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Asia's international production networks: Will India be the next assembly centre?

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Contents

Acronyms

ACMA	Automotive Component Manufacturers Association
AMP	Automotive Mission Plan
ASEAN	Association of Southeast Asian Nations
CAGR	Compound Annual Growth Rate
CV	Commercial Vehicles
ESC	Electronics and Software Exports Promotion Council
EU	European Union
FDI	Foreign Direct Investment
FTP	Foreign Trade Policy
GDP	Gross Domestic Product
G-L	Grubel-Lloyd
HS	Harmonized System
IBEF	India Brand Equity Foundation
ICT	Information and Communication Technology
IIT	Intra-industry Trade
IPN	International Production Network
ISIC	International Standard Industrial Classification
IT	Information Technology
P&C	Parts and Components
PPP	Purchasing Power Parity
PTA	Preferential Trade Agreement
MPV	Multipurpose passenger vehicle
MNC	Multinational Corporation
NAFTA	North American Free Trade Agreement
NATRiP	National Automotive Testing and R&D Infrastructure Project
NES	Not included elsewhere
NMP	National Manufacturing Policy
NTB	Non-tariff Barrier
OECD	Organisation for Economic Co-operation and Development
OEM	Original Equipment Manufacturer
R&D	Research and Development
RIS	Research and Information Systems for Developing Countries
RoO	Rules of Origin
SAARC	South Asian Association for Regional Cooperation
SEZ	Special Economic Zone
SITC	Standard Industrial Trade Classification
SME	Small and Medium-sized Enterprises
TKAP	Toyota Kirloskar Auto Parts
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UK	United Kingdom
US	United States
USD	United States Dollars
WTO	World Trade Organization

Asia's international production networks: Will India be the next assembly centre?

Rahul Sen and Sadhana Srivastava

Abstract

This paper analyses the current state of participation of India in the international production networks (IPNs) of manufacturing industries in Asia, and identifies the constraints and challenges for India's deeper participation in the near future. Using the disaggregated 5 digit SITC (Rev 3) level data, the estimates of intra-industry trade and export revealed comparative advantage in Parts and Components (P&C) in India's manufacturing sector are analysed separately from that of total trade flows over the period from 1994 and 2008. This provides useful insights into the nature and magnitude of production fragmentation involving Foreign Direct Investment (FDI). The analysis demonstrates that India has reoriented its growth strategy, towards an outward orientation, during the past two decades, but the pace of its reform has not caught up with this paradigm shift. As a result, the level of participation by Indian industries in global and in Asian IPNs is low. Most of India's exports comprise low-technology, labour-intensive goods that do not involve much fragmentation, such as textiles, gems and jewellery and animal and leather products.

Five key policy recommendations are proposed, based on the current state of India's participation in IPNs and the associated policy challenges. It is particularly noted that India's existing Preferential Trade Agreements (PTAs) do not appear to be designed with the objective of reducing the costs involved in setting up an IPN. A critical review is therefore required of India's current PTAs, including more inputs from businesses, to identify specific areas of gains from PTAs in order to create a business environment that would make India a potential assembly centre for global manufacturing activities in the near future. Implementation integrity and effective utilization of PTAs involving India and member countries will also be a key to whether PTAs will be successfully able to play a role in plugging India into global and Asian IPNs

Keywords: India, international production networks, intra-industry trade, Asia, PTAs

JEL code: F13, F14, F23

1. Introduction

Rapid globalization over the past two decades has increased the prevalence of production fragmentation, which is the division of the production process among different suppliers, with the constituent parts, components and accessories of products being produced by various producers in different countries. Production is divided on the basis of each country's comparative advantage, with each country specializing in a particular stage of the production sequence. This divides up the value added chain and facilitates firms to create cost-based advantages through small differences in costs, resources, logistics and markets.[1]

