INTRODUCTION

Since the end of the World War - II more than one and a half billion people in Asia, Africa and Latin America have embarked on an unprecedented adventure in nation building. These objectives encompass much more than industries and infra-structure. The effort are broader than the building of roads, the development of machines and production of more food. By and large they have been characterized by a sense of social purpose which is remarkable in itself.

Some of the common problems faced by these emerging nations had been, large scale poverty, little or no access to the benefits of scientific technology. Almost all were undernourished and lacked education and health. Yet overriding their awesome difficulties was their fierce determination to improve their condition. This age, historian Toynbee wrote, "will be remembered as the first age since the dawn of history in which mankind dared to believe it practical to make the benefit of civilization available to the whole human race." As a result, economics and politics of development, once of interest only to scholars, have moved to the top of the world's agenda.

The leisurely pace at which the United States and Europe developed during the nineteenth century, is no longer adequate to keep ahead of the rising global demands for a better existence. This means that governments will be pressed to strain every muscle and tap every resource to ensure economic products and the political and social justice which their people now expect and demand. In this research study I have attempted to highlight, taking the steel sector as a case, how
India as a nation marched towards economic growth and development against all odds.

India emerged as an independent nation in this international backdrop. Headed by its first Prime Minister Nehru, India was geared up meet the challenges of the times and pursue its ambitious goals of economic empowerment and political enhancement. India, like any other underdeveloped country was starting from a scratch and a position of deep structural dependence.

The situation necessitated India to depend upon technical and economic cooperation from number of developed countries. The purpose behind selecting this area i.e., study of India's international negotiations for technology transfer in the steel industry, is mainly to look into the changing dynamics of Indian economic diplomacy for one of its key sectors under the planned economic growth. Technology transfer negotiations in the steel industry have reflected pioneering efforts of India's economic bargainings.

Technology decision and pace of technical change affect most of the development processes. So, to ensure growth in the vital sectors of the economy, the mechanism of technology transfer becomes a very important pursuit of the developing countries.

The main features of Indian economic diplomacy had been virtually eroded before Independence. Soon after Independence the crucial decision was to start industrial development from a scratch. The gap between the industrial levels of the developed and the developing countries was tremendous. So, outside help was necessary to enable India to set up the few basic industries and train an army of technicians, engineers, management personnel and scientific manpower. The next
problem was availability of foreign exchange to buy equipment and machinery and pay for manpower training etc. India was on the look out for sources of credit on easy terms. The most important factor was to ensure that India was not forced to pay a high price for the economic help that it was seeking.

The immense size of India, both in terms of area as well as population led to the perception of India as a potential independent centre of power and its role as a major leader. Given this perception of an ambitious world role, a satellite status of the country with its self-dependent status for its industrialization and economic development was clearly unacceptable. This pursuit was to meet with resistance from those external powers whose own status and power would have been adversely affected by the new claimant to a share of the international decision making. Also during the 1950's, industrial technology was one of the most strategic tools for exercising international control. As the key to national supremacy, it was a fiercely guarded national asset. So a country like India, which had with clear differences with the monopolists of industrial technology, on economic and political outlook, faced a severe challenge in bargaining for industrial technology.

The USA, West Germany, Britain and later Japan and USSR formed the core suppliers of world steel in 1950's and 1960's. When the countries of the Third World began to join the status of steel producers, the resistance from these countries was but expected.

On the political front, the capitalist countries of the West would have liked India to jump on to their bandwagon to follow an anti-Communist political line. Yet, India chose to maintain an independent position vis-à-vis the two blocs of states. Opposition to Indian position went hand in hand with their opposition to the
policy of setting up steel and other core industries in the public sector. In such a situation, the cold war protagonists, most of whom enjoyed industrial supremacy, came out strongly against any economic aid to India.

When the former Soviet Union learned of the Indian technology requirements in the steel sector, Nikita Khrushchev came forward to assure assistance. In August, 1954, the Government of USSR evinced interest in setting up steel plants in India. The production committee of the Union Cabinet was quick to accept the Soviet assistance.

Events leading to the establishment of the Soviet aided steel plants in India had progressed expeditiously in view of the keenness shown by Soviet Union, India's capacity to absorb technology and extremely cordial relations between the two countries. This posed a challenge to the First-World countries. Federal Republic of Germany was quick to come up with a revised agreement with matching competitive terms. This time the United Kingdom also did not refuse to collaborate.

To keep up with the technology race, it becomes necessary to import new technology at frequent intervals, even for the same product. Otherwise the country finds itself cut off from the mainstream of technological advancement. In the long run, it is the bargaining capacity of the buyers and sellers which influence the mode, the form, the cost and the context of the technology transfer.

A number of technologies are competing against one another for the same product at various levels. Because of the too cautious process of Indian technology acquisition in the discriminatory international political atmosphere, the technology obsolescence began to set. Our bargaining strategy also suffered because of
changes in the balance of international power. There was also a lack of political motivation.

The strong pressure towards globalisation of the economy and ushering in of the Structural Adjustment Programme (SAP) after 1991 marks yet another phase of diplomacy for developing the steel industry in India.

Steel industry as a case study for India's initiatives for technology transfer

Methodologically, it was a formidable task. As will become apparent in the subsequent chapters, it had to be a complex inter disciplinary effort, involving parameters from such areas as economics and politics, both at international and national levels; technological issues concerning steel production; economic and social planning; managerial capabilities; manpower development; negotiating competence; and so on. To make matters more complicated, these parameters have to be considered in terms of the far-reaching changes that have occurred during the past four decades.

The first source of data was the documentation office of our library at Jawaharlal Nehru University and the catalogues at the Teen Murti Bhavan library. Nehru's encouragement and bold bargaining strategies are highlighted in many outstanding works by Sukhomoy Chakraborty, Sanjay Lal, K. Krishnamurthy, etc. Some scholars have reviewed it from the aspects of economic development, while others have studied this as a major step towards nation building and self reliance. A few have studied it purely as an issue of foreign collaboration in the area of industrial development of India. Yet others have studied this as an aspect of
international relations. I have studied these various approaches to find out the
diplomatic basis through which India successfully negotiated for technology transfer.

While trying to understand the problem, I realized that it would be very
important to see the Indian efforts to build up a self reliant base in the steel industry from the global context of the steel industry and the technology transfer regime. This formed the base of chapters one. there in, I have broadly highlighted the aspects of technology transfer, which influence the negotiations between the developing and the developed countries. I have touched upon the trans - national corporations, the International Patent Regulations regime and the other aspects of the monopolistic regime of the developed countries and the continued structural dependence of the developing countries for technology.

