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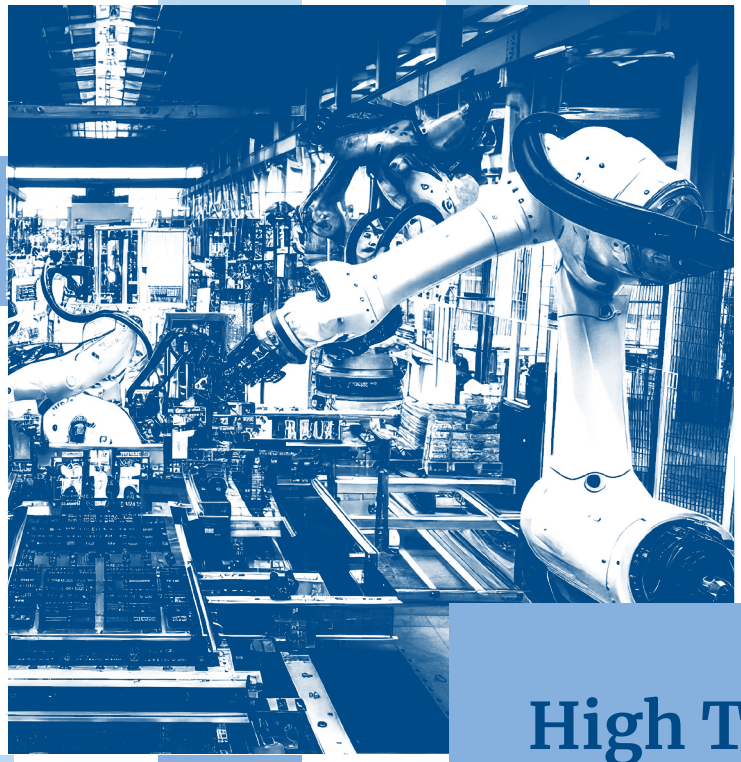

High Technology Manufacturing in India

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Introduction

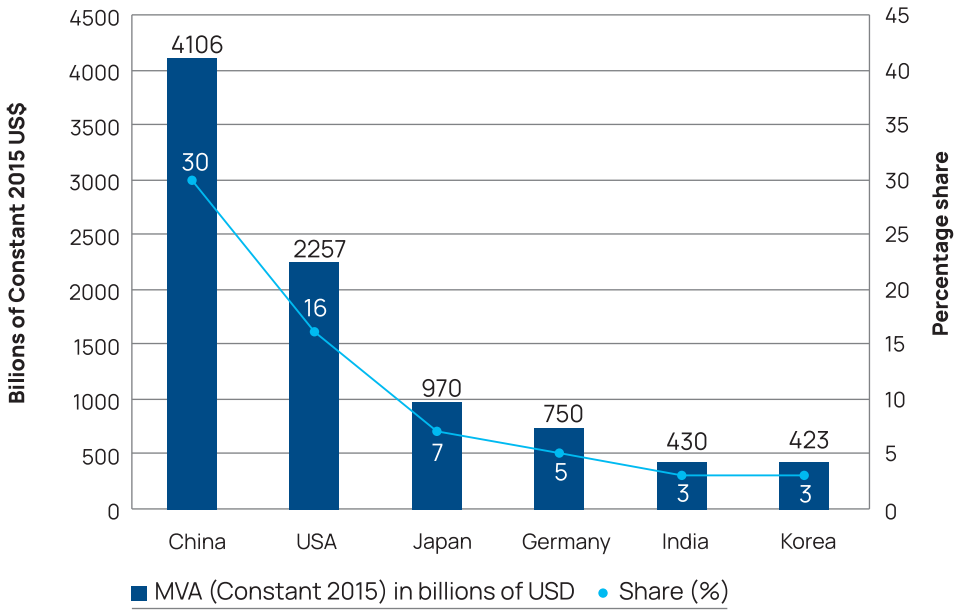
India is one of the largest but late industrializing countries in the world. From around 2006 or so, the country has been striving to industrialize through the manufacturing route as growth driven by the manufacturing sector has several long-lasting economic benefits. First of all the manufacturing sector has much more linkages with the other two sectors of the economy, namely the primary and tertiary sectors. Second, most of the innovations that are used in the primary and tertiary sectors emanate from the manufacturing sector. For these reasons and more countries across the world including that of India are on a conscious drive to increase the size and technical content of its manufacturing sector. The manufacturing sector in turn consists of several disparate industries. One way of grouping them is in terms of their respective employment content and another way is to group them according to their technical content. Although the manufacturing sector in most developing countries is supposed to be dominated by labour-intensive or low technology industries, the current emphasis is on growing the share of high technology industries. This emphasis on high technology manufacturing is for three specific reasons at least. First, high technology industries have very high levels of productivity, both capital and labour. So even if their share is small, their contribution to the GDP of the country is expected to be much larger. Second, high technology industries have much better linkages with downstream and upstream industries as most high technology manufactured products are based on an assembly of components. So, their multiplier effects on growth in the region where they are located are supposed to be much higher. Third, world trade in manufactured products is dominated by high technology products (Mani, 2004; Lall, 1998) and if a country wants to increase its share of exports, it must encourage the production of high technology manufactures. Given the capital-intensive nature of production, use of very often-proprietary technology, high failure rates etc., the role of the state in high technology products is very well accepted. Even in advanced countries such as the USA or Japan, where the market is perceived to be more efficient in the allocation of resources, high technology production has been supported through concerted state intervention. For instance, the role of the state in the SEMATECH project in the USA or the VLSI one in Japan is now very well accepted as the main reason for the supremacy of both the USA and

