Indian non-electrical machinery industry

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Abstract

Despite the implementation of economic reform measures, availability of cheap skilled and unskilled labour, good domestic demand and higher growth trend witnessed since 2003/04, India remains a marginal global player in the non-electrical machinery industry. The present status of the industry is unsatisfactory. It faces serious disadvantage while competing with the countries like China, which has developed strong presence in this industry. The industry is beset with many external and internal problems. Government of India may take important steps in creating level-playing field for the Indian manufacturers of machineries and equipments. Indian firms may attract FDI through MNEs with their potential to offer critical resources and assets, for developing additional capacities as well as for achieving global competitiveness in this industry.

Keywords: Indian non-electrical machinery industry, economic reforms, FDI

JEL: L64

1. Introduction

The main purpose of this article is to: i) discuss the importance of development of Indian non-electrical Machinery Industry (NEMI) for a developing country; ii) offer definition and coverage of Indian NEMI adopted in this study and describe the basic characteristics of this industry; iii) trace the evolution of the Indian NEMI since independence in the background of industrial policies and strategies of economic development followed by the Government of India (GoI); iv) examine the implications of economic reforms in terms of the developments and performance of Indian NEMI during 1993/94 to 2007/08; v) examine the present status and structure of the Indian NEMI; and vi) identify the major issues and concerns of the industry.

The studies focusing exclusively on Indian NEMI (capital goods or machinery sector) are only a few in numbers and not much information is available at the micro level or the industry level. Only a few studies (Suresh 2004, CII 2007, EXIM Bank 2008) have been conducted in the recent years that provides some material and insights for analyzing the problems faced by Indian machinery manufacturing industry, its competitive position in relation to global bench marks, growth prospects, etc. Moreover, the data available from official and other sources are also not adequate, comparable and precise for analyzing

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performance of this industry. This article is therefore based on the data/information contained in these studies, readily available additional data and information from some official and non-official sources (e.g. Centre for Monitoring Indian Economy) and the published articles focusing on implications of economic reforms for Indian manufacturing and capital goods sectors.

The remaining part of the article is organised in the following manner. Section-2 briefly offers the definition and coverage of Indian NEMI adopted in this study as well as describes the basic characteristics of the industry. Section-3 reviews the evolution of the Indian NEMI since independence till 1991 against the background of industrial policies and strategies for development followed by the GoI. Section-4 states the purpose and briefly discusses salient features of the economic reforms and its implications for the Indian economy with main focus on industrial growth. Section-5 examines the implications of the economic reforms in terms of the developments and performance of Indian NEMI during 1993/94 to 2007/08. Section-6 presents the present status and structure of the Indian NEMI. Section-7 discusses the major issues and concerns of Indian NEMI. The last section-8 offers conclusions.

2. Importance, Definition, Coverage and Characteristics

The importance of the development of strong machinery and machine tools manufacturing capability in a developing country has been adequately emphasized in the literature on technological change. Fransman (1985) stresses on the following rationales for developing indigenous machinery manufacturing industry in a developing country: First, all technical changes, whether product or process variety, require the development of new or modified machinery or equipment. Use of machinery improves labour productivity and replaces (wherever possible) subjective human judgments in the production process with more precise and controllable facilities. Secondly, the diffusion of improved vintages of machinery facilitates the process of technical change in the user firms as well. For example, when a capital saving innovation takes place in the machinery manufacturing industry, it not only contributes to the productivity of machinery manufacturing firms but also contributes significantly to the increase in the productivity of machinery user firms based in the economy. Thirdly, the productivity in the machinery-manufacturing sector increases more rapidly than in the machinery-user sector of the economy.

NEMI is defined for the purpose of this study as an industry manufacturing general as well as special purpose machinery, equipment, parts and components thereof, which are used in the process of production/service delivery in various sectors of economy such as agriculture, manufacturing, construction, mining, power generation, etc. As per this definition, Indian NEMI would include most of the products of Division 28 (manufacture of *machinery and equipment n. e. c.*), comprising of Group 281 (general-purpose machinery) and Group 282 (special-purpose machinery), of NIC-2008 (GoI 2008c).

In order to give a clearer picture of this industry, we categorise Indian NEMI into its representative segments manufacturing the following eleven groups of products:

i. Prime movers including engines, boilers and turbines,
ii. Fluid power equipment, pumps, compressors, taps and valves
iii. Bearings, gears, gearing and driving elements
iv. Lifting and handling equipments
v. Agricultural and forestry machinery
vi. Metal forming machinery and machine tools
vii. Machinery for metallurgy
viii. Machinery for earthmoving, mining, quarrying, construction,
ix. Machinery for food, beverages and tobacco processing
x. Machinery for textiles apparel and leather production
xi. Other special purpose machinery

In terms of the above categorization of NEMI, first four product groups roughly belong to the general-purpose machinery segment, whereas the remaining groups are included into special-purpose machinery segment.

The Indian NEMI, as defined above, is heterogeneous in terms of product range and user groups. In an important study, Pavitt (1984), however, classifies industries based on their technological characteristics, requirements of the users and appropriability regime. Thus, the study categorizes the entire industrial sector into four groups: i) supplier-dominated, ii) production intensive (scale-intensive), iii) production intensive (specialized-suppliers) and iv) science-based. In terms of this taxonomy, the NEMI falls into the group of production intensive *specialized suppliers*, which hold the following major characteristics:

- The technology trajectory of this industry is more oriented towards performance improving product innovations and less towards cost-reducing process innovations.
- This industry involves medium R&D and often continuous R&D costs. The feedbacks of the customers and from the internal sources (viz. production engineering department) are considered important in the innovative process. The users may provide operating experience, testing facilities and even design and development resources to the suppliers of the machinery and equipment.

- The industry also requires close interactions with the user industries to identify and fulfill their specific needs with regard to the supply of spare parts, servicing, repairs and maintenance of machines and equipment.
- The NEMI, whether general or special purpose machinery, is normally populated by the medium size firms. However, the innovative firms in the industry are relatively small in size.
- The competitive advantage of a firm in this industry depends to a large extent on non-price factors such as product design and development capability (and to a lesser extent on process innovation and production engineering) leading to frequent improvements in the design of the product, performance of the machine and their components in terms of reliability, precision, durability and finish and the ability to respond quickly and responsibly to the users' requirements.
- The industry has strong forward and backward linkages with the rest of the economy and thereby is capable of generating productivity and technology spillovers to suppliers of the raw materials and component and to the users' industry.
- The barriers to entry in this industry are relatively high, mainly due to higher level of technological expertise, product design and engineering skills required for production of machines and equipments, stringent norms of for machine performance, technical expertise needed for erection and installations of plants and after-sales services needed for repairs and maintenance of the machinery.
- The special-purpose machinery, as compared to the general-purpose machinery segment within NEMI, has relatively higher barriers to entry, longer manufacturing process, longer gestation period, longer delivery schedule, and is much less fragmented, more oligopolistic and less export oriented.

In view of the above characteristics, the Indian NEMI, despite being heterogeneous in terms of product profile, is treated as a single medium technology industry.

3. Evolution and Growth of Indian NEMI until 1991

3.1. *Policy Environment and Growth in Production*

The evolution and growth of the Indian NEMI can be seen in the context of Government's strategy to promote investment and growth in capital goods sector. Development of machinery manufacturing capability within the country has been a major objective of India's import substitution industrialization strategy initiated in the mid-1950s. Since the second five-year plan (1956-61), Government of India (GoI) emphasized on building up strong machinery and machine tools manufacturing sector in

the economy. As a result, the Mahalanobis Model of industrial development emphasized on self-reliance growth through building of machinery industries including machine tools, heavy electrical and non-electrical machinery and equipment (Krishna 2001).

The private sector firms were largely unwilling to step into the capital goods sector due to inadequate finance, lack of entrepreneurship, low profitability and long gestation period of investment. Therefore, GoI took upon itself the responsibility to build this sector by undertaking heavy public investments through Public Sector Enterprises (PSEs) for indigenously manufacturing various types of machinery and equipment and machine tools for user industries in construction and mining, manufacturing, infrastructure, agriculture sector, etc.[2]

During the decades of 1950s and 1960s, GoI established many PSEs [e.g. Hindustan Machine Tools (HMT), Heavy Engineering Corporation (HEC), Bharat Earth Movers Ltd. (BEML), Bharat Heavy Electricals Ltd. (BHEL), and Bharat Heavy Plates & Vessels (BHPV)] for manufacturing heavy electrical and non-electrical machinery, mining and earthmoving machinery, machine tools and other specialized equipments. Departmental undertakings of the Government comprising of railways, post and telegraph, defense, irrigation, drainage, power projects and PSEs in steel, cement and fertilizer industry also acted as the major source of demand for machinery and equipment produced by the PSEs. Public investment thus played a dual role. On the one hand, it served as primary source of demand for capital goods; on the other hand it alleviated constraints on the supply side through capacity creation (Jha and Tulsayan 2005). Gradually private capital supplemented the Government's efforts to develop this industry.

Given the negligible technological capability and machinery-manufacturing base, GoI followed import substituting industrialization (ISI) strategy for development of Indian NEMI that depended on protection from imports of capital goods but envisaged liberal import of (disembodied) technology. It was expected that this strategy would lead to building of strong diversified machinery manufacturing capability within the country. Some scholars (e.g. Desai 1984) have opined that the machinery manufacturing capacity in the country was built up almost totally with the deployment of imported technology.