This structural dependence of the developing countries for technology was then studied in the context of the steel industry in particular. The material for this section was mainly acquired from the UN publications, specially the UNIDO and UNCTAD divisions. This was made available to me from the UN office in Delhi and part of the material was posted from Vienna.

The process of what appears to be a straight forward collection of information provided a good example of the problems I had to face in data collection. In the first place, the libraries did have the needed materials. A good deal of time had to be spent in searching them. There were considerable hurdles in getting hold of the material that was available in the United Nations Office in Delhi. It turned out that even the UN office in Delhi was unable to provide the entire
range of information. This impelled me to write to the UNIDO headquarters in Vienna, to obtain the needed data.

The problems that I had to encounter in getting data of more nebulous character - for example the type of technologies used in different steel plants at different times - were many times more formidable. It needed a great deal of perseverance to search out the right document/person(s) to get the needed information. I would venture to contend that this has been almost a general pattern for collecting data for my research. I had made strenuous effort to overcome these limitations. I am conscious that despite this it has not been possible to get all the information, that I would have liked.

Having established the broad framework within which I could study my case, I proceeded to establish the Indian context for the technology transfer efforts. So, I talk about India's political ambitions soon after Independence and its great aspirations for power, the drawbacks in terms of economic backwardness and economic exploitation, the technological dependence and the lack of specialized education and training. Against this back ground, I have tried to look into the impact of national motivation and courage, which build the base of Indian steel diplomacy.

Rejecting the popular opinion, against going in for heavy industry at the outset, India made pioneering headway under the courageous leadership of Nehru and the competent support from his cabinet and the party. The entire political situation, economic context, military compulsions and social issues constitute the diplomatic bases of strength of the nation. These efforts from the outset have establish channels of negotiation and the various priorities for technology
absorption. Also these accounted for the successful headway through Five Year Plans, for the economic growth of the nation.

In the Third chapter, I specifically study the diplomatic pillars on which the Indian technology bargainings were based and projects implemented in the steel industry. During the course of bargaining we see that the preparations made in terms of initiatives, R&D institutions, technical educational institutes like the IITs along with consultancy organisation which provided us with a strong position vis-à-vis foreign negotiators. Thus, we see that government initiatives along with its preparedness helped us during our negotiators. Thus we see that the government initiative along with its preparedness provided strength to our negotiators. It is, however important to note that we could effectively give practical shape to our efforts in a very short span of time mainly because a favourable global political focus and the dynamics of cold war political helped India in its very first attempts into economy diplomacy.

The changes in the diplomatic bases for technology transfer negotiations overtime are studies in the fourth chapter. There have been significant developments in the technology for the steel industry globally, but precisely at time the Indian negotiating efforts slackened marked did not receive as much attention. There was also lack of funds on one side and lack of modernization on the other. This led to technological obsolescence. Along with this, there was the firm commitment of the government to expand steel capabilities only in the public sector. All these factors, resulted into a poor bargaining position for technology transfer vis-à-vis steel in India, inspite of many initiatives for strengthening the steel sector.
It was itself a major task to get data on the growth of steel industry. The SAIL library and the JPC office, New Delhi, were important sources. However, an even bigger challenge was to locate appropriate material and to interpret the situation in terms of our diplomatic activities. It took me considerable efforts to finally give some shape to this subject. I was helped mainly by detailed discussions. Information and insight on steel obtained from some key officials in this sector, like Mr. A.K. Sengupta and Mr. Sanjay Jain in SAIL and Mr. Ahmad Shah Feroz, the chief economist at JPC proved to be most valuable. Very enriching insights were also gained by my long interview with another Mr. Sanjay Jain of IDBI Bombay and Mr. Kharkar, General Manager, TISCO, at their Headquarters in Bombay.

Data regarding the facts and figures and the technical aspects were there but actual dynamics of forces deciding the changes in Indian steel diplomacy were studied after looking at a lot many facets of the subject.

Over and above, I needed considerable efforts in bringing together the information collected from these different sources, to understand and articulate the dynamics of the forces which influenced the changes in steel diplomacy overtime.

As mentioned earlier, the years since 1991 have seen far reaching radical changes in the entire structures of the economy. This led to two major developments: First, there was a virtual efflorescence of setting up of steel plants in the private sector which had acquired the latest technology. Indeed some firms have acquired international presence. Second and perhaps more important is the fact that there have been welcome developments in the public section in the form of considerable growth in the indigenous capacity for modernization in steel
production. The policy of liberalization has also enabled the State owned steel industry to easily buy those parts of the technology which could not be developed indigenously.

References have already been made to the hurdles that have repeatedly come in the way of collection of certain key information that was needed for this research. The problem of getting information from the steel firms in the private sector had become almost insurmountable as officials of these firms, such as The Jindals, the Mukund Steel, Bhushan Steel etc., chose not even to respond to separated requests of access to information.

A fortuitous avenue opened up when I had almost given up any hope of getting access on private steel technology acquisitions, in the form of an International Seminar held in Delhi from 5 to 7, November 1996.

The consultants who have been providing technologies to both the private and public sector plants were found to be refreshingly forthcoming with the crucial needed information, which I have incorporated in chapter Five. They provided the vital imparts needed to describe the final stage of Indian steel diplomacy.

Though the transfer technology agreements listing specific terms and conditions of various deals were difficult to access, the implications of such deals were very much in evidence in the development of steel industry. By studying the latter process, it was possible to highlight the basic strength and weaknesses of Indian diplomacy in the context of steel.
CHAPTER ONE

INTERNATIONAL TECHNOLOGY TRANSFER

AND THE WORLD STEEL ORDER

SECTION - I : THE ASPECTS OF TECHNOLOGY TRANSFER FOR INDUSTRIAL DEVELOPMENT

A) Technology : Key Element For Industrial Development and Dependence

The highlight of the industrial revolution of 1750 was the development of technology on a phenomenal scale which radically altered the ability of man to produce various goods and services. If we take productivity per person as a measure, we see that it barely doubled during the first 1850 years of the Christian era; whereas in the following 140 years the productivity per person registered an unprecedented growth of about twenty times. It becomes clear that the main characteristics of the Industrial Revolution was a self sustaining economic growth by the means of perpetual technological revolution and social transformation. Technology emerged as one of the prime motive forces for the growth and development of industrialisation. Today we see that at the heart of any form of economic activity from the least to the most sophisticated lies technology.

