went up from 18 in 1970 to 70 in 1981.[11] The change of policy becomes more evident from the fact that since the end of World War II, the Soviet Union has signed treaties, agreements and protocols with more than fifty Third World countries.[12] Of those, the most significant ones are the treaties which are entitled as "Friendship and Cooperation Treaties". As of now, the Soviet Union has signed a total of thirteen such treaties.[13]

The primary objective behind the Soviet policy on transfer of technology is to promote the technological capability of the recipient and make the developing countries technologically self-reliant. It makes them less dependent on the world capitalist market, primarily with regard to getting necessary technology and contribute to making conditions on which they acquire it in the world

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11. Daily Review, Novosti Press Agency (APN), Vol. XXIX, No. 19 (7149), January 27, 1983, part II, p. 1.

12. Zafar Imam, Towards a Model Relationship: A Study of Soviet Treaties with India and Other Third World Countries (ABC Publishing House, New Delhi, 1983), p. 27.

13. Ibid., 27.

capitalist market less burdensome and the availability of alternative sources of borrowing the technology.[14] The scientific and technical cooperation of the socialist countries with developing countries and the relation between them with regard to the transfer of technology are aimed at:[15]

- creating and expanding scientific and technical potential in developing countries;
- developing on a planned, stable and long-term basis equitable and mutually advantageous relations, free from all forms of dependence and exploitation;
- establishing a close link between science and production;
- efficient training of national specialists in the developing countries.

Another important aspect of Soviet economic and technical assistance is the desire to effect foreign policy positions of the developing countries. It is

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14. A.N. Bykov and Others, Soviet Experience in Transfer of Technology to Industrially Less Developed Countries, (UNITAR, New York, 1973), p.26.

15. Joint Statement by Socialist Countries at the 4th Session of the UN Conference on Trade and Development, Supplement to Foreign Trade, No.9, 1976, p.15.

manifest in the Soviet support to foreign policy postures of the newly independent countries on such issues as non-alignment, anti-imperialism and anti-colonialism.

2.2 Soviet Policy on Transfer of Technology: Major Features

Transfer of technology is an integral part of economic relations between Socialist countries and developing countries. In their economic and technological cooperation with developing countries, they pursue the following main aims:[16]

- strengthening their technological and economic capability;
- helping to strengthen domestic resources in accumulation of capital;
- to promote the capability of developing countries to prepare their own skilled manpower;
- to increase export earnings;
- to promote employment opportunities.

The basic principles governing the policy of socialist countries in the field of scientific and technological cooperation have been expressed in various official statements and documents. To illustrate the point, in a statement issued by the Government of the USSR and conveyed to

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16. UNCTAD, Doc.No. TD/B/C.6/25, Experience of Socialist Countries of Eastern Europe in the Transfer of Technology to Developing Countries (New York, 1978), p.7.

the Secretary General of the UN on 4 October 1976, regarding the changes in international economic relations, it was stated that the USSR will continue:[17]

> to develop cooperation with (developing) countries on a democratic and just basis to strengthen economic, scientific and technological ties with them on a stable, long-term and mutually advantageous basis [.....] to assist interested developing countries in the development of their natural resources in conditions ensuring the genuine sovereignty and respect for the legitimate rights of the cooperating parties; to increase the volume of technical assistance to developing countries with special emphasis on the implementation of complex projects and development of their own infrastructure, science and educational system.

Their policy is designed to enable the developing countries to combat economic backwardness - largely inherited from colonial past - to carry out industrialization and thereby, to consolidate economic and political independence. The basic objectives of the transfer of Soviet technology are: development of technological capability of the recipient developing countries; to reduce the restrictive practices involved in the technology transfer transactions and to break the monopoly of transnational corporations.

In the context of international transfer of technology to developing countries, the UN stipulates

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17. Ibid., p.4.

that technical aid and international transfer of know-how should not serve as a tool for economic and political interference in the internal affairs of the recipient country.[18] True to the UN decision, Soviet technology to developing countries is transferred on a government-to-government basis. State monopoly over foreign trade and economic transactions facilitate the government-to-government arrangements between the USSR and developing countries.[19]

(i) Long-Term Inter-Governmental Agreements

Soviet policy on technology transfer presupposes an inter-governmental agreement between the USSR and the recipient developing country. Such agreements determine the character and condition of commercial contracts signed by the All Union Corporation and foreign enterprise.[20] Inter-governmental agreements concluded between the USSR and developing countries provide a framework for direct contracts at the operative level. The main forms of inter-governmental agreements are as follows:[21]

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18. Charles, C. Okolie, Legal Aspects of the International Transfer of Technology to Developing Countries (Praeger, New York, 1975), p. 126.

19. A.N. Bykov, n. 14, pp. 24-27.

20. Ibid., p. 38.

21. UNCTAD, n. 16, p. 8.

(a) Agreements concerning the trade and payments; in this case transfer of technology is treated as any other sale or purchase of goods or services;

(b) Agreements on scientific and technical cooperation;

(c) Agreements on economic cooperation covering sale of complete plants, where technology is partly embodied in the machinery and equipment, partly transferred separately in the studies, designs, production processes and technical assistance connected with putting the plant into operation and training the personnel.

The basic terms of the inter-governmental agreement on transfer of technology are spelled out in the contract between corporations and the concrete terms are determined by the specific kind of resources transferred.[22] The basic terms also determine the legal rights and obligations of the parties involved; the deliveries of equipment, machinery and materials; the supply of specialists and technicians and the time schedule for production and training of domestic specialists. In addition, the basic terms regulate questions about payments and mutual account and the consideration of conflicts by tribunals.[23]

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22. Charles C. Okolie, n. 18, p. 118.

23. Ibid., p. 118.

(ii) Soviet Technology and Public Sector

A distinguishing feature of Soviet policy is its accent on the promotion of public sector in the recipient economy.[24] The USSR, under normal circumstances, transfers technology to the public sector in the developing countries. However, contracts are also concluded between socialist public corporations and private firms in developing countries, if the private firm is guaranteed by the government of the recipient country.[25] At times, agreements concluded by the USSR with developing countries stipulate the right of the former to cooperate with other socialist countries and their organisations in providing additional resources and manpower training in the developing country. The most illustrative example is India, where various branches of public sector such as iron and steel, power, oil, mining, machine building, etc., etc., have received Soviet assistance and technology.

Transfer of technology agreements concluded by the USSR are divided into 'general agreements' that provide general principles of law recognised by sovereign nations

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24. Daily Review, Novosti Press Agency (APN), January 27, 1983, p.3.

25. Charles C. Okolie, n.18, p.120.

and special agreements that provide for construction of certain industrial projects or fulfilment of certain specific work Contract is the main legal document that determines the mutual responsibilities of parties. It stipulates the volume of technical assistance, technology to be transferred and the terms and conditions of the transfer.

Soviet agreements on economic and technical cooperation with developing countries are not tied up, with the Soviet side never striving for any property rights in the projects. Enterprises and projects built with Soviet assistance are the property of the recipient country right from the beginning.[26] Soviet experts do not participate in the management of the enterprises after the expiry of terms. The USSR, as a matter of policy, does not establish companies in the developing countries, whereas western countries, through their privately owned corporations, establish subsidiaries in most of the developing countries.[27]

(iii) Training of National Personnel

The technology transferred to developing countries fails to produce the desired effect and remains a foreign

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26. V.N. Bykov, n.14, p.39.

27. Charles C. Okolie, n.18, pp.121-22.

body in the recipient economy, unless the transfer is accompanied by large scale training of local specialists and the creation of extensive scientific and technological infrastructure. Training of national personnel is a major feature of Soviet policy of transfer of technology to developing countries. The assistance in training in national personnel is aimed at consolidating the public sector in developing countries and enhancing the role of state in educational progress. The USSR's cooperation in this respect is conducted along three main lines.[28]

- aid in developing education and training national personnel in those countries themselves;
- training of specialists and students from these countries in the USSR;
- aid through international organisations like the UN bodies.

The training programme for personnel from developing countries are conducted within the framework of intergovernmental agreements and subsequent contracts concluded by the USSR with the developing countries. Upto 1972, the USSR sent around 10,000 specialists to developing countries. From 1955 till 1970, Soviet specialists trained

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28. A.N. Bykov, n.14, p.112.

by individual and group methods, more than 1,50,000 skilled workers and technicians in the course of construction and operation of various projects.[29] During the same period, about 35,000 specialists and workers from developing countries were trained in the USSR.[30]

(iv) Priority to Credit Transactions

Another outstanding feature of Soviet policy is the priority accorded to credit transactions in the economic relations with developing countries. As majority of developing countries are economically backward and face severe balance of payment problems, they find it difficult to purchase technology from advanced countries. Soviet credits enable the developing countries to get modern technology without much problems of foreign exchange. During 1955-68, the Soviet assistance to least developed countries accounted for $6,296 million , or more than 60 per cent of the total assistance of $9,705 million from socialist countries.[31] According to the figures available

29. Ibid., pp. 113-14.

30. Ibid., p. 119.

31. James R. Carter, n. 7, p. 69.

from the US State Department, between January 1, 1955 and December 31, 1968, the USSR extended approximately $6,296 million worth of economic assistance in the form of long-term credits and grants to thirty seven of the least developed countries.[32] As per the figures released by the Ministry of Finance, Soviet credits/loans received by India during 1955-77 amounted to Rs. 12,461.20 million.[33]

(v) Favourable Terms and Conditions

The terms and conditions associated with transfer of Soviet technology differ from country to country. The general conditions are favourable to the recipient developing countries. Generally, Soviet credits extended to developing countries carry an interest rate of 2.5 per cent, with 12 years being the average repayment period.[34] Repayment begins upon the completion of the deliveries or the entire project. Thus, Soviet credits extended for the construction of Bhilai Steel Plant carried an interest rate of 2.5 per cent to be repaid in twelve years, whereas the corresponding figures for Durgapur and Rourkela Steel Plants were much higher (see Table 2.1). Terms and conditions of Soviet credits offered to India, Egypt and Iran are discussed in detail in chapter III.

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32. U.S. Department of State, R.S.B. 50, p. 2. Cited in J.R. Carter, n. 7, p. 12.

33. India, Ministry of Finance, Department of Economic Affairs, Brochure on External Assistance (1974-75) (New Delhi, 1977), pp. 96-100.

34. James R. Carter, n. 7, p. 16.

Table 2.1

THE TERMS OF CREDIT FOR THE AIDED STEEL PROJECTS: BHILAI, ROURKELA AND DURGAPUR

Projects	Interest Rates in percentages	Repayment period	Grace period
Durgapur	Consolidated fund rate 5.50 to 6 per cent plus 0.25 per cent management fee	11 years	8 years
Durgapur Expansion	Consolidated fund rate 5.50 per cent to 6 per cent plus 0.25 per cent management fee	25 years	7 years
Bhilai	2.50 per cent	12 years	1 year
Bhilai Expansion	2.50 per cent	12 years	1 year
Rourkela	6.3 per cent	3 years	3 years
Rourkela Services and maintenance	3 per cent	20 years	7 years
Rourkela Expansion	5.75 per cent	20 years	5 years
Rourkela refinance	5.25 to 5.50 per cent	12 to 16 years except 1960-61 refinance for which only 4 years.	variable

Source: Government of India, Ministry of Finance, External Assistance, 1964, pp. 36-40.

For a country faced with severe foreign exchange shortage, repayment in local currency would be a special concession. The Soviet loans are more accurately described as repayment in kind.[35] Most often, the credits are repaid through exports of indigenous goods and materials to the USSR. According to the Soviet scholar Porkhorov, the total interest paid by developing countries to socialist countries in the case of a twelve year credit is 66 to 67 per cent lower than the corresponding payments of international financial institutions or private corporations of capitalist countries.[36]

(vi) Transfer of Soviet Technology and Soviet Planning

Economic relations and transfer of resources of the USSR with developing countries are based on the socialist planned economy. Planning embraces not only production, exchange, distribution and consumption but also economic relations with foreign countries. All activities of Soviet organizations rendering economic and technical assistance to foreign countries are covered by state plans, which is an organic part of the general

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35. Santosh K. Mehrotra and Patric Clawson, "Soviet Economic Relations with India and Other Third World Countries," Economic and Political Weekly, special number, August 1979, p. 1373.

36. G.M. Porkhorov, Foreign Economic Ties and Economic Growth of Socialist Countries (Moscow, 1972), p. 177.

economic development plan of the USSR.[37] The transfer of Soviet technology is envisaged in concrete annual plans which provide better coordination between foreign trade, industry and other branches of economy. State monopoly of production and foreign trade enable the USSR to effect the transfer process in accordance with inter-governmental agreements and state planning.

The Council of Ministers, Ministry of Foreign Trade and the State Committee for Foreign Economic Relations are the state bodies that supervise USSR's economic relations with foreign countries.

The 'All Union Corporations' are Soviet organizations that keep direct contact with foreign enterprises on matters related to diverse transfer of technology transactions. The long-term agreements based on Soviet planning focus not only on the immediate requirements of the recipient economy, but also take into consideration its long-term demand in determining the production capacity of the plants built with Soviet assistance.

2.3 Transfer of Soviet Technology: Methods and Mechanisms

The method and mechanisms involved in the transfer of Soviet technology to developing countries are formulated

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37. A.N. Bykov, n. 14, p. 34.

in terms of the scientific and technological infrastructure, the level of technical experience, national scientific and technological personnel and the scarcity of financial resources of the recipient developing countries. The transfer of Soviet technology to developing countries is regulated by inter-governmental agreements on economic and technical cooperation.[38] The special agreements/contracts that are concluded within the framework of inter-governmental agreements stipulate the method of transfer of Soviet technology, volume of technical assistance, and the terms and conditions. In the USSR, the state committee on foreign economic relations authorises the competent foreign trade organisation to conclude contracts for the transfer of technology with the competent organizations in the recipient country. The methods and mechanisms involved in the transfer of Soviet technology can be categorised as follows:

(1) Delivery of Machinery and Equipments:- The most typical form of transfer of Soviet technology is the delivery of machinery and equipments on sale and purchase contract basis.[39] Soviet Union exports machines and equipment granting state or commercial (firm) credits.

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38. A.N. Eykov, n. 14, p. 39.

39. Ibid., p. 47.

The aim of such credits is to contribute to the economic development of the developing countries. The developing countries now account for one-fourth of all Soviet exports of machines and equipments, whereas the figure for 1955 was a little more than one per cent.[40] Plant deliveries for the projects being built with Soviet assistance account for almost two-thirds of the total volume of Soviet exports of machinery and equipments to developing countries.

During 1955-65, delivery of equipments and materials for complete plants for 21 developing countries amounted to 1,412,320 thousand dollars. India alone accounted for 601,959 thousand dollars, whereas the UAR and Afghanistan accounted for 304,960 and 167,424 thousand dollars, respectively.[41] According to an U.N. study, the share of machinery and transport equipment in the trade of the USSR with the developing countries was 38.6 per cent in 1973, 29 per cent in 1974 and 31.3 per cent in 1975 (see Table 2.2).

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40. Ibid., p.105.

41. Marshall I. Goldman, Soviet Foreign Aid (Praeger, New York, 1967), p.204.

Table 2.2

SHARE OF MACHINERY AND TRANSPORT EQUIPMENT (SITC, SECTION 7) IN THE TRADE OF THE USSR WITH DEVELOPING COUNTRIES, 1973-75

(millions of dollars, f.o.b.)

1973		1974		1975	
Value	Per cent of total	Value	Per cent of total	Value	Per cent of total
1170.8	38.6	1342.8	29.0	1585.7	31.3

Source: TD/B/615/Add.1, Table 18.

Exports of machinery from the USSR to India, Iraq constituted more than 25 per cent of the total during 1974 and 1975, whereas it was over 40 per cent in the case of Iran (see Table 2.3).

(ii) Delivery of Disassembled Machines and Equipment:- Apart from the delivery of machinery and equipments, Soviet Union exports disassembled machines and equipments, to be assembled at local enterprises. Soviet sources point out that the shipment of unassembled machinery to the countries of Third World would make exports much more profitable, reduce transportation costs and enable the recipients to go through an 'intermediate' stage of

Table 2.3

SHARE OF MACHINERY IN USSR'S EXPORTS TO INDIA, IRAQ AND IRAN

(Unit: thousand dollars

Country	1973			1974			1975		
	Total exports	Exports of machinery	Col.(2)as a proportion of(1)	Total exports	Exports of machinery	Col.(2)as a proportion of(1)	Total exports	Exports of machinery	Col.(2) as a proportion of(1)
	1	2	3	1	2	3	1	2	3
India	298.66	71.974	24.1	369.041	97.876	26.5	387.401	101.37	26.2
Iraq	189.678	56.355	29.7	249.726	66.402	26.6	359.151	95.892	26.7
Iran	184.048	97.143	52.8	364.110	147.003	40.4	373.342	168.69	45.2

Source: Compiled from UNCTAD Doc. TD/B/C.6/25 Annex V.

industrialisation.[42] This aspect of the transfer process contributes to high rate of employment at local enterprises, as well as acquiring of more experience by the recipient country.