GoI also followed liberal policy towards FDI until the late 1960s, as a result the quantum (and share) of machinery and machinery tools industry in the total stock of FDI in manufacturing sector climbed up from Rs. 1.2 crore (1.7%) at the end of 1948 to Rs. 25 crore (6.4%) at the end of 1969 (Keshari

[2]Industrial Policy Resolution, 1956 granted exclusive right to the State for setting up new units to manufacture 17 groups of products and services (Schedule A), including heavy plant and machinery required by basic industries like metallurgical, mining, machine tools manufacture GoI.

1990). Industrial growth in India since the mid-1950s[3] to the year 1990 is generally divided into three distinct phases, notably, the first phase of rapid growth ending around 1964/65, the second phase of deceleration (1965/66 to 1979/80) and the third phase of revival in growth during the decade of 1980s (Krishna 2001). During the period from 1955-56 to 1964-65, Indian NEMI recorded a phenomenal growth of 22.5 per cent mainly on the strength of public investments, particularly in the non-departmental undertakings[4], while the overall industrial growth has been about 8 per cent during the same period (Ramana 1984 and Suresh 2004).

Since the mid 1960s, partly in response to foreign exchange crisis of late 1960s, oil crises of mid-1970s and also due to ideological influences, GoI sought to secure increasing controls on the domestic economy. This was mainly accomplished with the help of various Industrial Policy Resolutions and Statements, tightening of existing Industries (Development and Regulation) Act, 1951 and promulgations of new Acts [viz. Foreign Exchange and Regulation Act, 1973 (FERA), Monopoly and Restrictive Trade Practices Act, 1969 (MRTPA)], protective foreign trade policy and relatively restrictive FDI regime and even ad hoc discretionary measures (Majumdar 2007).

The controls through industrial licensing system included obtaining license before operations of an enterprise and establishment of a plant, adding a new product line to an existing plant, substantially expanding output, or changing a plant's location. Besides, the right to manufacture various types of industrial goods was also distributed among PSEs, small-scale industrial sector, private sector, mixed sector, etc. MRTPA, along with other provisions, acted as deterrent to enhancement of production capacity and growth of firms (beyond certain threshold limit of assets) either by organic or inorganic (merger, amalgamation and takeover) methods. Import was restricted through the requirement of obtaining license before effecting imports and through the imposition of high levels of customs duty on raw material, intermediates, capital and finished goods. Due to the GoI's focus on achieving self-sufficiency in production and general attitude of export pessimism, improvement in international competitiveness of the industries including NEMI was not given due importance.

Since the mid-sixties the inflow of FDI in the industrial sector was restricted by banning of FDI in certain sectors; following discretionary case-by-case approach of FDI approvals; limiting foreign equity participation normally to 40 per cent from a single entity; not permitting FDI in other than the High

[3]The analysis begins with the year 1955, because it was only with the formulation of second Five Year Plan (1955-59) that a conscious planning and industrial development strategy was outlined.

[4]It is largely this category that accounts in a major way for the role of public sector for building capacities in the machinery and equipment sector. Between 1951/52 to 1965/66, gross capital formation at 1970/71 prices grew at the compound rate of 11.1 per cent in public sector and in non-departmental undertaking at an extremely high rate of 25.7 per cent (Ramana 1984).

Priority Industries (HPI)[5] and without technology content; implementation of FERA and trade related investment measures (TRIMs)[6](Keshari 1990). Imports of (disembodied) technology were restricted by following case-by-case approach, terms and conditions of payment of royalty and technical fee, etc. Besides these restrictions, firms were also not allowed to use foreign brands and trademarks while selling their products in the domestic market.

Despite general tightening of FDI and technology import policy, since the HPI included many important segments of NEMI[7], FDI and import of technology continued to grow in the Indian NEMI. The stock of FDI in machinery and machine tools industry in rose from Rs. 25 crore at the end of 1969 to Rs. 71 crore at the end of 1980. During the same period, the share of machinery and machine tools industry in the total stock of FDI in the manufacturing sector rose from 6.4 per cent to 8.8 per cent. Out of total 1594 numbers of foreign collaboration approved during 1976 to1980, NEMI constituted 35 per cent (Suresh 2004)[8].

The literature on industrial performance has highlighted that the industrial growth in general was hampered since the mid 1960s to late 1970s on account of the import substitution policy, slowdown in public investment, poor growth in the agricultural output and income, inadequate infrastructure, unfavourable domestic term of trade and limited demand, but among all the factors demand side constraints were relatively more important (Krishna 2001).[9] Indian NEMI also suffered a severe setback during 1964-65 to 1975-76, as its growth came down to less than 5 per cent (Suresh 2004).

Indian NEMI experienced limited liberalisation in 1975, when GoI de-licensed a few segments of NEMI, notably industrial machinery and machine tools. During the decade of 1980s, GoI gave further impetus to Indian NEMI by undertaking liberalisations and other measures, the following aspects of which are worth mentioning. First of all, it offered broad-banding facility, which gave an opportunity for firms to change product-mix in various industries, including machine tools, earthmoving machinery, agriculture

[5]The Industrial Policy Statement of 1973, inter alia, identified 'High-priority Industries' (HPI) in which investments from large industrial houses and FERA companies were permitted on case-by-case basis.

[6]Major TRIMs in India included local content and dividend balancing requirements and export obligation on the part of foreign firms.

[7]For instance prime movers, boilers and steam generating plants, industrial machinery and machine tools, agricultural and earthmoving machinery belong to HPI.

[8]Calculated from data given in Table 4.

[9]Identified by Krishna (2001) based on reviews of the literature on the subject and critically examination of the empirical evidence on India's industrial growth and diversification during 1951 to 1990.

machinery, industrial machinery, ball and roller bearings. Secondly, it launched a technology up-gradation fund in August 1987 that was applicable to five groups of capital goods sector including non-electrical machinery industry. Thirdly, GoI significantly raised asset threshold for MRTP companies and permitted them to operate in a number of industries (including industrial machinery and machine tools) by directly seeking a license under the IDR Act without obtaining prior clearance from Department of Company Affairs. Finally, policies for import of capital goods, technology and FDI were liberalized and streamlined, and terms and conditions for imports were made easier. (Ahluwalia 1988).

There has been a turnaround in the growth during the period 1980/81-1990/91 as the average growth rate of GDP and the manufacturing sector improved to 5.6 per cent and 7.7 percent respectively (Nagaraj 2001, p. 687). During the same period, average annual rate of growth of Indian NEMI has been 6.5 per cent (Table-1). The explanations for the resurgence growth in the 1980s were similar and opposite to those factors which were responsible for deceleration in the growth after mid-sixties (Krishna 2001).

By the end of 1990, FDI in Indian NEMI grew further to Rs. 354 crore which accounted for 15.4% of total stock of FDI in manufacturing sector (Kumar 2005). The share of NEMI in the cumulative number of foreign collaborations agreements for the import of disembodied technology entered in the manufacturing sector during 1976 to 1991 stood at 32.7 per cent (Suresh 2004: Table-4).[10]

In view of the growth in Indian NEMI over 40 years' period during 1950/51-1990/91, its share in the value of total output of the registered manufacturing sector increased from 2.1 per cent in 1955/56 (Ramana 1984) to 6 per cent in 1990-91 (Suresh 2004). At the same time, the imports of non-electrical machinery as per cent of total imports, which were 18.1 per cent in 1960-61, reached to its peak of 21.7 per cent in 1986-87. However, it has been exhibiting declining trend thereafter (Suresh 2004). Exports of non-electrical machinery as per cent of total exports increased from 0.47 per cent in 1960-61 to 3.2 percent in 1980-81, which remained almost the same till 1990/91(Suresh 2004). Thus, the Indian NEMI could not increase its share in the exports basket of the country due to its inward orientation.

3.2. *Strengths, Weaknesses and Problems*

As far as the role of policy regime on development of technological capability and diversification in Indian NEMI is concerned, it has attracted both compliments and criticism. India's protectionist trade regime with liberal import of technology and FDI policy have been identified by some scholars as responsible for developing productionising capability in the firms (at least in larger ones), creating large assured market domestically and ultimately achieving high level of diversification in

[10]Calculated from data given in Table 4

NEMI. Lall (1987), for instance, has reported that the Indian machinery-manufacturing firms developed considerable depth and diversity in technological capability for manufacturing numerous products suited for Indian conditions, which were mainly brought about by adaptation and absorption of imported technology. By the end of 1970s, India achieved the capability to produce almost the entire range of non-electrical machinery needed for the domestic industry. The market structure in the industry was dominated by PSUs in machine tools, earth moving machinery, prime movers and boilers and private sector in industries like textile, dairy, cement, chemical machinery, etc. In many constituent segments of Indian NEMI, a few large firms accounted for the bulk of the output in the segment.

A World Bank's (1984) study also noted that the Indian machinery industry was capable of supplying complete, economic size units to the cement, sugar and thermal power industries. It was also able to meet about 80 per cent of the machinery requirements for large sized paper and pulp plants and 50 to 60 per cent of the machinery to the chemical industry. The Indian machinery manufacturing plants were also rated favourably compared to their western counterparts in terms of efficiency in the use of labour and other inputs. Despite higher domestic costs of inputs, the output prices for many items were found to be significantly lower in India than abroad. The study concluded that the situation would have been better, had there not been net disincentives to the sector because of greater protection on inputs than on outputs.

