

Economic Reforms and Technological Dynamism : A Study of Exports of Indian Manufacturing Industries

Ms. Swati Mehta

Industrialisation has always been seen as an essential attribute of development (Nayyar, 2008). Insofar as industrialization remains an engine of development, structural change and technological growth and modernization, growing manufactured exports are a sign that this engine is working (Lall, 2001). In a liberalizing world, export success becomes more important not only as a means of earning foreign exchange, but also acts as a indicator of efficiency of industrial sector. In this context, the aim of the present study is to analyse the growth and structure of India's manufacturing sector and its exports.

Before analysing this important query, it is imperative to have a flashback on the basic policies governing industrial sector in India. She had protected this sector for about three decades through licensing, high tariffs, quotas, control on growth of large private domestic firms in favour of public enterprises, government direction of investment (Lall, 2001) and so on. This protectionism by State, however, showed a rapid growth in the sector until the mid of the sixties (Ahluwalia 1985; 1991; Nayyar, 1994); when deceleration followed by stagnation creped in. The interventionist policies of the government were blamed for sluggish growth of the sector which does not permit competition and provides little if any, incentive for reducing costs or improving quality (Ahluwalia, 1985). This initiated a debate regarding the role of the government in India¹ and an overwhelming response for a change started mounting up.

The 1980s witnessed some changes with regard to import of intermediate inputs and capital goods, especially in context of giving a thrust to technological

upgradation (Ahluwalia 1991; Das, 2004). But the real change came in 1991 with the adoption of the Macroeconomic stabilization and Structural Adjustment Programme; wherein the State was dragged to the back seat. 'Globalization' a 'new game' emerges in which 'market' is the biggest player driven by technological race. This paradigm shift in the role of the State vis-a-vis markets led to a sense of optimism that the industrial growth will surge after being freed from the shackles of controls.

But now, after having adopted massive reforms for about one and a half decades and after seeing the initial optimism on adopting these reforms (Pack, 1988), it is obvious to hypothesis that the reforms have a positive effect on the sectors where it has a direct impact- industry and exports. In this sense, this study aims to analyse whether (i) the manufacturing industries and its corresponding exports witnessed a higher trend growth rate after the adoption of 1991 reforms and (ii) whether there is a technological upgradation from the low technology production and exports to the high technology ones.

There are numerous studies conducted by various scholars to examine the impact of reforms on the growth, structure and export performance of the industrial economy of India. Whereas, Nagraj (1997; 2003) and Chaudhury (2002) found the manufacturing growth rate is lower in the post-reform period as compared to the pre-reform period, Ahluwalia (2006) found the post-reform period as quiet fluctuating. The results although quiet similar, the reasoning diverges from decline in the role of the government with regard to the former studies and slowdown in reforms as

the probable reasoning presented by the later. But all the studies analysed the diversification within the manufacturing sector by classifying it into use-based sectors.

Again there are other set of studies that analyses the impact of reforms on exports. Srinivasan (1998), Lall (2001), Roy (2006) and Veeramani (2007), to name few. They all found that India does not seem to be competitive in a number of commodities and the export growth has not been distinctly high in the post-reform period. However, the export structure is analysed by Kumar and Siddharthan (1994) and Lall (2001) using the industrial classification based on the technology intensity in different industries, but they are quiet different in using the dataset- the former study was a firm-level analyses while the latter is quiet comprehensive based on organised manufacturing sector as a whole. They again converges on the basic results of their respective studies wherein they found the Indian export structure is static and dominated by simple and undifferentiated products.

Thus, from this brief survey of literature it is found that the industrial structure and the exports structure has been analysed separately by the scholars, which although is quiet inter-related. Unless the structure of the industries got shifted towards high technology intensive ones, it is quiet impossible to have the technology dynamism in the exports front which is very importance in the liberalized world (Lall, 2001). Thus, the contribution of this paper is to fill this gap in the existing literature.

The paper is structured into five sections. Besides the present section, the section II describes the data sources and methodology. The section III discusses the changing structure of Indian manufacturing sector and aimed to find out whether there has been a structural shift towards more complex high technology industries for securing the sustainable growth. The analyses of the changing structure of exports are

discussed in section IV. Section V finds the relationship between the industrial and export structure. Section VI finally concludes the study by presenting some policy framework.

Database and Methodology

The basic source of data used for this paper is the Annual Survey of Industries (ASI) published by the Central Statistical Organisation (CSO), Government of India, based on National Industrial Classification (NIC) 2004. The study covers the period from 1980-81 to 2005-06. The spurt in the trend growth rate of the 1980 is well evident in the literature¹. But to know the impact of the reforms on the industrial sector, it becomes important to know whether there is any such increase in the trend growth rate in the subsequent period. Thus, the whole period is divided into two sub-periods- the pre-reform period from 1980-81 to 1991-92 and the post-reform period from 1992-93 to 2005-06 for the comparative analyses of the impact of reforms. The analysis is based on the data for 59 three-digit industries and one four-digit industry (pharmaceutical) (Industrial codes and Names of the respective industries are in Appendix I) drawn from an electronic database brought out by the Economic and Political Weekly Research Foundation (EPWRF). Data for the two years i.e. 2004-05 and 2005-06 and the data on Pharmaceutical (NIC'04 code 2423) is drawn directly from ASI publications. To make the consistent data set for 1980 onwards concordance was done as four different industrial classifications came during this time period – NIC 1970 (1980-81 to 1988-89); NIC 1987 (1989-90 to 1997-98); NIC 1998 (1998-99 to 2003-04) and NIC 2004 (2004-05 to 2005-06). The variability in the dataset is made constant at 1993-94 prices as this being used as the current official base year. To analyse the technological complexion of the manufacturing sector, the industries are re-classified according to the technology based classification provided by the Organisation for Economic Cooperation

and Development (OECD) (2007), which divides the industries into four categories, that is, High technology industries (H-T), Medium-High Technology industries (M-H-T), Medium-Low Technology industries (M-L-T) and Low Technology (L-T). The OECD classification has used the research and development (R&D) intensities for technology based classification.

Secondly, exports data have been taken from UN-COMTRADE²; which consists of value of exports (in US\$). Here again, to make the consistent dataset concordance was done between Standard International Trade Classification SITC (1980 to 1987) and International Standard Industrial Classification ISIC (1988 to 2006). The exports data is made constant at US\$ 2000-01 using International Monetary Fund-International Financial Statistics (IMF-IFS) data. This dataset was then also re-classified according to the technology based classification to make the dataset compatible with the industrial dataset.