Technology becomes critical to the entire process of development, firstly, because it is a resource and creator of new resources at the same time, secondly, technology has emerged as a powerful instrument of social control and affects decision making for social change. At the heart of any form of economic activity, from the most rudimentary to the most sophisticated lies technology. 

outset it will be worthwhile to recall a widely accepted definition of the term technology, as it is used in this research. Technology can be defined as the systemization of the industrial acts, which is a package of designs of products, production and processing techniques and managerial systems that are used to produce a variety of goods and services to satisfy human needs.\textsuperscript{2}

The process of international diffusion of technology fits historically within the overall process of various spurts of industrialization which have characterized the advance of the process of industrialization over the past 200 years.\textsuperscript{3}

Understandably, this technology explosion was not uniformly distributed. While the technology profile of western industrialised countries which formed the 'centre' stood entirely transformed, the colonized countries, because of their 'peripherality' in the global order did not match the pace. In the framework of the modern theory of development, the flow of international investment has been regarded as the transfer of productive power. Technology mostly becomes a significant factor in such transfers. The investments flows from the country where marginal productivity is high to those where marginal productivity is low. Above all, it serves as the engine of growth. Hence foreign investment has been used as the means for filling the gap between the centre and periphery states. Foreign investment in a developing country is a comparatively new concept which gained wider applicability in the second half of the current century. This denotes a wide spectrum of international business arrangements which in essence entail a flow of

\textsuperscript{2} See Denis Goulet, \textit{The Uncertain Promise: Value Conflict in Technology Transfer}, New York, 1977, pp.7-12.

\textsuperscript{3} Luc Seote, "International Diffusion of Technology", in Singer, Hatti and Tandon, eds., \textit{Technology Transfer by MNCs}, Parts I & II, New Delhi, 1988.
capital and non-capital factors like technology, skill and enterprise from one country to another. This has acquired significance in the wake of the need and desire of contemporary developing countries to push up their growth rates.

Figure : 1  
Technology Flow wrt. Product Life Cycle

SALES

Development of Technology through technology generator

INTRODUCTION
Production commences in the DC

GROWTH
'TOT' to other developed areas

MATURENESS
Multinational diffusion of technology

DECLINE
DC stops production, cheaper to import

DC: Developed Country
LDC: Less Developed Country
TOT: Transfer of Technology

Sudden expansion of the market with the general acceptability of the product
Stage of severe competition which favours the various competitive measures to retain the existing market
Reduction of the cost due to economic advantages of the LDC's to sustain severe competition

TIME
'TOT' to LDC's

Source: The graphics is adapted from L.T.Wells' article on 'The Movement of American Goods which appeared in the Journal of Modern Economic Theory into the context of technology flow from the developed to the developing countries.

At this point we can refer to Figure 1 shown above, which shows the technology flow with respect to the product life cycle. In a developed country when a new technology is introduced, it commences production of a new sophisticated item. After some time this knowledge gets shared among other developed countries. Then the marketing rights and speculations of the trading of the new product engender technology transfer to other areas. This causes the sudden expansion of the market for this new product leading to its large scale
circulation in the market. At this stage we can say that a new technology grew and matured with time as its product gained general acceptability in the market, marketing rights and speculations of the trading of the new product engender technology transfer to other areas. This causes the sudden expansion of the market for this new product leading to its large scale circulation in the market. At this stage we can say that a new technology grew and matured with time as its product gained general acceptability in the market. With the passage of time due to severe competition in the capitalist world, the producer country of the product stops its production as now it is cheaper for it to import this product. The trans-national corporations (TNCs) play a vital role in the diffusion of technology from the producer country to the other developed states. The product gets established in the market and is no more a highly prices item. At this stage the technology is transferred to the least developed countries. In the meantime a new technology for a new product would have appeared in the developed countries markets to restart the life cycle.

Much of the developmental efforts of the developing countries are firstly focused at closing the gap between the technological levels by the strengthening of domestic technological capabilities in the developing countries. It is essential not only for the rapid acceleration of their social and economic development but also to overcome their excessive technological dependence on the industrialized countries.\(^4\)

General desire for rapid industrialization in the absence of a viable structural base sufficient to initiate and sustain the desired tempo of development has given a new impetus to the import of foreign capital and technology by the

developing countries in the post-second World War period. Capital and technology are the main propellants of economic development and the developed countries are the best source for such imports to the developing countries.\(^5\)

The process of economic development of the developing countries is making their entire economic structures dependent on the resources available from the advanced countries. Luc Seote defines dependency as the peripheral insertion of a nation state in the world system.\(^6\) This relationship of dependence and dominance gives the developed states the position of power with a lot of control over the developing countries. Through this equation the developing countries are being exploited economically and their dependence is being maintained over time.

At this point the analysis of Economic Commission on Latin America (ECLA) regarding the centre-periphery world system would help us put the technological dependence of developing states in perspective. Since 1948 the focus of ECLA's\(^7\) analysis was that the existence of this centre-periphery world system which favoured the industrial states. It highlighted the fact that those countries which specialized in the production of industrial goods would grow faster than those which specialized in the production of raw materials. Industry had a dynamic effect that primary production did not possess. Industrial growth

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\(^7\) Economic Commission on Latin America (ECLA) was created in 1948 as a regional body of the United Nations under the auspices of Raul Prebish. In the world system of states the numerous developing countries form the periphery. These states are revolving around the handful of industrialized countries which form the core of the world system.
promoted raw material extraction but conversely primary production did not necessarily stimulate industrial activity.

At this juncture, it would be appropriate to discuss, briefly, the theoretical perspectives on transfer of technology. Most dependency theorists and Third World scholars review to the "inappropriateness" or obsolescence of the technologies that are being transferred from the developed countries to the developing ones. However, certain other scholars, like Arghiri Emmanuel and Luc Seote have different views in this regard. In his book Appropriate or Underdeveloped Technology\(^9\), Ammanuel criticizes the advocates of an appropriate technology tailor-made to the needs of developing countries. For Emmanuel, this "appropriate" technology is an impoverished technology because it helps increase the developing countries' lag behind the developed ones, as well as enhance their dependence. Emmanuel argues that transfer of the most modern, capital-intensive technology is the need of the hour in the developing countries because it cuts short the development path. Further, technologies "appropriate" to the developing countries, which are usually labour-intensive, are less productive than the modern and capital-intensive technologies. For Emmanuel what is important is the amount of goods produced and not the number of jobs created to produce the goods. Maximization of the quantity of products leads to social welfare. Also, the multinational companies, being the repositories of advanced technology can be the instrument for technological development. Emmanuel is vehement in his argument that a technology "appropriate" to the underdeveloped

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countries would be an underdeveloped technology, which freezes and perpetuates under development.\textsuperscript{10}

For this rather one sided view Emmanuel is criticized by Harmut Elsenhans\textsuperscript{11}, who feels that development can take place only after the creation of mass market. For him, the action of governments and not that of multinational corporations (MNCs) alone can achieve this result. Further, Elsenhans feels that labour-intensive technologies need not lead to less production.

