Article

Technological Intensity of Indian Exports and the Performance of Emerging Asian Economies

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Abstract

The increasing share of technological-intensive products in the world trade has recognized technology and technological capabilities as a major factor for competitiveness and growth. Notably, the emerging countries are progressively becoming the exporters of the products that are technologically more intensive. Thus, the current study presents an analysis of Indian exports and the performance of emerging Asian economies in terms of technological intensity over the period 1980–2016. The study shows that the exports of all the said emerging economies have a large technological base owing to their significant investments in R&D and open-door policies. While, the figures of India also show a steady though slow technological upgradation from low-tech to medium-tech and high-tech exports but when compared to the standards of these emerging economies, they are low. Thus, in order to increase the technological intensity of its exports, there is a need to invest more in high-tech and medium-tech R&D activities and overcome the technological barriers. There is also a need to devise the policies that would make a favorable environment for attracting more outward-oriented foreign direct investment (FDI).

Keywords

Trade, FDI, R&D, technology, India

Introduction

The importance of trade, as an economic activity and an engine of economic growth, has long been constituted in respective research endeavors (Frankel & Romer, 1999; Maity, 2013; Mishra, Lundström, & Anand, 2011; Samen, 2010). The trade-based economy is also found as the most predominant pattern of economic growth (Kim, 2014). However, in the present era of

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globalization, understanding the performance of trade went beyond the parameters of comparative advantage epitome and emphasized the role of technology in determining international competitiveness, as competition became more innovation and knowledge based (Dueñas-Caparas, 2006). Early trade theorists like David Ricardo accented on the relative labor productivity differentials as the basis of trade and indicated that each country has a comparative advantage. This belief was extended in the model of Hecksher-Ohlin, where countries were subject to have two factors of production (labor and capital) and face identical production functions but with different factor endowments. Technology in these two models has been treated either as having no bearing on the process of production and trade or at no charge (Sen, 2010). However, the proponents of neotechnology trade theory modified these views and emphasized the role of technological innovation in conferring cost advantages and creating new markets. "Technological gap" approach of Posner (1961) and "product life cycle" (PLC) by Vernon (1970) provides a theoretical analysis of these issues. This is because technological innovation intends to build dynamic comparative advantage through new methods of production or new products (Mardas, 1994). The sustainable development goal nine, that is, *build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation*, embraced on September 26, 2015, also entails that without innovation and technology, industrialization will not take place and without industrialization, development will not take place (FAO, 2017). Further, the new technologies are based on extensive arenas of scientific research and are likely fueling the next beckon of global economic growth.

The increasing share of technological-intensive products in the world trade has recognized technology and technological capabilities as a major factor for competitiveness and growth. As technological capabilities makes the production process more efficient, it thereby reduces the vulnerability of countries to market fluctuations. Thus, countries having a higher degree of technological intensity in their trade with a large proportion of high technology goods, especially in their exports structure, have significantly improved their importance in the world exports and experience gained in their trade share (Leromain & Orefice, 2014). Moreover, a technological-intensive export structure contributes more to the long-run growth as compared to that of a low-technological one. This is because technological-intensive products tend to be highly income elastic, create new demands, substitute older products and tend to grow faster in trade (Desai, 2011; Laursen, 1999; Montobbio & Rampa, 2005). Given the importance of technological advances, the advancement of innovation has increasingly appeared in the policies of developing countries as well.

At one time, the developing world was believed by economists as full of market failures. However, state ownership, import substitution, and planning did produce some success, but over the time, where they got impinged and ossified, they conduced to stupendous failures and crises. The trade of developing countries up to the early 1980s was also inhibited by the widely followed "dual-track" development strategies, that is, to foster the export-oriented industries while at the same time blocking imports of manufactured goods to assist domestic-infant industries (Baldwin, 2008). However, starting in the mid-1980s, liberalization of trade and rise in intra-regional egressed in emerging economies. Simultaneously, the developing world progressively realized the need to implant private enterprise in a model of public action that promote diversification, technological dynamism, and restructuring beyond what market forces on their own would yield (Rodrik, 2004; Tuluy, 2016). Liberalization and economic opening up benefited the financial interests and export activities of developing countries, and there has been a shift in their export structure from low- to high-tech goods. Some of the extraordinary performers in the past few decades are the Asian countries

(especially East Asia). In the eminent economic growth of these emerging economies, the outdoor-looking policy and foreign direct investment (FDI) inflows have been at the center of their trade and investment policies. As these countries mainly plied monopoly rights, tax incentives, and cost advantages facilities to the foreign investors. After that, these countries had internalized the technology and knowledge by means of producing high-value-added and high-tech products and finally contended to export them in the global competitive market (Erdal & Göçer, 2015). At present, no productive activity in developing countries is insulated from the technological revolution. More than half of the world's value added in medium and low-tech industries and nearly half in high-tech industries in 2012 was accounted from developing countries (Industrial Development Report, 2016). Notably, the emerging Asian economies have become progressively important exporters.

