

International Research Journal of Social Sciences\_ Vol. 4(5), 67-75, May (2015)

# India's Manufacturing Exports: Technology Intensity Transition

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> **Available online at: www.isca.in** Received 4<sup>th</sup> April 2015, revised 11<sup>th</sup> May 2015, accepted 14<sup>th</sup> May 2015

## Abstract

This paper seeks to capture the shift in the technology intensity of India's manufacturing exports in the post liberalized period. The study is based on the data extracted from UNCOMTRADE-WITS database (SITC REV-3). Further, OECD classification of manufacturing industries on technology intensity is taken into consideration. Using trade indicators (such as RCA), the analysis reveals a steady, albeit slow shift from low technology intensive exports to medium-low technology intensive exports in India. Though improvement was marked for the medium-high technology intensive exports, dominance of low technology intensive exports still persists. The major factors for the persistence of low technology intensive exports are low level of RandD in manufacturing sector, lack of skilled personnel, relatively low level of FDI and competitiveness. However, in case of high technology intensive export as a concern for the policy makers.

Keywords: Technology Intensity, Manufacturing, Exports, India, JEL Classification Codes: 014; L60; F14; R58.

## Introduction

The patterns of economic development are associated with structural changes in exports and expansion of export diversification worldwide<sup>1</sup>. In a globally competitive scenario, countries completely relying on exports of primary products face constraints in the long run development process. Negative trends in the secular terms of trade, uncertainty arising from price variability and the consequent fluctuating export earnings, difficulties in achieving economic diversification have all proven to be detrimental for such countries amid development challenges and low incomes (Samen,2010; Lal,2000)<sup>2</sup>. Thus with the development process, there is a shift from natural resource based and low technology intensive exports to medium and high technology intensive exports. With regard to developing countries' share in manufacturing exports and high tech exports Mani (2000)<sup>3</sup> showed that export structure of developing countries is increasingly moving towards technology-intensive products like capital goods. Given that India is progressive on the path of development, it is tempting to find out whether such trends are valid in Indian context as well.

In Indian context, the trade statistics do not simply support such an analysis. Exports of agriculture and allied products witnessed a decline in share from 19.4% in 1990-91 to 9.9% in 2010-11. This may be due to fact that, the self-reliance has been taken into consideration in the post-liberalized period. The share of manufacturing sector though increased during 1990-2000, but has been experiencing a declining trend since then. From being around 73% in 1990-91, the share of manufacturing exports rose steadily to almost 80% in 1999-2000. However the period from 2000 to 2011 marks a slowdown in its share in India's total merchandise exports. In 2010-11, manufacturing exports

constitute 61.5% of India's merchandise exports. As noted by Kumar and Gupta (2008)<sup>4</sup>, lack of focused approach in identifying, sustaining and building the country's competitive advantage; concentration of exports in low value categories and relatively poor inflow of foreign direct investment (FDI) especially in export oriented industries are responsible for relatively weak performance of India's manufacturing exports.

Here, the questions are: If not the share of manufacturing exports, has the composition of manufacturing exports undergone a change? Is it that with a development India's manufacturing exports are now more technology intensive? With these views, the paper seeks to capture the shift in the technology intensity of India's manufacturing exports in the post liberalized period.

The paper highlights the technology intensity of Indian manufacturing exports. The following sections focus on different aspects of the study. Section 2 presents an overview on the manufacturing exports of India. Section 3 provides empirical analysis and results of the study. Conclusion of the study and suggested policy implications follows in section 4.

The study very well recognizes that share of high tech products in exports is not necessarily associated with indigenous technological capabilities as pointed out by Srholec  $(2005)^5$ . This issue was also highlighted by Lall (2000) who suggests that a significant part of the high-tech industry outbreak in developing countries might be "something of a statistical illusion", as they specialize in labour-intensive processes within high-tech-intensive industries. Similarly, Mayer et al.  $(2002)^6$ also noted that the rise in high-tech exports from developing countries is largely because of their increased participation in labour-intensive segments of high-tech electronics in the context of international production sharing. Despite these reservations, however, this study focuses on the structure of exports without further concerns.