While studying the technological capability of firms/industries in capital goods sector in developing countries, a few studies (Chudnovsky and Jacobsson1983) have pointed out that the ISI strategy did not offer incentive for Indian firms to develop product design and other innovation capability for producing quality products, therefore, Indian capital goods or machinery sector produced low quality and un-sophisticated products suitable for use only in developing countries.

A study by expert group set up by GoI (1987) reported that the performance of Indian machinery industry suffered from various limitations and problems due to interlinked external and internal factors including:

- Industrial licensing restrictions on MRTP companies in various segments of industry,
- Facility to import second hand machinery and import of equipment under "tied aid" programmes,
- Restrictions on terms of import of technology and FDI,
- Use of outmoded technology of production and lack of incentive for modernisation of industry, product design capability,
- Irrational structure of domestic taxes and tariff as well as higher level of excise duty and import tariffs,

- Higher input cost per unit of output due to higher prices of basic inputs like ferrous and non-ferrous metal and steel and infrastructure facilities,
- Gross under-utilisation of capacity as compared to international standards, due to unfavourable demand conditions.

While studying the performance of Indian engineering industry, to which NEMI forms an important part, Jacobsson (1991) found that the engineering firms depended more on imported technology and thereby directed less efforts toward in-house R&D due to the FDI and technology import policies in the 1980s. He concluded that the phase of liberalization in 1980s could not enable engineering firms to be more innovative. This was largely on account of easier access to imported technology and intense competition for capturing fragmented local market that did not justify investment in R&D.

The decade of 1980s could be considered as the beginning of the transition of Indian NEMI from a protected policy environment to an open market economy. Consequent to the economic reforms, which started in July 1991, coupled with India's signing of GATT-94 and fulfilling its commitments towards WTO, the Indian manufacturing sector including the NEMI has been facing a new set of challenges. We therefore discuss in subsequent two sections, nature of economic reforms initiated in July 1991, nature of India's commitments towards WTO and their implications for the Indian manufacturing sector and Indian NEMI.

4. India's Economic Reforms since July 1991

4.1 *Major Reforms in the Economic Policies*

GoI launched a series of intensive economic reforms in July 1991 in the wake of balance of payment crisis. These reform measures are broadly categorized as stabilization and structural reform measures. The broad aim of these reform, particularly the structural reforms, has been to meaningfully address the inefficiencies in India's policy frameworks inhibiting its macro economic performance (e.g. sustainable balance of payment and budget deficits or GDP growth) and micro economic performance (e.g. enhancement in productivity and exports at firm or industry level). The reform measures implemented since July 1991 applicable to the manufacturing sector included following set of major policy changes (Kumar 2000, GoI 2008ab).

Industrial policy reforms: This set of reforms focused on the abolition of licensing requirement for all industries, except a few *specified ones*, irrespective of investment levels; removal of the minimum economic scale of output in almost entire industrial sector for creation and expansion of production capacities;

repeal of the provisions of MRTP Act restricting growth and diversification in companies[11]; opening up of the various sectors (power, telecommunications, roads, ports, airports, etc.), reserved for production by PSEs, to private sector including foreign enterprises.

Trade and exchange rate policy reforms: This set of reforms focused on liberalization of imports through substantial reduction in tariff and non-tariff barriers[12]; initial devaluation of rupee and subsequent substantial convertibility of rupee on current account and partial convertibility on capital account respectively and implementation of export promotion measures.[13] Besides, as a major commitment made to liberalise its trade regime under WTO, India agreed to bind tariff rates to lower levels than those prevailing at the time of signing of the Agreement (viz. GATT-1994) for a large number of commodities. As a result of trade reform measures, India has dismantled import licensing system, removed almost all quantitative restrictions on import of most of the commodities and reduced the import tariff in the neighborhoods of the WTO bound rates.

Substantial liberalisation of policies relating to FDI and import of technology: This set of reforms granted automatic approval to the proposals of FDI and import of disembodied technology under foreign technological collaboration agreements and allowed majority equity participation by a foreign entity;[14] removal of trade related investment measures (TRIMs) that favoured domestic firms over foreign firms); removal of restrictions on the use of foreign brand name or trademarks for goods sold in the domestic market; replacement of FERA by Foreign Exchange Management Act, 2002 (FEMA) that among other things removed discrimination against operations of foreign companies in India. GoI now allows FDI with up to 100 per cent foreign equity participation in a manufacturing company under automatic route in all activities except in a few like cigars and cigarettes manufacture and defense equipments considered by foreign investment promotion board for prior approval of the government (GoI 2008a,b).

[11]MRTP companies were required to obtain prior permission from the government before they could expand their existing capacities; establish a new undertaking; merge, amalgamate or take over another undertaking.

[12]The GoI made exchange rate nearly market oriented, freed substantial portion of tariff lines for import, sharply reduced peak and average nominal import tariffs and effective rate of protection (Pant and Pattanayak 2005). For example, the weighted average of basic customs duty declined from128% in 1991/92 to less than 16% in 2007/08.

[13]To encourage exports, a large part of administered licensing of imports was replaced by import entitlements schemes (such EXIM scrips, Special Import License, EPCG schemes for imports of capital goods at nominal or zero rate of customs duty against export obligation, interest subvention schemes, etc.

[14]The principal changes in the FDI and technology import policies initially included automatic approval of FDI up to 51% of equity participation by a foreign entity in a group of 34 high priority (or technology intensive) industries, automatic approval of technological collaboration meant for import of disembodied technology, a case by case consideration of applications for foreign equity ownership upto 75% and even 100% in most of the infrastructure sector, streamlining of procedures for FDI and technological collaboration (Kumar 2000).

Strengthening of intellectual property regime (IPR): To fulfill its commitments towards WTO under trade related intellectual properties (TRIPs) agreement of GATT-94, GoI implemented a much stronger intellectual property regime, which *inter alia* provides patent protection to innovative products as well as to its processes and increased the duration of protection.[15]

4.2 *Implications of Reforms for the Indian Economy*

These policy reforms have substantially increased competition in the manufacturing sector including non-electrical machinery industry. A study by Pant and Pattanayak (2005) indicates that the economic reforms implemented since 1991 has the following implications for the Indian manufacturing sectors. First, it has made exchange rate nearly market oriented, freed substantial portion of tariff lines for import, reduced peak and average nominal import tariffs and effective rate of protection sharply. Secondly, it has eased the barriers to entry for new firms (both domestic as well as foreign), leading to the entry of a comparatively larger number of new firms during 1989-1995 but the smaller number of the new firms during 1996-2003. Third, it has reduced the share of PSEs and increased the share of FDI companies (defined as those with more than 10 per cent foreign equity) in aggregate sales of companies.

The reform measures also resulted in the considerable amount of corporate freedom and the national treatment to FCFs in the Indian manufacturing sector. For examples, the firms can take independent decisions on: undertaking industrial activity of their choice; fixing up of prices of their products and services; enlarging the size of their operation and widening the product base with a view to achieve economies of scale or scope; maintaining specific level of foreign equity holding; sourcing of inputs, technology and finance from India or abroad; repatriation of dividends and profits abroad or reinvestment of earnings within the firm; overall restructuring of their operation in profitable lines of business, etc. Along with economic freedom, there has been substantial growth in industrial output, FDI and exports across various industry groups in the aftermath of reforms.

The comprehensive economic reforms involving various sectors of economy led to improvement in the growth rate of real GDP and manufacturing sector since the FY 1992/93, but theses growth rates fluctuated during the different sub-periods between 1992/93 to 2006/07 (Table-8). During 1992/93 to 1996/97, the average annual growth rate in GDP worked out to 6.9 per cent. Although there has been some loss of growth momentum during 1996/97 to 2002/03, the annual growth rate in GDP averaged at 5.2 per cent during this period. The annual growth rate in GDP picked up considerably afterward,

[15]Some provisions of earlier Indian Patent Act of 1970 (IPA) protected processes of production invented by a firm but not to the products generated thereby for 7 years in food, pharmaceutical and agro-chemicals industries as against product patent for much longer periods prevalent in industrialized countries.

averaging at 8.8 percent during 2003/04 to 2007/08. As far as the growth in manufacturing sector is concerned, it has exhibited the similar pattern as that of GDP. During the period 1992/93 to 1996/97, the average annual growth rate for the manufacturing sector worked out to around 8.0 per, but the same declined to 5.7 per cent during 1996/97 to 2002/03, the annual growth rate picked up considerably afterward, averaging at 8.4 percent during 2003/04 to 2007/08 (Table-8).

The turnaround in growth during 2003/04 to 2007/08 is attributed on the demand side to the boom in the construction and real estate sector, a high growth in merchandise exports due to the buoyancy in the world economy, growth in domestic demand for consumer durables and housing, telecommunications and cellular phone services, information technology (IT) and IT enabled services; and on the supply side to the growth of credit and low rate of interest, unprecedented rise in mean gross domestic savings including corporate savings[16] from 24 per cent of GDP during 1997/98 to 2002/03 to 33 per cent during 2003/04 to 2006/07 and gross domestic capital formation including investment by private corporate sector[17] (Kumar 2008, Nagaraj 2008 and Mohan 2008).