The tremendous growth of information technology (IT) exports and outgrowth of some high technology industries brought forward the increasing significance of India also as a knowledge powerhouse and enabled it to be in the category of high technology producers from developing countries (Mani, 2008). For more than four decades after Independence, India had been following an inward-oriented policy of import substitution (Fayaz & Bhatia, 2016). Trade policy of India, following its independence, was centered on being self-sufficient and minimum dependence on international trade (Callen & Cashin, 1999). The policymakers of India only by the late 1980s had admitted the demand to open up the economy. However, the procedure was intermitted, uneven, and loath. The major departure from the pre-liberalization model of state controls was marked by New Economic Policy (NEP), which was adopted by India in 1991 to remove all sorts of restrictions in the areas of international trade and investments (Goswami & Saikia, 2012; Prakash, Nauriyal, & Kaur, 2017; Sarkar, 1997). The government also plunge a cautious and balk privatization process. Further, it relieved licensing process and established greater freedom for private players to grow. This outward-looking trade regime of India resulted in greater access to foreign technologies, a substantial rise in FDI, and thereby a considerable improvement in the manufacturing and exporting environment. Traditionally, the abundance of natural resources and unskilled and semi-skilled workers had given India a competitive advantage in resource-based goods and low-skill-intensive manufacturers. However, the abundance of natural resources in the global market is no longer a distinguishing factor of competitiveness, but the free and rapid movement of the capital and technology implies a significant rearrangement of comparative advantage (Braunerhjelm & Thulin, 2008).

The present study extends the empirical analysis on the structure of Indian merchandise exports in terms of technological composition. Classification on technology intensity, taken into consideration, is based on the revised definition of technology-intensive sectors developed by OECD (Hatzichronoglou, 1997). The OECD classification of products in terms of technology intensity is based upon the direct and indirect R&D intensity (indirect intensity describes the technology assimilated in acquiring intermediary or capital goods). This classification categorizes the products into high technology products, medium–high technology, medium–low technology, and low technology and resource-based goods. In broad terms, the first two categories are called technologically more advanced. Technological-intensive products are the science-based products and grow faster as compared to that of resource-based and low-tech products. All the countries use technologies (existing/new) in one way or another. At one end are the countries having the skills to apply the most sophisticated new technologies expeditiously. At the other end are the countries applying the simple technologies, many a times with the abject level of value added and efficiency, rendering basic inputs like natural resources or cheap unskilled labor (Lall, 1998). Developing countries are

taking advantage of their surplus labor in exporting high-tech goods, because the improving IT, transportation, and communication adeptness are wedging a massive fragmentation of production processes across the borders and from high to low wage countries (Oldenski, 2012). It may conceal some interesting differences in the performances of exports, particularly between developing countries (as they largely export-low technology products). The technological capacity (elements, equipment, and technical knowledge) of similar exports alters between the countries according to the nature of local manufacturing procedure. For example, a high-tech export in one country may come from mere assembly of imported parts with some local physical or technological inputs. However, in another country, the same export may involve substantial use of local physical and technological inputs and much more stages of production. For instance, electronic products are classified as high-tech products that are reasonable in general technology terms. But electronic exports by a developing country, by and large, involves comparatively simple labor-intensive assembly. However, the advantage in using OECD classification is that the underlying technological concepts are based on substantial empirical work, level-headed, and widely accepted. An attempt has also been made in this study to compare the performance of Indian exports with that of the emerging economies such as China, Hong Kong China, Malaysia, the Philippines, Singapore, the Republic of Korea, and Thailand. This is because the economies of these emerging giants have been growing at an average rate of around 8 per cent since the 1980s, with their dramatically increasing share of world trade and had a story of trade-led-development (WTO, 2014). The main objective of the comparative study is to know the technological intensity of their exports and the strategic resources that have been employed in the flow of their technological upgrading.

The article is organized as follows. In the second section, the export structure of India and the world has been presented. In the third section, the structure of exports of the emerging Asian economies has been presented. And in the fourth section, the scenario of Indian and China's economy has been presented.