Technical service of machinery and equipment is another promising aspect of transfer of Soviet technology through delivery of assembled/disassembled machinery and equipments. Such practices on an ever-growing scale by Soviet foreign trade organisations not only contribute to increasing export of Soviet machines and equipments and facilitate their exploitation in economically less developed countries, but also serve as an important means of transfer of technology to developing countries.[43]

(iii) Construction of Gift Objects and Delivery of Equipment on Lease:-

In some cases, the USSR constructs/presents gift objects to developing countries and in certain cases lease Soviet equipments to socialist and developing countries. Soviet organisations building gift projects are responsible for their standard and timely completion. The USSR presented

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42. Andreev I.F., USSR - The Biggest Exporter of Machinery and Equipment, Vneshnyaya Torgovlya, No.VI, Nune 1966. Cited in Elizabeth K.V. "New Trends in Soviet Economic Relations with the Third World," World Politics, Vol.XXII, October 1960, No.I, p.421.

43. A.N. Bykov, n.14, p.52.

a number of farm machines valued at 5 million roubles for equipping a 40,000 acre mechanised farm in India. Burma and India each received a Soviet twin-engined IL 14 transport plane with technicians for maintenance and operation.[44]

(iv) Turnkey Projects:- Delivery of 'Turnkey Projects' is another form of transfer of Soviet technology. It is the best suited form of transfer of technology in the early stages of industrialisation of the recipient country. In accordance with the inter-governmental agreements, the All Union Corporations of the USSR conclude necessary contracts for the delivery of the project. If the recipient country has difficulties in compiling the basic information, the USSR assists the former by sending a team of experts. Design work and delivery of equipments as per the contract is accompanied by supervision, assembly, maintenance, commissioning of the project and training of personnel, both in the USSR and abroad.[45]

Equipments which are too costly for the customer to buy for a limited scope of work are leased by Soviet organisations on contractual basis.[46] Usually, among the

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44. Joseph Berliner, n. 1, p. 47.

45. A.N. Bykov, n. 14, p. 54.

46. Ibid., p. 59.

equipments leased out are machines and equipment for geological prospecting, construction and transport and large special purpose machines like floating cranes, excavators, suction dredges, etc.

(v) Technical Assistance:- An important channel of transfer of Soviet technology, as distinct from the delivery of capital goods, is technical assistance. On the request of the developing countries, the USSR renders technical assistance to build industrial infrastructure, as well as for training national personnel. The All Union Corporation 'Technopromexport' does various kinds of work connected with USSR's obligation to render technical assistance. It includes despatch of experts, invitation of specialists from developing countries to raise their skill, deliveries of equipments for study centres, institutions, etc.[47] Technical assistance is provided along three different lines:

- technical assistance through UN bodies;
- bilateral technical assistance on concessional terms;
- technical assistance on commercial terms.

During 1953-57, Soviet pledges to the UN's technical assistance programme amounted to $5.7 million

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47. Ibid., p.59.

and the pledges from other countries of East Europe brought the bloc total upto $6.5 million.[48] By 1970, more than 300 industrial and other projects were completed and commissioned with Soviet assistance and cooperation in developing countries.[49] The USSR often renders technical assistance, in cooperation with other socialist countries and members of Council for Mutual Economic Assistance (CMEA).[50]

Lately, the USSR has considerably expanded technical assistance to developing countries on usual commercial terms (outside the framework of inter-governmental agreements) for cash payment on commercial short-term and medium-term credits.[51] Technical assistance on commercial terms are rendered to both state organisations and private firms in developing countries. The principal difference between the technical assistance under inter-governmental agreements and that on commercial terms lies in the different ways of drawing up and registering the forms of assistance and in less advantageous financial conditions (in the latter case) of assistance rendered.

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48. Berliner Joseph, n. 1, p. 45.

49. A.N. Sykov, n. 14, p. 109.

50. Ibid., p. 107.

51. Ibid., p. 55.

Soviet Aid administrator S.Skachkov cites several such commercial contracts previously concluded: with Iran for equipping a thermo-electric station, and with UAR for geological surveying and for the construction of vocational schools.[52]

(vi) Transfer of Technical Documents:- In accordance with the agreements concluded, the USSR transfers scientific and technical documents to developing countries. Most often, when Soviet technology is transferred through documents, USSR does not charge the recipient, other than the actual expenses incurred by Soviet organizations in preparing the documents. Agreements concluded by the USSR with Algeria, Kenya, Syria, Somalia, Tansania and many other developing countries contain provisions for free transfer of new technical data.[53] In the case of developing countries, whose economic and technical development is at a comparatively higher level, agreements may not contain provisions for free transfer of documents.

(vii) Licence Agreements:- Transfer of Soviet technology under licence agreements has increased considerably,

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52. Elizabeth, K.V., "New Trends in Soviet Economic Relations with the Third World," World Politics, Vol.XXII, October 1960, No.1, p.422.

53. A.N. Bykov, n.14, p.64.

especially in countries with a higher level of economic development and with greater experience of using Soviet technology. Such agreements have been concluded between the USSR with firms in India, Brazil and Egypt.[54] Soviet licence is made available to the developing countries without establishing any control over licensee's production or restricting in any way the sale of commodities produced with the use of Soviet licence.

(viii) Training of National Personnel:- The most important method of transfer of Soviet technology is training of national personnel of developing countries. Soviet assistance in this respect is rendered in various forms, such as:[55]

- training national personnel in their home countries
- training personnel from developing countries in the USSR;
- training through international organisations; and
- organising educational and vocational centres in developing countries.

During 1961-70, about 80,000 Soviet experts were sent to developing countries to train the national

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54. Ibid., p.67.

55. A.N. Bykov, n.14, p.114.

personnel.[56] Till 1970, Soviet specialists trained by individual and group methods, more than 1,50,000 skilled workers and technicians, in the course of construction/ and operation of various projects.[57] During the period 1955-70, about 35,000 specialists and workers from developing countries were trained in the USSR, apart from the training facilities provided through international organizations.

(ix) New Methods in the Transfer of Soviet Technology to Developing Countries

(a) Scientific and Technical Cooperation:- Soviet economic relations with developing countries are entering a new phase from the delivery of machinery and equipments stage to cooperation agreements for industrial, scientific and technical development. These agreements provide for exchanges of scientific delegations, transfer of experience, scientific and technical consultation, assistance in research work, collaboration in exchange of scientific and technical information and other forms of scientific contracts, including joint research work.[58] In a number of cases, joint research conducted in developing countries

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56. UNCTAD, Doc. TD/B/Ac.11/10/Add.I, Major Issues Arising from the Transfer of Technology to Developing Countries (New York, 1975), p.91.

57. A.M. Bykov, n.14, p.119.

58. Ibid., p.70.

can serve as a starting point for organizing industrial and technical cooperation, ensuring the setting up of new enterprises oriented to these countries' (developing countries) own requirements, including their export needs, and requirements of the Soviet Union.

Recently, such cooperation has begun with All Union Corporations and private enterprises in developing countries within the framework of inter-governmental agreements.[59]

(b) Joint Management and Mixed Companies:- Though transfer of Soviet technology through joint ventures and management contracts has not been widespread, new forms of partnership and cooperation for effective utilization of aid and trade are emerging in the USSR's relationship with developing countries. According to Y. Shainan, partnership of limited duration, with the Soviet share being gradually bought up by the assisted country, should be encouraged.[60]

Often enough in the past, a completed aid project handed over to the recipient government is either bankrupted by maladministration or offered to a western company for management. For the sake of efficiency and better management the USSR concedes the need for joint management as

59. Ibid., p.74.

60. Elizabeth, K.V., n.52, p.420.

a possible form of control preferable to sending emergency teams to reorganise administration, production and marketing.[61]

2.4 Transfer of Soviet Technology and Foreign Trade

Transfer of technology and foreign trade are two mutually inter-related aspects of economic development. The former will enable developing countries to export their goods and import suitable technology conducive to the requirements of national economy. Hence, restructuring of international trade can be achieved through the international transfer of resources. In this context, transfer of Soviet technology to developing countries through various channels such as export of machinery and equipments, delivery of turnkey projects etc. and its relationship with Soviet foreign trade merits attention.

International trade and foreign economic relations of the USSR develops within the framework of state planning. State monopoly of foreign trade enables the USSR to transfer its resources in the desired and planned manner, through economic and trade agreements. The Ministry of Foreign Trade and State Committee for Foreign Economic Relations are the apex state bodies responsible

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61. Ibid., p. 105.

for all trade transactions with other countries.[62] Long-term trade and economic agreements concluded by the USSR with foreign countries are incorporated in the five-year as well as current national plans.[63]

Over the years, foreign trade played a significant role in Soviet economic development. However, it is to be remembered that for a country with tremendous reserves of natural resources and a virtually unlimited internal market like the USSR foreign trade has never been of the same importance as for the export-oriented economies in search of new outlets for their exports.[64]

The proportion of exports in the USSR's total output varied between 0.3 per cent and 3.5 per cent in the pre-War years and remained roughly of the same order in the post-War era.[65] In 1982, Soviet foreign trade increased by approximately 9 per cent to reach 119.6 billion roubles in current prices compared with the previous year.[66]

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62. Vassil Vassilev, Policy in the Soviet Bloc on Aid to Developing Countries (OECD, Paris, 1969), p.28.

63. UNCTAD, Doc.TD/B/918, Prospects in Trade with Socialist Countries of East Europe: USSR, Policies, Development and Industrial Framework, 1982, p.11.

64. UNCTAD, Doc. TD/B/C.6/52, Experience of the USSR in Building up Technological Capacity, 1980, p.18.

65. Ibid., p.18.

66. Daily Review, Novosti Press Agency (APN), Vol.XXIX, No.72 (72.2), Wed. April 13, 1983, p.1.

Table 2.4

U.S.S.R.: IMPORTS AND EXPORTS

(in billion roubles at current prices)

Year	Total turnover	Exports	Imports	Balance
1960	10.08	5.01	5.07	-0.06
1965	14.61	7.36	7.25	+0.11
1970	22.08	11.52	10.56	+0.96
1975	50.70	24.03	26.67	-2.64
1980	94.09	49.63	44.46	+5.17
1981	109.74	57.11	52.63	+4.48
1982	119.6	63.1	56.4	+6.7

Source: Compiled from (1) UNCTAD Doc.TD/B/918, p.17, Table 3.
(2) Daily Review, n.66, p.1.

As on 1983 the USSR maintained commercial and economic relations with 143 countries, including 101 developing countries and the corresponding figures for trade and economic relations regulated by inter-governmental agreements was 116 and 79 respectively.[67] The major trading partners of the USSR are the socialist countries of East Europe (41 per cent of the total trade turnover in 1981) followed by the developed market economy countries (33 per cent) and the developing countries (about 26 per cent).[68]

67. Ibid., pp. 1, 8.

68. UNCTAD, n.63, p.19.

Pattern of foreign trade of the USSR reveals that in 1980, export of fuel and energy pushed machinery and equipment export to second position. Still, machinery and equipments continues to be a large item in Soviet exports to developing countries. Export of these items grew from 1.04 billion roubles in 1960 to 2.48 billion roubles in 1970 and reached 7.04 billion roubles in 1980 whereas export of complete Soviet equipments grew from 0.86 billion roubles in 1970 to 1.29 billion roubles in 1975 and reached 2.57 billion roubles in 1980, when they accounted for 32.7 per cent of the total exports of machinery and equipment.[69]

Generally, the trade agreements concluded between the USSR and developing countries envisage most favoured-nation status on a reciprocal basis in all matters concerning mutual trade.[70] The main features of Soviet foreign trade with developing countries are a constant rise in turnover, diversification of the trade pattern and commodity composition and exchanges with an ever-growing number of partner countries. The USSR's trade turnover with the latter grew from 5.2 billion roubles in 1970 to 28.3 billion roubles in 1981, which shows an increase of 5.4 times over a decade (see Table 2.5). The total exports

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69. Ibid., p. 19.

70. Ibid., p. 20.

of Soviet machinery and equipment to developing countries grew from 0.8 billion roubles in 1970 to 2.6 billion roubles in 1980 or more than three fold increase.[71]

Table 2.5

DEVELOPMENT OF THE USSR'S TRADE WITH DEVELOPING COUNTRIES

	1970	1975	1980	1981	1981 (1970=100)
Turnover	5.2	11.4	21.7	28.3	544
Export	3.2	5.9	12.3	15.1	472
Import	2.0	5.5	9.4	13.2	660

Source: UNCTAD. Doc. TD/B/918, p.32.

To sum up, Soviet foreign trade is closely associated with transfer of Soviet technology to developing countries through economic and technical cooperation. During 1971-80, 1035 projects were completed and put into operation in various countries with Soviet assistance. It included power stations with an aggregate capacity of 24 million KW, iron and steel works capable producing 17.9 million tonnes of steel, projects to produce 61.7 million tonnes of crude oil and 16.5 million tonnes of coal per annum etc.[72] It was also planned to put in operation 13

71. Ibid., p.33.

72. Ibid., p.19.

coke batteries, 9 blast furnaces and steel making plants capable of producing almost 9.5 million tonnes of steel per annum in 12 developing countries.[73]

2.5 Transfer of Soviet Technology and Development of National Economy

Transfer of resources from Soviet Union is an index of scientific and technological development of its national economy. It is illustrated by the growing scientific and technical cooperation of the USSR with other countries, with the growing scientific development in the Soviet society.

Tsarist Russia was predominantly agrarian in nature; with 80 per cent of the population engaged in agriculture. Whatever little industry Russia had at that time was financed by western capitalist firms.[74] After the October Revolution, Soviet economy has undergone structural changes with the completion of each five year plan.

From 1923 onwards, industrial sector received well over a third of all the resources invested in the economy, producer goods industry accounting invariably for no less than 80 per cent of all industrial investment.[75] The most noteworthy aspect of industrial

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73. Ibid., p.40.

74. Vinod Mehta, Soviet Economic Development and Structure (Sterling, New Delhi, 1970), p.20.

75. UNCTAD, n.64, p.12.

transformation is the change in the total output of producer and consumer goods. In 1928, producer goods accounted for 39.5 per cent of total industrial output, whereas it was 60.5 per cent for consumer goods whereas in 1978 the corresponding figures stood at 74 per cent and 26 per cent - almost a reversal of the trend (see Appendix 1).

The development of national economy over the sixty years since the formation of the USSR in 1922 will highlight the scientific and technological development in the Soviet society which can be summarised as follows:[76]

After 1917, the Soviet economy developed at stable rates which in several cases are higher than the world average. During the 1970s national income grew by 62 per cent, industrial production by 78 per cent and gross agricultural production by 66 per cent. The real per capita income rose by 46 per cent and labour productivity by approximately 50 per cent. In the same decade (1970-80), gross capital investments amounted to 1127 billion roubles as against 591 billion roubles in the previous decade. The pattern of investment reveals a growing share for equipment and machinery, which rose from 30 per cent in 1970 to 38 per cent in 1980. The production of means of

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76. UNCTAD, n.63, pp.6-8.

production accounted for 74 per cent of the total industrial output (see Appendix II). The current five year plan (1981-86) envisages an increase in industrial output by 26-28 per cent. Moreover, in the late seventies, Soviet industry started to shift the emphasis from quantitative to qualitative indicators.

In 1978 alone 675,000 new technology projects were implemented in the USSR at the expense of 8.7 billion roubles. It was expected to lower operational expenditure to the tune of 3.0 billion roubles in 1978. Moreover, annual economic effect from the introduction of new technologies would be equivalent to 4.3 billion roubles in 1978 (see Appendix II). Despite the commendable achievements in developing new domestic technology, the pace of its assimilation and diffusion among enterprises in the USSR has not been entirely satisfactory.[77]

As the USSR is an important source of technology scientific and technological development in the USSR is of great importance to developing countries. The growth of Soviet economy will be accompanied by further expansion of trade and economic links and transfer of resources to developing countries. It is evident from the fact that the share of developing countries in the total volume of

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77. UNCTAD, n.64, p.65.

Soviet economic and technical cooperation grew steadily since the post-War period. It increased to 64 per cent in the 1970s, from 55 per cent in the previous decades.

To be precise, the picture that emerges indicates that the Soviet policy on transfer of technology to developing countries is very much related to its foreign policy as well as the scientific and technological development in the Soviet society. The characteristic features that delineates Soviet policy from others can be assessed properly in specific context, which will be discussed in the succeeding pages.