Now regarding the methodology, firstly, for estimating the trend growth rates for the whole period spanning from 1980-81 to 2005-06, semi-logarithmic regression model is used in which, from the antilog of the estimated \hat{a}_2' , one is subtracted and the result is multiplied by 100 to get the compound trend growth rate. This log-linear method is also used by Ahluwalia, 1985; 1991; Nagaraj, 1997; 2003.

Secondly, for estimating the trend growth rates in the sub-periods of the time series, the empirical exercises in the literature (notably of Ahluwalia, 1985; 1991) had fitted separate exponential trend lines by the ordinary least square method for each sub-period of the series, which gives anomalous results (Goldar and Seth, 1989). So, for making full use of information and to avoid asymmetry and discontinuous bias, single kinked model is used in the present study. In this method only one regression equation is estimated instead of estimating separate regression equations

for different sub-periods for better analytical estimates³. The model can be derived using a simple equation as follows.

$$\text{Log } Y_1 = a_1 D_1 + a_2 D_2 + (b_1 D_1 + b_2 D_2) t + u_1 \dots\dots\dots(1)$$

where Y_1 is dependent variable

time $t = 1, \dots, n$ is broken at point k

d_j = dummy variable ($j = 1, 2$) which takes the value 1 in the j th sub-group and 0 otherwise.

$$a_1 + b_1 k = a_2 + b_2 k \dots\dots\dots(2)$$

Substituting for a_2 and assuming

$$a_1 D_1 + a_2 D_2 = a_1, \text{ we get } \text{log } y_t = a_1 + b_1 (D_1 t + D_2 k) + b_2 (D_2 t - D_2 k) + u_t \dots\dots\dots(3)$$

The estimates for b_1 and b_2 give the exponential growth rate for the two sub-periods.

We now delve into the data sources, and methodology used in the study.

Pattern of Industrial Growth

In knowledge driven economies, industrial success depends upon learning the constant changing industrial technologies. Whereas, high technology industries offer better prospects for future growth, they tend to be highly income elastic, create new demand and substitute faster for older products. Simple technologies, by contrast, tend to have slower growing markets, more limited learning potential and smaller scope for technological upgrading. They are also more vulnerable to easy entry by lower wage competitors, substitution by technical change and structural change from simple to more advanced technologies (Lall S, 2001).

So, whether the Indian manufacturing sector has a structural shift towards more complex high technology industries is an important issue to analyse. An attempt for this is made in this section.

Table 1: Value Added and Trend Growth Rates of Organised Manufacturing Sector (At Three-Digit Disaggregated level)

(Percentage)

NIC'04 Code	Industry	Proportionate Value added				Trend Growth Rates		
		1980-83	1990-93	2000-03	2003-06	Pre-reform (1980-91)	Post-reform (1991-06)	1980-06
High Technology								
2423	Pharmaceutical	3.25	3.6	5.8	4.35	17.2	0.8	5.02
300	Office, accounting & computer machinery	0.68	0.97	0.67	1.27	18.88	10.8	11.8
321	Electronic valves & tubes	0.11	0.26	0.95	0.38	12.1	8.11	10.2
322	TV & Radio transmitters	-	1.51	0.45	0.38	21.3	2.7	9.2
323	TV & Radio receivers	1.07	0.78	0.93	0.6	15.3	10.7	12.5
331	Medical appliances	0.86	0.48	0.77	0.73	2.6	10.6	7.5
332	Optical Instrument	0.03	0.02	0.08	0.11	6.8	16.2	13.5
333	Watches & clocks	0.3	0.26	0.20	3.33	12.2	1.8	4.8
353	Aircraft & Spacecrafts	0.17	0.21	0.06	0.1	17.2	0.8	5.02
H-T industries		6.51	8.15	9.93	11.3	10.85	6.29	8.87
M-H-T Industries								
241	Basic Chemicals	5.84	6.59	8.75	6.97	14.9	2.4	8.4
242*	Other Chemical products	5.17	5.31	5.05	3.75	11.62	1.5	6.07
243	Man-made fibres	-	0.75	0.92	0.39	-7.3	0.0	-10.6
291	General purpose mach.	3.27	3.08	3.07	2.87	7.8	8.1	8.0
292	Special purpose mach.	4.62	3.9	2.73	2.47	6.82	4.81	5.76
293	Domestic appliances	1.07	0.45	0.47	0.25	1.8	3.67	2.9
311	Electronic motors etc	3.29	2.75	1.37	1.56	6.9	2.3	4.3
312	Electricity distribution & Control appliances	0.39	1.03	0.87	0.87	18.2	10.3	13.3
313	Insulated wires & cables	1.27	0.97	0.55	0.32	12.3	0.2	4.5
314	Accumulators, cells etc.	0.54	0.36	0.49	0.3	5.97	7.46	6.9
315	Electronic lamps etc.	-	0.34	0.23	0.18	-	9.82	-
319	Other electrical equip.	0.25	0.15	0.26	0.32	-	8.8	-
341	Motor vehicles	4.87	4.38	1.65	4.1	10.1	1.0	5.12
342	Bodies for motor vehicle	0.1	0.15	0.05	0.09	19.12	3.66	7.35
343	Parts for vehicles	-	-	2.49	2.74	-	-	-
352	Railways & tramways etc	2.12	1.77	0.23	0.22	8.98	-8.88	-3.34
359	Transport equip. n.e.c.	0.88	1.45	2.42	2.66	12.75	13.4	13.08
M-H-T industries		33.1	33.46	31.63	30.13	7.68	3.14	5.75