In the Asian context, this phenomenon has had a significant impact on merchandise trade patterns and regional integration since the 1980s. At that time, international production networks (IPNs) were created by multinationals in labour-intensive manufacturing industries in several East and South-East Asian countries, including in China, Indonesia, the Republic of Korea, Malaysia, Singapore and Thailand. These IPNs have resulted in an increasing share of trade in machinery parts and components in both the exports and imports of these countries (Athukorala and Yamashita, 2005; Ando, 2006). This phenomenon has also provided development opportunities for the Indian manufacturing sector through technology transfer and access to global markets.[2] The creation of such Asian IPNs was fuelled by the adoption of an export-led outward oriented growth strategy by most Asian countries in the 1980s, in which foreign direct investment (FDI) played a major role. The pace of this outward orientation was more rapid in the above-mentioned countries than in India, despite India being one of the most rapidly growing economies in the world in terms of purchasing power parity (PPP).[3] India followed an entirely different growth strategy, in favour of self-reliance and import-substitution growth until about 1991 when it adopted (almost a decade later than most of the East and South-East Asian countries) an outward orientation. As a result, India was largely left out of the global division of labour in the 1980s, and therefore lagged in the development of intra-industry trade in parts and components (P&C) of manufacturing goods, which has been critical to the development of IPNs.

Since July 1991, the adoption of an outward orientation, with unilateral reduction of trade barriers and involving "calibrated" globalization, has allowed market forces and the private sector in India to play a significant role in India's growth process and to further integrate India into the global economy.[4] India's economy grew very rapidly between 2000 and 2009, with an average annual growth rate of 7.2 per cent and with the merchandise trade

[1] See Rajan 2003; Hummels et al., 2001; Yi, 2003; Krugman, 1995; Ng and Yeats, 2001, 2003; and Grossman and Helpman, 2005.
[2] See McKendrick et al., 2000; Kuroiwa and Toh, 2008 and Fujita, 2007.
[3] In 2010, India's GNI at PPP was about USD 4.2 trillion (World Bank, 2010).
[4] India adopted wide-ranging economic policy reforms. These reforms aimed to achieve macro-economic stabilization through improved fiscal management, reduction of distortions in the production structure and concomitantly increasing the competitiveness of India's external sector through reduction of trade barriers and encouragement of private capital flows (of which FDI was a major constituent).

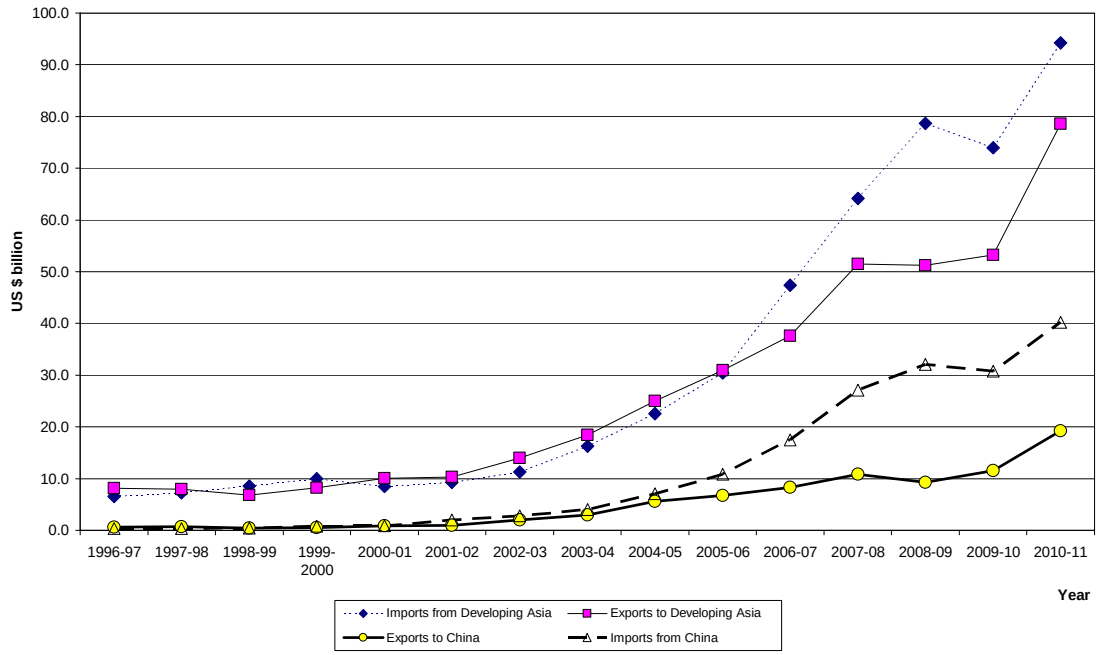
to GDP ratio doubling from about 21 per cent in 2000 to 42 per cent in 2008, compared with just 13 per cent in the pre-reform period in 1990. Rajan and Gopalan (2011) observed that after a decade of the ongoing reforms, India experienced an international trade renaissance with regard to its merchandise exports (including re-exports), with revenue more than doubling, rising from about 95 billion United States Dollars (USD) in fiscal year April 2005 to March 2006 to nearly USD 220 billion in 2011. India's exports grew at an average of almost 20 per cent per annum over the period between 2000 and 2009. Consequently, Indian policymakers have set an ambitious export target of USD 400 billion per annum by 2014 (Rajan and Gopalan, 2011). India's merchandise imports more than doubled from about USD 138 billion to USD 327 billion over the same period.