#### **Overview of India's Manufacturing Exports**

Manufacturing exports constitute the lion's share of merchandise exports of countries globally. Similarly, in case of India the dominance of manufacturing exports can be clearly visible. Manufacturing exports has always been a major contributor in India's total merchandise exports. However, as depicted in figure 1, its share declined substantially over the period 2000-01 to 2007-08 from above 76 per cent to 59 per cent. The share went up marginally thereafter, and is about to 61.5 per cent in 2010-11. The decline is largely attributable to the emergence of petroleum products (not covered under manufacturing) as one of the major items of merchandise exports for India in recent years. In contrast, in the case of Republic of China the share of manufacturing in total merchandise exports is 93 per cent (Planning Commission,  $2012)^{7}$ .

Exports in the manufacturing sector have not been able to make a major impact on the global scale. This is evident from comparison of India's position with its peer emerging economy China. While India's share in world manufacturing exports increased from 0.6 percent to 1.4 percent between 2000 and 2009, China tripled its contribution from 3.2 percent to over 10 percent in the same period (Planning Commission, 2012). India's share in global merchandise exports, in general, and manufacturing exports, in particular, though rising, has been not reflective of her economic strength and potential. The probable reasons may be the relatively slower rate of growth of manufacturing production, the low share of high tech exports, poor transport infrastructure and insufficient information with manufacturing about procedures and regulations of various countries affecting Indian exporters.

Recent Trends in Sectoral Composition of India's Manufacturing Exports: Manufacturing exports grew by a compound annual growth rate (CAGR) of 16.2 per cent during the first four years of XI five year plan (2007-08 to 2010-11). Engineering products emerged as the most dynamic sector with its share in total manufacturing exports increasing from 35 per cent in 2007-08 to 39.8 per cent in 2010-11. The sector has also registered accelerated growth during the first quarter of 2011-12. The second major contributor to India's manufacturing export performance is Gems and Jewellery, with a share of 22.2 per cent. Textiles are at the 3<sup>rd</sup> place accounting for around 13.9 per cent in the total manufacturing exports, a fall from over 17.8 per cent in 2006-07(Planning Commission, 2012). The top four items in India's manufactured exports are engineering goods, gems and jewellery, chemicals and related products, and textiles (Economic Survey, 2011-12)<sup>8</sup>. Since 2007-8, electronic goods have displaced leather and manufactures from fifth place with the share of the former increasing and the latter decreasing. There has been a gradual shift in India's manufacturing exports from labour-intensive sectors like textiles, leather and manufactures, handicrafts, and carpets to capital- and skill intensive sectors (Economic Survey, 2011-12).



Figure-1 Share(%) of manufacturing in total merchandise exports of India

Engineering goods exports has seen an almost steady rise in shares from 1999-2000 to the first half of 2011-12 and high growth rates of 84 per cent and 43.6 per cent in 2010-11 and the first half of 2011-12 respectively mainly due to the high growth rates of two major items machinery and instruments and transport equipments besides residual engineering items with very high growth rates. The major markets for Indian engineering exports in 2010-11 were China, the USA, the UAE, Singapore, Saudi Arabia, South Africa, Germany, Sri Lanka, and the UK. All these markets showed tremendous export growth with China tops at 409 per cent (Economic Survey, 2011-12).

With the highest growth rate among manufactures at 58.4 per cent in the first half of 2011-12, gems and jewellery, the second major export item, has retained its share of around 16-17 per cent since 2000-1. In 2010-11, this sector accounted for 14.7 per cent of India's total merchandise exports. India is the largest cutting and polishing centre for diamonds in the world. Of the global polished diamond market, India's share is estimated to be 70 per cent in terms of value, 85 per cent in terms of volume, and 92 per cent in terms of pieces. As per the Gem and Jewellery Export Promotion Council (GJEPC), this sector as a whole supports about 34 lakh jobs. The gems and jewellery manufacturing sector consists of large number of small and medium enterprise (SME) units, employing skilled and semi-skilled labour, almost entirely in the unorganized sector (Economic Survey, 2011-12).