M-L-T Industries								
231	Coke-oven products	0.65	0.45	0.24	0.55	9.75	5.65	7.03
232	Refined petroleum prod.	2.57	4.39	6.94	12.42	16.1	10.6	13.3
233	Process of nuclear fuel	-	0.005	-	-	-	-	-
251	Rubber products	1.76	1.94	1.72	1.24	8.76	3.77	5.87
252	Plastic products	0.67	1.28	1.79	1.48	14.9	9.2	11.6
261	Glass & glass products	0.52	0.53	0.54	0.44	8.11	5.86	6.71
269	Non-metallic mineral	3.96	4.98	4.58	3.93	8.54	5.86	7.14
271	Basic Iron ore & steel	12.36	7.97	6.79	12.51	3.35	7.57	5.44
272	Basic&non-ferrous metal	0.88	1.96	2.37	2.76	17.2	7.78	11.8
273	Casting of metals	-	0.97	0.71	0.69	-	11.1	-
281	Structural metal etc.	1.59	1.54	0.99	1.13	6.5	2.32	3.9
289	Fabricated metal etc.	1.41	1.39	1.73	1.55	6.5	8.32	7.57
351	Building & repair of ships	0.87	0.21	0.23	0.18	-10.6	7.14	1.41
M-L-T industries		27.3	27.66	28.61	38.89	6.82	8.98	7.68
L-T Industries								
151	Prod. & process of meat.	1.5	1.69	1.55	1.2	10.8	3.5	6.5
152	Dairy products	0.45	0.67	1.43	0.97	15.6	9.3	11.7
153	Grain mill products	1.15	1.23	1.55	1.22	9.1	6.6	7.6
154	Other food products	4.85	5.21	4.97	3.18	10.1	1.3	5.4
155	Beverages	0.71	1.06	1.21	1.06	9.8	4.5	6.6
160	Tobacco products	1.36	2.16	2.83	2.02	8.1	5.12	6.4
171	Spin, weaving of textiles	15.82	10.33	6.48	4.77	4.3	2.7	3.5
172	Other textiles	0.51	0.44	0.71	0.68	4.8	13.8	10.3
173	Knitted & crochet fabrics	0.22	0.39	0.63	0.61	15.4	13.2	13.9
181	Wearing apparel, not fur	0.48	1.58	2.12	1.74	26.5	8.8	16.3
182	Dressing & dying of fur	0.004	0.01	0.004	0.004	22.8	6.4	7.9
191	Leather	0.33	0.47	0.26	0.22	11.4	2.9	5.5
192	Footwear	0.38	0.66	0.56	0.41	13.5	5.2	8.1
201	Saw milling of wood	0.16	0.08	0.03	0.01	-2.2	-5.5	-4.9
202	Wood, cork& straw	0.36	0.29	0.19	0.19	3.4	1.8	2.2
210	Paper & paper products	1.93	2.13	2.18	1.46	7.3	3.6	5.12
221	Publishing	1.42	1.15	1.0	0.93	4.2	3.7	3.9
222	Printing	0.69	0.47	0.56	0.43	1.9	5.02	3.9
223	Reprod. recorded media	-	-	0.02	0.003	-	-	-
361	Furnishing	0.34	0.1	0.26	0.24	-7.2	9.3	3.9
369	Manufacturing n.e.c. jewellery	0.42	0.58	1.24	1.19	9.7	11.5	10.8
L-T industries		33.1	30.72	29.81	22.58	7.04	4.19	5.87
Organised Manufacturing #		100	100	100	100	7.25	5.33	6.6

Notes: Refer Appendix I for industry names.

* means 'Other chemical products' (242) does not include pharmaceuticals (2423)

The average of three years is taken to overcome with the yearly fluctuations, if any.

Real Value added in 1980-83 is Rs 1206990 Cr ; rose by 3% to Rs 4927123 Cr in 1990-93 ; rose further by 2% to Rs 15054897 Cr in 2000-

03 and by 0.6% to Rs 25054306 in 2003-06.

means that the value added may diverge from the sum due to round off errors.

Source: Calculated.

Data Source: EPWRF CD-ROM, 2004 and ASI (CSO), 2005, 06.

Table 1. shows the value added and trend growth rate

of the organised manufacturing sector at the disaggregated level throughout the period under study. Within the high technology industries (H-T), pharmaceutical (2423) with a weight of around 3% in 1980s and around 6% during early 2000; had the greatest fall in its trend growth rate as it fell from the double digit growth in the pre-reform period to even less than 1% in the post reform period, although the data for this industry is available only until 2003-04. The other industries which saw a drastic fall in the trend growth rate are the TV & radio transmitters (322), watches & clocks (333) and aircrafts & spacecrafts (353). However, amongst the nine high technology industries, only two shows their trend growth rate increasing in the post-reform era. These two exceptions are medical appliances (331) and optical instruments (332), with an average weight being 0.7 and 0.06, respectively throughout the period.

At a slightly lower ladder of technological complexity, are the sub-group of medium-high technology industries. A steep fall is seen in the trend growth of basic chemicals (241) (an important industry in terms of weight – around 7% throughout the period 1980-06), other chemical products (242 minus 2423), insulated wires and cables (313), motor vehicles (341), bodies for motor vehicles (342). All these were growing at a double digit rate in the pre-reform period, but in the post-reform, their growth rate came at a lower level of less than 4%, which subsequently had a negative impact on their weight amongst the manufacturing industries. The industries which show a higher trend growth rate in the post-reform era in this sub-group are man-made fibres (243), general purpose machinery (291), domestic appliances (293), accumulators etc. (314) and transport equipment (359); (with the average weight for these five industries for the period as a whole is around 9%).

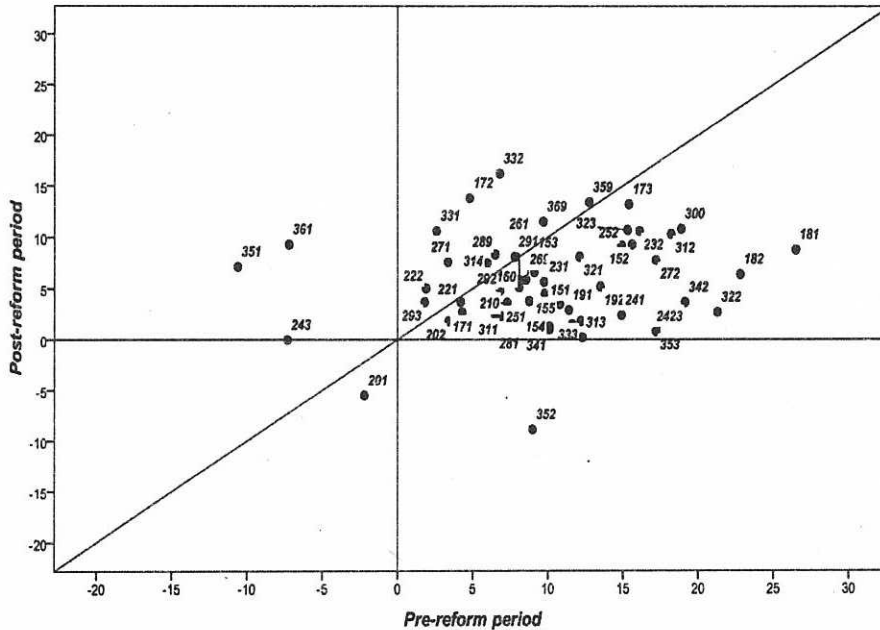
The only industrial sub-group which witnessed an overall rise in the trend growth rate in the post-reform period is the medium-low technology (M-L-T) industries. This was basically on account of the rise in the trend growth rate of its most important industry: Basic iron ore & steel (271). India is the fourth largest producer of Iron-ore in the world. This industry had a large share of around 12% in early 1980s in total organized manufacturing sector. However, from 1990-93 to 2000-03, its share fell to half, but it regained its position of early 80s during 2003-06. The other industries which showed a positive growth trend in the post-reform period are casting of metals (273), fabricated metal etc. (289) and building & repair of ships (351). Rest all industries in this sub-group also witnessed a slower trend growth rate in the post-reform period.