Japan in semiconductor production. Having successfully achieved its original target, the programme is now moving towards the development of other high technology industries such as biomedicine, cybersecurity and alternative energy. The specific way in which the state intervenes in the development of high technology industries can vary in terms of its content. There are at least three ways in which the state intervenes. The first mode is a direct one in which the state establishes a state-owned enterprise (SOE) which then manufactures the high technology product. The second mode is for the state to establish a public R&D programme either exclusively or in partnership with the market, develop the high technology and then transfer it to production enterprises whether owned by the state or the private sector. The third mode is for the state to craft the ecosystem for high technology production by having explicit policies and instruments for this to be developed by both public and private sector enterprises. Most industrializing countries such as India have used all the three modes. Modes 1 and 2 were very popular in the pre liberalization phase while Mode 3 is the preferred one in the post-liberalisation phase characterised by paring down of state intervention in economic activities

The growing importance of high technology manufacturing

In 2015, India emerged as the fifth largest manufacturer in the world defined in terms' her share in world Manufacturing Value Added (MVA). The small size of India's manufacturing sector can be inferred from the fact that in terms of her share in World MVA, India's manufacturing sector is only as big as that of Korea's and only about 10 percent of China's. Even within her GDP, according to the latest estimates for 2018-19 by the CSO, the share of the manufacturing sector in overall GDP works out to about 18.1 percent (Central Statistical Organization, 2020). The government is pursuing a strategy for increasing both the share of manufacturing and an improvement of its technology content through several high-profile strategies the most recent version of it is the "Make in India" strategy announced in 2014. The recently announced Atmanirbhar package further seeks to increase both the size and content of her manufacturing sector.

Figure 1 Manufacturing Value Added of India in Comparison with Other Leading Countries, 2019 (Constant 2015 in Billions of USD)



Source: Extracted from UNIDO INDSTAT 2 2020, ISIC Revision 3 database, https://stat.unido.org/database/INDSTAT%202%202020,%20ISIC%20Revision%203 (accessed on October 27, 2020)

For quite some time, and precisely since the start of the current millennium, India has been trying to shore up its small manufacturing sector both in terms of its size and in terms of its technological content. There are two visible manifestations of this "growing high technology manufacturing industry' strategy. First, several policy statements about specific high technology manufacturing sectors have been enunciated. Examples of this are the Aerospace manufacturing (contained in the civil aviation), Automotive, Biotechnology, Chemical, Electronics and telecommunications, Pharmaceutical, Semiconductor policies announced from time to time during the period. Second is the growing importance of high technology products in both the gross value added and exports of the manufacturing sector.

The growing importance of high technology products in India's manufacturing value-added

It is interesting to note that high technology manufactures account for about 55 percent of gross value added of the manufacturing sector. Unfortunately, lack of availability of consistently disaggregated data for earlier periods are not available and so one cannot track how much of an improvement in the high technology intensity of domestic manufacturing has taken place. Further our way of defining the high technology sector does fully correspond to the OECD definition. and so we do not foresee any overestimation of high-tech output. This means that India's manufacturing sector has a high share of technology-intensive industries such as chemicals in general, pharmaceuticals, automotive and machinery and equipment in general. In terms of ranking within the high technology sector, automotive and pharmaceuticals are the top two sectors. India is already well known the world over for its pharmaceutical industry which is very often referred to as the pharmacy of the developing world. Given the ongoing pandemic, India has a very important role to play both in terms of vaccine development and manufacturing and also in generic versions of therapeutic drugs. She has already a reputation as a hub for making compact cars and stands a good chance for becoming a hub for the manufacture of Electric Vehicles (EVs).