The share of chemicals and related products has fallen marginally over the years mainly because of the fall in shares of basic chemicals, pharmaceuticals, and cosmetics. The growth in 2010-11 and the first half of 2011-12, however, have been higher by 26.5 per cent and 34.2 per cent respectively. The steady fall in share of the textiles sector to single digits since 2000-01 is mainly due to a fall in shares of ready-made garments and cotton, yarn, fabrics, made-ups, etc. Clearly, India has not been able to utilize the opportunity provided by the phasing out of the Multi Fibre Agreement (MFA) in 2005. The rise of the electronics sector, though long overdue, is a welcome sign. This is due to the recent policies of the government to help this sector like including many electronic items in the Focus Product Scheme and customs duty exemption to many electronic components. The Tsunami in Japan which led to disruption of supply chains in Japan could also have benefitted India at a time when support measures were taken by India for this sector (Economic Survey, 2011-12).

**India's Technology Intensive Manufacturing Exports:** It is evident from the table 1 that the share of low-tech exports has declined from 34.19% in 1990 to 14.63% in 2011. There is a shift to medium-low and medium high tech exports.

 Table-1

 India's Technology Intensity Exports (% shows)

India's Technology Intensity Exports (% share)					
Year	НТ	L	MH	ML	
1990	6.69	34.19	19.41	39.70	
1991	6.55	35.52	20.86	37.07	
1992	5.12	35.54	17.62	41.72	
1993	5.47	32.47	16.97	45.09	
1994	5.64	34.80	18.24	41.32	
1995	6.41	32.94	19.13	41.52	
1996	6.94	34.49	21.01	37.56	
1997	7.15	33.94	20.84	38.07	
1998	6.36	32.06	20.53	41.05	
1999	6.21	29.48	19.19	45.12	
2000	6.24	29.19	20.39	44.19	
2001	7.83	29.48	22.63	40.06	
2002	7.45	27.07	22.29	43.18	
2003	7.51	24.22	23.31	44.96	
2004	7.03	22.89	25.78	44.31	
2005	6.41	20.28	27.88	45.43	
2006	6.90	19.10	30.13	43.87	
2007	7.77	17.72	29.63	44.88	
2008	8.94	15.73	32.25	43.08	
2009	13.62	14.47	30.60	41.31	
2010	9.93	15.09	29.80	45.18	
2011	11.89	14.63	28.46	45.02	

Source: Authors calculation from WITS UNCOMTRADE database<sup>11</sup>

The major share among all technology intensive exports is in medium-low category (45.02 in 2011) and it is showing an increasing trend. The share of medium-high tech exports is increasing (19.41 in 1990 to 28.46 inn 2011), showing an improvement. Though the share of high tech exports is showing an increasing trend, its share is very low (only 11.89 % in 2011) compared to other tech exports (figure 2).

India's High-tech Exports vis-à-vis Top 10 high-tech Exporters: The World Bank data shows that the high-tech export consist a small share in India's manufacturing exports. India is yet to cross the mark of 10 percent when it comes to high technology manufacturing exports. India's weak performance in this area can be gauged from the fact that in 2010 only 7.2 percent of India's manufacturing exports were from high technology category against China's 27.5 percent. The interesting fact is that the country specializing most in high-tech exports is the Philippines, where roughly 65% of its exports fall into the high-tech category. Other outliers include Malta, Singapore, Malaysia, Taiwan and Ireland, where high-tech products account for more than a third of exports (figure 3).

In fact a handful of typical examples of latecomer countries, such as Korea, Thailand, Costa Rica, Mexico and Hungary also perform quite well in the high-tech area. Looking at the specialization in high-tech exports, one could easily conclude that many developing countries have been extremely successful in catching up technologically and have even overtaken the United States, Japan and the EU in terms of the technological intensity of their economies (Srholec, 2005). However India seems to be seriously lagging behind in this area as share of high tech exports is only marginally increasing over the years and in fact registered a fall of around 2 percent during 2009-2010. Low levels of FDI and RandD and inadequate infrastructure could be the reasons for underperformance of India in the area of technology intensive manufacturing exports.