Exports Structure of India and the World

Of the many potential indicators of technological competency, the present study used the performance of manufactured exports. It is suitable to use the share of subgroup exports (in terms of technology) as a proxy for the technological-intensity of exports. Table 1 shows how the percentage share and growth rates of high, medium–high, medium–low, and low-tech exports of India and the world have changed for the period 1980 to 2016. In the total exports of India, the share of high-tech (HT) goods was 4.1 per cent in 1980, while that of medium–high tech (MH) and medium–low-tech (ML) goods were 8.2 per cent and 13.2 per cent, respectively. Indian exports were dominated by low technology and resource-based (L&RB) products with a share of 74.5 per cent in 1980. Various pro-business reforms, such as the removal of many price controls, easing restrictions on capacity expansion, and the reduction of corporate taxes, had been initiated in the early 1980s. Further, in 1991, the reforms like reducing investment licensing, liberalizing imports, privatizing some state-owned enterprises, and dropping the number of products earmarked for small-scale industry, were also initiated for an imperative liberalization of the economy. The influence of this liberalization on science and technology was noteworthy as the number of firms doing R&D increased. Also, an increasing number of multinational corporations (MNCs) started setting up their R&D centers in India, attracted mainly by the reasonably low cost and high level of accessible human capital

locally (Dahlman, 2007). Following these developments, a relative shift has been marked in all the subcategory exports over the period from low- to high-tech-intensive goods. As the share of HT (10.7%) and MH (18.4%) goods increased to more than double in 2016. The share of ML goods also increased substantially and reached 21.3 per cent in 2016 in the total exports of India, which however, was high during 2000 (i.e., 26.1%) but declined on the expense of HT and MH goods. Still, Indian exports are dominated by L&RB products with a share of 49.6 per cent in 2016, though, declined from a high of 74.5 per cent in 1980. Meanwhile, if we see the figures of world exports, reported in Table 1, the MH products (among these four category products, that is, HT, MH, ML, and L&RB) dominate the world exports with a share of 30 per cent in 2016. Followed by the exports of HT products (21%) that were high during 2015, that is, 22.7 per cent, the share of ML and L&RB products shows a decreasing trend in the total exports of the world. The share of ML products in the total exports of the world decreased from 15.3 per cent in 1980 to 12 per cent in 2016 while that of L&RB products declined from 48.2 per cent in 1980 to 36.4 per cent in 2016. Thus, the pattern of world exports is showing an increasing trend of HT and MH products and a decreasing trend of ML and L&RB products. The pattern of Indian exports is also in conformity with that of the world exports pattern. The HT and MH exports from India have also shown an increasing trend while that of L&RB and ML (after 2000) have shown a decreasing trend. However, the share of Indian HT and MH exports is half to that of world HT and MH exports.

In the pre-reforms period (1980–1990), the HT and MH exports from India experienced a strong growth while ML and L&RB exports experienced a negative growth over the same period. The reasons are well explained by Virmani (1991) who split the quantum of exports into manufactured goods and primary goods for a reasonably robust export function. He found a relatively low elasticity of exports of primary goods to the nominal exchange rate depreciation, (i.e., almost unaffected by a depreciation) as compared to that of manufactured goods, which were found strongly and positively related to depreciation. As a result of depreciation, HT and MH exports (which mainly come under the realm of manufactured exports) experienced a substantial positive growth. Meanwhile, ML and L&RB exports (which mainly come under the realm of primary exports), experienced a negative growth over the same period at the expense of increasing HT and MH exports. Even depreciation did not help it improve due to its less responsiveness to the import price change. The robust growth in all the subcategory exports of India during post reforms period occurred between 1995 and 2010 on the back of brisk growth in Indian as well as in global economy. HT exports of India grew by 32 per cent in 1995, 17.4 per cent in 2000, 23.4 per cent in 2005, and 6 per cent in 2010, while MH exports grew by 18.5 per cent, 21.3 per cent, 41.8 per cent, and 30.5 per cent over the same period. The peak growth in the ML exports of India was experienced during 2005 and 2010 (i.e., 32.2% and 40.8%). The growth rate of all these subgroups, experienced by India over the period is greater than that of those experienced by the world exports in each exports category.

It can also be concluded that the share of HT and MH exports in the total exports of India have increased to more than double in 2016 as compared to that of 1980. While the share of world HT and MH exports also increased but at a rate slower than that of India. In the present era of globalization, IT and technological capability is causing a significant shift in the demand for exports (Acharyya, 2007; Kohli, 2006; Kotwal, Ramaswami, & Wadhwa, 2011; Lall, 2000; Panagariya, 2005). Thus, a consistent policy attention is needed on developing technological capability to further augment the high-tech exports, as a higher share of high-tech products in the total exports lead to improved export performance and realize a sustainable export growth (Ferragina & Pastore, 2007).