Chapter III

TRANSFER OF SOVIET TECHNOLOGY TO INDIA, IRAN AND THE ARAB REPUBLIC OF EGYPT: A STUDY OF CAPITAL GOODS SECTOR WITH EMPHASIS ON THE IRON AND STEEL INDUSTRY

Capital goods sector, especially the iron and steel industry, is the backbone of modern industrial economies both in their initial stages of industrialisation and even past its take-off stage. In the long run, the rate of industrialization and growth of national economy would depend on the increasing production and cost effectiveness of this capital and energy intensive primary sector, including iron and steel, oil, heavy industry, power, etc. This is because its growth unleashes a chain reaction in the spurt of other industrial construction and agricultural activities just as it helps in further capital formation.

The distinct feature of capital goods is that they cause the reproduction and expansion of the stock of social wealth and the flow of social income through their contribution to gross fixed-capital formation. Thus, they fulfil the economic function of capital investment.[1] The

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1. UNIDO. Doc. IS.420, Capital Goods in Perspective, (Vienna, 1983), Sectoral Working Paper Series, No.11, p.2.

core of capital goods sector has the ability to reproduce itself and produce the means of production. Heavy industries, particularly iron and steel and machine tools constitute a dominant portion of this core sector. In the hierarchy of production, capital goods sector is one in which almost every other sector is dependent. World production of capital goods in value added terms can be estimated at over one-third of the world's industrial production.[2]

The imbalance in the capital goods sector between the developed and developing countries is evident from the low, merely 6 per cent contribution of the latter as a share of world production of capital goods.[3] Moreover, the share of developing countries in the world exports of capital goods is only 3.5 per cent as against their approximately 30 per cent share of imports. This adverse performance in production export and import, leading to dependence on imported capital goods is not conducive to the interests of the developing countries, even when savings are abundant and foreign exchange inadequate supply as the import are dependent on the market imperfections and the factor proportions of the producer cartels.

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2. Ibid., p. 3.

3. Ibid., p. 5.

Development of indigenous capability for design and manufacture of capital goods is an essential pre-requisite to unhindered industrial and technological development.[4] A well-developed capital goods sector is one of the essential conditions to effect assimilation, thereby avoiding not only the problems of technology transfer but also in the process contributing substantially to self-reliance, employment generation and the growth of secondary, tertiary and ancillary industries in the developing countries. Of the capital goods sector, iron and steel of different types and qualities, finds universal and diverse applications in all organised industrial sectors like transport, power, irrigation, communication, railways, defence, shipbuilding, agriculture and consumer industries.

As economic growth takes off and industrialisation spreads, demand escalates for key consumer goods which, in turn, boosts the demand for steel. In a developing economy steel demand always seems to keep ahead of available supplies and in a rapidly developing economy, it is a fast rising one. The demand for steel, in the functional sense, would comprise various types of requirements to produce capital goods and consumer durables; asset repair, maintenance and renewal needs; serve rehabilitation and replacement

4. UNIDO Doc. Io. 548, Manual for Planning the Development of Capital Goods Industries (Vienna, 1983), p.5.

and modernization programmes in the steel and steel-using industries and supplement inventories.[5] As the country enters the rapid growth stage, the steel intensity/consumption of its economy rises.[6] Thus, to sustain economic development and growth and to attain the LIMA target set for developing countries in the world iron and steel output (25 to 30 per cent of world production by year 2000 A.D.). Hence, it would be indispensable to attain self reliance in this vital sector by building steel plants of their own and mastering the steel production technology competitively.

3.1 Iron and Steel Industry - World Scenario

In the two centuries since the second half of 18th century when the first coke blast-furnace was put in operation in Britain, the centre of world iron and steel production, has dramatically changed. By the turn of the last century (1890-1900), the USA replaced Britain in iron and steel production. However, by 1970s, the USSR exceeded the USA in its phenomenal growth. In 1975, the USSR accounted for 22.8 per cent of world iron and

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5. N.R. Srinivasan, Iron and Steel Industry of India: A Monograph (The Tata Iron and Steel Company Limited, n.d., p.100).

6. 'Steel Intensity' is measured by the quantity of GNP measured in real, non-inflationary terms. The rapid growth phase is often defined as the stage in which real GNP per capita is between $400 and $2000 at 1963 prices.

steel production, whereas it was 17.6 per cent for the USA, 16.5 per cent for Japan and 3.2 per cent for Britain (see Table 3.1).

Table 3.1

HISTORICAL DEVELOPMENT OF IRON AND STEEL PRODUCTION

	Production as percentage of total				
	EEC[1]	UK	USA	Japan	USSR
1870	30.6	37.4	16.2		2.7
1880	31.0	26.8	27.5		4.0
1890	25.9	26.0	32.4		3.4
1900	26.3	17.5	35.4		6.2
1910	27.0	12.0	43.6		4.7
1920	20.3	13.4	59.8	1.1	5.1
1930	31.9	7.8	43.5	2.4	8.3
1940	20.5	9.3	42.9	4.8	12.9
1945	4.2	10.5	63.4	1.7	10.7
1950	16.5	8.6	47.1	2.5	14.2
1955	19.2	7.4	39.3	3.5	16.7
1960	21.0	7.1	26.4	6.4	18.8
1965	18.7	6.0	26.7	9.0	19.8
1966	17.9	5.2	26.3	10.1	20.4
1967	18.0	4.9	23.7	12.5	20.5
1968	18.6	5.0	23.0	12.6	20.1
1969	18.6	4.7	22.8	14.3	19.2
1970	18.9	4.9	21.1	16.1	20.0
1971	18.4	4.3	19.9	15.7	21.4
1972	18.6	4.2	20.3	15.9	20.6
1973	18.3	4.0	20.8	17.8	19.6
1974	19.4	3.3	19.8	17.1	19.9
1975	16.9	3.2	17.6	16.5	22.8

Source: UNIDO. Doc. ICIS.89, The World Iron and Steel Industry, 2nd Study, International Centre for Industrial Studies, p.42.

Over the past hundred years, the rise in world's steel output has been spectacular. In 1870, it was just short of ten million tonnes whereas it increased eight fold to 75 million tonnes by 1920 and climbed to 710 million tonnes in 1974.[7] The highest production of 747.5 million tonnes was achieved in 1979, while it came down to 703.3 million tonnes in 1981.[8] The USSR occupies the first place in world steel output with a production of 149 million tonnes in 1981. The USA comes next with 108.8 million tonnes and Japan, third, with 101.7 million tonnes.[9]

A typical integrated steel mill consumes four basic raw materials, iron ore, coal, fluxes and scrap.[10] The largest proportion of raw materials used in the production of iron and steel in relation to tonnage and value is iron ore. Iron ore production in the world, which was 611.4 million tonnes in 1965, increased to 794.5 million tonnes in 1970 and 853 million tonnes in 1980.[11] Again, the

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7. UNIDO Doc. IOD 118, Experience, Perspective and Projection of Developing Countries in the Iron and Steel Industry, Particularly in Africa and the Arab World (Vienna, 1977), p. 2.

8. N.R. Srinivasan, n.5, p.362.

9. Ibid., p.362.

10. William A. Johnson, The Steel Industry of India (Harvard, 1967), p.4.

11. N.R. Srinivasan, n. , p.363.

USSR stands first in the world iron-ore production[12] with an output of 244.76 million tonnes in 1980. The second important input, coking coal, is derived from various grades of bituminous coal. The world hard coal production in 1980 was 2760 million tonnes and the production of lower ranks of coal amounted to 961 million tonnes. The United States topped the world coal production (710 million tonnes hard coal) and the USSR came second with a production of 495.0 million tonnes.[13] Although developing countries produce over a fourth of the world's iron ore, they account for only 5 per cent of the world's coal output, while 95 per cent is produced in developed countries.

The highest per capita steel consumption, reckoned as crude steel equivalent, was 729 kgs. for Czechoslovakia in 1980. The next highest was Japan with 629 kgs. followed by the USSR 570 kgs., East Germany 549 kgs., and the USA 521 kgs.[14] Per capita annual consumption of steel was poor in most of the developing countries - it was only 16 kgs. for India.

According to an UNCTAD study, as on 1974, developed countries accounted for 72 per cent of the mining of iron ore, 95.3 per cent of pig iron production, 95.8 per cent

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12. Ibid., p.378.

13. Ibid., p.363.

14. Ibid., p.362.

of crude steel production and 90.3 per cent of crude steel consumption. On the other hand, the share of iron ore mining of developing countries was 28 per cent whereas their share of pig iron and crude steel production were 4.5 per cent and 4.2 per cent, respectively in 1974, and crude steel consumption was a meagre 9.7 per cent of the world total (see Table 3.2).

There is a severe competition in steel production between the two major economies of the world - the market economy countries and socialist countries. In the former group, the bulk of steel production is accounted for by the USA and Japan while the USSR stands first in the socialist group of countries, as well as in the world. While steel industry is beset with problems in almost all developed market economies it has been steadily progressing under direct state control in the socialist countries.[15]

In 1977, for the fourth consecutive year, the overall situation of world iron and steel industry was bad. The fall in production in the developed market economy countries - (394.2 million tonnes in 1976) - was balanced by the increase in production in the planned economy countries - (204.2 million tonnes in 1977 as against

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15. Ibid., p.369.

Table 3.2

Percentage contribution of developed and developing countries in world steel production at various stages of the production process, 1970-1974

Country or area	Stage 1 Number of iron ore					Stage 2 Production of pig iron					Stage 3 Production of crude steel					Consumption of crude steel				
	1970	1971	1972	1973	1974	1970	1971	1972	1973	1974	1970	1971	1972	1973	1974	1970	1971	1972	1973	1974
Developed	73	74	72	72	72	95.8	95.7	95.5	95.6	95.3	96.2	96.0	95.9	95.9	95.8	93.0	92.0	92.2	91.8	90.3
Developing	27	26	28	28	28	4.0	4.2	4.4	4.2	4.5	3.8	4.0	4.1	4.1	4.2	6.9	8.0	7.8	8.2	9.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: UNCTAD Doc.No. ST/ID/16, Trade and Structure Adjustment Aspects of International Iron and Steel Industry: The Role of the Developing Countries (New York, 1974), p.50.

199.0 million tonnes in 1976) together with that in developing countries - (75.9 million tonnes in 1977 as against 66.2 million tonnes in 1976).[16]

The global scenario of steel production before World War II shows that developing countries produced merely 1.3 million tonnes of crude steel, corresponding to less than one per cent of world production. It increased to 33.1 million tonnes in 1974 or 4.7 per cent of total world production.[17] According to one UNIDO projection, steel output of developing countries will grow from 36 million tonnes in 1974 to 125 million tonnes in 1985 registering an annual growth rate of 12 per cent (see Table 3.3).

Table 3.3

COMPARATIVE PROJECTED GROWTH FOR STEEL PRODUCTION: DEVELOPED AND DEVELOPING COUNTRIES - 1974-2000

	1974	%	1985	%	2000	%	Growth rate 1974-75	Growth rate 1974-2000
Industrialized countries	462	93	613	83	777	65	2.6	2.0
Developing countries	36	7	125	17	416	35	12.0	9.9
TOTAL	498	100	738	100	1193	100	3.6	3.4

Sources: UNIDO: Draft World Wide Study of the Iron and Steel Industry 1975-2000, Vienna, 1977.
UNCTAD: Trade and Structural Adjustment Aspects of the International Iron and Steel Industry: The Role of Developing Countries (p.9), UNCTAD/ST/MD/16/1978.

16. UNIDO Doc. ICIS 89, The World Iron and Steel Industry (Vienna, 1978), p.10.

17. UNCTAD Doc. ST/MD 116, Trade and Structural Adjustment Aspects of the International Iron and Steel Industry: The Role of Developing Countries (New York, 1978), p.8.

The steel imports of developing countries increased from 16.9 per cent in 1970 to 25.5 per cent in 1979, whereas exports registered a marginal increase of 6 per cent in 1979 from 2.9 per cent in 1970 (see Table 3.4).

Table 3.4

IMPORTS AND EXPORTS - DEVELOPING COUNTRIES STEEL TRADE

Country	Imports			Exports		
	1970	1975	1979	1970	1975	1979
Africa	2592	3286	3456	-	-	-
Latin America	3135	8069	6348	1060	372	2479
Asia	5628	8103	13831	1381	2157	5262
Southern Europe	1222	2824	2545	220	375	582
Middle East	2668	9472	9498	-	-	-
Total for developing countries	15245	31754	35670	2661	2904	8323
World Total	90396	113987	139764	90396	113987	139764
Percentage	16.9	27.9	25.5	2.9	2.5	6.0

Source: IISI Steel Statistics.

Further, it has been assumed that growth rate in steel consumption in the developing countries would be 7.5 per cent between 1976 and 1985 and 7 per cent between 1985 and 2000 A.D. Based on this, steel consumption by the developing countries is expected to be 213 million tonnes in 1985, which would be a 23 per cent share in the total world consumption of steel in 1985.[19]

19. U.R. Srinivasan, n.5, p.371.

Developing countries are also beset with many problems in the iron and steel industry. Heavy investments that are required to develop iron and steel sector are incompatible with the financial capabilities of a large number of developing countries. Construction of a 1.5 million tonnes integrated plant requires capital assets equal to US $3 billion.[20] International competition, coupled with increasing cost per unit of output, hinder the development of steel sector in the developing countries. Infrastructural shortcomings lead to wastage of energy and financial losses at the operational stages of the industry. Hence, transfer of technology to this important sector from industrially advanced countries has assumed importance.

3.2 Iron and Steel Industry in the USSR

Development of iron and steel industry in the USSR has proceeded at a pace that is without any parallel in any other country. In 1913, Russia produced only 4.2 million tonnes of steel and 4.2 million tonnes of pig iron, which was less than one quarter of German output

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20. UNIDO, 1990 Scenario's for the Iron and Steel Industry (Vienna, 1982), Doc. No./ID/WG.374/2 AND I, p.238.

and one seventh of American output for the same year.[21] (See table in Appendix 5).

In 1972, the USSR exceeded United States in steel production, with an output of 126 million tonnes, which was three times more than that of West Germany. Crude steel production in the USSR was 147.9 million tonnes in 1980, which was 20.6 per cent of world crude steel production (717.4 million tonnes)[22] (see Table 3.5). In the same year, the USSR accounted for 244.76 million tonnes of iron ore out of the world output of 853.0 million tonnes and it was highest in the world.[23]

Moreover, the USSR produced 495.0 million tonnes of hard coal and 162.0 million tonnes of lower rank coal, while the corresponding world figures were 2760 million tonnes and 961 million tonnes, respectively, in 1980.[24]

In terms of per capita consumption of steel (the important indicator of industrialisation) the USSR stands third in the world, with a consumption of 570 kgs.[25]

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21. Kenneth Warren, World Steel: An Economic Survey (New York, 1975), p. 248.

22. U.K. Iron and Steel Statistics Bureau, International Steel Statistics: West European Countries, Greece, Turkey, Yugoslavia, 1980, p. 48 and D.R. Srinivasan, n.5, Table 10-I, pp. 374-75.

23. D.R. Srinivasan, n.5, pp. 363, 370.

24. Ibid., p. 363.

25. Ibid., p. 362.

Table 3.5

USSR CRUDE STEEL PRODUCTION DURING 1970-80

(thousand tonnes)

	1970	1977	1978	1979	1980
By process (all qualities)					
Open Hearth	84052	91900	92800	90100	-
Oxygen	19935	39400	42500	43200	-
Electric	10710	14500	15100	14900	-
Other processes	1189	900	1000	900	-
Total	115886	146700	151400	149100	-
By Cast Method (all qualities)					
Cast to ingots	103753	134500	137000	133800	
Continuously Cast	4983	12200	14400	13300	147931
Steel for castings	7150	(a)	(a)	(a)	
Total	115886	146700	151400	149100	147931

(a) included with cast to ingots.

Source: U.K. Iron and Steel Statistics Bureau International Steel Statistics, East European Countries, Greece, Turkey, Yugoslavia, 1980, p.48.

Historically, with the completion of each of the five year plans, Soviet iron and steel industry attained new heights. The first five year plan (1928-32) emphasized building of capital goods sector, particularly iron and steel industry. The scale of activity can be judged from the fact that during the first plan period itself, 41 blast furnaces, 77 open hearth furnaces and 32 rolling mills were commissioned.[26] During the above period, pig iron production rose by 88 per cent and steel output by 37 per cent. The trend in production was maintained till the out break of World War II. During the War, Germany inflicted damages worth 10,000 million roubles on the Soviet iron and steel industry.