From being among the relatively insignificant players in global trade in 1990 (ranked below fortieth position globally, and constituting a share of 0.5 per cent of global merchandise exports and a share of 0.7 per cent in global merchandise imports), India moved rapidly up the global trade rankings over the next 20 years. It was ranked twentieth in world exports in 2010, with its share of global merchandise exports increasing to 1.4 per cent, and thirteenth in world imports, with its global merchandise import share increasing to 2.1 per cent. In the area of trade in commercial services, India's performance was highly impressive in 2010, when the country gained seventh position among both world exporters and importers of commercial services, constituting a share of 3.3 per cent for that year, compared with thirty-fourth among exporters and twenty-eighth among importers in 1995 (WTO, 2011a). Among developing countries globally, in 2010 India was ranked as the second largest exporter and importer of commercial services, after China (WTO, 2011a).

India's "look east policy" and its integration with South-East and East Asia production networks was a significant policy development. Since the beginning of the outward orientation policy, China has emerged as India's most important Asian trade partner (Figure 1 and Figure 2). Likewise, India's trade with Singapore has expanded considerably since the signing of the India-Singapore Comprehensive Economic Cooperation Agreement in 2005. In the period between April 2009 and September 2010, most of India's exports went to the Asian region, accounting for 55 per cent of total exports, up from 40 per cent in 2001/02;[5] during that period China accounted for 10 per cent of India's total exports.