5. Developments in Indian NEMI after 1991

As far as Indian NEMI is concerned, the most important aspects of economic reforms affecting this industry includes the liberal imports of capital goods and second-hand machineries, open door policy towards FDI and import of disembodied technology and promotion of exports. In the following sub-sections, we examine each of these aspects and their implications for Indian NEMI in terms of its import and export performance, inflow of FDI and import of disembodied technology and overall growth performance of Indian NEMI for the period 1991/92 to 2007/08.

5.1 *Import Liberalization and Import*

Measures of import liberalization impacting imports in the various segments of Indian NEMI has been as follows: First of all, the entire industry has been freed gradually from import licensing requirement and almost all the items have been included in the list of capital goods allowed for imports under open general license mainly to meet the requirements of modernization of the industry and export promotion. Secondly, the capital goods sector including non-electrical machinery was subjected to the drastic tariff reductions in the initial period of reforms. As a result, customs duty on capital goods was lowered from a peak of 90 per cent in 1991-92 to a peak of 35 per cent in 1993-94 and further to 25 per cent in 1994-95.

[16]In the last six year, corporate savings also rose sharply due to dramatic rise in corporate profit.

[17]Growth in investment by private corporate sector rose sharply from 5.5 percent of GDP in 2001/02 to 12.4 per cent in the year 2006/07 (Kumar 2008).

The rate of custom duty remained at 25% during 1994-95 to 1996-97 but fluctuated thereafter in the range of 10% - 25% during 1997-98 to 2006-07. Thirdly, with a view to encouraging exports, a large part of administered licensing of imports has been replaced by import entitlements schemes (e.g. Special Import License scheme and Export Promotion Capital Goods (EPCG) scheme for duty-free imports of capital goods) linked to export earnings. Fourthly, a scheme for imports of second hand machinery was introduced. Further the initial age limit requirement for import of capital goods not being more than seven years old was also relaxed. (CII 2007; Mathur and Sachdeva 2005).

Table-2 gives the trend growth rates in USD value of imports and share of imports of NEMI in total imports for different sub-periods during 1990/91 to 2006/07. It is clear from the table that the imports of non-electrical machinery grew rapidly (18.5 per cent) during the sub-period 1990/91-96. However, the growth rate for imports of NEMI turned negative during 1996/97-2002/03 on account of slowdown in economy and built-up of substantial capacity in the initial phase of reforms. The growth rate of imports improved substantially to nearly 40 per cent during 2003/04-2006/07- the period in which Indian economy experienced turnaround in its GDP growth. Due to the substantial growth in imports of NEMI during initial phase of reforms (1990/91-1995/96), share of import of NEMI in total import stood at 11.7 per cent in 1995/96. Share of NEMI as percentage of total import declined sharply to 6.2 per cent in 2002/03 but the same again picked up to 8 per cent in 2006/07 probably on account of improved performance of the industry during 2003/4-2006/7.

Some scholars (e.g. Desai 2001 and Nagaraj 2003a) have pointed out that the import liberalization effected through the sharp reductions in import duty and liberal import of second hand machinery led to the substantial increase in imports of machinery after 1991 and thereby adversely affected the domestic machinery manufacturing capacity. Notably, the domestic manufacturing capacities in textile machinery and machine tools were severely affected on account of imports far exceeding the domestic production in a number of segments like weaving, processing, knitting, etc. This has probably happened as the industry could not develop in the earlier periods adequate technological capability required to face competition from imports and lack of fresh investment due to reduced role of public sector in the industry (Suresh 2004).

The analysis of recent data presented in Table-3 shows that: i) growth in imports has been much higher than the growth in domestic production between FY 2000/01 to 2006/07, and ii) share of imports of NEMI in its market size has risen consistently and sharply from about 18 per cent in 2000/01 to 40 per cent in 2006/07. Thus the analysis of data also supports the view that imports are substituting the domestic production.

5.2 *Exports*

As NEMI is highly intensive in terms of capital, skill and technology, industrialized countries with higher endowments of these assets have a comparative advantage in respect of production and exports of NEMI. Five highly developed countries, namely the United States, Germany, Japan, Italy and United Kingdom, account for more than 58 per cent of exports in non-electrical machinery industry. The ability of a country to export capital goods including machinery would indicate a high level of technological sophistication in the economy. An important feature of the growth of the non-electrical machinery industry in the import-substituting strategy of industrialization is that the industry had domestic orientation sustained by a large domestic demand fueled by the investment expansion of the government.

To compete in international markets, machinery manufacturers need to emphasize on product design and development. Hence, technology development has an important role to play in establishing export competitiveness. Besides, the export market requires capabilities to meet stringent international norms in adhering to the quality standards, delivery schedule and after-sales services; therefore, the production for exports is much more difficult than selling in the domestic market. With greater competitive pressures since liberalization, it is expected that firms in the industry would increasingly try to access and adopt new technologies and quality standards even in the domestic market.

Table-4 shows the following: i) Exports from Indian NEMI grew 12.8 per cent during 1990/91-1995/96 but slowed down to 10.7 per cent during 1996/97-2002/03; ii) During 2003/04-2006/07, however, exports from NEMI achieved very high growth rate of about 38 per cent; iii) during the reform period exports from NEMI as a percentage of total exports improved consistently from 3.2 percent in 1995/96 to 4.0 percent in 2002/03 and further to 5.3 per cent in 2006/07.

5.3. *FDI and Import of Technology*

Given the absence of indigenous technological capability in this sector, foreign technological collaborations (FTCs) and FDI have been the most important source of access to foreign technology in the Indian manufacturing sector. With an almost open door policy on import of disembodied technology and FDI in the post 1991 period, Indian manufacturing sector witnessed increased recourse to foreign technological collaborations as well as FDI. Data presented on cumulative inflow of FDI during August 1991 to July 2007 in Table-5 show that: i) the share of manufacturing sector constituted about 56 per cent of cumulative inflow of FDI of about Rs. 2150 million (or USD 50.4 billion) in the country; ii) within the manufacturing sector electrical and electronic equipments (including computer software) received the highest amount with the share of 32.5 per cent, followed by transport equipment industry with the share

of 13.6 per cent, chemicals and fertilizers industry with the share of 8.6 per cent and NEMI with the share of only 5.1 per cent. Thus the NEMI attracted much less FDI than the other competing medium/high technology industries of the Indian manufacturing sector.

In respect of cumulative number of FTCs approved during August 1991 to July 2007, NEMI constituted the highest proportion. Table-6 reveals that the Indian NEMI occupied 16.6 per cent of cumulative number of FTCs, followed by electrical equipment (15.9%) and chemicals (11.2 %). As far as the cumulative inflow of FDI during August 1991-July 2007 among the different product groups of Indian NEMI is concerned, Table-7 shows that the miscellaneous mechanical engineering group commands the largest share (39 per cent), followed by the industrial machinery (16.5%), machine tools (13.8%) and agriculture machinery (13%). Hence, FTC has been more important source than FDI for obtaining foreign technology into the Indian NEMI.

5. 4. *Growth Performance*

Table-8 presents the annual average growth rates based on data on Index of Industrial Production (IIP) for different sub-periods between 1980/81 to 2007/08 for the Indian NEMI, electrical machinery and equipment industry, the entire industrial sector and GDP.[18] Growth performance of Indian NEMI during the entire period of economic reforms (i.e. 1991/92 to 2007/08) can be divided into four distinct phases. It is evident from the data that the Indian NEMI realized negative growth during first two years of first phase (1991/92 to 1993/94) but the growth rate began to pick up from the year 1993/94. The rate of growth in IIP for electrical machinery industry remained negative in every year of the first phase.[19] Similarly, average growth of the entire industrial sector and GDP slowed down considerably as compared to the year 1990/91. Drastic reduction in growth rate of GDP and industrial sector including Indian NEMI in the first phase was evidently the outcome of the balance of payment crisis of 1990/01 and demand contraction measures undertaken by the GoI immediately after the crisis.

Average annual growth rate in IIP for machinery industry has been quite high (17.25%) in the second phase (1994/95 and 1995/96). This sharp upturn in production in two years (1994/95 and 1995/96) is widely credited to huge capacity building exercise taken in the machinery sector in response to economic reform measures initiated by the GoI. The growth performance in the second phase was short-

[18]With the revision in IIP series with base 1993/94 data on IIP for non-electrical machinery industry (35) is not separately available. Therefore, we use data on IIP growth of the combined group of non-electrical machinery, machine tools and parts (35) and electrical machinery industry (36) as per NIC 1987 as proxy for the growth rate of NEMI since 1994/95.

[19]Rates of growth in index of IIP (base 1980/81) for EMI during 1991/92, 1992/3 and 1993/94 were –12.5%, -2.0% and -4.9% respectively (Economic Survey, 1992/93 and 1994/95).

lived and the same decelerated sharply on an average to 5.7 per cent during the seven years period of third phase (1996/97 to 2002/03).

The deceleration in growth of production in machinery industry as well as in the entire industrial sector during 1996/97-2002/03 is attributed to: i) declines in import tariff, particularly the duty free import under EPCG scheme and allowing the import of second hand machinery coupled with credit squeeze in 1996 causing bank lending (interest) rate to rise at an unprecedented level (above 20%); ii) slowing down in the process of reforms and emergence of infrastructure bottlenecks; iii) saturation reached in the pent up domestic demand of one time nature for a host of import-intensive goods, which could be domestically produced or assembled following trade liberalization (Desai 2001; Nagaraj 2003). Indeed, there has been turnaround in the economy since 2003/04 due to the improvement in overall growth of the economy, notably in IT and IT enabled services, private housing, road construction, communications and cellular phone services and consumer durables. As a result Indian machinery and equipment industry including NEMI again achieved a quite high rate of growth, averaging over to 14 per cent during 2003/04-2007/08 (Table-8).