**Empirical Analysis:** The study considers India's top 30 major manufacturing importer countries in the period 1990-2011: United States of America (USA), United Arab Emirates (UAE), China, Singapore, Belgium, Germany, United Kingdom, Italy, Sri Lanka, Netherlands, Indonesia, Turkey, South Africa, Nigeria, Israel, Brazil, Saudi Arabia, Republic of Korea, Thailand, Malaysia, Japan, France, Bangladesh, Spain, Egypt, Australia, Russian Federation, Iran, Brunei Darussalam and Bahamas. The Tradesift analysis concluded that these countries have the largest share in total manufacturing exports of India.

Data on manufacturing exports are from the United Nations "COMTRADE" database. The nomenclature used for the manufacturing industries is SITC REV-3 at 3-digit level. The manufacturing exports are also ordered into four groups of different technological intensities, according to the OECD

classification: low technological exports, medium-low, medium-high and high technology intensive exports.

Revealed Comparative Advantage (RCA): The study applies the trade indicator RCA which reveals the comparative advantage of countries worldwide to analyze the technological intensity of manufacturing exports of India. RCA uses the trade pattern to identify the sectors in which an economy has a comparative advantage, by comparing the country of interests' trade profile with the world average. Manufacturing industries listed in the Appendix, classified into four categories (high technology (HT), medium-high technology (MH), medium-low technology (ML) and low technology (L)) on the basis of technology intensive exports from 1990 to 2011 (table 2). The index of RCA is greater than one for 133 manufactured products selected from WITS UNCOMTRADE (SITC Rev-3) on the basis of OECD classification indicating that India holds comparative advantage in these products in the world market.

At the disaggregated level, average RCA is calculated for all 133 manufacturing commodities exported by India to the world during 1999-2011. The index values suggest that India's comparative advantage is focused in sectors like Pearls/precious stones. Leather manufactures. Floor coverings, made up textile articles, Cotton Fabrics/woven, organic compounds, and pig iron etc. The commodity with the maximum comparative advantage is identified as Pearls/precious stones which is medium low technology intensive manufacturing exports. High technology intensive exports have lowest average RCAs (less than 0.5) in the selected period relative to RCAs of other classifications. Contrarily, low technology intensive exports have average RCAs ranges 1-3.5. However, the trend of RCAs in low technological intensive exports is decreasing from 3.5 in 1990 to 2 in 2011. Figure 4 clarifies the trend of average RCAs in each category during 1990-2011. Manufacturing exports of medium low and medium high technology intensive shows an increasing trend from 1900 to 2011; moving from 0.8 to 1.50 and 0.4 to 1, respectively.

The analysis shows a steady, albeit slow shift from low technology intensive exports to medium-low technology intensive exports in India; the average RCA of low technological intensive manufacturing exports are decreasing in absolute terms and losing ground from 2001 with a peak in 2000 at 3.5, while the line graph of average RCA of medium low technological intensive manufacturing exports hovering around 1 and heading in a positive direction. Further, the medium-high technology intensive manufacturing exports also mark improvements from 2005; increasing at a higher pace amid global worries. However, the dominance of low technology intensive exports still persists in the manufacturing exports of India (highest average RCA, 1.9 in 2011).



Source: Authors calculation from WITS UNCOMTRADE database

Figure-2 India's Technology Intensive Manufacturing Exports



Source: WDI, World Bank, 2012<sup>12</sup>

Figure-3 India's High-tech Exports (% of Manufactured Exports) vis-à-vis Top 10 High-tech Exporters

Avelag	Manufacturing evo	orts		
Year	НТ	I I	MH	MI
1990	0.43	3 37	0.44	0.83
1990	0.43	3.56	0.44	0.09
1992	0.32	3.30	0.40	1.16
1992	0.32	2.95	0.41	1.10
1993	0.32	3.20	0.40	1.23
1995	0.34	3.04	0.44	1.17
1996	0.30	3.04	0.43	1.17
1997	0.41	3.10	0.52	1.12
1998	0.37	3.24	0.55	1.24
1999	0.35	3.25	0.55	1.21
2000	0.35	3.45	0.62	1 39
2000	0.36	3.45	0.62	1.32
2001	0.33	3.06	0.68	1.32
2002	0.33	2 77	0.70	1.51
2003	0.28	2.68	0.71	1.15
2004	0.26	2.00	0.75	1.41
2005	0.26	2.34	0.80	1.55
2000	0.28	2.49	0.30	1 33
2007	0.33	2.39	0.81	1.33
2009	0.35	1.98	0.69	1.34
2010	0.33	2.10	0.09	1 33
2010	0.38	1.88	0.64	1.25