However, most of the high technology products are targeted at the domestic market and as we can see from the next section that India's high technology intensity (high tech exports measured as a percentage of manufactured exports) although doubled itself over time is still less much less compared to other high technology promoting countries such as that of China.

Table 1 Share of High Technology Products in Total Manufactured Products (Values are in Rs in Crores; Based on Gross Value Added in Constant 2011-12 Price)

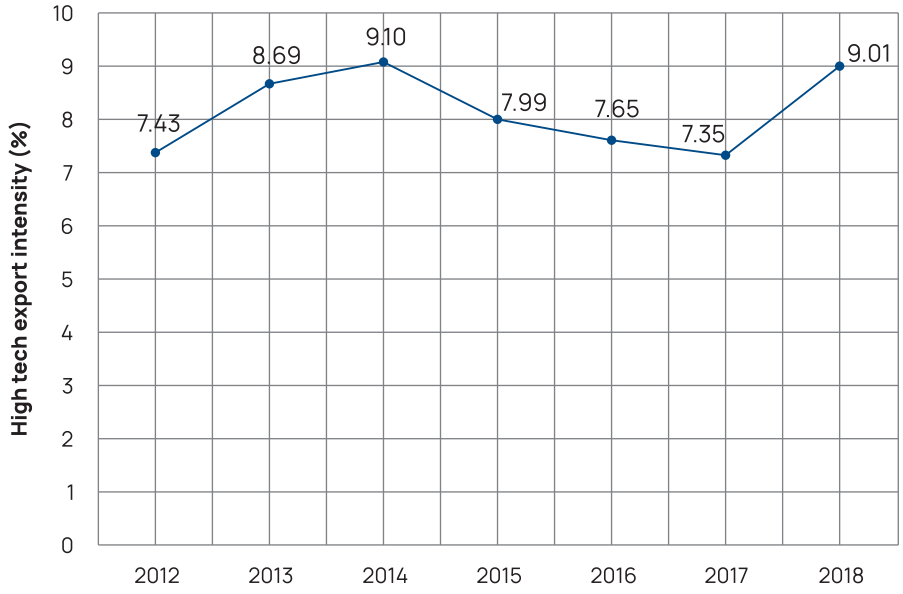
	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
Manufacture of transport equipment	147452	134846	165994	217971	233723	244065	263000
Manufacture of pharmaceutical; medicinal chemicals and botanical products	81284	93090	98406	110119	131359	134332	144163
Manufacture of optical and electronics products n.e.c	7146	6784	7846	11528	12013	13156	14395
Manufacture of machinery and equipment n.e.c	115054	97404	107335	113922	138626	159962	169864
Manufacture of electronic component, consumer electronics, magnetic and optical media	15341	17255	16125	15165	18238	16021	18289
Manufacture of electrical equipment	52646	51948	50636	53286	51552	76170	81593
Manufacture of computer, electronic & optical products	31679	37164	33107	45208	51678	50957	55328
Manufacture of computer and peripheral equipment	4441	7980	4823	6033	6471	7215	7556
Manufacture of communication equipment	4751	5145	4312	12482	14956	14566	15088
Manufacture of coke & refined petroleum products	142618	150254	218515	253450	231418	230452	211743
Manufacture of chemical and chemical products except pharmaceuticals, medicinal and botanical products	116682	112375	115005	119330	122965	124171	142679
Total High Tech	719094	714245	822104	958494	1012999	1071067	1123698
Total Gross Value Added	**1288919**	**1346108**	**1468900**	**1643539**	**1803931**	**1928554**	**2042267**
Share of High Tech (in %)	55.8	53	56	58.3	56.1	55.5	55

Source: Central Statistical Organization (2020)

The growing importance of high technology products in India's manufactured exports

As a late industrializing country, deficient in both disembodied technology and management and organizational skills, India's export basket was to a large extent dominated by labour-intensive manufacturers such a cotton textile, ready-made garments, gems and jewellery and leather and leather manufactures. However, India's export basket has slowly undergone a qualitative change with more high technology products taking a discernible position in it. The high technology product intensity has been increasing over the years and in 2018 stood at around 9 percent of all manufactured exports. In value terms, it has been growing at a rate of 17 percent per annum during this period. The growing importance of high technology production is evident even in Indian patenting abroad as almost the entire patents granted to Indian inventors at the USPTO, during the same period is in high technology areas such as pharmaceuticals and the computer-implemented inventions (Mani, 2020).