A country is said to be dependent when it lacks the essential power to make economic decisions and the bulk of the financial and technological means necessary for carrying them out.\textsuperscript{12} Technological dependence can be defined as the dependence on "intellectual" imports, whether in their "materialized" form (as an import of technology, standardization system, patents and licenses, or the results of researches in science and technology), or in its "live" form\textsuperscript{13} (as import of experts, advisers, teachers, sending abroad of students on foreign scholarships).

This idea of technological dependency is intrinsically linked to the specific nature of technology as a "public good" that can acquire commercial value (exchange value) only through appropriation. However, it is well-known that while most technology is developed and appropriated in industrialized countries, this very same technology monopoly is foreign in the LDCs. According to Sercovitch\textsuperscript{14}, "The control of foreign technology suppliers on decision-making..."
concerning investment, production, management and marketing in the context of concentrated and non-price patterns of rivalry make technological dependence a self-reinforcing phenomenon. Therefore, in spite of the possible dynamic externalities of imported technology, Sercovitch argues for the "permanent nature" of the technological dependency. This is further augmented by the lack of domestic private appropriation of the dynamic externalities of the technology "imported" e.g. learning by doing, that leads to the permanence of technological dependency.

Basically, the dependence theorists are critical of the transfer of technology because of their assumption that the inflow does not necessarily lead to the growth of internal technology capability in the developing country. It is argued further that certain legal provisions in technology transfer agreements, e.g. buy-back contracts, exports restrictions, etc., inhibit the indigenous production of the imported technology. Also, the licensing contracts create a psychological environment of continuous dependence on external technology, while limiting, at the same time, the opportunity of learning-by-doing in the host country.

However, since the mid-1970s, the experience of some developing countries, like Brazil, South Korea, and even India, have made the theorists cautious about the blanket application of the dependence critique of technology transfer. For example, Francis Stewart argues that the transfer of technology from the advanced countries to the Third World has enabled the latter to benefit from the manifold development of science and technology in industrialized countries without themselves going through the difficult and costly process of

16 ibid, p 61
developing it. This is one of the main advantages of being a late comer in terms of development. (this) may explain why a country may be justified in pursuing a policy of technology transfer and hence permitting the associated dependency.

Previously, modernization theorists had argued that specialization and international exchange were supposed to be the best mechanisms to eliminate the degree of inequality between countries. This traditional view was unobjectionable in theory; yet it was being contradicted by facts. Inequalities between the centre and periphery have been growing. The present prosperity of the West, which forms the centre states is based on its manufacturing system which obtained its initial head start in the Industrial Revolution - termed as the finest flower of the British genius, the result of their hard work, technology creativity and inventive intelligence.\textsuperscript{17} In ECLA's first-report eminent development economist, Raul Prebich, explained as early as in 1950, that the industrialized countries kept the benefits of technical progress for themselves instead of transferring these benefits by lowering of prices of industrial products. This way they increased their income by creating monopoly conditions.\textsuperscript{18}

Having been deprived of the technological advantage for so long, some of the developing countries have considered developing their technological capacity indigenously. But the process is slow and capital intensive. Others have oriented themselves towards development based on transfer of technology with less of indigenous technology development. Technology is transferred when technology transcends geographical borders from one organized setting into another with entirely different socio-economic environment.

\textsuperscript{17} Preira and Seabrook in \textit{Global Parasites}, Bombay, 1994, p.119.
Understandably, therefore, technology is not a neutral factor. It incorporates, reflects and perpetuates value systems and its transfer thus implies the transfer of a different structure from one socio-economic setting to another. Technology is thus both an agent of change and destroyer of values.

Generally technological dependence occurs when most of a country's technology is coming from abroad. The more concentrated the source of technology the greater is the dependence. Nowhere are the disparities between the industrialized countries and the third world more marked than in the crucial field of technological development. The dependence is almost total. The dependent developing countries are unable to exercise real choice in designing effective strategies for their technological transformation. The growth of the international system over the time has resulted in a profusion of institutions and mechanisms that maintain developing countries in a condition of dependence and that leads to an ever widening disparity between the richest and poorest of nations. Developing countries possess only 12.6 percent of global scientists and engineers engaged in research and development of which 9.4 percent are concentrated in a few countries of Asia. Developing countries account for 2.9 percent of global expenditure on research and development and 3.3 percent of global exports of machinery. They account for about 13.4 percent of global foreign direct investment and barely 10 percent of the patents. Conversely, in 95 percent of developing countries machinery and transport equipment come from the developed countries. Thus, international system, with its built-in automatic

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20 See Development and Technology Transfer, Series No.15, Technological Self Reliance of Developing Countries, UNIDO, July 1981.
mechanisms that maintain dependencies imposes severe constraints on the exercise of the technological options open to the developing countries. Some of the most severe of these constraints are the costs of technology transfer, the role of transnational corporations in the transfer process, the relevance of the technology transferred and the restrictions imposed by the international industrial property system.\textsuperscript{22} Technology dependence is a crucial element in the overall structure of dependence. The technological disparity is not merely a reflection of their inequality but an important cause of it.\textsuperscript{23}

B) The Process of Transfer of Technology

The transfer of technology occurs as a two way process. Usually it is important that the supplier of technology should agree to part with the innovation. Mostly the supplier looks for certain benefits from deals like additional earning, an opportunity to experiment with technology as an ambassador of goodwill and also a means of gaining political leverage. The process between two states with equitable levels of economic development leads to growth of economic co-operation and strengthening interdependence at the global level. But when transactions occur between the developed and the dependent states in the international community the dependent states are in no position to fight for the terms and conditions of the transfer from the developed donors.

During the last two decades there has been a rapid growth of technology exchange between enterprises in different countries and an emergence of industrial

\textsuperscript{22} \textit{ibid, Development and Technology Transfer,} p.1.
\textsuperscript{23} Hassan, Kamal, ed., \textit{Legal Aspects of the New International Economic Order,} Nicholas, 1980
technology as a highly marketable commodity. In a perfect market, competition would reduce to the marginal cost of acquiring technology. But the technology market, like so many others of importance to the developing countries, is imperfect, with great monopoly advantages for the seller because of secrecy and the protection of patents and trade marks. The technology is transferred (whether in the form of pure knowledge or embodied in foreign investment or machinery) under terms that are the outcome of negotiation between buyers and sellers, in situations frequently approximating monopoly or oligopoly. The final returns and the distribution largely depend upon the relative power of the bargainers and this almost certainly results in an unfavourable outcome for the dependent states. The general forms of payment for these technology are the lump sum payments, royalties and fees. The indirect costs of technology acquisition, which take the form of restrictions on sources of input and access to market outlets are held to be many times higher than the direct costs.