6. Structure of Indian NEMI and its Status in the World

6.1. *Present Structure of Indian NEMI*

Appendix presents the segment-wise and major product-wise status of the industry in terms of various parameters for the FY 2006/07. In terms of market leaders, it shows that the large PSEs have strong presence in some product groups of Indian NEMI (viz. BHEL over 60 per cent shares in boilers as well as turbines and BEML with over 50 per cent share in earthmoving equipments) followed by large private companies and FCFs. In the majority of product groups the subsidiaries of well-known MNEs are present as market leaders. They include Bellies India, Cummins India, Greaves Cotton, KSB Pumps, Sulzer Pumps India, Atlas Copco, Ingersoll-Rand, Fag Precision Bearings, JCB India, L&T Komatsu, Caterpillar India, Otis elevator, Stovec Industries, Kennametal India, etc.

As per Appendix, Indian NEMI includes 24 major product groups out of which 16 products belong to special purpose machinery segment and 8 products are included in the general purpose machinery. Table-9, derived from the Appendix, presents the information on the product groups belonging to different ranges of market size and their share in the aggregate market size of Indian NEMI. As evident from this table, seven largest product groups occupy 65 per cent of aggregate market size (Rs. 89,837 crore). Table-10, derived from the Appendix, exhibits important differences in terms of market size,

dependence on imports and export earnings capability between two major segments of Indian NEMI, general purpose and special purpose machinery considered in this study.

Product groups belonging to different ranges of market concentrations presented in Table-11, derived from the Appendix, shows that the market structure of nine product groups are highly concentrated (i.e. 95% <CR4>70%), of seven product groups are medium concentrated (i.e. 65%>CR4>40%) and of the remaining the product groups are less concentrated (CR4<40%). In respect of import dependence, measured as share of imports in market size of each product, Table-12 shows that import dependence of 7 product groups was quite high. Eight product groups have import dependence in the range of 20-40% and the rest of the products had less than 20 per cent of import dependence.

As far as the share of export earnings in the market size of each product group is concerned, four product groups belong to the range of 25-55 per cent, 6 product groups belong to the range of 10 to 20 per cent of their respective market size and remaining 14 product groups achieved export earnings of less than 10 per cent of their individual market size (Table-13). With impending privatization of large PSEs, entrance of large MNEs in every segment would significantly affect the development of Indian NEMI in terms of industry structure and ownership pattern.

6.2. *Technological Capabilities*

Broadly, machinery-manufacturing industry requires two types of *technological capabilities*. The first is referred as production engineering or productionising capability while the second is designated as design capability. The production engineering refers to the gradual mastery of an increasing range of manufacturing processes such as machining, welding, assembly, etc. Indian machinery manufacturing firms have adequate ability to productionise given drawings for the product but do not have sufficient expertise in preparing designs and drawings. Productionising capability may develop in a firm through 'learning-by-doing' or informal efforts to assimilate and adapt technology during the process of production and interaction with customers. It may also come through minor R&D efforts. Indian engineering firms undertake a low level of R&D and devote a major portion of their R&D for adapting imported technology to local needs and shop-floor based problem-solving related to the running, maintaining and repairing of plants (Basant 1997). It is pointed out that the average R&D intensity of Indian capital goods manufacturing firms is less than one per cent, far below the world standard as well as the R&D intensity of firms in Indian pharmaceuticals and automobile industry (CII 2007).

However, the acquisition of design capability is crucial for innovation and developing durable competitive advantage. This requires a deep knowledge of materials and an understanding of the specificity of user industry's requirements. The designing capabilities are divided between basic design and

detail design capability. While basic design capability enables a firm to launch completely new products (innovation), the detail design capability equips a firm to adapt a particular application, raw materials, components, etc. without modifying the general feature of the product. In-house R &D activities of a firm leading to basic design capability for development of a new product is crucial for acquiring international competitiveness. Although GoI provides fiscal incentive in the form of depreciation benefits leading to tax benefits to enterprises undertaking R&D, it has not been effective in inducing firms to undertake significant amount of innovative activities (Suresh 2004).

Among the countries of the world, India scores very high in terms of availability and quality of scientists and engineers, yet the share of human resources devoted to design and engineering activities in Indian capital goods enterprises is 20 to 50 per cent lower as compared to the enterprises in the industrialized countries (UNIDO 2005). Indian firms have the ability to achieve a high level of precision in process technology, yet they are not able to produce quality products due to lack of supporting technologies (e.g. precision measuring, material engineering and process control). The defect rates of final products are quite high as compared to Japan and the USA, and about 20 per cent of firms use obsolete machinery and equipment. (EXIM Bank 2008; CII 2007).

6.3. *Status of NEMI in the World*

Traditionally, USA, Japan and Germany have been the largest suppliers of non-electrical machinery and equipment to the world. Of late, Asian countries such as China, Taiwan and South Korea have also become important players in production and export of various types of non-electrical machinery. Consumption of non-electrical machinery and equipment has also increased substantially in developing Asian countries due to the thrust given to the value added manufacturing. The shifting of the manufacturing base of machinery and equipment from developed to developing countries has provided major opportunities of exports from technologically advanced countries of the developing economies.

The USA is the largest manufacturer of NEMI consisting of general purpose and special purpose machinery. In the world's total production of NEMI in 2005, the USA enjoyed a share of 19.4 per cent, followed by Japan (15.6 per cent), Germany (14.9 per cent), and China (7.3 per cent). India occupies eleventh position with 1.4 per cent of world production in NEMI. Amongst the developing countries, China with 33.8 per cent of total production of NEMI is the largest manufacturer, while India with its share of 6.7 per cent is placed at the fourth position. (EXIM Bank 2008, p. 31).

In sum, India's share in the world market is insignificant indicating ample scope for expansion of market share. To capture a decent share in global market of NEMI, Indian firms need to leverage on their

strengths and hard work on the opportunities available. Besides, the Government of India and the Indian firms based in NEMI have to jointly make efforts to solve the problems and challenges facing Indian NEMI in the post-WTO era. We therefore discuss the issues, challenges and concerns of the Indian NEMI in the next section.

7. Issues, Challenges and Concerns

Competitiveness of Indian NEMI is determined by a combination of policy, industry and firm-specific factors. Increasing opportunities and competition associated with economic reforms and globalization have brought to the fore shortcomings of the Indian policies, infrastructure and weaknesses of the Indian firms against the international benchmarks/standards applicable to NEMI and the firms operating therein. We therefore turn towards the discussions on the major issues and challenges facing the Indian NEMI in the following sub-sections. This discussion is mainly based on the finding of the Final Report on the Indian Capital Goods Industry prepared by Confederation of Indian Industry in 2007.

7.1 Liberal Imports

Finished goods

Due to sharp reductions in import tariffs on capital goods, notably with the launch of various schemes for import of capital goods at nil duty, and liberal policy for import of second hand machinery, the domestic manufacturers have been put to disadvantage vis á vis foreign suppliers. The low customs duty of around 5 per cent on import of second hand machinery, which is at par with import of new equipment, has led to unhealthy price competition, import of junk machinery and machinery creating environmental hazards. Import of finished products has gained at the expense of domestic production, leading to a rising share of imports in the aggregate market size of Indian NEMI. Many product segments of Indian NEMI such as machine tools, textiles, printings and metallurgical machinery and pumps of all types have been severely affected by huge imports from China and other countries.

Raw material and components

Compared to international standards, the quality of raw materials components produced in India is not up to the mark mainly in terms of the dimensional tolerances and metallurgical properties. Therefore, large and reputed machinery-manufacturing firms prefer to import raw material from international market for maintaining the quality of the final products to the international standards. Moreover as certain types of raw material used in the industry are not produced domestically, they have to be necessarily imported. Due to dismantling of price controls and sharp reduction in import duties, the prices of raw material, except for a few types, have been more or less in line with international prices. In recent years, international prices of raw material have risen faster than the price of final products but rise in prices could not be

passed on to customers. At the same time, the rising price of raw material has induced only a few larger domestic producers to resort to value engineering techniques for efficient usage of raw material and cost reduction. Hence, the profit margins of most of the Indian machinery producers have been thinning despite good demand for their products.

7.2 *Lack of Level Playing Field*

Indian manufacturers of machinery and equipment lack level playing field vis á vis their foreign counterparts due to poor quality of infrastructure (e.g. poor road conditions and connectivity with sea-ports and airports, inefficient distribution channels, poor logistics, etc.), unreliable power supply and higher cost per unit of power and fuel, higher working capital requirements, higher rate of interest and incidence of indirect taxation (excise duty, octroi duty/entry tax, central/state sales tax, VAT, service tax, etc.). Poor infrastructure affects competitive delivery schedules and increases operating costs. The delivery time of locally made machinery in many cases is 1.5 to 2 times longer than that in industrialized nations. Companies tend to lose orders due to longer delivery schedules. To obviate the problem of unreliable power supply many machinery-manufacturing firms have set up their own captive power plants but that has added to the costs. Overall the infrastructure inadequacies are estimated to translate into 5 per cent cost disadvantage for the Indian machinery manufacturers against the overseas manufacturers.