The lowest in the technological complexity are the low-technology (L-T) industries. This sub-group is the largest in terms of the number of 3-digit industries; also witnessed an overall fall in the trend growth rate in the post-reform era in most of the industries. Only four industries in this sub-group saw a rise in their growth rate in the post-reform era. These industries are other textiles (172), printing (222), furnishing (361) and manufacturing n.e.c. jewellery (369), with the total average weight of mere around 1% throughout the period under study.

The overall analyses show that very few industries (28%) were able to grow at a higher growth rate in the post-reform period as compared to the pre-reform period.

The following figure 1, however, depicts the positioning of the various industries in both the pre-reform period and the post-reform period. The industries which are lying above the diagonal have shown a higher trend growth rate in the post-reform period as compared to the pre-reform period.

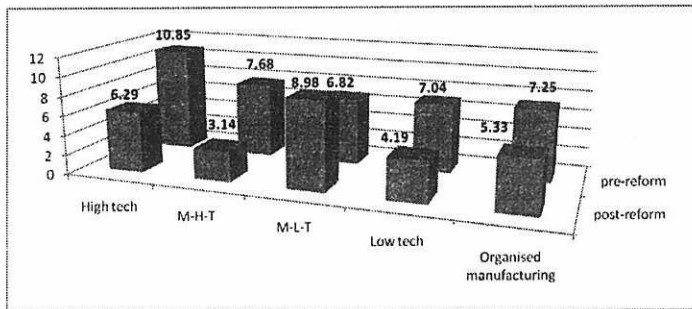
Figure 1. Trend growth rates: pre-reforms vs post-reforms (at 3-digit disaggregated level)



Thus, the figure shows that amongst the 60 industries, there are only 14 industries, with an average weight of less than 20% for the period, lying above the 45-degree line. In other words there are only 23% industries which showed an increase in their trend growth rate in the post-reform period. This clearly

shows that there is a deceleration in around 77% of the industries in the post-reform period. Now, for the query of whether there is a diversification within the manufacturing sector towards more technology intensive industries, again table 1 along with figures 2 and 3 depicts the results.

Figure 2. Trend growth rate pre-reform vs post-reform period (at the different technological intensive industries)



To reiterate, the figure 2 shows a significant slowdown in the growth of the entire industrial sector after the adoption to the structural adjustment programme where the trend growth rate was 7.25% during the pre-reform period, it fell to 5.33% in the post-reform period. Except the medium-low-technology (M-L-T)

industries, all the other three sub-groups showed a deceleration in the growth rate during the post-reform period, to the tune of around 45%. In the M-L-T industrial sub-group, the trend growth rate accelerated to 8.98% in the post-reform period from 6.82% in the pre-reform period. The high growth of the M-L-T

industries in the post-reform period could be best ascribe to the higher trend growth rate witnessed in the Basic Iron & Steel industry (271) which could be the consequence of the 'Mahalanobis model under which conscious effort was made to build capacity in this core intermediate goods sector' (Ahluwalia, 1991). Now taking the case of the high-tech (H-T) and M-H-T industries where the trend growth rate fell from 10.85% and 7.68% in the pre-reform period to 6.29% and 3.14% in the post-reform period, respectively. This slower growth rate would probable mean that there is a paucity of technological capacity in these industries on the supply side (the easy flow of which was implicit in the trade liberalisation theories (Pack, 1988) prescribed by the market-fundamentalists). This clearly signifies the tacit aspect of knowledge which makes its transmission rather sticky. Indeed, this is one of the fundamental reasons why technological catch-up remains a challenging task in the era of globalisation (Cimoli et.al, 2009). On the demand side, these industries lack competitiveness both in the domestic market and foreign markets (since in the globalised

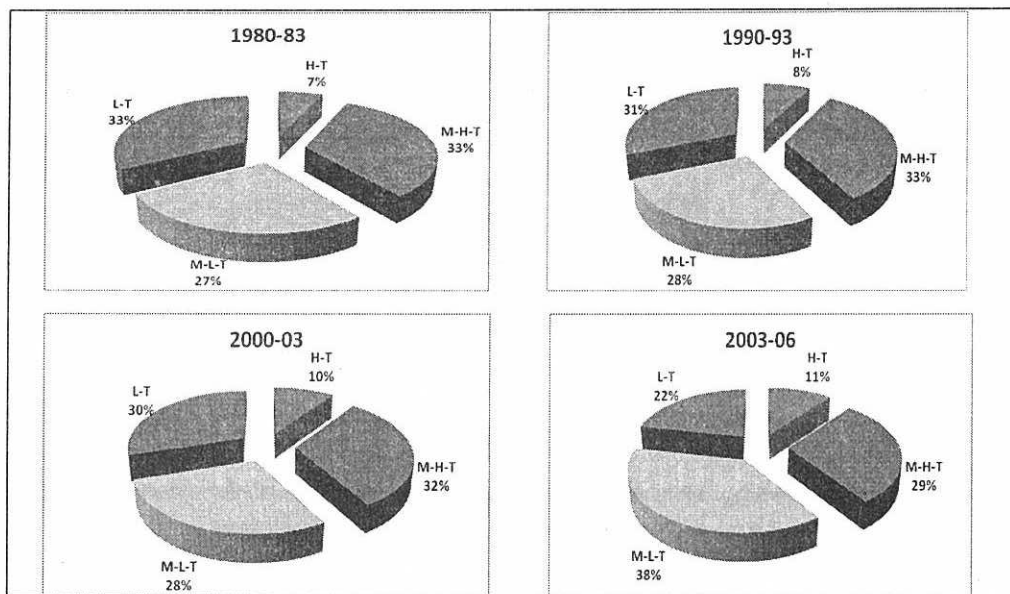
era the market is not the constraint for the competitive industry).