Table 1. Share and Growth Rate of Exports by Technology, 1980–2016

Shares (%)								
	World				India			
Year	HT	MH	ML	L&RB	HT	MH	ML	L&RB
1980	13.4	23.1	15.3	48.2	4.1	8.2	13.2	74.5
1985	17.2	24.5	13.4	45.0	4.7	5.1	16.5	73.7
1990	17.9	30.6	14.0	37.5	5.3	9.1	20.8	64.8
1995	18.9	28.9	13.4	38.8	6.0	9.4	23.3	61.3
2000	24.3	26.9	11.6	37.3	6.8	10.7	26.1	56.4
2005	22.9	27.4	13.2	36.5	6.2	14.4	25.7	53.7
2010	20.7	24.5	13.1	41.7	7.9	14.6	24.7	52.7
2015	22.7	27.0	13.0	37.4	10.3	17.5	21.2	51.0
2016	21.0	30.6	12.0	36.4	10.7	18.4	21.3	49.6
Rate of Growth (% p.a)								
	World				India			
Year	HT	MH	ML	L&RB	HT	MH	ML	L&RB
1980	21.0	16.7	18.2	31.0	36.6	43.4	–3.3	5.3
1985	8.8	8.0	0.3	2.8	0.8	–11.4	12.3	–12.9
1990	15.3	14.7	12.0	18.2	–2.5	8.8	–6.5	9.9
1995	22.9	18.6	24.5	24.5	32.0	18.5	17.4	20.8
2000	16.7	6.2	8.4	16.9	17.4	21.3	11.2	16.3
2005	11.2	10.2	14.7	8.7	23.4	41.8	32.2	30.5
2010	18.4	23.0	26.7	26.1	6.0	30.5	40.8	19.3
2015	–4.1	–8.5	–11.7	–22.4	–9.6	–4.6	–12.4	–23.3
2016	–41.5	–28.5	–41.7	–38.6	2.9	3.4	–0.9	–4.1

Source: Author's calculations based on the data from UNCOMTRADE.
Notes: HT is high technology goods, MH is medium–high technology goods, ML is medium–low technology goods, and L&RB is low technology and resource-based goods.

Exports Structure of Emerging Asian Economies

The present section deals with the exports structure of some emerging Asian economies such as China, Hong Kong, Malaysia, Philippines, Singapore, Korea, and Thailand. Since the 1980s, the Asian countries have been experiencing an impressive economic growth with trade and investment as the main drivers of their success story. Their trade regime shifted from an import substitution to export promotion and technology driven (Ismail, 2013). Hong Kong, Korea, and Singapore have made the evolution from developing to being a developed one. In the developing world, East Asia is the only region that continuously increased its share of global gross domestic product (GDP). However, the rapid rise of China made it one of the key players from East Asia. While Malaysia and Thailand are known as next-tier Asian newly industrialized countries (NICs). Moreover, some of these economies comprising China, Korea, and Thailand, have gained from their heavy investment in resources and infrastructure to become the so-called Factory Asia (WTO, 2015). The exports of these countries have been analyzed regarding their share in each technological categories as it is quite informative and pertinent to look at the strategies of these emerging economies. Table 2 shows that all the seven countries hold a reasonable share of HT and MH goods in their total exports which increased over the period. Hong Kong (55.1%) outperformed the economies such as the Philippines (49.2%), Singapore (42.3% in 2015), and Malaysia (36.2%) and emerged as the largest exporter of HT goods in the group. The export structure of Hong Kong experienced a remarkable change over the period as the share of HT goods in its total exports substantially increased from 22.8 per cent in 1995 to a high of 55.1 per cent in 2016, which indicates substantial technological dynamism. The entrepreneurial milieu of Hong Kong rests as one of the world's utmost obvious and well organized. Its freewheeling business and trade atmosphere are evidence to the influence of economic autonomy. It is one of the economies most reliant on trade and FDI (Hill & Jongwanich, 2011). China has also been very effective at propagating knowledge internally and soliciting global knowledge via trade and FDI. The share of the HT goods also increased remarkably from 13.6 per cent in 1995 to 31.5 per cent in 2015, though it was high during 2010 (i.e., 34.1%). The major factor behind the gain of China in the world trade are its WTO accession, liberalization, rapid industrialization process, and market-oriented economic reforms. Second, its adoption of revolutionary initiatives to encourage FDI inflows made by MNCs, as it has been the largest recipient of FDI among the developing countries (Li, Scrollay, & Maani, 2016). China has enhanced its outlays on R&D by means of FDI with a deliberate intention to establish an innovation system. This is because the investment in innovation system is essential to increase industrial performance and ensure technological advances and thereby the growth of trade competitiveness (Tang & Hussler, 2011; Zhang, 2014). In a similar manner to that of China, countries such as Singapore, Korea, Philippines, Malaysia, and Thailand have also been holding a reasonable share of HT goods in their respective total exports. However, it started to decline in the recent past first due to the global financial crisis, then by the recent slowdown in the global demand and somewhat at the expense of ML exports. Singapore's share increased from 38.7 per cent in 1990 to 59.2 per cent in 2000 but after that declined to 41.9 per cent in 2010 before increasing marginally to 42.3 per cent in 2015. While Korea's share of high-tech exports increased from 22.5 per cent in 1990 to 35.1 per cent in 2005 and after that declined to 31.2 per cent in 2010 and in 2015 further declined to 30.1 per cent. Singapore shifted to free trade after a short-lived period of import substitution and was also aggressively engaged in seeking and targeting FDI. Singapore's adoption of the small- and medium-sized enterprise-public