The growth of iron and steel industry of the USSR in the post-War period till today has been spectacular. While the first five year plan envisaged 58,000 million roubles for capital investments, it was 594,000 million roubles for capital investments, it was 59%,000 million roubles in the fifth five year plan 990,000 million roubles in the sixth five year plan. Metallurgy consumed two-thirds of the capital investments, of which the iron and steel sector accounted for the major chunk. During 1946-50, the pig-iron production doubled and the steel output rose

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26. Lazar Reitburd, Soviet Iron and Steel Industry: Development and Prospects (Moscow, 1956), p.11.

twenty two fold and rolled metal 2.5 fold.[27] With 149 million tonnes in 1981, the USSR occupies the first place in world steel production.[28]

In the post-War period, modern techniques such as fluxed sinter, introduction of steam to the blast, use of oxygen in the metallurgy, evaporation cooling in the open hearth process, continuous pouring of steel, modern blooming mills, etc. were incorporated in the iron and steel industry.

Another startling new technique known as "Pressure blowing" or high top pressure blast furnace operation was introduced and it was reported that it raised production by five to seven per cent and reduced coke consumption by four per cent and cut flue dust by 7 per cent.[29] Introduction of oxygen-enriched air in the metallurgy raised steel output in open hearth furnace by 20 per cent on the average and improved the quality considerably. The use of oxygen in electric furnaces increased the output by 25 to 30 per cent. In 1960, 40 per cent of all the steel produced was with the use of oxygen.[30]

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27. Ibid., p. 23.

28. N.R. Srinivasan, n.5, p. 362.

29. M.Gardner Clark, The Economics of Soviet Steel (Cambridge, 1956), p. 265.

30. Lazar Koltsburd, n. 26, p. 41.

'Mechanization and automation' signify advanced techniques in the iron and steel industry. In the fifties, Soviet metallurgists developed mechanization and automation to a point where all processes in furnaces and rolling mills could be controlled from one board, like at many Soviet hydro-electric stations.[31] By 1955, operation of almost all blast furnaces was not only mechanized, but also automated. Automation which increases productivity and reduces final expenditure was employed for 90 per cent of open hearth production in 1956. Moreover, automation was introduced to rolling mill operations - from the heating of the metal to the final stage.

During 1946-54, national average for blast-furnace productivity increased by 45 per cent and open hearth productivity by 61 per cent.[32] Automation, says Soviet metallurgists, has increased productivity by 7 to 10 per cent and cut fuel expenditure by 2 to 6 per cent. According to Gardner Clark, an expert on Soviet steel industry, the productivity of Soviet blast furnaces and open hearth furnaces is higher than that of America, but the productivity per worker is less.[33] A group of West European

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31. Ibid., p.46.

32. M.Gardner Clark, n.29, p.258.

33. Ibid., p.247.

experts who visited a few Soviet iron and steel plants in the fall of 1955 were thoroughly impressed by the automatic equipments they encountered during their ten day trip.[34]

Thus, the systematic introduction of latest technology made it possible to raise the productivity of blast furnaces, open hearth furnaces and rolling mills of Soviet iron and steel industry. Today, the USSR with its vast experience and greater skill of personnel can build swift low cost and high quality iron and steel industry.

At present, the USSR has five major metallurgical bases which, in the declining order, are the Ukraine, the Urals, the Kusbass, European Russia and the Karaganda. The most important iron ore production has been from the Ukraine and the Urals; but it is now known that far away, the biggest reserves are in the Chernozem Steppes of the European RSFSR in the Kursk Magnetic Anomaly (KMA) area. KMA area alone is credited with forty per cent of the mineral resources of the USSR as on January 1958.[35] Magnitogorsk, Novo Tagil and Cholyanbinsk Works accounted for 62 per cent of the production from Urals, the major economic region.

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34. Ibid., p. 262.

35. Kenneth Warren, n. 21, p. 244.

In 1955, Magnitogorsk's blast furnace No.6 reported a record coefficient of 0.59 which means that it turned out a daily average of some 2420 short tonnes. It exceeded the world record of 1981 short tonnes achieved by the blast furnace 'J' of Bethlehem Steel Company in May 1954.[36]

The iron and steel industry in the USSR has made rapid strides in many fronts under direct state control. Apart from ordinary iron and steel products such as rails, structural beams and channels, bars etc. the USSR emphasises the production of five special branches of industry: iron and steel pipes, ferro-alloys, quality steel, ammunition steel and steel mills equipment.[37] In particular, Soviet iron and steel industry has kept itself abreast of current world developments and has been systematically planning development on long-term basis of ten to fifteen years in advance.[38]

In this task, Gipromez, the state organisation for design in steel industry, has been the spearhead for development. As far back as 1933, Gipromez had foreseen that the future steel works should be accomplished in two stages. In the first and immediate stage, the blast

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36. Gardner Clark, n.29, p.265.

37. Ibid., p.11.

38. N.R. Srinivasan, n.5, p.369.

furnaces, converter and continuous casting would receive attention for maximum process development. The second and distant stage envisaged fully automated new type of steel works, integrating processes from mining to hot and cold finishing, and incorporating centralized control systems involving continuous coke making, a probable replacement of the blast furnace by coalless techniques employing direct reduction and plasma metallurgy, continuous rolling mills where rolling, heating and conditioning will be carried out sequentially without intermediate reheating or storage, and also employing the technique of endless rolling by butt-welding slabs end to end, electromagnetic transport of iron and steel materials and finally keeping in view newer products and quality in steel.[40] It has been stated that the new type of steel works could be regarded as an important milestone in the new era of a forthcoming industrial revolution. Soviet achievements in quality steel production, technological and managerial and design skills placed it among the most advanced technological leaders in world steel industry. Soviet experience in building and operating and in R & D related to steel sector has made gainful contributions to the tackling of steel production problems. Its achievements in the state of the

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40. Ibid., p. 369.

art combined with its willingness to share their technology justifies to a large extent the propensity of the Third World Countries to seek their help in achieving self-reliance on the steel sector.

3.3 Transfer of Soviet Technology to India

(a) Iron and Steel Sector

The evolution of public sector iron and steel industry in India highlights the interplay of international politics and the efforts of a developing country for self-reliance in industrial development. The importance of iron and steel sector in the national economy has been mentioned in the preceding pages. It is in this context that Soviet assistance to India's public sector, particularly iron and steel industry, has to be evaluated.

Independent India decided to go for industrialisation and naturally high priority was accorded to the development of steel sector. On the eve of independence, demand for steel was very high - around four million tonnes - but internal production was barely 1.5 million tonnes, and the import bill was over Rs.20 crores.[41] Inability to mobilise necessary capital at home as well

41. M.Sebastin Stanislaus, Soviet Economic Aid to India: An Analysis and Evaluation (New Delhi, 1975), p.115.

as foreign exchange problems thwarted all efforts to set up a steel plant in the public sector till February 1952. India approached Germany, U.K., U.S.A., France, Japan and World Bank for financial assistance to set up a steel plant in the public sector which was blatantly discouraged by all. Germany and the UK were not only unwilling to advance aid but also raised objections about policy and management thus leading to protracted negotiations. It is in this situation that the Government of India signed an agreement with the German Combine Krupp Demag to set up Rourkela Steel Plant on 31 December 1953 on highly unfavourable terms in which the latter was to hold 20 per cent of shares in ownership. On the other side, the Metallurgical Equipment Export Company, representing six engineering concerns, made an offer to the Birla mission that visited London during this period to supply equipments worth £45 million for a steel plant in the private sector.[42] Negotiations with Germans and the British which started in 1953 dragged on for over two years. It is at this juncture that the USSR offered to assist India to build a one million

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42. The Times (London), 31 December 1958, cited in Vishnu Mohan, Transfer of Technology from Developed to Developing Countries: A Case Study of Bhilai Steel Plant, unpublished M.Phil dissertation, submitted in the School of International Studies, Jawaharlal Nehru University, New Delhi, 1981, p.34.

tonnes steel plant in public sector and an inter-governmental agreement to that effect was signed in February 1955, on terms favourable to India.

Soviet offer sent ripples in the Thames and the Rhine. In the wake of Soviet entry in the field, both British and German parties hastened to finalise agreements with the Government of India. When the agreement was signed by the Government of India with Germans in November 1956, they waived off both their insistence for share in the steel plant and directorship in the Hindustan Steel Limited (HSL) which was formed in 1954 to construct and manage Rourkela Steel Plant. Thus, Soviet offer enabled India to establish three integrated public sector steel plants during the Second Five Year Plan period. On 3rd January 1955, the British Government made an offer to build a steel plant in the public sector.

Bokaro, the third intgrated steel plant in the public sector carries with it the humiliating experience, India had with the USA. Although at different times, the UK, the Soviet Union, Japan and West Germany came into picture of Bokaro from the time it was thought of in 1960, it was the US that India approached formally for help. The history of Bokaro steel plant highlights the conflicting interests - the American interest for overriding

control of the management of the project with a minimum financial risk on the one hand and the Indian desire for maximum participation in terms of consulting, supervision of construction and supplies of indigenous equipments and materials. American opposition to a steel plant in Indian public sector emerged from ideological and economic considerations. It is evident from the American attitude as expressed in the statement that the commitment of about half a billion dollars to a single steel plant in the Indian public sector was contrary to the 'American way of life', the ideology of free enterprise.[43] Another consideration was the threat posed by Bokaro to American interests, specifically to US shipping and steel interests. Mr. Obbard, the Ex-Vice-President of the U.S. Steel Corporation, observed that the demand for US steel by financing of Bokaro would be marginal. A final 'anti-collaboration' argument proceeded from the opposition that American credits to Bokaro would be an unsound investment.[44] The Americans stuck to the 'turnkey' concept by which the Americans would build the plant, manage it for a period of ten years and hand it over to India. The most humiliating part of the negotiations was that they

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43. Padma Desai, The Bokaro Steel Plant: A Study of Soviet Economic Assistance, (North-Holland, Netherlands, 1972), p. 27.

44. Ibid., pp. 29-30.

called into question the reliability of Indian statistics.[45] Finally, India withdrew when US turned down India's request for aid for setting up the plant. Once again, the USSR offered assistance to construct Bokaro Steel Plant and extended a credit upto 190 million roubles bearing 2.5 per cent interest per annum.[46] On the other hand, German credits carried the highest percentage of interest (6.3 per cent) whereas Durgapur, credit from Britain, carried 5.5 to 6 per cent interest plus 0.25 per cent management fees.

To sum up, Indian public sector steel industry stands testimony to the efforts made by a developing country to achieve self-sufficiency in capital goods sector in the complex international environment. In the subsequent pages, we will evaluate the features of Soviet assistance and the performance of Soviet aided steel plants in India.

Bhilai

On 2 February 1955, Soviet Union signed an inter-governmental agreement with India to set up an integrated

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45. M. Sebastin Stanislaus, n.41, p.115.

46. Indo-Soviet Agreement on Bokaro, 25 January 1965, reprinted in Bimal Prasad, ed., Indo-Soviet Relations 1947-72: A Documentary (Delhi, 1973), p.281, Article 1.

iron and steel works of the capacity of one million tonnes of ingot capacity, at Bhilai, in Madhya Pradesh, with provision for expansion to 2.5 millions tonnes and four million tonnes later. As per the agreement, design of the works and the component parts as well as the manufacture of the equipments were to be carried out by the Soviet organisations, whereas Indian organisations were to provide details of quality and quantity of ores, coal and raw materials, necessary data to enable the Soviet organisations to carry out their duties, and labour and other facilities essential for topographical and other works.[47]

Aid given by the USSR for the first phase of Bhilai was Rs.101.96 crores and for expansion purposes, two other credits of Rs.95.29 crores and Rs.7.43 crores were sanctioned in 1959 and 1961 respectively.[48] The credits so raised were to be repaid by twelve equal instalments payable on or before the 15th day of March of each year in which each such credit is raised. Interest will accrue at two-and-a-half per cent per annum from the date on which each credit is raised and will be similarly repaid. All payments to

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47. Ibid., Indo-Soviet Steel Agreement, pp.87-88, Article II and III.

48. M.Sebastin Stanislaus, n.41, p.72.

be made shall be in Indian rupees to a separate account in favour of the Soviet organizations to be opened with the Reserve Bank of India.[49]

The Bhilai steel plant with one million tonnes ingot steel capacity was commissioned in September 1961 and the 2.5 million tonnes unit in October 1967, with a final cost of Rs.201.39 crores and Rs.149.45 crores, respectively (see Appendix 6). The 4.5 million tonnes stage with an anticipated cost of Rs.1600.50 crores is expected to be commissioned in December 1984 (see Appendix 6).

In the expansion scheme of Bhilai, there was a progressive reduction of foreign exchange component as well as the number of foreign specialists. Foreign exchange component was 48 and 42 per cent for the one million tonnes and 2.5 million tonnes stages, respectively. It was further reduced to 30 per cent in the 3.2 million tonnes expansion estimate.[50]

Production Performance

The product mix of the integrated steel plants of India has been designed to serve the diverse needs of

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49. Bimal Prasad (ed.), Indo-Soviet Relations 1947-72: A Documentary (Delhi, 1973), pp.89-92.

50. M.Sebastin Stanislaus, n.41, p.73.

various sectors of economy and includes blooms, slabs, billets, bars, light, medium and heavy structurals, rails, sleepers, wheels, hot and cold rolled sheets and strips, etc. Bhilai, the first integrated steel plant in India's public sector, produces heavy structurals, merchant products, wire rods, heavy rails etc., that are highly important for the development of various sectors of the economy.

Operationally, the performance of Bhilai has been very good compared to other steel plants. In terms of capacity utilization it was the best and highest among the integrated steel plants of the Steel Authority of India Limited (SAIL).

Bhilai steel plant, since inception (1958-59), till 1981-82, produced 44.11 million tonnes of hot metal, 11.96 million tonnes of pig iron for sale, 38.32 million tonnes of ingot steel and 31.28 million tonnes of saleable steel while the corresponding figures for the four integrated steel mills together (Bhilai, Durgapur, Rourkela and Bokaro) were 104.15 million tonnes, 24.54 million tonnes, 86.45 million tonnes and 66.51 million tonnes respectively (see Appendix 7). Thus, Bhilai accounted for 42.35 per cent of hot metal, 48.74 per cent of pig iron for sale, 44.33 per cent of ingot steel and 47 per cent of saleable steel produced by four integrated steel plants of SAIL since inception.*

*Calculated from Appendix Table 7.

During 1981-82, actual production of ingot steel in Bhilai steel plant was 2.11 million tonnes against the revised target of 2.41 million tonnes and it represents 84.6 per cent of the rated capacity (2.5 million tonnes) and 87.6 per cent of revised target saleable steel production (1.82 million tonnes) achieved 92.6 per cent of rated capacity as well as revised target (see Appendix 8).

In 1982-83, in terms of production of hot metal, Bhilai achieved 80 per cent of the rated capacity while production of sintering plant achieved 60.6 per cent. With an average pushing of 503 ovens per day that was 89.0 per cent of the revised target, Bhilai topped among the public sector plants (see Appendix 9).

During 1982-83, Bhilai accounted for 21.3 lakh tonnes of ingot steel, 18.3 lakh tonnes of saleable steel and 4.57 lakh tonnes of pig iron, which was the highest among the integrated steel plants of SAIL (see Table 3.6).

In terms of percentage, in 1982-83, Bhilai produced 35 per cent of ingot steel, 35.4 per cent of saleable steel and 46.4 per cent of pig iron of the four integrated plants of SAIL (see Table 3.6).

Table 3.6

INDIA: PRODUCTION 1982-83

(in lakh tonnes)

	Bhilai	Bokaro	Durgapur	RSL	Total
Ingot steel	21.3 (35.17)	18.3	9.5	11.4	60.55
Saleable steel	18.3 (35.43)	15.3	8.1	9.91	51.64
Pig iron	4.57 (46.40)	3.92	1.05	0.29	9.85

Source: Compiled from 11th Annual Report, SAIL; 1982-83, Ministry of Steel and Mines, New Delhi, pp.5-6.

Bokaro

As the pace of industrial development gathers momentum, the demand for flat products go up faster than long products. Domestic production of quality flat products will reduce the burden of importing steel. The experience gained from setting up three steel plants with extensive foreign collaboration and the determination to achieve self-sufficiency by gradually reducing imports of flat steel items as well as the desire to develop indigenous talents and use indigenous equipments to the fullest extent were the important determinants leading to the establishment of Bokaro steel plant in Bihar.