Domestic producers of machinery are also required to maintain high level of inventory due to transport bottlenecks, delays in custom clearance and supply commitments. As a result, working capital requirement of Indian manufacturers of NEMI is as high as 40-45 per cent against global benchmark of 15 per cent of net sales. Besides, high interest rate regime in India results in a substantial 7 to 8 per cent interest rate differential relative to the reference foreign countries. Interest rate differential together with higher capital requirement causes about 4 per cent capital cost disadvantage. The overall cost disadvantage to domestic machinery producing firms vis-à-vis foreign manufacturers/contractors roughly works out to 15 to 24 per cent on account of higher incidence of indirect taxes, custom duty, financing costs and inadequate infrastructure. (CII 2007).

7.3 *Lack of Global Marketing and Customer Orientation*

The emergence of the global market, through lowering of tariff barriers, has led to a blurring of margins between domestic and export markets. As a result machinery firms worldwide are increasingly becoming global in their mindset and operations. Yet, Indian firms, in general, lack export thrust in their marketing strategies and focus largely on the domestic market; exports gain importance only in case of fall in domestic demand. The reasons for inward orientation of Indian machinery manufacturing firms are the

following: First, domestic market has low degree of buyer sophistication, which allows the firms to get away with less than desirable quality and necessity for innovation. Secondly, the export transaction costs in India are among the highest in the world. High transaction costs not only increase the price of the final export product, but also result in inordinate delays in export fulfillment.[20] Thirdly, India does not have strong institutional mechanisms for providing short-term and long-term credit for exports of machinery and equipment. Credit period in international markets ranges from 90 to 360 days at interest terms varying from 0.25 to 4 per cent with 1 to 3 years moratorium. Export–Import Bank of India is unable to offer such competitive rates to its clients.

Fourthly, Indian firms invest less in marketing activities and have low customer orientation. Very little effort is made on branding. Investments in marketing, increased customer orientation and branding could act as entry barriers for foreign firms into the Indian market. Finally, the sale of machinery, particularly heavy machinery and equipment, is not a one-time transaction and is generally followed by technical support in transportation, erection, training, continuous service maintenance and periodical upgrade of technology. Trends in international market suggest that foreign firms are increasingly adopting solution-based approach to selling while Indian domestic firms continue to adopt a product-oriented approach towards their customers.

7.4 *Inadequate Technological Capability*

Firm level innovation is very low in Indian NEMI. Most of the Indian machinery firms import technology, but very few of them improve upon it. R&D expenditure as a percentage of sales amongst Indian Non-electrical machinery are much lower as compared to global benchmarking based on the R&D intensity of international companies. Moreover, technological competitiveness of the Indian firms in NEMI is highly skewed. While a few firms are close to the international frontiers in terms of product design, engineering capability and process technology, technological capabilities of most players are extremely limited. Many firms are capable of achieving high levels of precision, yet they are unable to produce high quality products due to lack of supporting process technologies such as precision measuring, material engineering and process control. Most Indian manufacturers define quality of machinery largely by performance parameters and dimensional accuracy. They lack in terms of aesthetics or finish of the goods, which adversely impacts the competitiveness of the Indian machinery in a discriminating and sophisticated international market.

[20]According to available studies: i) total cost of transaction of engineering goods in India works to around 10 per cent of the total export earnings and ii) if procedural complexities were eliminated, the export sales of Indian machinery is likely to go up significantly by 28 per cent [Exim Bank's (2008) estimates].

7.5 *Management and Operational Inefficiencies*

Operational efficiencies of Indian firms in NEMI are comparatively low. Very few Indian domestic firms use techno-managerial processes like just-in-time (JIT), total quality management (TQM), total production management (TPM), etc. for making their business processes like procurement, distribution, marketing and servicing more efficient. Except in a few product groups (e.g. earthmoving) quality consciousness is low in most of the product groups of Indian NEMI. There most of the domestic companies spend inadequate resources on training their employees for achieving world-class bench marking in productivity and quality. As a result, labour productivity measured by sales per employee is much lower in comparison to international benchmark. The limited presence of Indian machinery firms in the value chain leads to diminished cost and differentiation advantage.

8. Conclusions

Indian NEMI is a major part of machinery producing industry. It is defined for the purpose of this study as mainly consisting of the products of *general purpose machinery* and *special purpose machinery*. Despite being heterogeneous in terms of product profile and sources of demand, Indian NEMI is treated in terms of its technological and other characteristics one among the medium technology industries. In particular, Pavitt (1984) places it in the category of *production intensive specialized-supplier* industries. The Indian NEMI can be considered as the mother of the economy since it provides machinery and equipments to and has strong linkages with almost all the sectors of the economy including agriculture, infrastructure, construction, mining, oil and gas, manufacturing and services. Thus, the presence of efficient and competitive machinery sector in an economy helps to improve the competitiveness and growth of its user sectors. It is also a strategically important industry from the point of national security and economic independence. The imported plants and machineries may initially come at the lower costs but the importers normally pay higher price for maintenance contracts, spare parts and technical supports. Therefore, it is in the interest of the user sectors and the government to develop Indian NEMI as a vibrant and internationally competitive industry.

Recognising the benefits of this industry, Indian government promoted it under the import-substitution regime with the help of heavy public sector investment and liberal import of technology from the developed countries. As a result, Indian NEMI recorded phenomenal growth during mid 1950s to mid 1960s and developed capacity to supply a large number of machineries and equipment. However, as in the case of other industries, this industry too developed technological backwardness and inefficiency over a period of time. Besides, the Indian government in the aftermath of economic reforms has been gradually

withdrawing from and even disinvesting in the existing PSEs operating in the manufacturing sector including Indian NEMI. The expectation has been that the space created by the withdrawal of PSEs shall be taken over by the private sector enterprises including FDI enterprises.

The economic reform measures being implemented since 1991 have impacted this industry in many important ways. For instances, it has reduced the share of PSEs, increased import of finished goods greatly, improved accessed to foreign technology and FDI and improved its export performance to some extent. In the initial years of reforms, the industry experienced negative growth but the growth rate picked up sharply during 1994/95 to 1995/96. This growth could be not sustained mainly due to the slowdown in the overall growth of the economy during the subsequent phase of 1996/97 to 2002/03. However, the Indian NEMI has experienced consistently high double-digit growth during 2003/04-2007/08. It has been witnessing downturn since 2008-09 mainly due to the contagion effect of global recession. The industry in all likelihood is expected to perform better since 2010/11 on account of huge investments expected in the infrastructure sector.

Despite the implementation of economic reform measures, availability of cheap skilled and unskilled labour, good domestic demand and higher growth trend witnessed since 2003/04, India remains a marginal global player in this industry. The present status of the Indian NEMI is unsatisfactory. It faces serious disadvantage while competing with the countries like China, which has developed strong presence in this industry. The industry is beset with many external and internal problems. The external problems include huge imports, including that of the second-hand machinery and equipments, displacing and posing threats to the existing Indian manufacturers; unavailability of quality raw material and components domestically; lack of level playing field due to the inverted duty structure, infrastructure bottlenecks and high cost of finance, all impairing international competitiveness of Indian producers. The internal firm or industry specific problem involves inadequate technological capabilities, notably in the areas of design and drawings and process technology; management and operational inefficiencies, lack of global marketing and customer orientation, etc.

Against the above background, GoI may also take important steps in creating level-playing field for the Indian manufacturers of machineries and equipments. As restricting import and developing additional capacity and competitiveness in such a medium/high technology industry independently is not a feasible option in the present post-WTO context. FDI through MNEs, with their potential to offer critical FSAs resources and assets, may play an important role in developing additional capacities as well as the global firm-level competitiveness in this industry.

Table-1: Average Percentage Growth Rate of Indian NEMI, 1981 to 1991

Industry/Year	1975/76-1984/85	1980/81-1984/85	1985/86-1990/91	1980/81-1990/91
Non-electrical machinery industry	5.8	06.4	06.7	6.5
Electrical machinery industry	-	10.7	25.7	18.0
Manufacturing sector	-	-	-	7.4
GDP	-	-	-	5.6

Sources: Compiled from the data given in Suresh (2004) and in various issues of Economic Survey, Ministry of Finance, Government of India.