research institute (SME-PRI) innovation network model and FDI leveraging model has strongly pushed it into the specialized high-tech industry for exports markets (Wong, 1999). Arguably, Singapore has one of the well-developed systems of vocational and industrial training that has enabled the speedy transformation of its unskilled workforce into an extremely skilled one (Lai & Yap, 2004). Meanwhile, the Republic of Korea over the course of time has transformed itself into a high-income and one of the world's most technologized dynamic industrial economy. During the early 1960s, it was a typical developing country with a large population and with a wretched base of resources and production (Westphal, Rhee, & Purcell, 1981). The 1980s and 1990s are known as innovation phase for Korea, as it experienced heavy R&D investments both by the public and private sector along with the extensive support of government for the launching of important technological institutions (Gupta, Healy, Stein, & Shipp, 2013). However, Korea counts on very little on FDI. Instead, primarily it assimilated a lot of its technology via trade, reverse engineering, copying, and technology licensing (Yung, 1990). Further, the outward-looking development strategy, technological innovations combined with well-educated and well-disciplined workforce helped it to bring about what is called the "Korean Miracle" (Chung, 2011).

The Philippines also transformed itself into an exporter of technological-intensive products. The share of HT products in its total exports increased substantially from a low of 17.1 per cent in 1995 to 49.2 per cent in 2016, though, it was high during 2000, that is, 69.9 per cent. While that of Malaysia also increased from 29.5 per cent in 1990 to 36.2 per cent in 2016. Between the period 1950s and 1970s, the Philippines followed protectionist and restrictive policies as a part of its inward-looking and import-substituting industrialization strategy. After the 1970s, the country's multi-track approach of liberalization (unilateral, regional, and bilateral), signing of various free trade agreements (FTAs) with the newly industrialized economies (NIEs), implementation of an export-incentives program, and further with the opening of export-processing zones, led to a rapid increase in its manufacture exports (PHILEXPORT, 2017). While Malaysia has extended several tax incentives to promote its R&D activities but dissimilar to that of countries such as Singapore, Korea, and China. As R&D schemes are extended only to the domestically owned and controlled companies (Lai & Yap, 2004). That is why the increase in the share of HT goods from Malaysia is not that impressive. Same is the case of Thailand that also experienced major industrial transformation amid rapid growth and development. It has been quite successful in attracting FDI in export-oriented manufacturing and has successfully shifted from agriculture to manufacturing while incorporating key production (notably automobiles and electronics) into regional value chains (ADB, 2015). The share of HT goods in its total exports also increased from 16.1 per cent in 1990 to 30 per cent in 2000 but after that declined to 20.7 per cent in 2015. It has been experiencing difficulty in contending against low-cost locations in less skill-intensive economic activities and is facing a decline in growth as well as productivity and thereby is at the peril of falling into the "middle-income trap" (UNCTAD, 2015). Still, Thailand is a leading exporter of several products and competitive industries in automotive and electronic components.

Among all the said emerging economies, Korea showed a remarkable performance in the exports of MH goods followed by the strong performance of Thailand over the period 1990 to 2015. The countries such as China, Philippines, Malaysia, and Singapore are also in the group that had increasing exports of MH goods. Hong Kong is the only country in the group that had a declining share of MH exports. The concentration of ML exports is also marked high in Korea which increased over the period and reached 21.3 per cent in 2015, followed by China (14.8%), Thailand (12.7%), Malaysia (9.4%), and the Philippines (6.5%).