An Indo-Soviet agreement was signed on 25 January 1965, to set up an iron and steel works at Bokaro with a capacity of 1.5 to 2 million tonnes of steel per year with provisions for expansion of the works to four million tonnes of steel per year. According to the agreement, Soviet organisations were to prepare the detailed project report, prepare the working drawings for the construction of the plant, deliver equipments and materials that are not available in India, and render assistance to Indian organizations in the various stages of the project.[51] Article 4 of the agreement envisages that Indian and Soviet parties shall promote maximum possible participation of Indian organizations in carrying out design work and in the supply of equipment and materials for the construction of the works.

The USSR extended a credit of 190 million roubles, bearing 2.5 per cent per annum which was to be used by the Government of India starting from 1 January 1966, in payment for (a) the designing work carried out by the Soviet organisations and (b) the equipment and the materials which are not available in India and delivered from the USSR.[52] Terms and conditions for repayment of Bokaro credit were similar to that of Bhilai steel plant.

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51. Indo-Soviet Agreement on Bokaro, Articles I, II and VII cited in Bimal Prasad, n.46, pp.281-82.

52. Ibid., p.284, Article 7.

The first phase of 1.7 million tonnes ingot steel capacity which was originally scheduled to be commissioned in 1971 was commissioned in 1978 at an estimated final cost of Rs. 981.34 crores. The second phase (four million tonnes ingot steel capacity) is expected to be commissioned by June 1984. (See Appendix 6). The latest technological developments available in the USSR was to be utilised in this plant. Iron would be made in 2000 cubic metre furnaces which would be among the largest in Asia. The four million tonnes expansion scheme comprises modern raw material handling system, Sinter Band-3 complex, coke oven battery No.6 and 7, blast furnace No.5, SMS II, CRM complex and 3 units of the captive power plant that are scheduled to be commissioned on or before December 1984 (see Appendix 10).

As already mentioned in the agreement, Bokaro marks a major step forward in the use of indigenous equipments and materials. In the first phase of 1.7 million tonnes of ingot steel capacity, only 37 per cent of the equipment has been imported, as against 87.7 per cent and 77.0 per cent during the first phase and expansion upto 2.5 million tonnes of Bhilai. In the second stage of Bokaro, the share of imported equipment is expected to come down to 14 per cent.[53]

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53. Vinod Mehta, Soviet Union and Indian Industrial Development, (New Delhi, 1975), p.50.

The Heavy Engineering Corporation and the Mining and Allied Machinery Corporation are the principal suppliers of mechanical equipment to Bokaro steel plant. The Heavy Engineering Corporation alone is supposed to supply 72,000 tonnes of mechanical equipment and 26,500 tonnes of steel structurals.[54] The Gardon Reach Workshop, Jessops, Instrumentation Limited, Kota, and many other public sector undertakings will be associated at different stages of the project.

Production Performance

Bokaro steel plant produces flat products that are highly important for the further development of the country. Saleable steel items manufactured at Bokaro are hot rolled coils, plates, sheets, cold rolled coils, sheets and hot rolled pickled coils. The product mix of 1.7 million tonnes stage is 789,000 tonnes of hot rolled light plates, sheets and coils and 425,000 tonnes of cold rolled sheets and coils.[55]

From the date of commissioning in 1972-73 upto 1982, Bokaro produced 13.57 million tonnes of hot metal, 5.45 million tonnes of pig iron for sale, 7.7 million tonnes of ingot steel and 5.79 million tonnes of saleable steel (see Appendix 7). When converted into percentage, Bokaro

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54. O.P. Mehta, From Bhilai to Bokaro (n.d pp. 29-31.

55. M. Sebastin Stanislaus, n.41, p.76.

accounted for 13 per cent of hot metal, 22.2 per cent of pig iron, 8.9 per cent of ingot steel and 8.7 per cent of saleable steel produced by the four integrated steel plants of SAIL.*

During 1981-82, with a production of 1792000 tonnes of ingot steel, Bokaro achieved 71.7 per cent of rated capacity while it was 87.4 per cent of the revised as well as original target. Saleable steel production reached 1472000 tonnes, which is 74.7 per cent of rated capacity and 92 per cent of revised target (see Appendix 8). The same year, hot metal production reached 59.9 per cent of the rated capacity while it was 56.6 per cent for sinter products. With an average pushing of 402 ovens per day, it achieved 82.9 per cent of revised target. (see Appendix 9).

In 1981-82, saleable steel products of Bokaro comprised 80,000 tonnes of slabs, 584000 H.R. coils, 379000 H.R. plates (including thick plates) 155000 tonnes H.R. sheets, 177000 C.R. coils, 92000 H.R. coils and 5000 H.R. pickled coils. In 1982-83, Bokaro alone accounted for 30 per cent of ingot steel, 29.6 per cent of saleable steel and 39.8 per cent of pig iron produced by the four integrated steel plants of SAIL.[56] Additionally, the plant has made considerable progress in the production

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*Tabulated from Appendix 7.

56. Bokaro Annual Statistics 1982-83, 'Managing Directors Forward', Bokaro.

of special quality steels as well as changing the production of critical items such as 2.55 mm. and below in H.R. coils and 0.63 mm. in C.R. coils.

Vishakhapatnam Steel Plant

Indo-Soviet agreement on Vishakhapatnam steel plant is another step forward in the transfer of Soviet technology to developing countries. The provisions in the agreement emphasise the fact that development of scientific and technological capability of a country promotes its bargaining capacity as well as indigenous participation considerably.

Indo-Soviet agreement for a steelworks at Vishakhapatnam with an annual capacity of three million tonnes of which the first stage with a capacity of about 1.2 million tonnes was to be completed in four years from the date of commencement of construction was signed on 12 June 1979 in Moscow.[57]

Vizag project, with a 3.4 million tonnes ingot steel capacity, was estimated to cost Rs.2256 crores.[58] It was revised in 1980 and now it is expected to cost

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57. Ministry of Steel and Mines, Agreement between the Government of India and the Government of the USSR for cooperation in the Construction of an Iron and Steel Works at Vishakhapatnam, 1979, pp. 1 & 6, Articles 1, 15.

58. Data Hand Book, SAIL, New Delhi, 1981, p.35.

Rs. 3098.98 crores. The first phase is scheduled to be commissioned in 1985, while the 2nd phase, in 1987 (see Table 3.7).

Table 3.7

VISHAKHAPATNAM STEEL PROJECT

Capacity	3.4 mt. ingot steel	2.983 mt. saleable steel
Estimates	OE	RE
Rs. in crores	2256.00	3098.98
Year of estimate	1977	1980
Commissioning schedule	Original approved commissioning date 1985-87	Expected commissioning date 1985 (Ph. I) 1987 (Ph. II)

Source: Project Division, SAIL, Ministry of Steel and Mines, New Delhi.

The most noteworthy aspect of the cooperation agreement as the title itself indicates is the larger involvement of Indian organisations from the preparation of detailed project report (DPR) to the final commissioning of the plant. DPR for Bhilai and Bokaro was prepared by Soviet organisations, whereas in the case of Vishakhapatnam it was to be prepared jointly by Indian and Soviet organisations.[59]

59. Ministry of Steel and Mines, n.37, pp. 1-2, Article 2.

Soviet Union extended a credit of 250 million roubles, specified in the Soviet-Indian agreement on economic and technical cooperation of 27 April 1977 for the first stage of the project.[60] As per the agreement signed between the Government of India and the USSR on 12 May 1983, another credit of 140 million roubles was extended for the second stage of three million tonnes of steel annual capacity.[61]

The amount of credit that will be utilised is to be repaid within seventeen years by equal annual instalments. The first instalment is to be repaid three years after the year of utilisation of the corresponding portion of the credit.[62] It carried an interest of 2.5 per cent per annum. The credit so extended was to be utilised as per the provisions in Article I of the agreement.[63]

Thus, in the case of Vishag steel plant, Indian participation is much higher than Bhilai and Bokaro steel plants. Moreover, the credit extended for the second stage of the plant was to be repaid in 17 years time, whereas it was 12 years in the case of Bhilai and Bokaro.

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60. Ibid., p.4, Article 7.

61. Ministry of Steel and Mines, Agreement Between the Govt. of the Republic of India and the Govt. of the USSR on Economic and Technical Cooperation in the Construction of the 2nd Stage of the Iron and Steel Works at Vishakhapatnam (New Delhi, 1983), p.1, Article 1.

62. Ibid., pp.2, 3, Article 2.

63. Ibid., pp.1, 2, Article 1.

Evaluation: Soviet Aided Steel Projects

Production of steel is one of the indicators of modernisation and development of industry. Self-reliance in industry presupposes sufficient domestic production of iron and steel which is the barometer of progress.

Today, the rated capacity of Soviet aided steel plants that have been commissioned is 4.2 million tonnes of ingot steel and 3.32 million tonnes of saleable steel. When the expansion stages are completed, the three Soviet aided steel plants in India's public sector are likely to have a production capacity of 11.4 million tonnes of ingot steel and 9.302 million tonnes of saleable steel (see Table 3.8).

Table 3.8

RATED CAPACITY OF SOVIET AIDED STEEL PROJECTS
(million tonnes)

Plants	Commissioned date	Rated capacity Ingot steel	Rated capacity saleable steel	Expected date of commiss. (expansion)	Rated capacity Ingot steel	Rated capacity Saleable steel
Bhilai	Sept. 61	2.5	1.935	Dec. 1984	4	3.156
Bokaro	Feb. 78	1.7	1.355	Dec. 1984	4	3.156
Vishakhapatnam	-	-	-	1985-1987	3.4	2.933
TOTAL	-	4.2	3.320	-	11.4	9.302

Source: Compiled from Data Hand Book, SAIL: 1982, Ministry of Steel and Mines New Delhi.

Production of steel in India entered a new stage with the Soviet Union offering assistance to build steel plants. In 1982-83, Bhilai and Bokaro together accounted for 86.35 per cent of pig iron, 65.30 per cent of ingot steel and 65 per cent of saleable steel produced by the four integrated steel plants of SAIL (see Table 3.9).

In 1981-82, Bhilai, with the present installed capacity of 2.5 million tonnes of ingot steel, achieved production of 2.1 million tonnes which is about 84.6 per cent of the rated capacity. Percentage fulfilment of rated capacity was 92.6 per cent and 80 per cent for saleable steel and hot metal, respectively (see Table 3.10).

On the other hand, Bokaro with a rated capacity of 2.5 million tonnes ingot steel, produced 1.79 million tonnes which is 71.7 per cent of the rated capacity. In the production of saleable steel, Bokaro achieved 74.7 per cent and hot metal 59.9 per cent of the rated capacity (see Table 3.10).

To sum up, in 1981-82, Bhilai achieved the highest percentage of rated capacity in ingot steel production followed by Bokaro. Moreover, Bhilai stood first in the fulfilment of rated capacity of saleable steel and hot metal production among the integrated steel plants in India.

Table 3.9

PRODUCTION IN THE FOUR INTEGRATED STEEL PLANTS OF SAIL 1982-83

(Unit: '000 tonnes)

Item	Bhilai	Bokaro	Durgapur	Rourkela	Total of 2 + 3	Grand Total	% of 6 to 7
1	2	3	4	5	6	7	8
Pig iron	457373	392755	105330	29032	850128	984490	86.35
Ingot steel	2130010	1828820	952117	1144103	3958830	6055050	65.38
Saleable steel	1831172	1528934	812908	991506	3360106	5164520	65.0

Source: Tabulated from Eleventh Annual Report, SAIL, Ministry of Steel and Mines, 1982-83, New Delhi.

Table 3.10

PERCENTAGE FULFILMENT OF RATED CAPACITY AT MAIN PRODUCERS DURING 1981-82

(Unit: '000 tonnes)

Unit	Ingot steel			Saleable steel			Hot metal		
	Rated capacity	Actual productivity	% of 2 to 1	Rated capacity	Actual productivity	% of 5 to 4	Rated capacity	Actual productivity	% of 8 to 7
	1	2	3	4	5	6	7	8	9
BSP	2500	2115	84.6	1965	1819	92.6	2970	2377	80.0
DSP	1600	930	58.1	1239	782	63.1	1700	1023	60.2
R & D	1800	1203	66.8	1225	1091	89.0	1600	1336	83.5
BSL	2500	1792	71.7	1971	1472	74.7	3660	2192	59.9
IISCO	1000	600	60.0	800	488	61.0	1300	800	61.5
SAIL	9400	6640	70.6	7200	5551/ 6440	78.4 77.0	11230	7728	68.8

Source: Compiled from Data Hand Book, SAIL, 1983, Ministry of Steel and Mines, New Delhi, pp. 8411.

Bhilai steel plant has produced 44.12 million tonnes of hot metal, 38.33 million tonnes of ingot steel and 31.29 million tonnes of saleable steel since inception.

Table 3.11

IMPORTANT PRODUCTS OF SOVIET AIDED PROJECTS: PRODUCTION SINCE INCEPTION ('000 tonnes)

	Production in Soviet aided projects			Total production in six integrated plants	% of 4 to 5
	Bhilai (a)	Bokaro (b)	Total (a+b)		
1	2	3	4	5	6
Hot metal	44110	13577	57695	168131	34.3
Ingot steel	38332	7707	46039	146452	31.4
Saleable steel	31293	5790	37083	114651	32.4

Source: Tabulated from Data Handbook, SAIL, 1982, Ministry of Steel and Mines, New Delhi, p. 38

On the other hand, Bokaro produced 13.50 million tonnes of hot metal, 7.7 million tonnes of ingot steel and 5.8 million tonnes of saleable steel since its inception. The two Soviet aided steel plants together accounted for 34.3 per cent hot metal, 31.4 per cent of ingot steel and 32.4 per cent of saleable steel produced by the six integrated steel plants in the country so far (see Table 3.11).

Steel production and capacity utilisation among the integrated steel plants was highest in Bhilai. During 1981-82, capacity utilisation of saleable steel alone reached 92.6 per cent in Bhilai, the highest in India.

Cost of production, labour productivity, investment per ton, financial returns, etc., indicate the efficiency of a steel plant. The actual cost of production of steel in the various Indian steel plants show that Bhilai is the most economical unit, even when compared with the two private sector steel plants.[64] The highest cost of production at Durgapur (Rs.355.19 per ton) is due to low capacity utilisation. Another important factor is that the cost of production in all units of steel sector has gone up for which cost escalation of production material is responsible (see Table 3.12).

Table 3.12

COST OF PRODUCTION PER TONNE OF INGOT STEEL IN VARIOUS PLANTS IN INDIA

(in rupees per tonne)

Units	1968-69	1969-70
TISCO	320	320
IISCO	336.95	336.95
Bhilai	286.30	286.31
Rourkela		
O.H.	316.75	316.75
L.D.	323.02	323.62
Durgapur	355.19	355.19

Source: CPU Report I, Hindustan Steel Ltd., Fifth Lok Sabha 1971-72, p.34, cited in M.Sebastin Stanislaus n.61, p.257.

64. M. Sebastin Stanislaus, n.61, p.256.

Cost of production of Bokaro was high compared to the other steel plants (see Table 3.13). Padma Desai concludes that Bokaro could not be built at a low cost on account of three reasons:[65]

Table 3.13

COST OF PRODUCTION IN RUPEES PER TONNE OF BOKARO (ESTIMATED) AND ROURKELA (ACTUAL) OUTPUTS

Item	Rourkela actuals for 68-69	Bokaro current estimates of steel ministry		Estimates indicated by the B. Soviet DPR at 4 MT
		17 m.t. steel	4 m.t. steel	
Pig iron	347.53	379	277	151 (basic iron) 163 (foundry ")
Steel ingots	411.15	629	425	224
H.R. Coils	647.63	860	585	345
H.R. Sheets	701.24	-	-	-
C.R. Sheets	1111.93	1100	743	437

Source : Padma Desai, n.43, p.78

(i) the cost of basic construction materials such as cement, structurals, reinforcing steel etc., are higher in India than say, Japan;

(ii) cost of equipments manufactured in India is likely to be higher than in other countries with a long fabricating experience;

65. Padma Desai, n.43, p.75

(iii) the plant cost per annual ingot tonne for Bokaro's 1.7 million tonnes stage gets pushed upon account of fixed investment costs, incorporated from stage I itself for the eventual expansion to the 5.5 million tonnes capacity.

Delay in the commissioning schedule as well as supply of equipments from various sources may have contributed to the escalation in the cost of production of Bokaro steel plant.[66] In terms of gross block investment per tonne of steel ingot production, Bhilai shows the best results. It was lowest for Bhilai (Rs. 1441) among the public sector steel plants and highest for Rourkela (Rs. 2264).[67]

Another important factor responsible for the efficiency of steel plants is labour relations because good labour relations increase the labour productivity. Upto 1980-81, Bhilai had the best labour productivity among the integrated steel plants in India. Next year, Bokaro steel plant pushed down Bhilai to the second position (see Table 3.14).