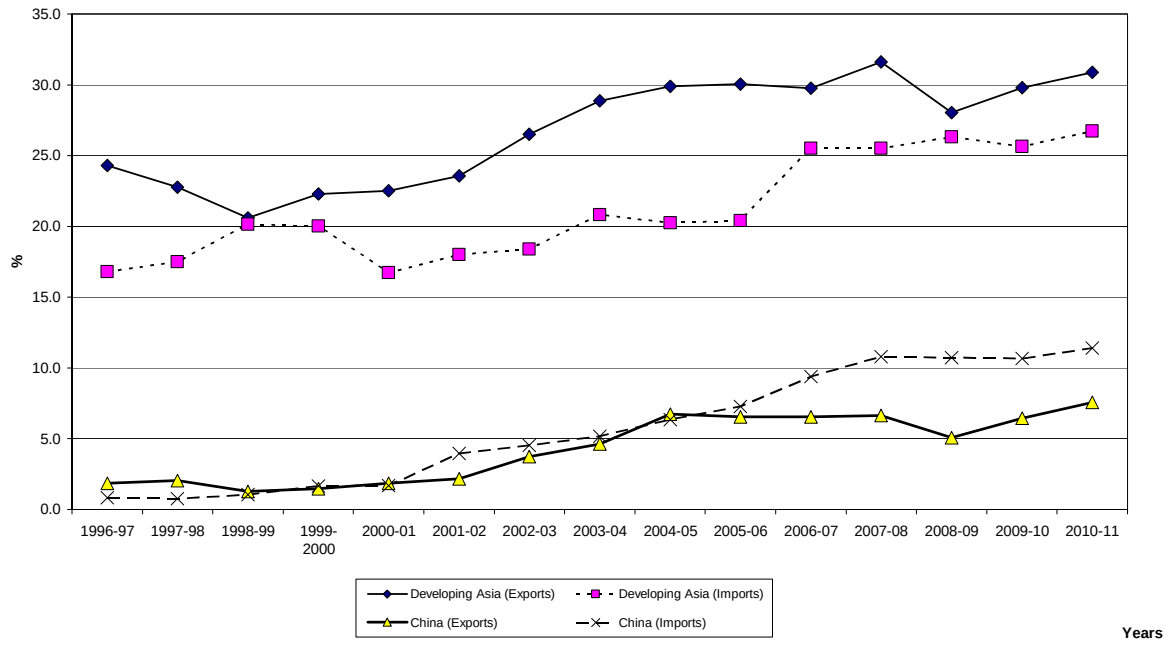
[5] See Rajan and Gopalan, 2011.

Figure 1
India's Merchandise Trade with Developing Asia and China: 1996-97 to 2010-11



Source: Reserve Bank of India, 2011.

Figure 2
India's Shares in Merchandise Trade with Developing Asia and China: 1996-97 -2010-11



Source: Reserve Bank of India, 2011.

The FDI regime in India has also been significantly liberalized, with the opening up of India's economy to foreign investors in industries such as power and fuel, electrical equipment, transport, chemicals, food processing, metallurgical, drugs and pharmaceuticals, textiles and industrial machinery, as well as in a range of commercial service activities. In the 1990s, besides liberalizing inward FDI inflows, India also liberalized its procedures for outward FDI. This resulted in a number of Asian countries investing in India as well as Indian companies investing in other countries in Asia. Between April 2000 and September 2011, India attracted a cumulative total of FDI inflow worth USD 150 billion, with Singapore (10.1 per cent), Japan (4.8 per cent) and the Republic of Korea (0.6 per cent) being ranked as the second, fifth and fourteenth-highest foreign investors in India during that period (Department of Industrial Policy and Promotion, 2011). Notably, India entered into Preferential Trade Agreements with these countries and with the ten-member Association of Southeast Asian Nations (ASEAN) during this period.

Recognizing that the manufacturing sector plays a key role in sustaining India's rapid growth, the Government of India approved the draft national manufacturing policy (NMP), with the aim of increasing the share of manufacturing in gross domestic product (GDP) from the current (2011) share of 16 per cent to 25 per cent by 2025. In order to provide the necessary environment for India to emerge as a global manufacturing hub, the government plans to build mega-industrial zones that contain world-class infrastructure facilities. The project is expected to improve connectivity within the country and create 100 million new jobs. This policy is expected to complement the foreign trade policy to assist export promotion activities by providing the necessary environment for India to emerge as a global manufacturing hub. As the Indian economy continues to globalize after two decades of "stop-go" economic reforms, and given the government's aim for the economy to emerge as a manufacturing hub, it is important to analyse whether India is beginning to integrate into IPNs in Asia and globally, and whether that potential has been successfully utilized by the manufacturing sector. It is also important to identify the policy challenges that businesses are likely to face when aiming to connect India with the Asian IPNs.