 Table-2

 Average RCA of Manufacturing Exports of India from 1990-2011

Source: Authors' calculation from WITS UNCOMTRADE database (SITC REV-3)

![](_page_5_Figure_5.jpeg)

Source: Authors calculation from WITS UNCOMTRADE Database

Figure 4

#### Average RCA of Manufacturing Exports (SITC REV-3) of India from 1990-2011

### Conclusion

The study is based on the data extracted from UNCOMTRADE-WITS database (SITC REV-3). Further, OECD classification of manufacturing industries based on technology intensity is taken into consideration. RCA trade indicator has been used to analyze the revealed comparative advantage of the technology intensive exports.

The analysis reveals a steady, albeit slow shift from low technology intensive exports to medium-low technology intensive exports in India. Though improvement was marked for the medium-high technology intensive exports, dominance of low technology intensive exports still persists. The major factors for the persistence of low technology intensive exports are low level of RandD in manufacturing sector, relatively low level of FDI and competitiveness. However, in case of high technology intensive manufacturing exports, India still lags behind. The study highlights incentivizing high technology intensive export as a concern for the policy makers.

It is important to focus not only on so called 'high-tech' category exports, but also on medium-tech exports to promote the technology intensity of India's manufactured exports. Further, it is necessary to enable policy thrust to link up the manufacturing firms with required technology infrastructure. Government should take initiative of providing support for in-house RandD efforts that would help manufacturing industries to reach global market. In Indian manufacturing, high-tech industries are contributing less than their potential. Therefore, high technology intensive manufacturing products should get into India's export basket. Policy incentive should facilitate participation of high technology intensive manufacturing industries in global production and technology networks.

Policy efforts should be given to improve RandD expenditure, skill enhancement, more innovation activities, and more liberalize FDI inflows into India. India to derive maximum growth centric advantage through Science and Technology (SandT), its science and technology fundamentals have to be strong and excellent. Study suggests that, reforms would be required for the expansion of manufacturing sector with an aim of huge employment generation and value addition to the Indian economy.

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Technology Classification of Commodities at 3 Digit Level						
Code	Commodities at 3 digit level	Classification	Code	Commodities at 3 digit level	Classification	
511	Hydrocarbons/derivatives	MH	679	Iron/steel/pipe/tube/etc.	ML	
512	Alcohols/phenols/derivatives	MH	682	Copper	ML	
513	Carboxylic acid compound	MH	683	Nickel	ML	
514	Nitrogen function compounds	MH	684	Aluminum	ML	
515	Organic-inorganic compounds	MH	685	Lead	ML	
516	Other organic compounds	MH	686	Zinc	ML	
522	Elements/oxides/hal. salt	MH	687	Tin	ML	
523	Metal salts of inorganic acids	MH	689	Misc. non-ferrous based metal	ML	
524	Other inorganic chemical	MH	691	Iron/steel/alum. Structures	ML	
525	Radio-active etc. materials	MH	692	Metal store/transport cont.	ML	
531	Synth org colour agents	L	693	Wire-production exc. Ins electro.	ML	
532	Dyeing/tanning extracts	L	694	Nails/screw/nuts/bolts	ML	
533	Pigments/paints/varnish	L	695	Hand/machine tools	ML	
541	Pharmaceuticals excluding medicaments	HT	696	Cutlery	ML	
542	Medicaments include vet	HT	697	Base metal hold equipment	ML	