Thus, production in Bhilai steel plant is on the profit side. Moreover, it exports steel to more than

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66. Ibid., p.71.

67. M. Sebastin Stanislaus, n.41, p.256.

Table 3.14

LABOUR PRODUCTIVITY INGOT TONNES PER MAN YEAR

Year	Labour productivity for works personnel					
	Bhilai	Durgapur	Rourkela	Bokaro	IISCO	TISCO
1976-77	82	49	62	-	-	-
1977-78	87	49	56	-	-	72
1978-79	80	43	52	-	33	65
1979-80	76	40	49	69	30	62
1980-81	69	33	43	48	33	63
1981-82	71	38	47	77	34	62

Source: Data Handbook, SAIL: 1982, Ministry of Steel and Mines, New Delhi, p.116.

forty countries including USSR, USA and Japan, thereby earning precious foreign exchange to the country. As on 1982, Bhilai has exported its products worth Rs.5292.3 million f.o.b. since its inception. It represents 69 per cent of the export earnings of the public sector steel plants of SAIL, including IISCO.[68] (See Table 3.15)

Besides, Bhilai's contribution to train personnel, the most important aspect of technological capability of steel industry, is highly commendable. More than 800 Indian engineers from this plant have already undergone

68. Tabulated from Data Handbook, SAIL: 1982, p.64.

Table 3.15

EXPORTS PLANTWISE (RS.MILLION F.O.B.)

Period	Rourkela	Bhilai	Durgapur	Bokaro	Total
1959-60 to 1973-74	163.24	1944.9	306.4	112.3	2526.8
1974-75	-	53.6	0.02	32.4	86.0
1975-76	23.7	376.4	75.1	132.8	608.0
1976-77	17.5	1385.8	250.6	308.3	1969.2*
1977-78	71.5	972.9	151.8	338.1	1534.3
1978-79	46.8	463.6	35.9	146.1	692.4
1979-80	15.6	65.0	11.8	39.6	132.0
1980-81	-	30.1	23.0	69.6	122.7
1981-82	-	-	-	-	-
TOTAL	338.3	5292.3	854.6	1179.2	7671.4

*Includes Rs.7.0 million of IISCO Materials which were purchased and exported by HSL.

Source: Data Handbook, SAIL, 1982, Ministry of Steel and Mines, New Delhi, p.64.

training in the USSR and over 10,000 have been trained at the plant itself and at the Bhilai technical institute.[69]

Bokaro, the second Soviet-aided steel plant in India, is a step forward in the indigenous participation

69. R.K.Sharma, Indo-Soviet Relations: Economic Analysis (New Delhi, 1980), p.47.

in steel industry. Dastur and Company, the Indian firm of consulting engineers, was gradually displaced from its dominating role as designer and builder of Bokaro steel plant.[70] Soviet insistence for the limited role of Dastur and Company as per Soviet sources is based on the principle of promoting public sector in the developing countries. In this context, Sebastin Stanislaus observes that the Soviet Union has been fairly generous to part with her technological knowledge in building modern workable steel mills and also in helping to organise a government-owned central engineering and design bureau in Ranchi.[71]

Bokaro's contribution to the economy will be its role in import substitution. It is expected to reduce foreign exchange expenditure on the import of steel which, at present, is of the order of Rs.250 crores per annum. Further, Bokaro expects to generate over Rs.100 crores from internal sources for reinvestment.[72]

To sum up, Soviet contribution to India's steel industry is highly commendable. Indeed, Soviet assistance in this sector has gone a long way to promote technological

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70. Padma Desai, n.43, p.69.

71. Sebastin Stanislaus, n.41, p.117.

72. For a detailed account of the financial returns of Soviet aided steel plants in India, see R.K. Sharma, Indo-Soviet Relations: Economic Analysis (New Delhi, 1980).

capability of India in capital goods sector, particularly in the iron and steel industry. Despite various criticisms, Soviet-aided steel plants in India stand high in terms of percentage utilisation of rated capacity, total production, cost of production, labour productivity and financial returns, including export earnings. It is to be recalled that setting up of a steel mill would set in motion a number of ancillary industries, which in turn move other industries.

Allied Sectors

Soviet Union has transferred technology to various branches of capital goods sector in India. Soviet assistance rendered to India has promoted the growth of public sector, particularly basic goods industries such as iron and steel, coal, power, heavy machine building and oil. Among the projects of Indo-Soviet cooperation, six enterprises are in the metallurgical industry, ten in coal and mining, ten in power generation, sixteen in machine building, eleven in oil, six in agriculture and ten in educational and scientific fields. As on December 1969, the USSR has extended credits worth Rs.1749.38 crores for the development of Indian industries. The amount of credits utilised, according to the figures available as

on December 1966, works out to 61.9 per cent of the credit extended.[73]

In the following pages, Soviet assistance and technology made available to the four important sectors of Indian economy will be discussed.

(i) Coal Industry

India being rich in coal deposits, the progress in coal industry is a factor that has great importance to various industries, particularly iron and steel. There are already four projects in the coal industry built with Soviet assistance - the Bandi project with an annual capacity of 1.1 million tonnes of coal, Durgachhar with an annual capacity of 1.1 million tonnes of coal, coal quarry in Manikpur with a capacity of 1.0 million tonnes of coal per annum and a coal washery with a capacity to process three million tonnes of raw coal per year.[74] A central electrical and mechanical workshop for the maintenance and repair of coal mining machinery has been set up with Soviet assistance at Korba.

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73. R.Rodinov, V.Sonin, Soviet Indian Economic and Trade Exchanges: 10 Years of Soviet Indian Treaty, Soviet Land Booklets (New Delhi, 1961), p.16.

74. D.K. Sharma, n.69, p.59.

The Indo-Soviet agreement on economic and technical cooperation, signed on 10 December 1980, envisages different new projects in coal industry. It also provides for cooperation in the construction of a coal power complex in the region of Singrauli coal deposits. The complex will have a huge thermal power station of 3000 MW and a mine at Nigahi with an annual capacity of 15 million tonnes of coal. The second big project with an open cast mine at Kalunda, which is expected to have a capacity of 12 million tonnes, will use modern highly mechanised technology for extraction and enrichment of coal.[75] The agreement also provides for participation of Soviet organisations in the building of the coal mine at Jhanjhra with a capacity of 2.0 million tonnes per year.

The agreement also envisages design, construction and renovation of the following projects:[76] Jayant project (10 million tonnes); Nowgaon project (3 million tonnes); Kalunda project (12 million tonnes); Nigahi project (15 million tonnes); Sudar Dih project (1.0 million tonnes); Jharia project (2.8 million tonnes); Kakrakonda project (0.6 million tonnes);

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75. N.Rodionov, V. Sonin, n.73, p.22.

76. Ibid., p.29.

Power:- Power is another important sector of industry, a major pre-requisite for economic progress. The installed power generation capacity of India in 1951 stood at 2.3 million kilo watts, whereas it was expected to reach 35 million kilowatts in 1980.

Soviet cooperation in power sector is evident in fact that till 1980, sixteen power stations have come up with its cooperation, enabling India to generate 3041 MW of additional electric power.[77] Soviet-aided power stations account for 20 per cent of the total power production in India.[78]

Oil Industry

Oil, the vital commodity in the economic life of all countries is controlled by a few giant international corporations. In this background, self-reliance in oil production is a wild dream of developing countries.

India was virtually dependent on foreign supplies of mineral oil and oil products. In 1950, Indian oil import bills was around Rs.100 crores, too high an amount for any developing country with foreign exchange shortage. All efforts for domestic oil production was blocked by oil giants. It is in this context that Soviet Union

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77. N.K. Sharma, n.69, p.60.

78. Ibid., p.61.

extended help to ascertain the possible oil potentialities in the country. Soviet experts estimated the recoverable reserves of oil at four billion tonnes and gas at two trillion cubic metres.[79] Western geologists were sceptical of India having any oil field then or in the foreseeable future.

In September 1959, the USSR extended a credit of Rs.30 crores for geological survey and extraction of oil and natural gas. Another credit was granted in February 1961 under the Rs.60 crores credit for various projects.

The Oil and Natural Gas Commission (ONGC), set up in 1955 with Soviet cooperation, has drilled approximately 1300 wells and discovered more than 36 deposits of oil and gas. The ONGC has already extracted about 65 million tonnes of oil and more than 5000 million cubic metres of natural gas.[80] Public sector oil fields, developed with the cooperation of the USSR, account for 60 per cent of oil production.[81]

Soviet cooperation has been extended to set up three major oil refineries in India - Koyali, Barauni and Mathura. Barauni, the first oil refinery has a

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79. M.Sebastin Stanislaus, n.41, p.78.

80. R.K. Sharma, n.69, p.55.

81. Ibid., p.55.

rated capacity of four million tonnes per year. The two million tonnes capacity refinery at Koyali was built to process the crude available in Ankleshwar, Kalol, Navagam and other oil fields in Gujarat. Its annual capacity has been expanded to 7.3 million tonnes. At present, India's third oil refinery is under construction at Mathura in U.P., with a capacity of six million tonnes. Barauni and Koyali oil refineries accounted for more than 30 per cent of the capacity of all refineries in the country during 1968-69 to 1975-76.[82]

Moreover, the USSR has enabled India to develop necessary skills and personnel for oil industry.

Heavy Engineering Industry

Indo-Soviet cooperation in heavy engineering industry is another step forward in the transfer of Soviet technology to developing countries. When India became independent, the indigenous production of heavy machinery and equipment was zero. At present, Indian heavy engineering industries produce about 10,000 tonnes of heavy equipments for different sectors of national economy. In this context, four Soviet-aided heavy engineering enterprises stand out; they are: (1) Heavy Machine Building Plant (HMBP) at Ranchi;

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82. Ibid., p.57.

(2) Mining equipment plant at Durgapur; (3) Heavy electrical equipment plant at Hardwar; and (4) Precision instrument plant at Kota.

The HMBP which belongs to the Heavy Engineering Corporation of India was set up with Soviet assistance in the early sixties. In accordance with the inter-governmental agreements, Soviet organisations carried out survey and design work, delivered about 45,000 tonnes of equipments and trained Indian personnel. The total cost of the plant was estimated to be Rs.43.23 crores, with a foreign exchange content of Rs.21.92 crores.[83]

HMBP produces blast furnace and coke oven equipment, all types of rolling stock, electrical overhead travelling cranes of different capacities, crushing and grinding machinery, excavators and other items. Since 1966, HMBP has been supplying equipments for Bhilai, Bokaro and Kota plants.[84]

It is estimated that about 60 per cent of the machinery needed to complete the first phase of Bokaro steel plant was supplied by HMBP.[85] The equipments

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83. M.Sebastian, Stanislaus, n.41, p.95.

84. Vinod Mehta, n.53, p.53.

85. R.K. Sharma, n.69, p.65.

produced at the Ranchi plant has increased from 34,000 tonnes in 1971-72 to 42,000 tonnes in 1976-77.[86] This 'plant of plants', together with the Czech assisted Heavy Machine tool plant, has become a major landmark in India's industrialisation.

New trends of 'production cooperation' has been a new chapter in the history of HMEP. Today, this plant supplies equipments to Soviet aided projects in Third World Countries[87] and also to many other countries, including the Soviet Union.

The mining equipment plant at Durgapur under the mining and allied machinery corporation manufactures mining equipment, including coal combines, cutting machines, hydraulic columns, etc. Besides supplying equipments for projects of the coal and mining industry, the Durgapur plant also manufactures equipment for steel plants at Bhilai and Bokaro.[88]

The Heavy Electrical Equipments Plant (HEEP) at Hardwar with Soviet assistance belongs to the state-owned BHEL. It produces power engineering equipments,

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86. Ibid., p.65.

87. N.Rodinov, V.Sonin, n.73, p.57.

88. Ibid., p.58.

hydraulic and thermal turbines, generators etc. The plant was the first in India to master the production of turbo generators with a capacity of 200 MW.

According to the Indo-Soviet agreement of December 1971, the precision instruments plant was built at Kota, Rajasthan. It manufactures a variety of precision electrical devices and control systems for the metallurgical, machine building, power engineering and other industries. This plant, which is functioning at its rated capacity, earned a profit of Rs. 11.3 million during 1972-73.[89]

To sum up, transfer of Soviet technology to heavy engineering sector has enabled the country to produce heavy machinery equipments and precision equipments highly essential for industrial development. Moreover, the USSR has trained a large army of skilled workers and technicians, both in India and the USSR for various plants.

3.4 Transfer of Soviet Technology to the Arab Republic of Egypt

The Arab Republic of Egypt is a major recipient of Soviet aid in the post-war years. Apart from petroleum, iron and steel is a priority sector in the

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89. Vinod Mehta, n. 53, p. 55.

Egyptian industry. Development efforts of the economy needed massive foreign exchange which Egypt was incapable of mobilizing. Egypt is a major producer of pig iron and steel in the Middle East.

Soviet aid has made significant contribution to the economic development of Egypt. In fact, 33 per cent of Egypt's 1960/61 to 1964/65 plan was financed by the USSR.[90] The credits extended by the USSR to Egypt during 1954-66 amount to 702.0 million roubles (780.0 dollars) according to Soviet sources and 1011 million dollars as per American sources (see Table 3.16).

Table 3.16

SOVIET CREDITS TO DEVELOPING COUNTRIES 1954-66

Country	Soviet source		American source (million $)	Total from socialist countries (mill. roubles)
	In million roubles	In million dollars		
India	912.7	1014.1	1012	1367.2
Iraq	164.3	182.5	184	194.7
Iran	35.0	38.9	64	75.5
UAR	702.0	780.0	1011	879.5

Source: Vassil Vassilov, Policy in Soviet Bloc on Aid to Developing Countries (OECD, Paris, 1969), p. 63.

90. Vassil Vassilov, Policy in Soviet Bloc on Aid to Developing Countries (OECD, Paris, 1969), p. 77.

The inter-governmental agreement on economic and technical cooperation signed on 29 January 1958 between the USSR and the Arab Republic of Egypt is a milestone in the economic relations between the two countries. It envisages the transfer of Soviet technology in various sectors of the national economy of the ARE, particularly to metallurgy, engineering, power, mining, geological prospecting of oil, etc. As on 1 January, 1971, the USSR has enabled Egypt to build 83 projects in metallurgical, engineering and various other fields along with the popular Aswan High Dam and hydro installations.[91] In the pages that follow, the Soviet experience in building the Helwan Iron and Steel plant, Helwan industrial complex and Aswan Dam will be discussed.

(1) The Helwan Iron and Steel Plant and Metallurgy Complex

In the early fifties, the Helwan Iron and Steel plant that was constructed with the cooperation of a West European firm, was demonstrating a very poor technical and economic performance.

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91. A.N. Bykov and others, Soviet Experience in Transfer of Technology to Industrially Less Developed Countries (New York, 1973), UNITAR Research Reports, No. 10, p. 142.

According to Soviet experts in metallurgy, the unsatisfactory performance of the steel plant, the only one in the whole country, was due to many factors, among them:[92]

- serious defects overlooked by the firm at the designing stage of both the main metallurgical units and a number of auxiliary sections;
- lack of knowledge of the personnel about the elementary technical rules and progressive methods of work;
- Unsatisfactory structure of the management of the plant and the shops;
- Low level of knowledge and technological discipline;
- Shortage of auxiliary equipment;
- Absence of production and technical instructions and rules of technical exploitation, etc.

In accordance with the contracts signed by the USSR and the AFL, a large group of experts in metallurgy was despatched to study and take appropriate corrective measures in the plant. On the basis of the recommendations of the Soviet metallurgists technology of the production

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92. Ibid., pp. 164-65.

of pig iron, steel and rolled stock was drastically modified. The transfer of Soviet experience and technology brought surprising changes in the output of the steel plant. In 1969-70 fiscal year alone, the plant's profit reached 7,35,000 Egyptian pounds. The reconstructed plant will yield annually 1,500,000 tonnes of steel; 1,750,000 tonnes of pig iron; 1,244,000 tonnes of ash-free coke; 3,147,000 tonnes of skip agglomerate; 1,000,000 tonnes of rolled stock; 5,500 tonnes of assembled section and 12,000 tonnes of casting.[93]

According to the contracts signed by the Soviet organisations and their counterparts in Egypt, the former rendered technical and economic assistance in the construction and operation of a complex of sheet-metal rolling shops at the Helwan Steel plant. The Soviet organisations took part in designing, building and commissioning of these shops.

Another instance of Soviet experience in the transfer of technology is the construction and commissioning of the Helwan plant producing forged pieces and chains. The design capacity of this plant that went into production in 1964 is

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93. Ibid., p. 140.

for forged pieces - 15,000 tonnes a year
for chains - 750 tonnes a year
for dies - 200 tonnes a year.