Low-technology (L-T) industries which are on the lowest ladder amongst the technology intensive industries, also witnessed a fall from 7.04% in the pre-reform period to 4.19% in the post-reform period; which again could be the result of technological stagnation and also due to its direct linkage with the agriculture sector. The poor to indifferent agriculture performance in the post-reform period (Nagaraj, 2003) has a demand constraint as well as supply constraint on these industries.

Thus, to conclude all the technology intensive sub-groups, except the M-L-T industrial sub-group, witnessed a deceleration in their trend growth rate in the post-reform period as compared to the post-reform period.

Next, to ascertain the importance of technological complex industries amongst the manufacturing sector, comparative analyses of the respective weights of different industrial sub-groups based on their technology intensity are taken into account; as shown with the help of table 1 and the subsequent figure 3.

Figure 3. Structural shifts within organised manufacturing sector



Notes: The pie-diagram is showing the results in round off figures.
 The average of three years is taken to overcome with the yearly fluctuations, if any.
 Data Source: EPWRF CD-ROM 2004, ASI (CSO) 2004-05 and 2005-06.
 Source: Calculated.

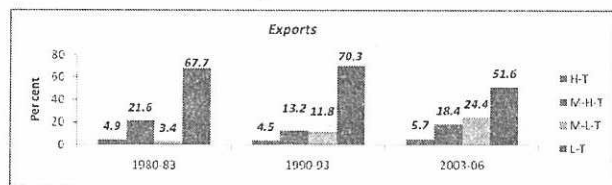
The figure 3 shows that the average contribution of high technology industry (H-T) towards the net value addition of the organised manufacturing for 1980-83 is 7% whereas the low technology (L-T) industries are contributing a whopping 33%. The medium-high technology (M-H-T) industries and the medium-low technology (M-L-T) industries were respectively, high and low by 3% to 30% share. However, the average of 1990-93 saw a rise of 1% in the share of high technology (H-T) industries and medium-low technology (M-L-T) industries. The fall is seen in the low technology (L-T) industries of about 2% to 31%, whereas the medium- high technology (M-H-T) industries remained at the previous level. The decade of massive reforms saw an increase of about 2% coming from the high technology industries; raising the total average contribution to 10% during 2000-03, is definitely a positive sign. However, low technology (L-T) and medium-high technology (M-H-T) industries witnessed some fall but medium-low technology (M-L-T) industries maintained at the previous level. The share of high technology (H-T) industries reached 11% during 2003-06. During this period the contribution of medium-low technology (M-L-T) industries witnessed the high of 10%. This was followed by the drop in shares of low technology (L-T) and medium-high technology (M-H-T) by 8% and 3%, respectively. Thus, the analyses shows that (i) the overall trend growth rate of the organised manufacturing sector do not witnesses an acceleration after the adoption of the reforms in 1991; (ii) the trend growth rate of high technology (H-T) industries and medium-high technology (M-H-T) industries also decelerated in the post-reform period, which puts the industrial sustainability in to jeopardy; and (iii) the increase in the weight of high technology (H-T) industries from 1980s to 2000s is too small, which was seen to be somewhat countervailed by the fall in the weight of medium-high technology (M-H-T) industries; which overall gives a gloomy picture. Somewhat similar reshuffle was also witnessed amongst the medium-low technology (M-L-T) and low technology (L-T) industries.

So, the overall results refute the assumed hypotheses of having a positive effect of reforms on the Indian organised manufacturing sector.

Growth and Structure of Manufactured Exports

A low technology export structure is good starting for a poor, labour-surplus economy, but over time, countries have to upgrade to more technology-intensive activities. Otherwise, they can maintain export growth only by taking shares from low-technology exporters. It needs considerable technological effort, high level of skill and, increasingly, entry into different brand-conscious segments of market. Thus, to conclude export structure matters. In this regard an attempt made in this section to analyse the structure of India's exports.

Figure 4 India's Exports Structure



Data Source: UN-COMTRADE.

The total exports in 1980-83 were US\$ 6542509 Thousand; rose by 1.45% to US\$ 16036681 Thousand in 1990-93; rose again by 3.35% to US\$ 69763143 Thousand in 2003-06.

Source: Calculated.

Figure 4 shows that during the early 80's, high technology manufacturing exports from India is nearly 5%, which fell by 0.5% during the early 90's, but showed an increase in its share (5.7%) during 2003-06. India's major exports are basically low-technology industries. It was around 70% of the total manufactured exports during 80's and 90's, but fell to 50% in 2000's. India also have a good number of M-H-T exports but the share of M-L-T industries are rising steadily from mere 3.4% during early 80's to around 24.4% during 2000. Thus, the export structure seems to be moving in favour of M-L-T industries and very marginally bending towards H-T industries (definitely a positive sign due to the complex and highly competitive world of high technology products).

The following table (Table 2) shows the trend growth rate of exports from India during the pre-reform period (1980-91) and post-reform period (1992-06).

Table 2 *Trend growth rate of exports*

(Percentage)

NIC'04 Code	Industry	EXPORTS		
		Pre-reform (1980-91)	Post-reform (1992-06)	1980-06
High Technology				
2423	Pharmaceutical	22.76	17.23	22.87
300	Office, Accounting & Computing machinery	19.48	13.54	16.18
321	Electronic valves & tubes	18.29	16.07	16.99
322	TV & Radio transmitters	20.20	33.51	28.91
323	TV & Radio receivers	20.56	19.96	20.20
331	Medical appliances	11.63	28.15	20.56
332	Optical instruments	11.96	18.18	16.1
333	Watches & clocks	40.35	37.30	38.40
353	Aircrafts & Spacecrafts	18.65	20.80	20.08
Total High Technology		22.26	1.01	18.06
Medium-High Technology				
241	Basic chemicals	43.18	16.88	31.52
242*	Other Chemical products	22.75	15.03	16.42
243	Man-made fibres	1.41	18.41	10.85
291	General purpose mach.	15.72	21.41	18.53
292	Special purpose mach.	29.56	13.2	21.05
293	Domestic appliances	-5.92	18.18	8.76
311	Electronic motors etc.	23.24	32.84	28.53
312	Electricity distribution & Control appliances	18.18	24.11	21.65
313	Insulated wires & cables	10.29	9.42	9.75
314	Accumulators, cells etc.	8.55	5.97	6.82
315	Electronic lamps etc.	13.31	24.73	21.05
319	Other electrical equip.	18.65	28.92	24.36
341	Motor vehicles	14.22	17.59	15.95
342	Bodies for motor vehicles	-8.33	-4.78	-5.73
343	Parts for vehicles	8.98	22.75	15.95
352	Railways & tramways	20.92	11.07	13.54
359	Transport equip.n.e.c	11.29	14.68	13.09
Total Medium-High Technology		17.59	20.32	16.3