Table-3 Technology Classification of Commodities at 3 Digit Level

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551	Essent.oil/perfume/flavr	MH	699	Base metal manufacture n.e.s	ML
553	Perfume/toilet/cosmetics	MH	711	Steam generating boilers	MH
554	Soaps/cleansers/polishes	MH	712	Steam/vapour turbines	MH
562	Manufactured fertilizers	MH	713	Internal combust engines	MH
571	Primary ethylene polymer	MH	714	Engines non-electric n.e.s	MH
572	Styrene primary polymers	ML	716	Rotating electro plant	MH
573	Vinyl chloride etcpolym	ML	718	Power generating equipment n.e.s	MH
574	Polyacetals/polyesters	ML	721	Agriculture machine ex tractor	MH
575	Plastic nes-primary form	ML	722	Tractors	MH
579	Plastic waste/scrap	ML	723	Civil engineering plant	MH
581	Plastic tube/pipe/hose	ML	724	Textile/leather machinery	MH
582	Plastic sheets/film/etc	ML	725	Paper industry machine	MH
583	Monofilament rods/sticks	ML	726	Printing industry machine	MH
591	Household/garden chemical	MH	727	Food processing machines	MH
592	Starches/glues/etc.	MH	728	Special industry machines	MH
593	Explosives/pyrotechnics	MH	731	Mach-tools remove materials	MH
597	Oil etc additives/fluids	MH	733	Mtl m-tools w/o mtl-rmvl.	MH
598	Misc chemical prods n.e.s	MH	735	Metal machine tool parts	MH
611	Leather	L	737	Metalworking machine n.e.s	MH
612	Leather manufactures	L	741	Industry heat/cool equipment	MH
621	Materials of rubber	ML	742	Pumps for liquids	MH
625	Rubber tyres/treads	ML	743	Fans/filters/gas pumps	MH
629	Articles of rubber n.e.s	ML	744	Mechanical handling equipment	MH
633	Cork manufactures	L	745	Non-electrical machines n.e.s	MH
634	Veneer/plywood/etc.	L	746	Ball/roller bearings	MH
635	Wood manufactures n.e.s	L	747	Taps/cocks/valves	MH
641	Paper/paperboard	L	748	Mech. transmission equipment	MH
642	Cut paper/board/articles	L	749	Non-electro	MH
	1 1			parts/accessories/machines	
651	Textile yarn	L	751	Office machines	HT
652	Cotton fabrics, woven	L	752	Computer equipment	HT
653	Man-made woven fabrics	L	759	Office equip. parts/accessories	HT
654	Woven textile fabric n.e.s	L	761	Television receivers	HT
655	Knit/crochet fabrics	L	762	Radio broadcast receiver	HT
656	Tulle/lace/embr./trim etc.	L	763	Sound/TV /recorders etc.	HT
657	Special yarns/fabrics	L	764	Telecomm equipment n.e.s	HT
658	Made-up textile articles	L	771	Elect power transmission equip	MH
659	Floor coverings etc.	L	772	Electric circuit equipment	MH
661	Lime/cement/construction material	ML	773	Electrical distrib. equipment	MH
662	Clay/refractory material	ML	774	Medical etc./ all diagnostic	MH
				equipment	
663	Mineral manufactures n.e.s	ML	775	Domestic equipment	MH
664	Glass	ML	776	Valves/transistors/etc.	MH
665	Glassware	ML	778	Electrical equipment n.e.s	MH
666	Pottery	ML	781	Passenger cars etc.	MH
667	Pearls/precious stones	ML	782	Goods/service vehicles	MH
671	Pig iron etc. /ferrous alloy	ML	783	Road motor vehicles n.e.s	MH
672	Primary/prods iron/steel	ML	784	Motor vehicle parts/access	MH
673	Flat rolled iron/steel products	ML	785	Motorcycles/cycles/etc.	MH
674	Rolled plated m-steel	ML	786	Trailers/caravans/etc.	MH
675	Flat rolled alloy steel	ML	791	Railway vehicles/equipment	MH
676	Iron/steel bars/rods/etc.	ML	792	Aırcraft/spacecraft/etc.	HT
677	Iron/steel railway materials	ML	793	Ships/boats/etc.	ML
678	Iron/steel wire	ML			

Source: OECD, "ISIC REV. 3 technology intensity definition<sup>9</sup>,"