The Soviet organisations have done design work, work drawings and drawings of non-standard equipment, production tooling and instruments.

The Helwan Coke and Chemical plant, another unit of the metallurgical complex, was commissioned on 9 April 1964, with Soviet cooperation. El-Tebbin Metallurgical Institute another unit of the complex, is set up with the cooperation of the Soviet organisation technoexport.

The Moscow Institute of Steel assisted the organisation of teaching and research at the El-Tebbin Institute. The task of the Institute that was inaugurated on 12 June 1971, is to train Egyptian engineers and metallurgists to take up suitable assignments with metallurgy industry, particularly at the Helwan iron and steel plant. The Institute trains metallurgical engineers in economics and organisation of production, rolling, foundry work, blast furnace and open hearth furnace work and mining. The programme of the Institute is designed in such a way that Egyptians will be trained to take up teaching and organising work of the Institute in the future.

The last stage of Helwan Iron and Steel complex was to be completed in 1975, when the fourth blast furnace was to come into operation, which would increase annual production to 1.5 million tonnes.[94] By 1982, the expanded production of iron and steel was expected not only to meet domestic needs, but provide a net balance of about half-a-million tonnes a year to be exported to the USSR and Arab-African countries.[95]

The Aswan Dam and Power Complex

Aswan Dam was a major step forward in harnessing the poorly utilized resources of Egypt. The history of Aswan Dam reveals more about the international power struggles, military confrontation and the efforts of Egypt to mobilize finance for realizing the long cherished dream. Beginning in the fall of 1952, various West German, English, French and American engineering and banking firms presented Cairo with alternative proposals and plans. The United States, United Kingdom and the International Bank for Reconstruction and Development together submitted an offer to finance the dam. Soviet Union also expressed their desire to participate in the construction of the

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94. Arab Economic Report: January 1977 (see section on Egypt).

95. Yusuf J. Ahmad, Absorption Capacity of the Egyptian Economy (OECD: Paris, 1976), p. 25.

project. On 17 December 1952, Soviet Ambassador to Cairo announced that the Soviet Union hoped that it would be able to participate in the financing of the dam "unless contrary stipulation in Egypt's accord with the western powers excludes the USSR specifically".[96] Unfortunately, America objected to Soviet participation and insisted to keep Russia away from the project. Egypt, a non-aligned country felt it as a slur on its dignity. Finally, in 1956, America withdrew its offer to finance the Dam. Despite the massive efforts and huge finances involved in the project, the USSR committed themselves to construct the dam and complex.

An inter-governmental agreement between the USSR and the ARE on rendering economic and technical assistance in building the first stage of the Aswan High Dam was signed on 27 December 1958. The Government of USSR offered a loan of 400 million roubles to cover the cost of the operations to be carried out by the Soviet side in all matters related to the Dam. The loan extended, carried an interest rate of 2.5 per cent per annum, to be repaid in twelve equal instalments, commencing one year after the complete execution of the work on the first stage of the High Dam at Aswan and the filling up

96. Marshal I. Goldman, Soviet Foreign Aid (New York, Praeger, 1967), p.64.

of the basin, on the condition this could not be later than 1 January 1964.[97] Another loan of 900 million roubles was extended by the USSR to complete the High Dam at Aswan in its final form as per the agreement signed on 27 August 1960.[98] It carried the same repayment conditions as in the case of the first assistance loan.

Construction work on the Aswan complex was undertaken by leading Arab firms, whereas the design, research and prospecting work was carried out by the All Union Zhuk Design and Research Institute, Gidroproekt. Energosetproyekt, the All Union Design and Research Institute of power systems and electrical network, and Gidroyproyekt were the general suppliers to the project. The All-Union Corporation Technopromexport was the general supplier of the principal technological and construction equipment.[99]

The Aswan High Dam and power complex render tangible economic effects to Egypt. It generated 3.15

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97. Agreement with the USSR concerning the project for the implementation of the High Dam, approved by Decree No. 0 of January 9, 1959 (official gazette No. 2n) Articles 5, 6. Cited in Marshal I. Goldman, n. 96, pp. 212-16.

98. For details, consult the text of agreement signed on August 27, 1960 to complete the High Dam at Aswan in its final form. Cited in Marshal I. Goldman, n. 96, pp. 217-21.

99. A.N. Dykov, n. 91, pp. 153-54.

thousand million kwh electricity during 1951-71 which can be increased up to 6.9 thousand million kwh. Another important contribution of the Dam is that it enlarged the cultivated area by 1.4 million feddan (in 1964 Egypt had in all 6.25 million feddan or 2.6 million hectares of irrigated land). Electricity generated by the Aswan hydropower station is used for the enlargement of the Helwan iron and steel plant. After completion it is expected to consume 10.5 per cent of all power generated by the Aswan hydro-electric station (800,000,000 kwh in 1974-75). Finally, between 1960 and 1969, over 18,000 skilled Arab workers were trained in 75 trades, among them more than 14,000 on the site and more than 4,000 in training centre. Moreover, 26,000 workers were annually employed at the site.[100]

According to the inter-governmental agreement, the All Union Corporation Yuzhstankoeksport offered assistance to set up an Aluminium plant with a capacity of 100,000 tonnes annually in Egypt. To provide ferro-silicon to Helwan iron and steel plant Soviet Union has rendered cooperation to build a ferro silicon plant with a capacity of 20,000 tonnes. Soviet-

100. Ibid., pp. 155-57.

Egyptian economic cooperation and Soviet technology is extended to the latter in various other sectors of national economy.

The USSR committed an amount of 120 billion roubles in July 1974 to assist a number of projects including the expansion of Nag Hammadi Aluminium Complex and construction of a cement plant and textile factory. Moreover, Soviet Union had made an offer amounting to $151.04 million to development projects planned for 1975 and had indicated its willingness to provide further 5,000 million roubles for the five year plan period 1976-80. A wide variety of projects were apparently approved for implementation, including a further sum of $102.40 million for the expansion of Helwan Iron and Steel complex.[101] Agreements were signed to supply a 440 MW nuclear power station and to build a second iron and steel plant with a capacity of 3 million tonnes a year at Alexandria.[102] The Soviet participation in Egyptian steel and other sectors has apart from bringing other direct and indirect benefits helped in eradicating to a large extent the problems and difficulties that had

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101. Yusuf J. Ahamad, n.95, p.116.

102. Ibid.

beset the operation of the Bolvan steel plant. By incorporating their available design and construction expertise, operation and management experience and by creating a vast potential of trained and skilled local manpower it has helped the recipient country to build self-reliance to some extent.

3.5 Transfer of Soviet Technology to Iran

Iran is another major recipient of Soviet technological experience in the Middle East. The inter-governmental agreement signed by the USSR and Iran on 13 January 1959, envisaging cooperation in the construction of an iron and steel plant, an engineering plant and a trunk gas pipe line was an important step forward in the transfer of Soviet technology. Along with cooperation based on inter-governmental agreements with credit offers, today, the USSR transfers technology to Iran on commercial terms also. During 1954-66, the credits extended by the USSR to Iran amounted to 35 million roubles (see Table 3.16). The iron and steel plant at Isfahan is the symbol of Soviet technology to Iran.

The Iron and Steel Plant at Isfahan

The inter-governmental agreement signed on 13 January 1966, envisages Soviet assistance to Iran to build

an iron and steel plant with complete cycle at Isfahan. The initial capacity of the plant is 600,000 tonnes of steel, with provision to increase it to 1.9 million tonnes and finally to four million tonnes per year. The credit extended for the purpose carried an interest rate of 2.5 per cent which is to be repaid in 12 years.[103]

Soviet organisations undertook the design work and delivery of equipment and materials as specified in the contract. The Soviet organisation Tyazhpromexport was the general supplier. The contract envisages technical assistance in building the plant and also the Chegart iron ore base necessary for its operation. The plant and the entire industrial complex was designed by the Soviet organisation Giprocs.

The design incorporates the most progressive technology, automation of the entire production process and the work of individual shops and units and a unified automated despatcher service. The ore stockyard providing for automatic blending of iron ore, a continuous casting steel installation, repair shops and a centralised control system using electronic computers and industrial

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103. A.N. Bykov, n.91, p.165.

FV are virtually unique.[104] The blast furnace with a volume of 1,033 cubic metres produces 550 to 600 thousand tonnes of pig iron annually.

The second phase of the existing plant of Aryamehr Steel works at Isfahan is now being constructed with the cooperation of the USSR, which was due to be completed in 1976, so that the capacity would reach four million tonnes by 1980. In the beginning, all complicated construction and operation work was being done by Soviet specialists, whereas later up to 90 per cent of work at certain sections including maintenance, was being done by Iranians themselves.

Apart from rendering assistance in the construction and operation of the plant, the USSR imparts training to Iranians at various stages of the project. A study centre with 540 students has been in operation in Tehran from 1969 for training metallurgical engineers and technicians.[105]

Engineering Plant at Arak

In accordance with the inter-governmental agreement of 1966, the Soviet All Union Corporation Promashexport rendered technical assistance to build an

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104. Ibid., p. 166.

105. Ibid., p. 167.

engineering works at Arak. The Soviet organizations supplied design documents for both the first and second section of the engineering plant such as work drawings, design and technical documents etc., and various technological documents. Moreover, the USSR prepared a detailed draft of organization and management of production embracing all sides of the plant's operation, organization of production process and management, technical preparation of production, etc.[106]

The production of the plant comprises overhead electric cranes, conveyors, elevators and transporters, boilers, auxiliary boiler equipment and equipments for sugar refineries and cement factories.

A training centre attached to the Arak plant set up with Soviet assistance began functioning in 1970.

Trans-Iranian Pipeline

The inter-governmental agreement of 1966 included provisions for building the Trans-Iranian pipeline. Soviet organizations actively participated in the design, construction and supply of equipments and other technical assistance needed for the project. The Kiev institute,

106. Ibid., pp. 169-73.

Giprogas, was the general designer of the pipeline project, whereas the USSR ministry of gas industry was the general supplier and contractor.

The Soviet organizations built the second section of the gas pipeline stretching for 607 kilometres using pipes forty inches in diameter, assembled technological equipment and conduits at the eight main compressor stations and also a gas motor station in Asters; delivered 36 installations for pumping over gas at the main compressor stations with a power of 10,000 kw each and control and automation systems.[107]

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107. Ibid., p. 176.

C O N C L U S I O N

Technology is a major pre-requisite for industrial growth and economic development. Most of the developing countries are either technologically backward or economically underdeveloped or both. Hence, international transfer of resources is a short-cut method to promote their technological capability and economic progress. It may also reduce the technological imbalances and inequities among nations.

Transnational corporations, the primary carriers of industrial technology to developing countries, are mainly concerned with profit. To ensure maximum profit, they tend to maximise control over technology. Consequently, technology may be transformed through such channels and mechanisms which serve their interests best. It has led to various major issues in the realm of transfer of technology which have restricted the growth potential of developing countries.

In the post-war period, the emergence of the USSR as a potent source of technology posed a serious challenge to the activities of trans-national corporations. The characteristic features of Soviet policy on transfer of technology not only contributed positively to the economic development of many a developing country but also improved the bargaining power of the latter vis-a-vis

trans-national corporations, thereby limiting the restrictive practices of monopoly corporations.

The Soviet policy on transfer of technology seems to be one of the functions of its foreign policy as well as an indicator of the Socialist production system. Moreover, the USSR appears to have a strong desire to promote the socialist way of production so that inequities and imbalances are not repeated in the production system of the newly independent developing countries. The scientific and technological advancement and growth in the Soviet society since the October Revolution bears a positive relationship with the growth of the transfer of Soviet resources to developing countries. It is evident from the steady increase in the quantum of resources transferred and Soviet foreign trade. The USSR seems to pursue a varying bilateral approach in its economic relations with developing countries depending on the economic development of the recipient and the overall international situation. As a matter of policy, the USSR transfers technology on a government-to-government basis through inter-governmental agreements. As far as possible, Soviet technology is made available primarily to the public sector of the recipient countries. Unlike the trans-national corporations, the USSR never aspires for share and ownership in

the recipients organisation. Long-term credits that carry relatively very low interest and favourable repayment conditions have facilitated transfer process effectively and are appreciated by the recipients. All these factors have contributed to the technological capability which, in turn, have improved their bargaining power in the international market for technology.

Transfer of Soviet resources to India, Iran and the Arab Republic of Egypt has been made through various inter-governmental agreements. It is the public sector in these countries that has received maximum Soviet assistance. Thus, Bhilai, Bokaro and Vishakhapatnam steel plants in India, Isfahan steel works in Iran, the Helwan steel plant in the ARE and various allied public sector undertakings have received Soviet credits and technology. The credits extended by the USSR to these countries carried an interest rate of 2.5 to 3 per cent which was to be repaid only after twelve or more years, either in local currency or through commodities. On the other hand, the credits received from capitalist countries and international organisations carried much higher rate of interest and repayment conditions.

Transfer of Soviet technology has been made available to the vital sectors of the national economy of

those countries. It is illustrated by the fact that Bhilai and Bokaro, the two Soviet-aided steel plants in India, alone account for one-third of the total steel output of the country. The Soviet-aided Helwan steel plant in the ARE is expected not only to meet domestic needs, but provide a net balance of about half-a-million tonne per annum to be exported. Similarly, the modern integrated steel plant at Isafahan in Iran meets most of the domestic requirements of steel in that country.

Production performance, financial returns, labour productivity and cost of production of Soviet-aided steel plants in India, Iran and the ARE merit appreciation. Thus, as illustrated earlier, with the achievement of 92.6 per cent of rated capacity in the production of ingot steel and 69 per cent of export earnings, Bhilai excelled all other integrated steel plants in India. Moreover, the general performance of Soviet-aided projects have been highly satisfactory in these countries. Soviet contribution in training national personnel of the recipient countries - the most important aspect of technological capability-is undoubtedly commendable. However, it has to be admitted that certain Soviet-aided projects in developing countries have not come up to the expected standards. This may be attributed to the organisational

inadequacies and the technical nature of the projects involved. These short-comings do not weigh much when compared to the Soviet contribution to the industrial progress of the recipient country.

The Soviet experience with India illustrates the success and the basic objectives of Soviet policy of promoting the technological capability of the recipient. Probably, the major factor for India's failure to mobilise assistance for a public sector steel plant in the fifties and later in sixties, from West would have been the technological backwardness of the country at that time. It is the Soviet offer to build Bhilai steel plant that enabled India to establish Durgapur and Rourkela with western assistance on much favourable terms.

An evaluation of Indo-Soviet agreements on Bhilai, Bokaro and Vishak unfolds the progressive enhancement of India's technological capability by the USSR in this vital sector of national economy. Soviet experience in transfer of technology with India demonstrates the gradual and increasing participation of Indian organisations at various stages of the process. Thus, while Bhilai steel plant was a 'turnkey project', various public sector organisations participated in the construction of Bokaro from the design stage to production.

Unlike Bhilai and Bokaro, the 'Detailed project report' of Visakhapatnam steel plant was prepared jointly by Indian and Soviet organisations. In fact, the major role assigned to Indian Organisations at design, drawing and construction stages of this plant indicates the technological capability that India has achieved in the iron and steel sector.

To be precise, the Soviet experience in transfer of technology by assigning increasing involvement of Indian organisations has contributed substantially to the technological capability of the country in the iron and steel sector. As a result, India has improved its bargaining power in the iron and steel and allied sectors.

The transfer of Soviet technology to the vital sectors of the national economy of India, Iran and the Arab Republic of Egypt is a major step forward in promoting the technological capability of these developing countries. It has contributed considerably to their industrial growth and economic advancement. In the final analysis, the Soviet experience in transfer of technology to developing countries coincides with the aspirations of developing countries.

Appendix 1

USSR: Pattern of industrial output, 1913-1978

(in percentages of the total)

	Producer goods a/ (group "A")	Consumer goods (group "B")
1913	35.1	64.9
1923	39.5	60.5
1940	61.0	39.0
1950	68.8	31.2
1960	72.5	27.5
1970	73.4	26.6
1975	73.7	26.0
1977	73.9	26.1
1978	74.0	26.0

Source: UNCTAD. Doc. TD/B/C.6/52, Experience of the USSR in Building up Technological Capacity, 1980, p.15.