Emerging technological developments are being used as new instruments of technological dominance of the developing countries by the developed countries. These include high degree of privatization and commercialization of science and technology and research and development activities, leading to a growing hold of the Trans-National Corporations and increasing resort to Intellectual Property Rights (IPR) to maintain monopoly positions.

\[\text{\cite{ibid, Development and Technology Transfer, p 4}}\]
\[\text{\cite{ibid, Development and Technology Transfer, p 5}}\]
\[\text{\cite{Business Standard, 5 September 1989, Rich Out to Boost Inequality, NAM Study.}}\]
The Role of Intellectual Property Rights

Philosophically and historically attitudes to Intellectual Property Rights (IPRs) have ranged between two extremes - on the one hand we have the Hegelian dictum that 'one idea belongs to its creator because the idea is a manifestation of the creator's personality or self." On the other hand there is the utilitarian view that stresses the role of innovations in promoting industrialisation by local diffusion of knowledge.27

National IPRs laws usually embody aspects of both views with strong IPR regimes setting greater store by the 'natural rights" view point and weak regimes emphasising the other end of the spectrum. The deliberations attended upon by the recently concluded Uruguay Round witnessed a marked polarisation of views on IPRs, with the industrialised countries spearheaded by the USA taking up the cudgels for strengthening IPRs globally and the developing countries offering spirited resistance to the USA's initiative.

One of the primary reasons for the movement in favour of stricter global IPR regime gaining currency in developed world is to be sought in the fundamental changes in the character of technology which have occurred in the past two decades. As highlighted by Freeman (1974)*, Mytalka (1987)* and Keplinsky (1989)28, the knowledge intensity of production has increased and simultaneously so has the science oriented knowledge. As knowledge intensity has

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28 Read C Freeman The Economics of Industrial Innovation. Penguin, 1974, Harmandsworth.
grown, the individual inventor has been replaced by the corporate entity, and growing scientisation has increased the optimal plant size, implying scope for exploitation of economies of scales very often by transcending national boundaries. Also the post-1970s have witnessed a major transition from mass production to flexible specialisation, brought about by the instability in global markets, shifting the focus from price competition to product characteristics and design in the arena of international trade.

Against this background, the priority accorded to innovative designs assumed central importance. Since such protection is usually weak in developing countries and since the main innovations in design are centred around the developed countries, there is a natural tendency to strengthen IPRs in this direction in the latter group of countries. The "electronic revolution" has called into question some of the traditional approaches to IPRs. Because the pace of diffusion in electronics is quite rapid, imitations are often costless and difficult to prove and duplication via reverse engineering can be relatively easy, thus technological leakage is common and the affected interests in developed countries have been quite active in lobbying for stronger protection. Similar is the case of innovations and developments in the area of biotechnology which are likely to have significant impact on agriculture and health the world over.29

Role of New IPRs in Transfer of Technology in India

The IPR regime will certainly increase the technology suppliers willingness to transfer new technology to LDCs because of reduced fear of illegal imitations. With a strong IPR regime in place the risk premium will go down with more

technology available for sale. Not only will the choice set of Indian firms enlarge but royalties may also come down owning to increased competition among technology suppliers. Thus the possibility can not be ruled out that the new regime may not only make more technology available but also do so at a cheaper rate. Further the increased duration, the relaxation in payment ceilings and the wide application of the automatic approval embodied in the New Industrial Policy, 1991 are also likely to generate greater interests in the Indian technology market from foreign suppliers. Thus, technology of more recent vintage will be available to Indian firms.\(^{30}\)

**The Role of Trans National Corporations (TNCs)**

TNCs have been responsible for approximately 80 to 90 percent of the technology transferred to the developing countries and most of them have been dependent upon the TNCs for acquiring and expanding their technological development capability. This has mainly involved "contractual transfers" for acquiring the technologies required for science intensive industrial sectors. Because of their necessity to continually expand and grow, TNCs must have an increasing number of responsive buyers. Since the capacity to sell largely determines their profile, they must inevitably produce for those who can afford rather than those who need. The extraordinary market power of the TNCs determines the availability and pattern of technology transfer in advanced science-based sectors where technology ownership is concentrated in a few large enterprises.\(^{31}\)

\(^{30}\) ibid, p 262

\(^{31}\) *ibid, Development and Technology Transfer*, p 5.
These oligopolistic sources are motivated mainly by business (profit maximization) rather than developmental (social welfare) considerations. They have sought to minimize the value added of their production in a developing country. This procedure has frequently been aggravated by the excessively high prices at which technological know-how is being supplied. The transfer of technology from the parent company to foreign affiliates, because it takes place as a purely internal process, provides opportunities to manipulate the prices of goods and services. The extent to which TNCs manipulate transfer prices appears to depend upon the gains vis-à-vis the costs, in terms of the effort and the risk involved. The transfer price manipulation seriously prejudices a developing country's possibilities for economic development. They also have adverse effects on competition and balance of payments, domestic capital formation and local industrial structure.

Transfer Pricing

Transfer pricing is a function of the corporate system and it may well be an area in which the power of TNCs is greater than the governments to control them. The current IPRs system confers on the owner a monopoly of production and distribution in a specified territory for a given period of time. When these monopolized foreign held patents are used in the production process, the agreements entered into by the developing countries frequently contain high royalty payments and charges for the technology. Hence the foreign exchange burden of these costs which are much larger than the direct-costs applies to all developing countries regardless of whether they have national patent laws.\(^\text{12}\)

\(^{12}\) ibid, Development and Technology Transfer, p 5.
Mechanism of Transfer of Technology

Technology transfer or acquisition of foreign technology usually take place when at least the following three conditions are met, namely - (a) decision-makers of one country wish to use a certain technology; (b) that technology is not available locally; and (c) they believe it is cheaper or easier for them to get the technology transferred than to reproduce it. Following this decision the actual process of transfer proceeds in three stages - (a) the specified technology is sent to the recipient country by the host country or the donor country; the (b) assimilation and diffusion of the new technology; then (c) the development of the indigenous capacity of the recipient for innovation and adaptation.