Medium-Low Technology				
231	Coke-oven products	-21.1	-6.57	-9.15
232	Refined petroleum prod.	44.19	4.08	24.36
233	Process of nuclear fuel	0.3	-22.89	-22.97
251	Rubber products	37.44	13.88	24.61
252	Plastic products	50.1	20.20	33.51
261	Glass & glass products	25.73	25.11	25.36
269	Non-metallic mineral	56.83	17.23	34.99
271	Basic Iron-ore & steel	41.62	20.44	31.78
272	Basic&non-ferrous metal	95.81	2.33	41.06
273	Casting of metals			
281	Structural metal etc.	70.74	9.31	30.99
289	Fabricated metal etc.	33.51	16.29	25.23
351	Building & repair of ships	89.84	43.19	59.52
Total Medium-Low Technology		20.53	17.94	21.53

Low Technology				
151	Prod. & process of meat	75.7	3.45	40.1
152	Dairy products	-6.39	30.6	16.65
153	Grain mill products	62.41	9.97	34.85
154	Other food products	17.47	8.65	12.86
155	Beverages	98.87	16.42	37.85
160	Tobacco products	13.42	13.42	13.42
171	Spin,weaving of textiles	29.05	8.87	20.44
172	Other textiles	22.26	11.29	17.35
173	Knitted & crochet fabrics	3.76	22.14	12.41
181	Wearing apparel, not fur	59.04	0.3	33.11
182	Dressing & dyeing of fur	20.44	-21.81	-21.57
191	Leather	22.75	7.04	14.79
192	Footwear	50.98	5.02	25.86
201	Saw milling of wood	-3.54	1.005	0.3
202	Wood, cork& straw	20.92	16.1	17.7
210	Paper & paper products	45.35	30.6	36.61
221	Publishing	60.8	16.88	34.98
222	Printing	13.88	24.86	21.17
223	Reprod. Recorded media			
361	Furnishing	12.98	40.64	30.08
369	Manufacturing .n.e.c jewellery	15.37	16.88	15.95
Total Low Technology		20.92	11.40	15.72
Total Industries		20.8	14.57	16.65

Notes: For the proper nomenclature of the industries, see Appendix I.

* means 'Other chemical products' (242) does not include 'pharmaceuticals' (2423).

The figures are made constant at \$US 2000 prices.

The respective deflators are taken from IMF-IFS data.

Source: Calculated.

Data source: UN-COMTRADE

Table 2 shows that the overall trend growth of the individual high technology exports remained at a double digit level in both the periods, with a rising trend witnessed in case of TV & radio transmitters (322), medical appliances (331) and aircraft & spacecraft (353); but the overall trend growth rate fell massively in the post-reform period.

In case of medium-high technology (M-H-T) industries, the trend growth rate of overall exports grew from 17% in the pre-reform to 20% in the post-reform period. However, the rate of exports grew in general purpose machinery (191), domestic appliances (293), electronic motors (311), motor vehicles (341), parts of vehicles (343), among others.

The case of medium-low technology (M-L-T) industries is somewhat different. Although the trend growth rate

of these industries grew in the post-reform period (Table 1 & Figure 1), the trend growth of exports fell in the post-reform period for almost all industries; thus showing the overall growth rate of exports fell from 20% in the former period to 17% in the later period. Similar are the trend of the overall low technology industries wherein their trend growth rate fell from 21% in the pre-reform period to 11% in the post-reform period. However, dairy products (152), knitted & crochet fabrics (173), printing (222), furnishing (361), manufacturing n.e.c. jewellery (369) showed a higher trend growth rate in the post-reform period in case of the low technology industries.

Thus, the Table 2 shows that the exports of all manufacturing industries fell from 20.8% in the pre-reform period to 14.6% in the post-reform period.

Table 3: India's Major Exports

Sr.No	EXPORTS		
	1980-83	1990-93	2003-06
1.	Other textiles (172)	Manufacturing n.e.c. jewellery (369)	Manufacturing n.e.c. jewellery (369)
2.	Leather (191)	Wearing apparel, not fur (181)	Refined petroleum prod. (232)
3.	Motor vehicles (341)	Spin, weaving of textiles (171)	Wearing apparel, not fur (181)
4.	food products (151,152)	Prod. & process of meat (151)	Basic chemicals (241)
5.	Other chemical products (242)	Other textiles (172)	Spin, weaving of textiles (171)
6.	General purpose mach. (291)	Other chemical products (242)	Basic Iron-ore & steel (271)
7.	Refined petroleum prod. (232)	Leather (191)	Other chemical products (242)
8.	Special purpose mach. (292)	Basic chemicals (241)	Other textiles (172)
9.	Glass(261)	Refined petroleum prod. (232)	Prod. & process of meat (151)
10.	Basic iron ore (271)	Footwear (192)	Pharmaceutical (2423)

Notes: Refer Appendix I for the proper nomenclature of the industries.

Figures in brackets are the NIC'04 codes of the industries.

The results are based on the value of the quantum of exports in the respective years in decreasing order.

Data source: UN-COMTRADE.

Source: Calculated.

Table 3 shows India's major export during the period of two and half decade. In case of exports, major bulk is from the low-technology (L-T) industries. It is followed by few products (refined petroleum (232) and basic chemicals (241)) from the medium-high technology (M-H-T) industries. Major export industry from the high-technology (H-T) segment is only pharmaceuticals (2423).

The overall picture shows that India is still following the traditional trade structure with some very minor changes, although.

Relationship between Manufacturing Industries and Manufactured Exports

Spearman's rank correlation coefficient is estimated to find whether the relationship between the growth of exports corresponding the growth of value addition.

Table 4. Correlation between trend growth rate of industry and exports

INDUSTRY	CORRELATION COEFFICIENT
High technology industries	-0.73
Medium-high technology industries	0.27
Medium-low technology industries	-0.18
Low technology Industries	-0.66
Total Organized manufacturing	0.02

Note: The results are significant at two-tailed 95% level.

Source: Calculated.

Table 4 shows that the relation between the trend growth rate of industries and its corresponding exports is positive but very low, which is evident from the low magnitude of the correlation coefficient. In case of the high technology and low technology industries, the correlation coefficient shows that the higher trend of value added in these industries are not coupled with the higher export rate. Similar is the result is for the medium-low technology industries, but the magnitude of this industrial group is very low. The only industrial group which shows some relationship between the

growth of value added and the corresponding exports are the medium-high technology industrial group, but again the positive relationship is too low in magnitude. This shows that either the high domestic demand or the lower competitiveness of the exports in the competitive markets abroad failed to generate the higher exports in the industries which show a higher trend in value added.