The share of ML goods in the total exports of Hong Kong decreased from 9.8 per cent in 1995 to 7.8 per cent in 2016. While in the exports of Singapore, the share of ML goods remained more or less 6 per cent over the period. In the share of manufacturing, a secular decline (a phenomenon referred to as deindustrialization) has been experienced by all the advanced countries including Hong Kong. It is not a negative phenomenon but is the innate effects of the industrial dynamism in an already developed economy (Rowthorn & Ramaswamy, 1997). The highest concentration of L&RB exports, during the early 1990s, was in the Philippines (71.5%), followed by Thailand (68%), China (61.3%), Malaysia (57.5%), Hong Kong (53.5%), Korea (44.6%), and then by Singapore (38.8%). Mostly, the L&RB products lean to be at the abject end of the technology ambit with minimum requirements of technical skills. But with the development of industries, there is a normal disposition for the share of these products to decline. This disposition

Table 2. Share of Exports by Technology, 1990–2016

Year	China	Hong Kong	Malaysia	Philippines	Singapore	Korea	Thailand
				HT			
1990	—	—	29.5	—	38.7	22.5	16.1
1995	13.6	22.8	45.5	17.1	54.3	27.5	22.7
2000	21.6	29.6	56.5	69.9	59.2	34.7	30.0
2005	34.3	43.1	47.5	64.9	50.3	35.1	25.5
2010	34.1	50.0	38.3	32.9	41.9	31.2	21.7
2015	31.5	54.2	35.1	47.8	42.3	30.1	20.7
2016	—	55.1	36.2	49.2	—	—	—
				MH			
1990	—	—	7.1	—	16.5	15.6	7.4
1995	12.7	13.9	12.3	6.9	16.7	25.6	13.1
2000	16.0	13.5	9.8	7.3	15.6	24.4	17.2
2005	16.8	13.0	12.0	11.0	19.5	29.6	24.3
2010	19.3	12.6	11.9	13.6	19.4	29.5	26.9
2015	21.3	10.6	14.2	18.0	22.6	34.2	31.9
2016	—	10.2	14.9	17.9	—	—	—
				ML			
1990	—	—	5.9	—	6.0	17.2	8.5
1995	12.4	9.8	5.4	4.4	6.2	17.2	8.5
2000	11.0	9.1	4.6	2.6	4.7	15.9	9.5
2005	12.1	8.8	6.2	3.9	6.2	19.2	11.8
2010	13.9	9.2	8.3	5.0	6.0	23.7	11.8
2015	14.8	7.9	9.4	6.5	6.1	21.3	12.7
2016	—	7.8	8.7	5.0	—	—	—

(Table 2 Continued)

(Table 2 Continued)

Year	China	Hong Kong	Malaysia	Philippines	Singapore	Korea	Thailand
				L & RB			
1990	—	—	57.5	—	38.8	44.6	68.0
1995	61.3	53.5	36.8	71.5	22.8	29.7	55.7
2000	51.4	47.7	29.1	20.2	20.6	25.0	43.3
2005	36.9	35.1	34.3	20.2	23.9	16.0	38.5
2010	32.7	28.1	41.5	48.5	32.6	15.5	39.6
2015	32.5	27.3	41.4	27.7	29.0	14.4	34.8
2016	—	27.0	40.3	28.0	—	—	—

Source: Author's calculations based on the data from UN Comtrade.

is marked in all the said countries that their share of L&RB exports declined over the period.

The empirical works brought out the importance of technological intensity as a major determinant of export growth, functioning through the most eminent end of the value chains and by producing greater demand in export destinations. The primary sources of generating technological-intensive products and technological competitiveness are innovation and R&D activities. The R&D (% of GDP) spending in India as compared to that of other countries such as Korea, China, Singapore, Malaysia is low though increased marginally (as % of GDP) over the period 1996–2014 (Figure 1). The heavy investment of Korea in R&D had a strong role in its industrial policy, yet, it relied least on the FDI (Figure 2) for acquiring and upgrading its technological base. Korea built up remarkable local R&D capabilities by delineating comprehensively on foreign technology in forms that supported local control (Lall, 2001, pp. 1–82). China has marked a consistent increase in the R&D investment. The R&D expenditure is low in the countries like the Philippines, and Thailand also, but the proportion of high-tech goods in their total exports, in comparison to that of India is still higher. Most of the high-tech electronics are assembled in low-income countries while design and component manufacture continues in high-income countries. The Philippines also assemble and test final products, but the classification of such exports as high-tech one leads to the result that it has a more technological-intensive export structure. While the R&D investments in Thailand is lower than that of other emerging economies as these investments are largely from the public expenditure rather than from the private sector (UNCTAD, 2015). However, in India like other low-income countries, much of technological effort is informal, that is, adaptations and copying, incremental improving, instead of formal R&D. While it is the formal technological efforts (R&D spending and technological acquisition) which involves the actions taken by economic actors to enhance their organization and production methods, upgrade their technological level, develop new activities, and enter new markets that are closely and jointly associated with developing new product lines (Dutz & Dahlman, 2007; UNCTAD, 2015).