While the goal of industrialization has been historically determined by a conflictual interstate system, the means for its accomplishments have varied among the late industrialized countries. Fundamentally, they have involved purposive state protection and encouragement of local industry. It was predetermined within the existing international system that the economically backward newly independent states would follow the path of industrialization set by the industrialized countries. It is a teleological phenomena which is captured in a significant comment by Karl Marx: "the image of underdeveloped countries was embodied in the shape of the industrially developed countries".13

Transfer of technology from the industrialized countries has enabled some developing countries to benefit from their advancements in science and technology. The transfer has allowed these developing countries to use

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13 Arun Bose, Marx on Exploitation and Inequality, *An Essay in Marxist Analytical Economics*, Oxford University Press, Delhi, 1980
technologies without themselves having to go through the difficult and expensive process of developing it.\textsuperscript{34}

Technology transfer has introduced high productivity techniques and also in many cases a desire for technical change. So there are some benefits from the present system of transfers. However, as Susan Strange has observed, technological dependence can be seen as both the cause and effect of general dependency relationships.\textsuperscript{35} It leads to foreign investment, loss of control and introduction of alien patterns of consumption and production. This creates what is termed as an euclans economy dependent on the advanced countries for inputs, market management, finance and technology. There exists a vicious circle in which a weak technology system reinforces dependence. This vicious circle is one element which makes the developed country's industrial and economic structure more prosperous. To serve their own interests they generally perpetuate this dependent dominant relationship in the world economic order. Dependent countries provide them with vast markets for various products and numerous technologies which have gone out of the markets or have saturated the markets of the advanced states.\textsuperscript{36} 


A) Industrialisation and Relations Among The Developed and Developing Countries

As we have noted so far, in most developing countries industrialization is the single most powerful factor which accelerates and sustains the process of modernization to meet the rising aspirations of the state to achieve self generating growth. Yet this attempt by the developing countries to industrialize and grow is perceived by the early industrial states as a threat unless the late comers, the developing countries are tied to them by a dependent relationship. They perceive any such attempt to industrialize as a zero sum game specially in view of the impact it will have on their relative economic and military capability. Consequently the developed/industrialized countries undertake overt or covert measures to thwart it.

Even if the developed industrialised states do not do so by design, structurally they have the advantage of a head start. They have a strong industrial and communication network, trained and skilled manpower, along with capital and technology which the late comers lack. Thus it is quite natural for the industrialized states to control the world markets at large. In a situation like the late comers or developing countries require an effective state protection to commence its process of industrialization. In such a situation when transfers do take place, radical discontinuity is observed between the two sets of social structures. The advanced capital intensive technologies available from the early industrialized countries create severe adaptation problems for the newly industrializing states. On one hand, the very reliance on the import of foreign
technology from the advanced industrialized states places the control of the newly industrializing states elsewhere than in their own hands. On the other hand, the non-availability of technology among the poor states retards the process of industrialization. Technology is the vital input without which development does not take place. Yet this necessity becomes the source of dependence and subjugation, because of its non-availability in the late industrialization. Besides, the advanced manufacturing technologies require large blocks of capital which are not available in the backward economies. But technology transfer occurs inspite of conflicting interests of both sides. The supplier seeks lucrative, free and diverse markets in which they can generate revenues on their investments in research and development (R&D). The technology supplier is able to take advantage of a wide range of weaknesses of the recipient dependent country including lack of capital and appropriate skills and information and their vulnerability in the international relations.

The purchaser of technology, on the other hand, wants to master the imported technology and exploit it to develop his country and remain competitive domestically and internationally. Thus, finally, we see that the technological and ideological developments, as a result of the successful achievement of industrialization serve to inhibit the industrialization process among the peripheral states by creating tremendous economic and political conditionalities.

The Case of Steel Industry in Industrialized Countries

In the mid-eighteenth century industrialization began as a state sponsored phenomenon for economic development, first in the pioneer industrial country of

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37 ibid, p 24
Great Britain and then in the other countries. The reason for the state involvement lay in the fact that they operated in an international environment where inter-state conflict was a common phenomena and their resolution, in a characteristically self-help system, depended, in the ultimate analysis, on war. For this purpose capitalist industrialization added not only to their economic capabilities but also their military potential. Hence industrialization was considered as an imperative for national security and it could be neglected only at the cost of political dependence.38

With this background we focus on the fact that those countries reaped enormous economic benefits in which the iron and steel industry played the pioneering role. It is this industry that supplied the basic inputs to the pace-setting sectors of the economy. For example, in the second half of the eighteenth century, main inputs for the agricultural sector, for the manufacture of the steam engine, equipment for textile manufacture and machine tools came from the steel industry.

The iron and steel industry, since its inception, was the key strategic industry which defined the capability and the status of power of the country in which it was situated. Because of iron and steel industry, the machine tools and capital goods could be designed according to the most modern technologies not only in steel but in every other industry, thus increasing productivity many folds. Hence the marketing potential of their goods increased. The growth of the armaments industry and military power also saw unprecedented opportunities through the growth and development of iron and steel.  

The nineteenth century witnessed the massive construction of railroads which demanded further growth of the industry. Between 1860 and 1880, there

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38 ibid, Baldev Raj Nayyar, pp 26-27.
were significant technological developments (Bessmer, Siemens-Martin and Thomas Steel making processes - given in the appendix) expansions of on techniques which enhanced the quality and the capacity of this industry to meet the demands of the different sectors of the economy, for example, shipbuilding, construction of buildings, rails, military accessories, etc.39

The steel industry continued to be the pivotal link for a country's economic development by strengthening its capital goods industries and the core sectors which translated itself to national power and potential for national defence. This industry also determined the crucial link for the expansion of capitalism in Europe and in the USA. The production of steel, developed and matured in conjunction with railways, accelerated formation of national markets and naval construction reinforced the expansion of capitalism abroad. At the dawn of the twentieth century, even though the electricity and chemical industries were becoming the nerve centres of accumulation, the arms race implied by the transition to modern imperialism maintained a strategic role for the steel industry.40

The power and prosperity of the advanced countries following the capitalist path induced them to grow as colonial powers which had international ramification and repercussions. For the birth of colonialism we could logically assume that the iron and steel industry constructed the stage on which the industrial powers launched their onslaught in the far off lands of Asia, Africa and Latin America. The shipbuilding industry had strengthened and the railways had become the life lines of the states, with these, the colonizers could take their products to new and far off destinations. Because of these considerations, the

production capacity of the centre states had risen many folds which, in turn, created new techniques and growth of the new machinery and capital goods sectors. The new modes of transportation also ensured the bulk transportation of the rich natural resources from the far flung lands of Asia and Africa and Latin America.

The globe was now clearly divided into two groups of states: one were the powerful industrial and political giants, with powerful international links of dominance and the other dominated, underdeveloped and poor countries. The former formed the handful of core states in the international system. The latter were entirely subjugated by the economic and military power which the centre states wielded over them. The latter, as has been mentioned earlier, formed the numerous peripheral states. As could be expected, the competition grew among the various centre states to be more powerful than the rest by colonizing more areas of land, with larger markets and reserve for natural resources and acquire political stronghold globally. Soon the interests of the colonizers began to clash over the colonial rights of one colony over the other. More than once, the world witnessed wars in the global scale, over this equation of power. The countries at the centre had strong reserves of military and industrial power which were ably aided by a tough industrial infrastructure. When a war broke out, it was a severe test of strength among the colonizers. The iron and steel industry was at the foundation of the industry and military nexus of the powerful states.