To have a clear perspective as to which industry have a greater exports, exports intensity is calculated.

Table 5. Export intensity of 3-digit industries

(Per cent)

NIC'04 Code	Industry	Exports intensity				Exports intensity growth	
		1	2	3	4	5	6
		1980-81	1990-91	2000-01	2005-06	Pre-reform	Post-reform
High Technology							
2423	Pharmaceutical	-	-	4.5	-		
300	Office, accounting & computer machinery	39	43.51	45.04	62.42	4.51	1.53
321	Electronic valves&tubes	176.4	62.09	22.1	31.16	-114.31	-39.98
322	TV & Radio transmitters	-	1.18	6.42	19.18	-	5.24
323	TV & Radio receivers	9.17	5.9	6.93	17.66	-3.27	1.03
331	Medical appliances	37.54	25.42	52.16	91.55	-12.12	26.74
332	Optical Instrument	155.6	157.7	86.56	194.9	2.1	-71.14
333	Watches & clocks	1.2	2.41	35	50.05	1.21	32.59
353	Aircraft & Spacecrafts	18.7	13.54	425.1	188.4	-5.16	411.56

M-H-T Industries							
241	Basic Chemicals	2.48	14.71	25.98	71.27	12.23	11.27
242	Other Chemical products	3.92	24.39	30.64	50.02	20.47	6.25
243	Man-made fibres	-	10.76	30.06	60.51	-	19.3
291	General purpose mach.	11.79	13.47	24.27	47.16	1.68	10.8
292	Special purpose mach.	4.08	18.31	22.27	49.58	14.23	3.96
293	Domestic appliances	14.22	4.78	10.94	35.56	-9.44	6.16
311	Electronic motors etc	1.81	2.79	19.65	26.03	0.98	16.86
312	Electricity distribution & Control appliances	6.92	7.74	17.5	29.75	0.82	9.76
313	Insulated wires & cables	7.84	7.22	4.9	12.64	-0.62	-2.32
314	Accumulators, cells etc.	38.13	31	15.43	18.49	-7.13	-15.57
315	Electronic lamps etc.	-	4.22	15.03	18.63	-	10.81
319	Other electrical equip.	164.6	143.6	92.4	102.4	-21	-51.2
341	Motor vehicles	17.37	5.44	11.97	24.45	-11.93	6.53
342	Bodies for motor vehicle	640.6	52.8	19.47	15.43	-587.8	-33.3
343	Parts for vehicles	-	-	21.31	42.54	-	-
352	Railways & tramways etc	1.23	1.48	5.05	7.55	0.25	3.57
359	Transport equip. n.e.c.	67.41	12.99	14.47	14.01	-54.42	1.48

M-L-T Industries							
231	Coke-oven products	7.32	0.06	0.28	3.09	-7.26	0.22
232	Refined petroleum prod.	1.22	12.46	18.67	45.75	11.24	6.21
233	Process of nuclear fuel	-	-	-	-	-	-
251	Rubber products	3.13	15.31	27.62	55.02	12.18	12.31
252	Plastic products	3.88	10.2	18.7	35.3	6.32	8.5
261	Glass & glass products	8.08	10.67	32.81	54.62	2.59	22.14
269	Non-metallic mineral	0.53	4.26	16.4	26.63	3.73	12.14
271	Basic Iron ore & steel	1.62	4.14	19.3	36.12	2.52	15.16
272	Basic&non-ferrous metal	0.18	21.82	22.2	53.4	21.64	0.38
273	Casting of metals	-	-	-	-	-	-
281	Structural metal etc.	0.17	5.87	12.9	19.64	5.7	7.03
289	Fabricated metal etc.	11.37	55.13	77.8	108.9	43.76	22.67
351	Building & repair of ships	0.06	55.97	18.87	253.6	55.91	-37.1

L-T Industries							
151	Prod. & process of meat.	0.7	42.23	68.32	69.1	41.53	26.09
152	Dairy products	3.15	0.18	1.91	9.98	-2.97	1.73
153	Grain mill products	1.13	14.84	19.14	39.93	13.71	4.3
154	Other food products	6.62	8.05	8.27	8.71	1.43	0.22
155	Beverages	0.03	4.3	2.92	3.66	4.27	-1.38
160	Tobacco products	4.09	5.23	3.5	6.47	1.14	-1.73
171	Spin, weaving of textiles	8.01	24.32	45.48	54.47	16.31	21.16
172	Other textiles	176.7	363.9	303.5	357.2	187.2	-60.4
173	Knitted & crochet fabrics	269.6	110.1	94.05	136.2	159.5	-16.05
181	Wearing apparel, not fur	7.97	448.9	318.4	339.7	440.93	-130.5
182	Dressing & dying of fur	606.5	3.97	1.46	4.96	-602.53	-2.51
191	Leather	64.3	195.2	191.8	239.1	130.9	-3.4
192	Footwear	26.6	108.1	111.5	160.1	81.5	3.4
201	Saw milling of wood	17.2	1.44	2.08	13.53	-15.76	0.64
202	Wood, cork& straw	8.82	9.4	16.12	27.58	0.58	6.72
210	Paper & paper products	0.29	1.24	7.95	18.5	0.95	6.71
221	Publishing	0.43	10.14	59.76	60.52	9.71	49.62
222	Printing	0.79	2.36	5.8	14.74	1.57	3.44
223	Reprod. recorded media	-	-	-	-	-	-
361	Furnishing	3.42	8.22	14.43	65.6	4.8	6.21
369	Manufacturing n.e.c. jewellery	2149.5	1433.2	852.95	512.02	-716.3	-580.25
Total Industries		114.6	62.58	44.1	60.6	-52.06	-1.97

Export intensity is total exports/ value of output*100.

Source: Calculated.

Data Source: EPWRF CD-ROM, 2004 and ASI (CSO), 2005, 06 and UN-COMTRADE.

Table 5 exports intensities have been calculated for the four individual years – 1980-81, 1990-91, 2000-01 and 2005-06 to know the proportion of exports made by the industries out of their total outputs. Further for comparative analyses, the growth in the export intensities for the pre-reform period (1980-81 to 1990-91) and for the post-reform period (1990-91 to 2005-06) is calculated (Table 5; columns 5 and 6).

The analysis shows that amongst the high technology industries, export intensities of all except two viz. electronic valves & tubes (321) and optical instruments (332) has increased in the post-reform period.