The ability to produce technology intensive products which incurred by R&D and innovation, rendered by FDI, have become important. FDI played a crucial role, by providing technological know-how, financial capital, and managerial expertise, in the economic activities of developing countries. China is a very high FDI-intensive economy followed by Hong Kong and Singapore (Figure 2). At the other end, India traditionally had a very low reliance on

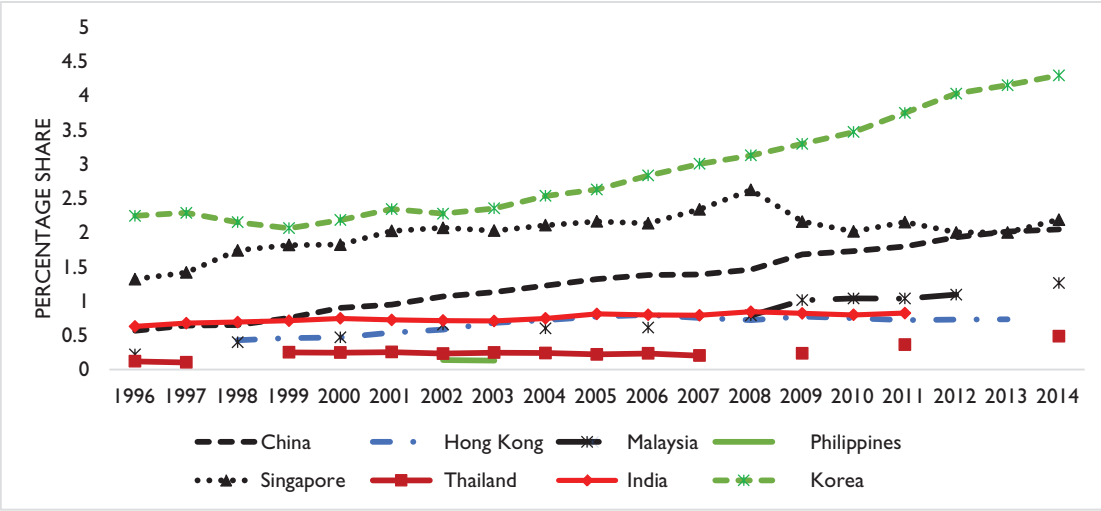

Figure 1. R&D Expenditure (% of GDP)

Source: The World Bank (2017).

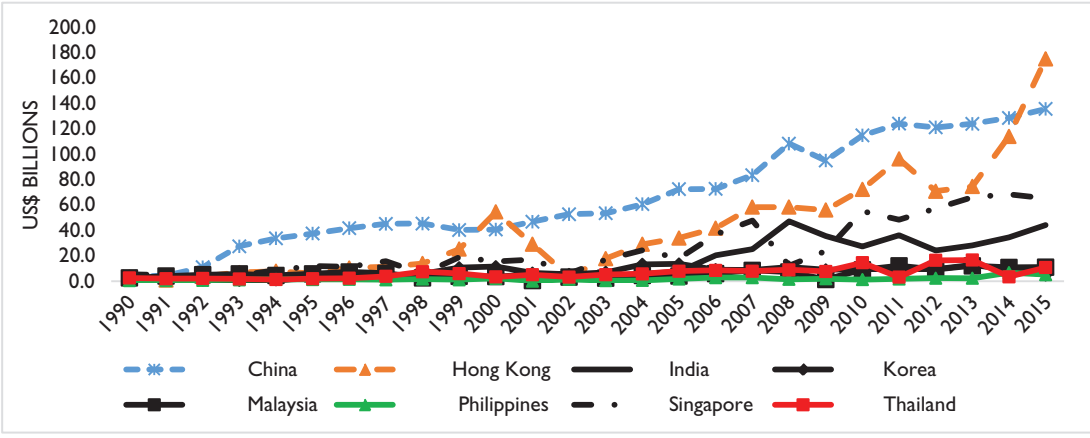

Figure 2. FDI Inflows (US$ Billions)

Source: UNCTAD (2017).