The two devastating World Wars caused persisting crises in international relations. This caused far reaching damages, which shattered the political and economic structures of the countries involved. The steel industry which could always be hailed as the symbol of industrialization on a near global scale, was
forced to confine its production to very limited range of countries. In 1946, the first year of peace after World War-II, the United States accounted for well over half of world steel output. It was helped by government financed wartime expansion and ready access to raw materials. On the other hand, production had come to a standstill in many parts of Europe and Japan not only because of the war time damage, but also due to acute shortage of raw materials. USA became the leading exporter at a time of scarcity - a position they were to retain until the European producers began to recover in the 1950s.

The post war recovery placed heavy demands on production capacity that had survived the war. World steel output more than doubled in the years between 1946 and 1955 (see Table 1.1 on next page).

The following couple of decades, i.e. mid 1950s to mid 1970s saw even more spectacular growth in the world steel production.

B) The Genesis of Technological Gap Among The Steel Producing Countries

Rapid industrial reconstruction and overall economic growth were powerful impetus for the expansion of established centres. But their growth rates were outpaced by the new entrants to this industry from the newly independent developing world. Their rapidly growing steel consumption stimulated the development of domestic iron and steel industry. At the same time the large established steel making centres saw rising levels of production in order to realize

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### Table 1.1

**Leading producers of steel since the Second World War**

(Millions of tonnes of crude steel and percentage)

<table>
<thead>
<tr>
<th>Rank</th>
<th>1939</th>
<th>1945</th>
<th>1955</th>
<th>1975</th>
<th>1988</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>United States</td>
<td>47.9</td>
<td>United States</td>
<td>72.3</td>
<td>United States</td>
</tr>
<tr>
<td>2</td>
<td>Germany</td>
<td>20.5</td>
<td>United Kingdom</td>
<td>12.0</td>
<td>USSR</td>
</tr>
<tr>
<td>3</td>
<td>USSR</td>
<td>18.8</td>
<td>USSR</td>
<td>11.0</td>
<td>FRG</td>
</tr>
<tr>
<td>4</td>
<td>United Kingdom</td>
<td>13.4</td>
<td>Canada</td>
<td>2.6</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>5</td>
<td>France</td>
<td>9.9</td>
<td>France</td>
<td>1.7</td>
<td>France</td>
</tr>
<tr>
<td>6</td>
<td>Japan</td>
<td>6.7</td>
<td>India</td>
<td>1.4</td>
<td>Japan</td>
</tr>
<tr>
<td>7</td>
<td>Belgium</td>
<td>3.1</td>
<td>Sweden</td>
<td>1.2</td>
<td>Belgium</td>
</tr>
<tr>
<td>8</td>
<td>Czechoslovakia</td>
<td>2.4</td>
<td>Japan</td>
<td>1.1</td>
<td>Italy</td>
</tr>
<tr>
<td>9</td>
<td>Italy</td>
<td>2.3</td>
<td>Germany</td>
<td>1.1</td>
<td>Czechoslovakia</td>
</tr>
<tr>
<td>10</td>
<td>Luxemburg</td>
<td>1.8</td>
<td>Australia</td>
<td>1.1</td>
<td>Poland</td>
</tr>
</tbody>
</table>

| Total of 10 | | | | | |
| 126.8 | 105.5 | 238.3 | 509.1 | 564.7 |

| World | | | | | |
| 137.3 | 111.7 | 270.0 | 646.0 | 777.2 |

| Share of 10 | | | | | |
| 92.3 | 94.4 | 88.3 | 79.8 | 72.6 |

| Share of 6 (aa) | | | | | |
| 85.3 | 88.8 | 80.8 | 66.8 | 56.3 |

| Share of ECE (bb) | | | | | |
| 92.5 | 95.0 | 92.4 | 72.3 | 63.3 |

| Producers (cc) | 35 | 35 | 40 | 60 | 65 |

(aa) 6 traditional leading steel producers (United States, Germany-FRG, USSR, United Kingdom, France and Japan).

(bb) 28 countries (26 European countries, United States and Canada).

(cc) Total number of steel producing countries.

Source: UN/ECE steel section data bank
the technical economies of scale brought by new technologies.\(^{42}\) A booming automobile market, growing trade in capital goods, rapid increase in fixed assets and building up of high level of inventory throughout the developed world largely enabled the steel industry to perform at its peak.\(^{43}\) The turning point in this booming industry came with the recession that followed the critical oil crisis.

The industrialized economies had been the quickest in developing and adopting new technologies in all fields and particularly in their steel industry. This resulted in a technological gap between them and rest of the world's steel industry. For example, the automobile industry generated a great push for growth and technological change. In the capital goods sector as well, progress in the technological processes required higher quality steel. Demand for smaller and more fuel efficient cars required stronger and lighter steels of new kinds (cold rolled high-strength steel with improved durability). The micro-electronic industry had the tendency to reduce the amount of iron and steel used per unit of output but at the same time increased the demand for higher quality steel. Great technological advances in the production and usage of steel led to further installation of equipment and also existing plant modernization with new techniques like continuous casting and heavier coil weights.

The world steel order, as it exists today, gives a clear picture of the vicious circle of technology dependence which is shown in Figure- 2 on the next page. As can be seen, the industrially powerful countries kept the technology of steel generation strictly to themselves. They presumed very categorically that the old

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\(^{42}\) ibid, p. 4.

equation of the peripheral states providing for the natural resources will continue and the centre states would provide with the finished manufactured product.

The centre states would have also liked that the dependence on their steel industries would mean they would find unlimited market opportunities in the economies of the developing countries. Till very recently the steel industry in the developed countries appears as a pure national activity, controlled and managed by national capital, operated by national workers, supplying mainly the national markets.
As is well established, this primary industry has lagged behind in this process of internationalization of capital since its inception. But the extension of world markets and steeply rising labour costs provided a major thrust to internationalisation in these countries.

Paradoxically, rising plant capacities in the developed countries coincided with weak or stagnant domestic demands. After a high level of development, the use of steel for basic infrastructures and the core areas becomes almost negligible. Shifts in the structure of demand also came because energy prices went up in 1979. This led to a move towards higher quality and lighter weight steel for use in specialized areas. At the same time more traditional outlets for steel like ship building were also declining. This led to a falling capacity utilization among the market economies with the attendant problems of low steel prices and widespread losses.