Table-2: Growth Rates of Imports and Share of Imports in Total Imports

Period	1990/91-1995/96	1996/97-2002/03	2003/4-2006/07
Imports (%)	18.5	-2.8	39.6
Percentage share of imports in total imports	11.7 (1995/96)	6.2 (2002/03)	8.0 (2006/07)

Sources: Compiled from data given in Suresh (2004)-Table 6 and in "Commodity Composition of India's Imports and Exports", Foreign Trade and Balance of Payments, August 2007, Centre for Monitoring Indian Economy Ltd., Mumbai

Table-3: Domestic Production, Imports and Market Size, 2000/01 to 2006/07

(Rs. Crore)

Year	FY01	FY02	FY03	FY04	FY05	FY06	FY07	Avg.
Market Size	38415	38717	40550	46113	56064	77419	95419	56100
Import	6791	7360	8962	12055	17127	28400	37914	16944
Domestic production	31624	31357	31588	34058	38937	49019	57505	39155
Growth in imports (%)	-	8	22	35	42	66	34	34
Growth in domestic Production (%)	-	-1	1	8	14	26	17	11
Share of import as % of market size	18	19	22	26	31	37	40	30

Source: Compiled and computed from the data given in Industry, Market Size and Shares, April, 2008, Centre for Monitoring Indian Economy Ltd., Mumbai

Table-4: Export Growth and Export Share of Indian NEMI

Period	1990/91-995/96	1996/97-002/03	2003/4-006/07
Average Growth in Exports of NEMI (%)	12.8	10.7	37.7
Percentage share of exports of NEMI in total exports	3.2 (1995/96)	4.0 (2002/03)	5.3 (2006/07)

Sources: Compiled from data given in Suresh (2004)-Table 6 and CMIE (2007), Commodity Composition of India's Imports and Exports, Foreign Trade and Balance of Payments, August 2007

Table-5: Distribution of cumulative inflow of FDI in India, (Aug. 1991 to Jul. 2007)

Industry	FDI (Rs. million)	FDI (USD million)	Cumulative FDI as % Manufacturing
Electrical Equipments (Including Computer Software & Electronics)	391038.2	8963.7	32.5
Transport equipment Industry	163057	3856.2	13.6
Chemicals and Fertilizers	103382.9	2548.6	8.6
Non-Electrical Machinery Industry	61798.6	1497.0	5.1
Cement, Gypsum, Glass and Ceramics	60061.1	1402.0	5.0
Drugs and Pharmaceuticals	54152.1	1255.1	4.5
Food Processing	51689.3	1283.2	4.3
Metallurgical	39429.2	909.2	3.3
Others	276771.3	6649.0	23.0
Total (Manufacturing)	**1201380**	**28364**	**100.0**
Other than manufacturing sector	**948806.1**	**22043.65**	**44% of grand total**
Grand total	**2,150,185.8**	**50,408.1**	

Source: GoI (2008), FDI in India Statistics, Department of Industrial Policy and Promotion, New Delhi

Table-6: Cumulative Approvals of FTC in India, August 1991 to July 2007

Sector	Number of approvals	Percentage of total approval
Nom-electrical machinery industry	1310	16.6
Electrical Equipments and electronics (including computer software)	1253	15.9
Chemicals (other than fertilizer)	883	11.2
Transport equipment Industry	730	9.3
Other sectors	3710	47.1
Total approvals	7886	100.00

Source: GoI (2008), FDI in India Statistics, Department of Industrial Policy and Promotion, New Delhi

Table-7: Product wise Distribution of Cumulative Inflows of FDI in Indian NEMI, (August 1991 to July 2007)

Product Groups of NEMI	Rs. Crore	Share (%)
Misc. Mechanical Engineering	24273.8	39.3
Industrial Machinery	10194.3	16.5
Machine Tools	8520.0	13.8
Agricultural Machinery	8042.9	13.0
Medical and Surgical Appliances	5085.8	8.2
Earthmoving Machinery	3397.9	5.5
Prime movers	1067.3	1.7
Industrial Instruments	841.7	1.4
Boilers	374.9	0.6
Total	61798.6	100.0

Source: GoI (2008), FDI in India Statistics, Department of Industrial Policy and Promotion, New Delhi

Table-8: Growth Rates for Machinery, Industrial Sector and GDP, 1991/92-2007/08

Industry	1991/92	1992/93	1993/94	1994/95-1995/96 (Annual average)	1996/97-2002/03 (Annual average)	2003/04-2007/08 (Annual average)
Base Year	1980/81			1993/94		
Non-electrical machinery industry (NEMI)	-2.9	-4.0	4.5	15.1*	**	**
Electrical Machinery (EM)	-12.4	-2.1	-4.9	26.0*	**	**
Machinery and equipment industry (NEMI+EM)	***	***	***	17.25	5.7	14.2
Manufacturing sector	0.8	2.2	5.5	10.8	5.3	8.4
GDP Growth	1.3	5.1	5.9	7.3	5.7	8.8

Notes: * Base year 1980/81; ** data are not separately available for NEMI; *** combined data unavailable for these years
Sources: Economic Survey, 2007/08 and various previous issues

Table-9: Ranges of Market Size and Product Groups Therein

Market Size (Rs. Crore)	Product Groups	Share in aggregate MS (%)
6000-11550	Textile machinery, Machine tools, Tractors, Boilers, Engines of all types, Earth moving machinery, Bearings	65
1600-4000	Pumps of all kinds, Turbines, Compressors of all types, Valves, Material handling equipment, Printing machinery, Chemical machinery, Metallurgical machinery, Gears, Cranes, Environment control equipment	30
260-1000	Lifts & Escalators, Drilling equipment, Construction machinery, Sugar machinery, Agricultural machinery Cement machinery	5

Source: Calculated from data given in CMIE (2008), Industry, Market Size, and Shares

Table-10: Export, Import, Sales, Market Size between GPM and SPM

Major Segment	Exports (E)	Imports (M)	Sales	Market Size (MS)	E as % MS	M as % MS
General purpose machinery (GPM)	5,493 (55%)	9,670 (29%)	25,334 (45%)	35,004 (39%)	16	28
Special purpose machinery (SPM)	4,451 (45%)	23,979 (71%)	30,857 (55%)	54,833 (61%)	8	44
Indian NEMI (Total)	9,944 (100%)	33,649 (100%)	56,191 (100%)	89,837 (100%)	11	37

Source: Calculated from data given in CMIE (2008), Industry, Market Size, and Shares

Table-11: Ranges of 4-firm Concentration Ratio and Product Groups

Ranges of Four-firm Concentration Ratio (%)	Product Groups
70-95	Sugar machinery, Boilers, Cement machinery, Drilling equipment, Tractors, Lifts & Escalators, Construction machinery, Steam and hydro turbines, Earth moving machinery
40-65	Chemical machinery, Environment control equipment, Valves, Engines of all types, Material handling equipment, Agricultural machinery, Bearing, Compressors of all types
10-40	Gears, Pumps of all kinds, Cranes, Printing machinery, Textile machinery, Metallurgical machinery, Machine tools

Source: Calculated from data given in CMIE (2008), Industry, Market Size, and Shares

Table-12: Ranges of Import Dependence and Product Groups

Import Dependence (%)	Product Groups
50-90	Metallurgical machinery (87%), textile machinery (80%), printing machinery (69%), machine tools (67%), cranes (62%) and pumps of all kinds (54%)
20-40	Material handling equipment, Gears, Bearing, Engines of all types, Compressors of all types, Lifts & escalators, Steam and hydro turbines, Agricultural machinery
0-20	Environment control equipment, Earth moving machinery, Valves, Drilling equipment, Sugar machinery, Construction machinery, Boilers, Tractors, Cement machinery, Chemical machinery

Source: Calculated from data given in CMIE (2008), Industry, Market Size, and Shares

Table-13: Export Share in Market Size and Product Groups

Share of Exports in Market Size (%)	Product Groups
25-55	Valves (52%), Metallurgical machinery (30%), Pumps of all kinds (28%), Agricultural machinery ((26%)
10-20	Compressors of all types, Printing machinery, Bearings, Tractors, Machine tools, Engines of all types
>10	Steam and hydro turbines, Gears, Boilers, Material handling equipment, Cranes, Textile machinery, Environment control equipment, Drilling equipment, Construction machinery, Sugar machinery, Earth moving machinery, Lifts & Escalators, Cement machinery, Chemical machinery

Source: Calculated from data given in CMIE (2008), Industry, Market Size, and Shares

Appendix

Exports, Imports, Sales, Market Size, 4-Firm Concentration, Market Leaders-Special Purpose Machinery, 2006/07

(Rs Crore)

Product Group (no. of firms)	Exports (E)	Imports (M)	Sales	Market Size (MS)	E % MS	M % MS	CR4 (%)	Market Leaders
Textile machinery (65)	455	9,280	2,251	11,530	4	80	16	LMW, Sulzer India, Veejay Lakshmi Engg. S K F India
Machine tools (200)	1,063	6,701	3,250	9,951	11	67	10	Kennametal India, A C E Designers, Sandvik Asia, H M T Machine Tools
Tractors (19)	1,294	25	9,175	9,200	14	0	77	Mahindra & Mahindra, Tractors & Farm Equipment, Escorts, International Tractors
Earth moving machinery (19)	120	1,282	5,894	7,175	2	18	70	B E M L, JCB India, Telco Construction Equipment, L & T-Komatsu, Caterpillar India
Material handling equipment (63)	108	952	1,531	2,483	4	38	47	Mcnally Bharat Engg. Co, Elecon Engineering Co, TRF, Godrej & Boycee Mfg. Co.
Printing machinery (18)	400	1,793	480	2,272	18	79	18	Manugraph India, Stovec Industries, Shilp Gravures, Positive Packaging
Chemical machinery (68)	0	0	2,200	2,200	0	0	62	L&T, Godrej, Ingersoll-Rand , BHEL, Heavy Plate and Vessels, Tema India
Metallurgical machinery (7)	644	1,843	272	2,115	30	87	12	L &T, Tata Steel, Disa India, Mukand
Cranes (28)	83	1,204	750	1,954	4	62	29	Action Construction, Equipment, T I L, Mukand, Hercules Hoists
Environment control equipment (49)	50	312	1,325	1,637	3	19	62	Paharpur Cooling Towers, Thermax, Ion Exchange, B O C India
Lifts & Escalators (12)	15	301	700	1,001	1	30	74	Otis Elevator , U T Johnson Lifts, Kone Elevator,
Drilling equipment (27)	28	108	884	992	3	11	78	Sandvik Asia, Atlas Copco (India), Addison, Revathi Equipment
Construction machinery (48)	17	15	748	763	2	2	73	Escorts Construction Equipment, Gujarat Apollo Industries, Ashoka Buildcon, Sayaji Iron & Engg.
Sugar machinery (10)	13	25	645	670	2	4	95	Thyssenkrupp Industries India Pvt, Fives Cail K C P, Texmaco
Agricultural machinery (54)	161	138	485	623	26	22	44	V S T Tillers Tractors, Tractors & Farm Equipment, Kerala Agro Machinery Corporation, Aspee Agro Equipment.
Cement machinery (8)	0	0	267	267	0	0	83	L &T, API, FL Smith, Walchandnagar .