FDI up to the late 1980s. However, following an open-door policy since the 1990s, it has increasingly expanded the scope for FDI and it has been successful in attracting a bulk of FDI. But not all countries that have positioned in place foreign investment promotion strategies have come across with success as only a few can afford to take a sustained inflow of high quality and outward-oriented FDI for granted. Up to the recent past, FDI in India was coming to a limited number of sectors with an upper limit and certain other terms and conditions. The diminutive share of FDI in India goes to the labor-intensive manufacturing sector (Aggarwal, 2005), though, a meaningful share of FDI in such sectors would be

likely to increase the technological intensity of exports and have relatively high employment-generating potential. In the recent years, the government has taken up some initiatives like relaxing FDI norms in sectors such as Public Sector Undertakings (PSUs) oil refineries, defense, power exchange, and the stock exchange to reap the positive benefits of FDI.

India and China

India's evolution as a key global player is indicated by the Competitive Industrial Performance (CIP) index over the period 1990–2013, in which it improved 19 places (Industrial Development Report, 2016). But, the CIP rankings for China suggest a more rapid process of rising industrial competitiveness. The strategy of China is deliberate and methodological as compared to that of India. As China has adopted a conventional route (an evolution followed in many developed countries including Japan, South Korea, the United States, and Taiwan) in transiting to a robust industrial economy from an agricultural one (Konana, Doggett, & Balasubramanian, 2004). Further, China is establishing critical linkages among its industrial, agricultural, and services sector. However, the growth model of India has not followed the manufacturing route but has gone directly to a services economy, without making the industrial base strong enough. The striking growth of Indian economy is largely attributed to the services sector. But service sector lacks the vital linkages with the remainder of the economy. While, the manufacturing sector has strong backward linkages which imply that expansion of it will positively affect the other sectors of the economy and will also help in addressing the problem of unemployed large unskilled and semi-skilled labor (Munjal, 2007). Nonetheless, it is undebatable that India, like China, is aggressively engaged in economic liberalization for strong and sustained growth. Indian economy has been projected as the economic pole of global growth due to its expanding and diversifying export basket. The Atlas of Economic Complexity recently updated the rankings of 124 countries on an Economic Complexity Index (ECI) based on the global trade data. ECI, by Hausmann and Hidalgo, measure the extent of productive knowledge that bring about the production of a country. The products vary in terms of technology or we can say differ by the extent of knowledge involved in their production, which goes from zero for resource based to maximum values for highly complex products such as aircrafts (Inoua, 2016). According to ECI rankings, China is at number 26 in 2015, however, in the most recent rankings, have fallen six places from 20 in 2014 while India moved up two positions from its 2014 place (i.e., 50) and currently is at number 48.

Conclusion

The exports of all the said emerging economies are found to have a large technological base owing to the significant investments in R&D. Moreover, all these countries are outward oriented, and most of them heavily relied on FDI. Essentially, outward oriented not only means low tariff and nontariff barriers but open to outside ideas and have use exports as a means to force on domestic firms to mend their competencies. The figures of India, when it comes to the intensity of technology in manufacturing exports, also shows a steady though slow technological upgradation from low-tech to medium-tech and high-tech exports but when compared to the standards of these emerging economies, they are quite low. Thus, the performance of India seems good but not impressive. R&D has been cited as a core element in the economic growth of developed countries and it leads lessons for the developing world to build more research know-how. Developing countries like India can attain an increase in productivity by making efficient use of existing knowledge. Hence, for the

development, addressing the constraints such as institutions for education, packages of technical skills, network, and capabilities to enable the effective use of existing knowledge is critical. Further, in order to increase the technological intensity of its exports, there is a need to invest more in high- and medium-tech R&D activities and overcome the technological barriers. As high-tech-intensive products have a tendency to grow faster and have greater spillover effects on knowledge and skills-intensive activities. There is also a need to devise the policies that would make a favorable environment for attracting more outward-oriented FDI. Because such FDI inflows conduce to accelerate R&D activities by providing much-needed capital, which helps to produce high-tech products within a low-cost local investment environment and increase the export revenue from high-tech goods (Erdal & Göçer, 2015; Zhang, 2014). In addition, India have an incentive to move up the value chain as these emerging Asian economies heavily engaged in exports of high-tech goods.

Dataset

UNCOMTRADE: https://comtrade.un.org/data/
UNCTAD: Foreign direct investment flows and stock, http://unctadstat.unctad.org/wds/ReportFolders/reportFolders.aspx
The Atlas of Economic Complexity: http://atlas.cid.harvard.edu/
The World Bank: Research and development expenditure (% of GDP), http://data.worldbank.org/indicator/GB.XPD.RSDV.GD.ZS

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