Faced with the fall of domestic demand, the various capitalist countries resorted to export by depending more and more to the external markets. Supported by strong surpluses, the industrial countries increased their penetration of international markets.

The avenues for the growth of the steel industry in developing countries were very limited. The whole range of activities were controlled by what was in the best interest of the market economies. The developing countries needed the technology, the financial investment, along with manpower training to set up functional integrated steel plants. Ideally, industrialised countries would like to approve such a goal if a direct foreign investment scheme was allowed by the peripheral states, so that the former could have a direct monopolistic hold.

ibid, F.Yachir, Introduction, p 8
The vicious cycle of technological dependence as shown in Figure-2, can also be witnessed in case of technology transfer in steel industry. As shown, the technology of basic steel production that had been transferred by the industrialised countries to the developing countries do not necessarily belong to the latest technological standards. This gave them a chance of getting yet another lump sum return on their investment in research and development. So once again the vicious cycle of dependence is at play. The developing countries are tied to them with aid and payment for technology and through structural dependence. In spite of all these "payments", it is not transfer of technology that taken place but, "transfer of under development", by maintaining the gap between the centre and the periphery, so that the latter could present the ideal dumping ground for the old outdated technologies for years to come.

The logic of world market is such that it induces a relative specialization of different countries, not according to an abstract competitive advantage, but to their particular social and technological condition of production. Such a specialization is unequal by its very nature. It implies a growing differentiation between the advanced capitalist economies and the new producing countries, particularly those of the periphery. However, mainly because of the unequal development of this industry at the global level during the preceding two decades, the mid-1970s saw the disruption of this old international steel order.

The following two decades have seen a marked change in the relative positions of the main steel producing countries on the world market because of the following three reasons:

(A) The relatively stronger post 1950s growth of European and American industries had been partly dependent on more dynamic home markets.
Later, Japan joined as a major producer of steel. But the dynamic growth of the new national industries is much more linked to the growth of exports and to the capacity of the advanced countries to create external outlets for their steel. Accordingly, it has been observed that the volume of international trade has increased more rapidly than that of world production.

(B) The growing dominance of Japan in the world market is linked to its increasing penetration of external markets. This contrasts with the American steel industry's limited expansion during the mid 1970s and beyond. The deteriorating American position left Japan and Europe facing each other in the world market.

It seems that centrally planned economies like USSR and China were much more successful at maintaining high levels of capacity utilization through their planning and distribution system. But in these economies too, the trend towards lower steel industry became apparent with the passage of time.

(C) At the same time, steel production increased in the traditionally non-producing countries, leading to the emergence of new exporting countries such as Canada, Australia, South Africa along with dynamic growth of the industry in the developing countries.

The above mentioned phenomena did not operate independently of one another. The shift in the balance of forces within the states of the centre undermined the monopoly position which they had in the international markets. Acute competition initiated a process of relocation of the steel industry in new

\[45\] ibid, F. Yachir, pp.1-3, 10-12.
producing countries, specially those at the periphery which were endowed with cheap labour force and, more importantly with cheap sources of energy and iron ore. In addition, these countries did not have or could not enforce stringent environmental laws or standards.

C) Growth of Steel Industry in the Peripheral States

The growth of the steel industry over the last two decades has been the result of a complex interaction of domestic and external factors. It becomes important to mention here that the partial relocation of this industry has not affected the periphery states as a whole. Only two categories of countries have participated:

(1) Semi-industrialized countries of Asia and Latin America (South Korea, Taiwan, India, Brazil, Mexico, Argentina); (2) Oil exporting nations like Algeria, Nigeria, Iraq, Iran, Qatar, Saudi Arabia, Venezuela. Thus, the integration of the periphery states into the new steel order has been highly selective.

However, the efforts of the peripheral states to break away from the stronghold of dependence has not gone very far mainly because in so many other areas of industrial development they heavily depended on the centre states for technology and finance.

Among the periphery countries mentioned above, the growth of the steel industry has been a part of an overall programme of industrialization directed by the state, though in some cases it was done in close association with private or foreign capital. In the second category of states, the investment in steel is mainly associated more with profit maximization than with the building of an industrial
base. At this point we can infer that countries in the first group participated in the shaping of the new steel order, while oil exporting countries merely adjusted themselves to the changes directed from the outside.

Where steel industry is growing mainly as the result of state initiative, often on the basis of local technology and with a more diversified product structure, it is difficult to ascertain whether the dependency has deepened. Where the growth of the industry is on the relocation model, mainly as a result of the strategies of TNCs, the dependent nature of such a development is quite obvious.

The structural dependence of the steel industry in developing countries is evident in the very nature of its inception. In these countries the steel production almost constantly lagged behind the expansion of its demand in the economic structure. The development of steel industry generally follows a demand-->import-->production sequence, which is the exact opposite of the pattern followed by the advanced industrial countries.

The developing countries are slowly moving up in steel production at the expense of the developed countries. The industry is developing within the large framework of dependent state capitalism with permanent tendencies towards technological modernization in this sector which induces the use of modern equipment. The technological gap that the new producers of the developing countries have is difficult to close. However, the process of technology upgradation and transfers are being accentuated by the gradual integration of these small countries into the folds of world market.
Coming specifically to the case of the Indian steel industry, the classical production process based on the reduction of iron ore in the blast furnace using coking coal is still the predominant and standardized method of steel production. In eight out of nine plants, the method used is the open-hearth system and the oxygen system, both in the public and in the private sectors.

However, of late, there has been a trend towards modernization and the open hearth process is being replaced by the L-D process, i.e., reduction of iron ore by hydrocarbons or non-coking coal. A wide spectrum of new techniques is now being made available to these countries as a result of very significant technological progress and its transfer.

The development of steel industry in the semi-industrial countries was the outcome of a well directed dual state strategy. It consisted of taking over heavy production responsibilities by the state while promoting the contribution of private capital, sometimes also in association with foreign capital. This strategy makes it essential for the state to work on a specific technological policy for the growth and prosperity of this industry. The steel industry in Brazil and India can be seen as good examples where favourable technology deals helped the establishment of large steel mills in their respective countries.

Today though the basic steel making technology has been standardized, but the focus of global requirement has shifted to special high quality lighter steels for use in various sophisticated industries like the automobile, electronics, space equipment, etc. The high capacity blast furnaces, continuous casting machinery and automated rolling mills represent that group of techniques still kept out of the reach of the peripheral states.
Though the countries of the centre are facing a challenge at the world market due to the reasons mentioned above, still their technological edge keeps them on the winning side in negotiations for technology transfer to the peripheral states.