Against the above backdrop, this paper analyses the current state of participation of India in the IPNs of manufacturing industries in Asia, and identifies the constraints and challenges for India's deeper participation in the near future. Furthermore, the changing directions of India's trade policy and those of FDI are critically analysed with regard to their role in fostering greater participation by India in Asian IPNs. This analysis includes an examination of India's recent initiatives towards Asian economic integration in terms of entering into regional and bilateral preferential trade agreements (PTAs) with ASEAN, the Republic of Korea and Japan. This paper describes two case studies of industries (auto-components and electronics) that have integrated into Asian IPNs. Key recommendations for how Indian industries can integrate into Asian IPNs are then provided, highlighting the implications for other countries in South Asia.

This paper is organized as follows. Following the Introduction, Section 2 presents a theoretical and empirical review of the existing literature on Asian IPNs and the involvement of India. Section 3 expands on Srivastava and Sen (2011) by analysing the trends, extent and patterns of production fragmentation in India's merchandise trade in parts and components for manufacturing products during two distinct sub-periods. The first sub-period examined in this paper is 1994-2004, the first phase of calibrated globalization of the Indian economy. The second sub-period examined here is 2005/08, the period in which effects of the ongoing integration of India into the global economy began to emerge, and during which the events running up to the global economic crisis of 2008/09 occurred. This latter period was chosen in order to examine the effects of the economic reforms in India during the previous decadal period and in more recent years.

The framework of Athukorala (2005) and Athukorala and Yamashita (2005) is applied in analysing the extent and trends in trade in P&C in India's manufacturing sector, separately from that of total trade flows, for which disaggregated product level data from the United Nations Comtrade database is used at the 5-digit level, based on the Standard Industrial Trade Classification (SITC) Revision 3. The extent of intra-industry trade in these P&C trade sectors in the Indian economy is also estimated. Intra-industry trade estimates provide indirect evidence of the role of FDI in the process of production fragmentation, especially when the sector concerned is more producer-driven. It also uses estimates of marginal intra-industry trade in India's manufacturing trade in P&C to provide useful insights into the nature and magnitude of production fragmentation. Furthermore, the section includes an analysis of the extent of revealed comparative advantage in India's exports of these products over the period between 1994 and 2008 to ascertain which industries are becoming integrated into Asian IPNs by way of becoming specialized in their production and thereby creating an global export platform for those P&C products.

Section 4 describes two case studies of Indian industry experience of integration into Asian IPNs. Following Srivastava and Sen (2011) and Nag (2009), the auto-components and electronics components industries emerge as the two potentially most important sectors wherein there is evidence of international production fragmentation and, hence, scope for participation in global and Asian IPNs. Section 5 analyses the policy challenges that are impeding India's strong participation in Asian IPNs, and focuses on the unilateral measures that have been undertaken as a part of economic reforms as well as those within a select group of countries or regions through regional and bilateral PTAs. The unilateral measures analysed relate to India's overall direction of trade policy, involving (a) the reduction of tariffs and non-tariff barriers (NTBs) as well as steps to improve trade facilitation, and (b) the state of the country's infrastructure, which has been identified as one of the biggest structural bottlenecks towards integrating India into IPNs. Section 6 provides policy recommendations derived from the analysis, highlighting the implications for India in particular and for South Asia in general.