Appendix 2

USSR: Expenditure on new technology projects and their economic effect
(in current prices)

Year	Number of projects implemented (thousands)	Total actual expenditure on implementing innovation projects (including expenses of previous years (billion roubles)	Labour released for other work (thousand workers)	Savings due to unit cost reduction or lowering operational expenditure (annual rate) (billion roubles)	Annual economic effect resulting from the introduction of new technologies (billion roubles)
1970	423	5.0	399	2.0	2.6
1971	449	4.9	447	2.1	2.8
1972	497	5.3	482	2.2	3.0
1973	509	6.6	553	2.5	3.5
1974	579	6.7	588	2.6	3.7
1975	621	7.5	576	2.8	3.8
1976	633	8.0	542	2.8	4.0
1977	670	8.2	543	3.0	4.2
1978	675	8.7	558	3.0	4.3

Source: UNCTAD. Doc.TD/B/C.6/52, Experience of the USSR in Building up Technological Capacity, 1980, p.64.

Appendix 3

Share of machinery in USSR exports to selected developing countries in 1973, 1974, 1975

(Thousands of U.S. dollars)

Country	1973			1974			1975		
	Total exports	Exports of machinery	%	Total exports	Exports of machinery	%	Total exports	Exports of machinery	%
Afghanistan	45.174	16.550	36.6	84.657	16.026	19.0	90.053	25.362	28.2
Algeria	84.729	27.533	32.6	151.096	29.031	19.2	148.949	53.2[illegible]	35.8
Bangl[illegible]	58.311	12.191	20.9	54.794	10.324	18.8	49.337	7[illegible]	[illegible]
Brazil	13.4[illegible]	7.819	62.7	123.288	8.951	7.3	123.740	4.615	[illegible]
Egypt	371.512	101.059	27.2	412.740	115.748	28.0	346.8[illegible]7	97.742	[illegible]
Guinea	54.032	40.709	72.3	30.685	9.060	29.5	[illegible]	9.372	[illegible]
India	8[illegible]	[illegible]	24.1	369.041	97.876	26.5	387.401	10[illegible]	[illegible]
Iran	174.[illegible]	97.143	52.8	364.110	147.003	40.4	373.342	168.[illegible]	45.[illegible]
Iraq	1[illegible]	5[illegible]	29.7	249.726	[illegible]	26.6	359.[illegible]	[illegible]	26.7
[illegible]	[illegible]	[illegible]	7.5	74.[illegible]	4.479	6.0	[illegible]	[illegible]	[illegible]
Pa[illegible]	16.890	6.189	36.6	41.370	11.626	28.1	49.[illegible]	26.[illegible]	[illegible]
Syrian Arab [illegible]	[illegible]	34.231	35.4	96.027	31.922	33.2	151.[illegible]	36.288	27.[illegible]
	[illegible],454.155	474.465	32.6	2,051.644	548.448	[illegible].7	2,1[illegible].048	[illegible]28.753	29.[illegible]

[illegible] are derived from USSR statistics available in the UNCTAD secretariat, cited in UNCTAD. Doc. TD/B/C.6/25 Annex V

Annex 4

USSR - [illegible] and import structure
(Percentages, based on data in current prices)

	1960	1965	1970	1975	1980
TOTAL EXPORTS	100	100	100	100	100
Including:					
Machinery, equipment and means of transport	20.5	20.0	21.5	18.7	15.8
Fuel and electric power	16.2	17.2	15.6	31.4	46.9
Ores and concentrates, metals and metal products	20.4	21.6	19.6	14.3	8.8
Chemical products, fertilizers, rubber	3.5	3.6	3.5	3.5	3.3
Timber, pulp and paper products	5.5	7.3	6.5	5.7	4.1
Textile raw materials and semi-manufactures	6.4	5.1	3.4	2.9	1.9
Foodstuffs and raw produce for foodstuffs	13.1	8.4	8.4	4.8	1.9
Industrial consumer goods	2.9	2.4	2.7	3.1	2.5
TOTAL IMPORTS	100	100	100	100	100
Including:					
Machinery, equipment and means of transport	29.8	33.4	35.5	33.9	33.9
Fuel and electric power	4.2	2.5	2.0	3.9	3.0
Ores and concentrates, metals and metal products	16.8	9.8	9.6	11.6	10.8
Chemical products, fertilizers, rubber	6.0	6.2	5.7	4.7	5.3
Timber, pulp and paper products	1.9	1.9	2.1	2.2	2.0
Textile raw materials and semi-manufactures	6.5	4.4	4.8	2.4	2.2
Foodstuffs and raw produce for foodstuffs	12.1	20.2	15.9	23.0	24.2
Industrial consumer goods	17.2	14.2	18.3	12.9	12.1

Source: UNCTAD.TD/B/918: Prospects in Trade with the Socialist Countries of Eastern Europe: USSR Policies, Developments and Institutional Framework, UNCTAD Secretariat, 1982, p.5.

Appendix 5

PRODUCTION OF PIG IRON, STEEL, AND ROLLED PRODUCTS, 1913–1954 (1,000 tons)°

	Pig iron	Ingot steel	Rolled metal
1913	4,216	4,231	3,506
1914	4,137	4,466	3,645
1915	3,764	4,120	3,263
1916	3,804	4,276	3,371
1917	2,964	3,080	2,411
1918	597	402	357
1919	117	199	170
1920	116	194	117
1921 22	180	318	259
1922 23	314	615	474
1923 24	670	993	690
1924 25	1,309	1,868	1,390
1925 26	2,203	2,911	2,250
1926 27	2,961	3,592	2,744
1927 28	3,282	4,251	3,408
1928 29	4,021	4,851	3,898
1929 30	4,964	5,761	4,503
1931	4,871	5,620	4,159
1932	6,161	5,927	4,288
1933	7,110	6,889	4,882
1934	10,428	9,693	6,734
1935	12,478	12,419	9,363
1936	14,393	16,185	12,454
1937	14,487	17,730	12,996
1938	14,651	18,000	13,200
1939	14,519	17,604	12,630
1940	14,902	18,300	13,100
1941 Plan	18,000	22,400	15,800
1942	4,800	†	†
1943	5,600	8,500	5,600
1944	7,400	10,600	7,200
1945	8,900	12,300	8,400
1946	10,000	13,400	9,600
1947	11,300	14,600	11,000
1948	13,900	18,600	14,100
1949	16,500	23,300	17,900
1950	19,300	27,300	20,800
1951	22,000	31,400	23,900
1952	25,100	34,500	26,800
1953	27,400	38,000	29,500
1954	29,900	41,000	32,200
1955 Plan	34,000	44,000	34,000
1960 Plan	50,000	60,000	†

Source: M.Gardner Clark, The Economics of Soviet Steel, Harvard University Press, Cambridge, 1956, p. 10.

COMMISSIONING DATES AND COST ESTIMATES OF VARIOUS STAGES OF PUBLIC SECTOR STEEL PLANTS - AT A GLANCE

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PLANTS	CAPACITY		FINAL COST (Rs. in Crores)	COMMISSIONING SCHEDULE	
	INGOT STEEL	SALEABLE STEEL		ORIGINAL APPROVED COMMISSIONING SCHEDULE	COMMISSIONED/EXPECTED COMMISSIONING SCHEDULE
BOKARO STEEL PLANT	1.7 Mt.	1.355 Mt.	@ 981.34 (Estimated)	1971	Commissioned February 1978
	1.7 Mt. to 4 Mt.	3.156 Mt.	£ 1637.55 (Estimated)	March 1977	Expected Commissioning December 1984
BHILAI STEEL PLANT	1 Mt.	0.77 Mt.	201.39	Dec. 1959	Commissioned September 1961
	1 Mt. to 2.5 Mt.	1.965 Mt.	149.45	Aug. 1964	Commissioned October 1967
	2.5 Mt. to 4 Mt.	3.153 Mt.	1600.50 Sanctioned	Dec. 1976	Expected Commissioning December 1984 7th BF
ROURKELA STEEL PLANT	1 Mt.	0.715 Mt.	220.10	Dec. 1959	Commissioned November 1962
	1 Mt. to 1.8 Mt.	1.225 Mt.	160.21		Commissioned February 1969

Source: Data Handbook, 1982; Steel Authority of India, Ministry of Steel and Mines, Government of India, New Delhi, 1983, p.103.

Continued...

Appendix 7

SAIL: TOTAL HOT METAL, PIG IRON FOR SALE, INGOT STEEL, SALEABLE STEEL PRODUCED AT THE INTEGRATED STEEL PLANTS SINCE INCEPTION: UNITWISE

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PLANTS	HOT METAL		PIG IRON FOR SALE		INGOT STEEL		SALEABLE STEEL	
	PERIOD	QUANTITY MILLION TONNES	PERIOD	QUANTITY MILLION TONNES	PERIOD	QUANTITY MILLION TONNES	PERIOD	QUANTITY MILLION TONNES
BHILAI	1958-59 to 1981-82	44.11	1958-59 to 1981-82	11.96	1959-60 to 1981-82	38.32	1959-60 to 1981-82	31.28
DURGAPUR	1959-60 to 1981-82	22.38	1959-60 to 1981-82	5.32	1960-61 to 1981-82	17.8	1960-61 to 1981-82	12.69
ROURKELA	1958-59 to 1981-82	24.09	1958-59 to 1981-82	1.81	1959-60 to 1981-82	22.63	1959-60 to 1981-82	16.79
BOKARO	1972-73 to 1981-82	13.57	1972-73 to 1981-82	5.45	1973-74 to 1981-82	7.7	1974-75 to 1981-82	5.79
TOTAL : A		104.15		24.54		86.45		66.51
O IISCO	1973-74 to 1981-82	7.33	1973-74 to 1981-82	0.97	1973-74 to 1981-82	5.32	1973-74 to 1981-82	4.23
TOTAL : A+B		111.48		25.51		91.77		70.74
VISCO	1911-12 to 1981-82	75.3	-	-	1911-12 to 1981-82	74.25	1911-12 to 1981-82	57.09

Source: Data Handbook, 1982; Steel Authority of India, Ministry of Steel and Mines, Government of India, New Delhi, 1983, p. 14.

Appendix 8

SAIL: PERCENT FULFILMENT TO TARGET & CAPACITY AT MAIN PRODUCERS DURING 1981-82 AND PRODUCTION TARGETS FOR 1982-83

Unit: '000 tonnes

	PLANT	PRODUCTION : 1981 - 82						1982 - 83	
		Annual Rated Capacity	TARGET		Actual	% FULFILMENT TO			Annual Rated Capacity	Target
			Original	Revised		Original Target	Revised Target	Rated Capacity		
INGOT STEEL	BSP	2500	2100	2414	2115	100.7	87.6	84.6	2500+1500*	2525
	DSP	1600	1000	1142	930	93.0	81.4	58.1	1600	1200
	RSP	1800	1400	1646	1203	85.9	73.1	66.8	1800	1530
	BSL	2500	2050	2050	1792	87.4	87.4	71.7	2500	2250
	IISCO	1000	660	758	600	90.9	79.2	60.0	1000	760
	SUB-TOTAL SAIL	9400	7120	8010	6640	92.1	82.9	70.6	9400+1500*	8265
	TISCO	2000	1940	1940	1956	100.8	100.8	97.8	2000	1940
	TOTAL	11400	9150	9950	8156	93.9	86.4	71.5	11400+1500*	10205
	ASP	100	110	110	86.01	78.2	78.2	86.0	160	120
SALEABLE STEEL	BSP	1965	7050	1965	@ 1819	103.9	92.6	92.6	1965+1188*	1980
	DSP	1239	780	910	782	100.3	85.9	63.1	1239	965
	RSP	1225	1080	1225	1091	101.0	89.1	89.0	1225	1187
	BSL	1971	1600	1600	1472	92.0	92.0	74.7	1971	1758
	IISCO	800	520	600	488	93.8	81.3	61.0	800	600
	SUB-TOTAL SAIL	7200	5730	6300	5651/ 5550£	98.6/ 97.99£	89.7/ 88.1 £	78.4/ 77.0 £	7200+1183*	6490
	TISCO	1500	1550	1550	1605	103.5	103.5	107.0	1500	1550
	TOTAL	8700	7280	7850	7256/ 7156 £	99.7/ 98.3 £	92.4/ 91.2 £	83.4 82.2	8700+1188*	8040
	ASP	60	61.18	61.18	52.04	85.1	85.1	86.7	103	72.10
	SSP	32	3.18	3.18	3.21	100.9	100.9	10.0	32	11.00

Source: Data Handbook, 1982: Steel Authority of India, Ministry of Steel and Mines, Government of India, New Delhi, 1983, p.11.

SAIL: PERCENT FULFILMENT TO TARGET & CAPACITY OF INTEGRATED STEEL PLANTS FOR 1981 - 82 AND PRODUCTION TARGETS FOR 1982 - 83

Unit: '000 tonnes

PRODUCTS	PLANTS	PRODUCTION 1981 - 82							PRODUCTION TARGET 1982-83	
		Rated Capacity	TARGET Original	TARGET Revised	Actual	% FULFILMENT TO TARGET Original	% FULFILMENT TO TARGET Revised	% FULFILMENT TO Rated Capacity	Rated Capacity	Production Target
Average Pushing of Ovens/ day	BSP	-	518	565	503	97.1	89.0	-	-	554
	DSP	-	240	288	224	93.3	77.8	-	-	260
	RSP	-	334	384	315	94.3	82.0	-	-	350
	BSL	-	440	485	402	91.4	82.9	-	-	512
	IISCO	-	204	244	206	101.0	84.4	-	-	247
	SUB-TOTAL SAIL	-	1736	1966	1650	95.0	83.9	-	-	1923
	TISCO	-	370	370	344	93.0	93.0	-	-	377
	TOTAL	-	2106	2336	1994	94.7	85.4	-	-	2300
Sinter	BSP	3540	2400	2760	2146	89.4	77.8	60.6	3540	2988
	DSP	1500	750	859	446	59.5	51.9	29.7	1500	900
	RSP	1200	1200	1368	745	62.1	54.5	62.1	1200	1200
	BSL	4600	3055	3178	2602	85.2	81.9	56.6	4600	3780
	SUB-TOTAL SAIL	10840	7405	8165	5939	80.2	72.7	54.8	10840	8868
	TISCO	1200	1240	1240	1236	99.7	99.7	103.0	1200	1240
	TOTAL	12040	8645	9405	7175	83.0	76.3	59.6	12040	10103
Hot Metal	BSP	2970	2450	2742	2377	97.0	86.7	80.0	2970	2820
	DSP	1700	1140	1291	1023	89.7	79.2	60.2	1700	1320
	RSP	1600	1350	1559	1336	99.0	85.7	83.5	1600	1490
	BSL	3660	2500	2600	2192	87.7	84.3	59.9	3660	3050
	IISCO	1300	830	938	800	86.4	85.3	61.5	1300	940
	SUB-TOTAL SAIL	11230	8270	9130	7728	93.4	84.6	68.8	11230	9370
	TISCO	1900	1840	1840	1774	96.4	96.4	93.4	1900	1840
	TOTAL	13130	10110	10970	9502	94.0	86.6	72.4	13130	11210

Source: Data Handbook, 1982, Steel Authority of India, Ministry of Steel and Mines, Government of India, New Delhi, 1983, p.8.

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SAIL: COMMISSIONING SCHEDULE OF MAJOR PROJECTS OF SAIL

Plant	Scheme		Revised Schedule	Likely Schedule
BOKARO STEEL PLANT	4.0 MT Expansion	Raw Material Handling System	March 1980	October 1982
		Sinter Band-3 Complex	October 1980	Commissioned in April 1982
		Coke Oven Battery No. 6	December 1980	October 1982
		Coke Oven Battery No. 7	March 1981	April 1983
		Blast Furnace No. 5	June 1981	November 1983
		SMS - II	December 1980	April 1983
		CRM Complex	December 1982	December 1984
	Captive Power Plant	Ist Unit	December 1982	May 1983
		2nd Unit	June 1983	September 1983
		3rd Unit	December 1983	March 1983
BHILAI STEEL PLANT	4.0 MT Expansion	Convertor Shop — LD I & II	March 1981	March 1983
		Convertor Shop — LD III	March 1981	March 1984
		Continuous Casting Shop — Ist bloom & Ist Slab Caster	September 1981	March 1983
		Continuous Casting Shop — 2nd Slab Caster	September 1981	March 1984
		Plate Mill — Area I	June 1981	December 1982
		Plate Mill — Area II	August 1981	June 1983
		Plate Mill — Area III	December 1981	December 1983
		Oxygen Plant	March 1981	December 1982
		Power Plant	March 1981	November 1982
		B.Fce.no. 7 & C.O. battery no. 9 Complex	June 1983	December 1984
ROURKELA STEEL PLANT	Silicon Steel Project		January 1981	August 1983
DURGAPUR STEEL PLANT	Captive Power Plant	Unit I	September 1982	September 1983
		Unit II	March 1983	March 1984

Source: Project Directorate.

Source: Date Handbook, 1982: Steel Authority of India, Ministry of Steel and Mines, Government of India, New Delhi, 1983, p.105.

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