Amongst the medium-high technology industrial group, the export intensity of its 75% industries has increased in the post-reform period. Basic chemicals (241), man-made fibers (291), special purpose machinery (292), electronic motors (311) and electronic lamps (315) showed higher export intensity in the post-reform period (Table 8; column 6).

The case of the medium-low technology industrial group with respect to the export intensity shows a positive growth rate in the post-reform period. The export intensity of glass (251) and fabricated metals (289) being the highest in the sub-group.

The case of the low technology industries is bit different. The export intensity of a number of industries turns negative in the post-reform period as compared to the pre-reform period. Some of such industries are beverages (155), tobacco (160) and textiles (172,182). On the other hand, the export intensity of publishing (221) rose in the post-reform period. However, manufacturing n.e.c. jewellery (369) showed a comparative fall its export intensity in the post-reform period; but its overall export intensity is highest amongst all at all points of the survey.

Thus, the overall export intensity of all industries shows it fell massively in the pre-reform period, but in the

post-reform period export intensity still remained negative, although with a lower magnitude.

Conclusion and Policy Framework

The analyses in the study shows some positive signs of structural shift within the industries, but the change are too slow to relish upon. The slower trend growth rate of value added and exports witnessed in the post-reform period washes away the initial optimism depicted at the time of adopting these reforms. Moreover, the top slots of India's exports are still occupied by low-technology (L-T) and medium-low technology (M-L-T) industries.

To address these problems, the core problems need to be analysed. Firstly, the strategy adopted by India in 1991 (economic reforms) seem to fail in yielding the desired results. The slower trend growth rates of manufacturing sector, its exports, slower structural transformation - all are signalling that. Secondly, India has a very limited number of highly trained knowledge workers; poor infrastructure – in terms of power supply, roads, ports and airports (Dahlman, 2008).

Since, Indian prospect depend on 'dynamizing' the export structure (Lall, 2001), it requires the formulation of correct strategy. The policy framework for the manufacturing sector engulfing the heterogeneous industries should be unique for each industry concerned; ranging comprehensively from specific 'technology generating', 'technology acquiring', 'specific capability building approaches', and also 'specific export oriented policies'. For this a greater and healthy role of government is required. Thus, a correct mix of market and government (Stiglitz, 2006) should be formulated for each industry concerned, specifically for the high technology industries. Secondly, a greater amount of overall investment in infrastructure as well as in human capital and technology (Lall, 2001) is indeed required.

References

- Ahluwalia, I.J. (1985):** *Industrial Growth in India, Stagnation since the Mid-Sixties*, Oxford University Press, New Delhi.
- Ahluwalia, I.J. (1991):** *Productivity and Growth in Indian Manufacturing*, Oxford University Press, New Delhi.
- Ahluwalia, I.J. (2006):** 'Trade Liberalisation and Industrial performance A disaggregated view of Indian manufacturing in the 1990s', in Tendulkar, Mitra, Narayanan and Das (eds), *India: Industrialisation in a Reforming Economy, Essays for K.L. Krishna*, Academic Foundation, New Delhi, 271-304.
- Alexander, P.C. (1978):** *Report of the committee on Import-Exports Policies and Procedures*, Ministry of Commerce, Government of India.
- Boyce, J.K. (1986):** 'Kinked exponential Models for growth rate estimation', *Oxford Bulletin of Economics and Statistics*, Vol 48(4), 385-91.
- Chaudhuri, S. (2002):** 'Economic reforms and Industrial Structure in India', *Economic and Political Weekly*, Vol. 37. No.2, 155-162.
- Cimoli, M., Dosi, G. and Stiglitz, J. (2009):** 'The political economy of capabilities accumulation: The past and future of policies for industrial development' in Cimoli, Dosi, and Stiglitz (eds), *Industrial Policy and Development The political Economy of Capabilities Accumulation*, Oxford University Press, New York, 1-18.
- Dagli, V. (1979):** *Report of the Committee on controls and Subsidies*, Ministry of Finance, Government of India.
- Dahlman, C. (2008):** 'Technology, Globalisation and International competitiveness: Challenges for developing countries', in Connor and Kjölleström (eds), *Industrial Development for the 21st century*, Orient Longman, Zed Books and United Nations, Hyderabad, India, 8-29.
- Goldar, B. and Seth, V. (1989):** 'Spatial Variations in the rate of industrial growth in India', *Economic and Political Weekly*, 1237-40.
- Kumar, N. and Siddharthan, N.S. (1994):** 'Technology, firm size and export behaviour in developing countries: The case of Indian enterprise', *The Journal of Development Studies*, 31(2), 289-309.
- Lall, S. (2001):** *Competitiveness, Technology and Skills*, Edward Elgar, UK.
- Nagraj, R. (1997):** 'Industrial Policy and Performance since 1980 Which way now?', *Economic and political Weekly*, Vol 38, No.35.
- Nagraj, R. (2003):** 'What has happened since 1991? Assessment of India's Economic reforms', *Economic and political Weekly*, Vol 32. No.44-45.
- Nayyar (2008):** 'India's Unfinished Journey Transforming Growth into Development' in *Liberalization and Development*, Oxford University Press, New Delhi, 373-407.
- Nayyar, D. (1994):** *Industrial Growth and Stagnation The debate in India*, Oxford University Press, New Delhi.
- OECD (2007):** *Science Technology and Industry Scoreboard*, OECD, Paris.
- Pack, H. (1988):** 'Industrialization and trade', in H. Chenery and T.N. Srinivasan (eds), *Handbook of Development Economics*, Vol.1, North Holland, Amsterdam, 334-373.
- Roy, S.S. (2006):** 'Persistence in India's manufactured export performance', in Tendulkar, Mitra, Narayanan and Das (eds), *India: Industrialisation in a Reforming Economy, Essays for K.L. Krishna*, Academic Foundation, New Delhi, 349-370.
- Srinivasan, T.N. (1998):** 'India's export performance: A comparative analyses', in Ahluwalia and Little (eds), *India's Economic Reforms and Development Essays for Manmohan Singh*, Oxford University Press, new Delhi, 197-228.
- Stiglitz, J. (2006):** *Making Globalization Work*, Penguin, New York, US.
- Sutcliffe, R.B. (1971):** *Industry and Underdevelopment*, Addison-Wesley publishing company, London.
- Veeramani, C. (2007):** 'Sources of India's Export Growth in pre- and post-reform periods', *Economic and Political Weekly*, vol. XLII, No.25, 2419-2427.