2. Theoretical and empirical literature on Asian IPNs

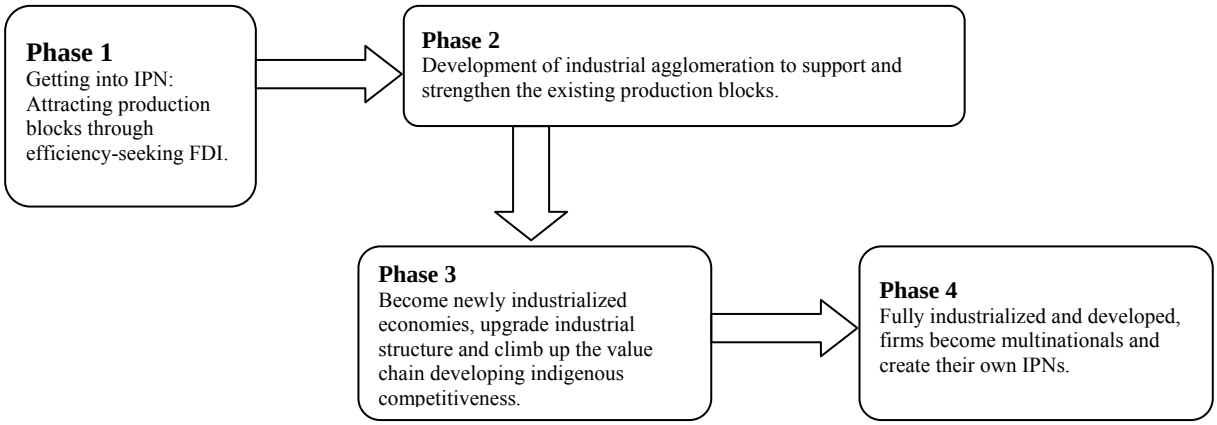
The phenomenon of international production fragmentation is a significant feature of Asian IPNs. While such fragmentation takes place through two routes: subcontracting (that involves arm's length transactions) or foreign direct investment, it is the second mode of fragmentation that creates IPNs. According to Gereffi (2001), the choice between the two modes is mainly influenced by the producer-driven or the buyer-driven nature of such fragmentation with respect to their main drivers and the core competencies that mark either the investment-based or trade-based phase of globalization. In the case of buyer-driven production fragmentation, economies of scale provide the main basis of comparative advantage in labour-intensive industries viz. garments, footwear, toys etc. Here, production is carried out by setting up decentralized production networks involving various exporting countries (via arm's length transactions) whereby retailers, designers and trading companies set up and coordinate horizontal networks.

On the other hand, producer-driven fragmentation is significant in industries that are characterized by industrial capital and vary in their core competencies and entry barriers (Gereffi, 2001). In the global context, the value chains are controlled by multinational corporations (MNCs) that play central roles in coordinating production networks, which includes backward and forward linkages. Industries that are subject to design, research and development and significant economies of scale, such as those for semiconductors, automobiles and heavy machinery, are likely candidates for the creation of IPNs controlled by MNCs. In Asia, IPNs of these industries have enabled different countries to participate along the global value-added chain of a good. As a result, there has been rapid expansion in intra-firm and intra-industry trade (IIT) transactions between countries participating in the production networks.

Kimura (2007 and 2009) developed an analytical framework based on the spatial nature of production networks and applied it to the Asian context, particularly to the member countries of ASEAN. He links it to the policy elements according to the phase of economic development and argues that the ability of each ASEAN country in utilizing the mechanics of production and distribution networks is affected to the extent to which it is industrialized or developed. Kimura (2007) developed a 2x3 matrix that identifies the set of policies that can impact upon the three sets of costs that essentially influence the development of a country's participation in Asian IPNs. These costs include a) network set-up costs to develop new production networks; b) service link costs to connect each production block within a network and c) production costs in each production block. Kimura also identified four phases of industrialization, based on current participation in production and distribution networks (Figure 3). The first phase essentially includes countries that need to get into the production networks, and which are building a business-friendly investment climate in order to attract new production blocks. Typically, these are low-income developing economies, which face

significant policy challenges in attracting efficiency-seeking or export-platform FDI.[6] The second phase requires development of industrial agglomeration to support the existing production blocks. For countries in the second phase,[7] it is important to attract foreign small and medium-sized enterprises (SMEs) that form into industrial clusters of vertical production networks by removing investment bottlenecks and improving service link arrangements. The third and forth phases comprise countries that are industrialized and whose firms are already internationally competitive and have become multinationals, developing their own production and distribution networks. Thus, developing the international competitiveness of indigenous firms is crucial to moving towards the last two phases of industrialization in IPNs.