Appendix (cont.)

Exports, Imports, Sales, Market Size, 4-Firm Concentration, Market Leaders- General Purpose Machinery, 2006/07

(Rs Crore)

Product Group (no of firms)	Exports (E)	Imports (M)	Sales Turnover	Market Size (MS)	EMS (%)	MMS (%)	CR4 (%)	Market Leaders
Boilers (29)	504	137	7,495	7,632	7	2	93	BHEL, Thermax, Cethar Vessels, Walchandnagar Industries
Engines of all types (37)	698	2,386	4,800	7,186	10	33	56	Cummins India, Kirloskar Oil engines, Greaves Cotton, Simpson & Co.
Bearings (67)	872	2,089	3,937	6,025	14	35	43	S K F India, National Engineering Industries, F A G Bearings India, N R B Bearings
Pumps of all kinds (112)	1,097	2,142	1,800	3,942	28	54	34	Kirloskar Brothers, BHEL, K S B Pumps, Sulzer Pumps India
Steam and hydro turbines (5)	262	840	1,985	2,825	9	30	70	BHEL, Triveni Engineering & Inds, Belliss India, Kirloskar Hydrair Pvt.
Compressors, all types (34)	521	898	1,827	2,726	19	33	40	Elgi Equipments, Emerson Climate Technologies (India), Atlas Copco (India), Ingersoll-Rand (India)
Valves (91)	1,376	448	2,219	2,667	52	17	61	Audco India, Larsen & Toubro, BHEL, K S B Pumps
Gears (36)	163	730	1,271	2,001	8	36	34	Elecon Engineering, Premium Energy Transmission, Fairfield Atlas, Eicher Motors
GPM (total)	5,493	9,670	25,334	35,004	16	28		
SPM (total)	4,451	23,979	30,857	54,833	8	44		
Grand Total	**9,944**	**33,649**	**56,191**	**89, 837**	**11**	**37**		

Notes: a) There is no exhaustive list of companies for which random sample can be drawn or data can be collected for each group. However, the company covered in each product group includes most important ones, in addition to other companies for which data could be procured on best effort basis; b) Total sales turnover of a product group is an estimated sale of all the Indian companies pertaining to the group. CMIE found official estimates of production to be underestimated in case of several product groups. Therefore, it has sourced gross value of output from ASI only in a few cases and in other cases it has sourced data from segment wise information on sales turnover/production given in annual reports of companies.

c) Market size (MS) is estimated as sales plus the value of import. Data on four-firm concentration ratio (CR4) signifies aggregate sales turnover of four largest firms in a product group as a percentage of it market size.

d) The detailed 8-digit ITC-HS classification has been used for data on values of exports and imports, which in turn have been obtained from the Directorate General of Commercial Intelligence and Statistics, Calcutta. EMS and MMS respectively are export and import as percentage of market size

Source: CMIE, Industry, Market Size, and Shares, April 2008

References

Ahluwalia, I. J. (1988), "Industrial Policy and Industrial Performance in India", in Lucas, R. E. B. and G. F. Papanek (eds.), The Indian Economy: Recent Development and Future Prospects, pp. (New Delhi: Oxford University Press, 1988).

Basant, R. (1997), "Technology Strategies of Large Enterprises in Indian Industry: Some Explorations", *World Development*, Vol. 25, No. 10, pp.1683-1700.

Chudnovsky, N. and S. Jacobsson (1983), Capital Goods Production in the Third World, (London: Frances Printer Publishers).

CII (2007), Final Report on Indian Capital Goods Industry, (New Delhi: Confederation of Indian Industry).

Cygnus (2007a), Indian Bearings Industry: Industry Insights, (Hyderabad: Cygnus Business Consulting and Research).

Cygnus (2007b), Indian Capital Goods: Industry Insights, (Hyderabad: Cygnus Business Consulting and Research).

Desai, A. V. (1984), "India's Technological Capability: An Analysis of its Achievements and Limits," *Research Policy*, Vol. 13, pp. 303-10.

Desai, A. V. (2001), "A Decade of Reforms", *Economic and Political Weekly*, December 15, pp. 4627-30.
EXIM Bank (2008), Indian Capital Goods Industry- A Sector Study, *Occasional Paper* No. 124, (Mumbai: Export-Import Bank of India).

Fransman M. (1985), Conceptualising Technical Change in the Third World in the 1980s: An Interpretative Survey, *Journal of Development Studies*, Vol.21, No.4, 572-652.

GoI (1987), Report of the Expert Group on Modernization, Technology Upgradation and Accelerated Growth of the Industrial Machinery Industry, (New Delhi: Ministry of Industry, Government of India).

GoI (2008a), Investing in India: Foreign Direct Investment Policy and Procedures, (New Delhi: Department of Industrial Policy & Promotion, Ministry of Commerce & Industry, Government of India).

GoI (2008b**),** Consolidated Policy on Foreign Direct Investment: Press Note 7 (2008), (New Delhi: Department of Industrial Policy & Promotion, Ministry of Commerce & Industry, Government of India).

GoI (2008c), National Industrial Classification-2008, (New Delhi: Central Statistical Organisation, Ministry of Statistics and Programme Implementation, Government of India).

Jacobsson, S. (1991), "Government Policy and Performance of the Indian Engineering Industry", *Research Policy*, Vol. 20, No. 1, pp. 45-56.

Jha, R. and V. Tulsayan (2005), "Machine Tools Absorption and Capital Formation: Dynamics of the Equilibrium Adjustment Process", *Economic and Political Weekly*, Vol. 26, February, pp. 842-49.

Keshari, P. K. (1990), "Foreign Investment in India: Some Emerging Trends", *Journal of Foreign Exchange and International Finance*, Vol. 4, No. 2 pp. 148-56.

Krishna, K. L. (2001), "Industrial Growth and Diversification", in U. Kapila (ed.) Indian Economy since Independence, Chapter 18, pp. 483-509, (New Delhi: Academic Foundation).

Kumar, A. (2008), "Faltering National and Global Growth Prospects," *Economic and Political weekly*, July 12, pp.15-19.

Kumar, N. (2000), "Economic Reforms and Their Macro-Economic Impact, *Economic and Political weekly*, March 4-10, pp. 803-12.

Lall, S. (1987), Learning to Industrialize, (London: Macmillan Press).

Majumdar, S. K. (2007), "Institutions in Transition: Property Right Regime Changes and the Saga of Foreign Firms in India", *India Review*, Vol. 6, No.2, pp.91-115.

Mathur, A.S. and Sachdeva, A.S. (2005), "Customs Tariff Structure in India", *Economic and Political Weekly*, February 5, pp. 535-39.

Mohan, R. (2008), "Growth Records of the Indian Economy, 1950-2008: A Story of Sustained Savings and Investment," *Economic and Political Weekly*, May 10-16, pp.61-71.

Nagaraj, R. (2001), "Indian Economy since 1980: Virtuous Growth or Polarisation", in U. Kapila (ed.) Indian Economy Since Independence, Chapter 27, pp. 678-703 (New Delhi: Academic Foundation).

Nagaraj, R. (2003a), "Industrial Policy and Performance Since 1980: Which Way Now," *Economic and Political Weekly*, August 30, pp.3707-15.

Nagaraj, R. (2008), "India's Recent Economic Growth: A Closer Look", *Economic and Political Weekly*, April 12-18, pp.55-61.

Pant, M. and Pattanayak, M., "Does Openness Promote Competition: A Case Study of Indian Manufacturing," *Economic and Political Weekly*, September 24, 2004, 4226-31.

Pavitt, K. (1984), 'Sectoral Patterns of Technical Change: Towards a Taxonomy and a Theory', *Research Policy*, Vol. 13, No. 6, pp. 343-373.

Ramana, R. (1984), "Performance of Capital Goods Sector in India, 1955-79: A Theoretical Analysis", *Economic and Political Weekly*, Vol. 19, Nos 31-33, August, pp.1311-18.

Suresh, M. P. (2004), "A Strategic Approach to Strengthening International Competitiveness in Knowledge Based Industries: Non-electrical Machinery Industry", *RIS Discussion Paper*, # 81/2004.

UNIDO (2005), Indian Manufacturing Industry: Technology Status and Prospects, (Geneva: United Nations Industrial Development Organisation).

World Bank (1984), India: Non-electrical Industrial Machinery Manufacturing-A Sub-sector Study, Report No. 5095, August.