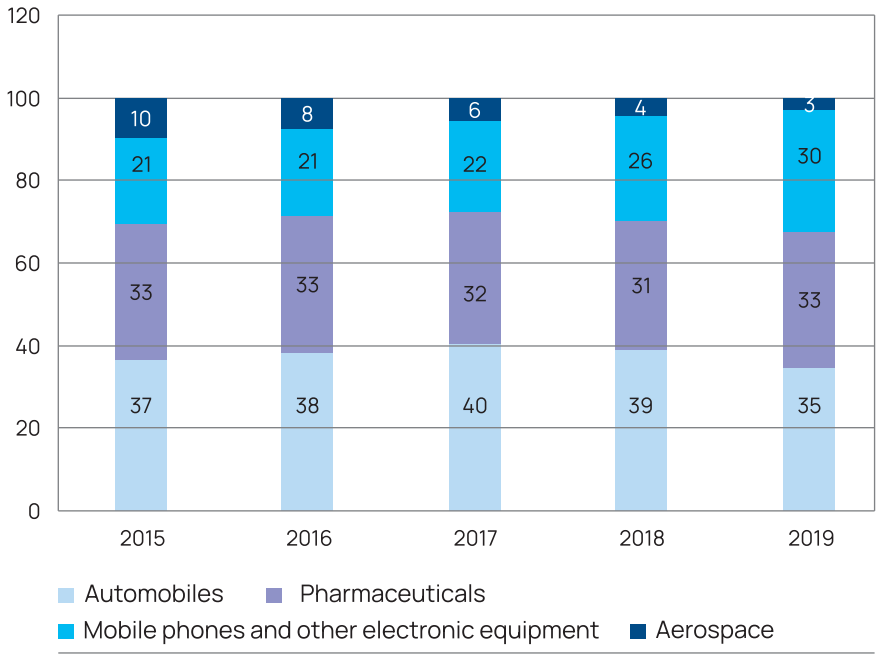
Figure 2 Increasing High technology export intensity, 2012-2019



Source: World Bank (2020)

High technology exports from India are driven by four items, namely automobiles, pharmaceuticals, mobile phones and other electronic equipment and parts and aerospace. Of these four, exports of three of them have been increasing (although there is a decline in aerospace exports since 2015). Exports of mobile phones have been steadily declining. However, India has a consistently positive trade balance in only three of them namely aerospace, automobiles and pharmaceuticals, while it has a growing negative trade balance in mobile phones. This is a bit counter-intuitive as India had a long strategy of developing local technological capability in telecommunications equipment where a considerable amount of state investments in manufacturing and R&D were done. Further with a total subscriber strength of nearly 1 billion telephone subscribers and growing India has one of the largest markets in the world for telecommunications equipment but it has virtually no serious manufacturer of telecom equipment, but only assemblers of equipment based on imported components. It was seen that gross value added to the gross value of output ratio is very low in the case of this industry (Mani, 2020).

Figure 3 Exports of high technology products- disaggregated from 2015 through 2019



Source: ITC Trade Map-International Trade Statistics, http://www.trademap.org/tradestat/Product_SelCountry_TS.aspx?nvpm=1|699|||TOTAL|||2|1|1|1|2|2|1|1|1|1| (accessed on October 27, 2020)).

Of these four industries, only the success achieved in the pharmaceutical industry has merited any detailed attention. Although there are some studies available on the automobile and telecommunications equipment industries, there are, practically, no studies on the aerospace industry in the country. While the role played by the policy on patents in explaining the growth of India's pharmaceutical industry has been debated, the role of public policies in shaping the growth trajectory of the other three high technology industries has hardly attracted any attention in the scholarly literature. In fact, in India, there has been an erroneous tendency to equate high technology with luxury consumption goods which are hardly suited for the bulk of the consumers with very low purchasing power. But as recent events and discussions have shown rather conclusively that each of these four high technologies has made a perceptible difference to the living conditions of an average Indian citizen. For instance, having a successful and innovative generics drug industry has made many lifesaving drugs at affordable prices and especially in times of the current coronavirus pandemic, having one of the cheapest telecommunications services and indeed equipment (although much of the latter is imported) has increased the affordability of telecommunication services and reduced the rural-urban digital divide by a significant amount. Likewise having a successful aerospace industry has increased communications services and have increased the diffusion of telemedicine and education in unreachable physical locations. This has again become very relevant in times of the current pandemic where almost the entire school and higher education is now conducted online. Further, having a domestic automobile industry has increased both the movement of passengers and goods across large tracts of the country. In other words, the growth of high technology industries has gone towards improving the quality of life of an Indian citizen.

1 See the OECD definition at https://wayback.archive-it.org/5902/20150701011436/http://www.nsf.gov/statistics/seind93/chap6/doc/6s193.htm (Accessed on October 26, 2020)

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