Figure 3. The four phases of industrial development through utilizing IPNs



Source: Based on Kimura, 2009.

Based on the above framework, India's current situation would probably be characterized as being in the first phase, with potential to develop its strengths towards entering the second and perhaps the third phase in the near future. Hew et al. (2009) observe that PTAs involving tariff reductions offer developing countries in Asia the potential to reduce their service link costs to attract new production blocks within the existing network. Behind the border and non-tariff measures involving trade and investment facilitation are absolutely crucial, however, if they are to develop a business friendly environment that will reduce the overall costs of participating in the production network. Hew et al. emphasize that, in the long run, PTA measures need to be supported by strong domestic reforms in the area of institutional and infrastructure development. This is of significance to policymakers in India, if they utilize PTAs to integrate industries into Asian IPNs.

[6] The lesser developed ASEAN economies (Cambodia, Lao PDR and Myanmar) are currently in this category (Kimura, 2009).

[7] According to Kimura (2009), Viet Nam has already moved into this phase, with most of the other low-income South-East Asian countries trying to develop capabilities to enter the phase.

Kimura and Ando (2005) explain production networks in East Asia in two dimensions. The first dimension involves fragmentation based on distance, involving intra- and/or inter-firm fragmentation. This is likely to increase service link costs (greater transportation, telecom, logistics, distribution, coordination) wherein border barriers are high, but have the potential to reduce production costs owing to location advantages in the form of lower wages, access to resources, lower utility costs and access to technological capability.

The second dimension involves fragmentation based on controllability, wherein firms are likely to increase service link costs (in the form of loss of control and lack of trust) and incur additional information costs (seeking suitable partners, monitoring costs, contract costs, dispute settlement costs and legal costs), while reducing production costs generated by de-internalization advantages or their ownership advantages resulting from better technology and managerial ability in some production processes. They observed a significant expansion in trade of P&C in manufacturing in East Asian countries in the period between 1981 and 2001 following the creation of IPNs in East Asia, particularly those involving Japanese firms.

Some empirical evidence on expansion of intra-regional trade in East Asia has been established in the literature. Athukorala (2005), for example, is a detailed study that analyzed the implications of Asian IPNs and product fragmentation for regional and global trade patterns of East Asian countries over three years: 1992, 1996 and 2000. Using 5-digit product level trade data according to SITC Revision 3 (SITC, Rev. 3) classification, Athukorala observed that the share of developing East Asia (East Asia excluding Japan) in world exports of P&C manufacturing goods increased from 16.6 per cent in 1992 to 26.8 per cent in 1996. Notably, all reporting countries except Singapore recorded increases in their market shares, with a significant expansion in assembly exports from China to the world. By the year 2000, P&C exports accounted for 32 per cent of total manufacturing exports to the world from developing East Asia (including China), compared with the world average of 25.4 per cent, 22.8 per cent for the North American Free Trade Agreement (NAFTA) group and 20.3 per cent for the European Union (EU) (Athukorala, 2005). This study also observed that the share of P&C products in total manufacturing exports increased to nearly 50 per cent in Malaysia, the Philippines and Singapore, and over 35 per cent in Thailand by the year 2000, and also accounted for a significant proportion of the increase in manufacturing exports of these countries over this time period.[8]

In a more recent study, Athukorala (2010) examined the implications of global production sharing for economic integration in East Asia, and observed that the share of components in total intra-regional exports in ASEAN countries increased from 34.6 per cent

[8] Notably, between 1992 and 2000 components exports accounted for 74 per cent of total export increment in the Philippines, 64 per cent in Singapore, 54 per cent in Malaysia, and 47 per cent in Thailand., while share of components in total manufacturing exports more than doubled in China (from 6.7 per cent to 14.5 per cent) and more than tripled in Viet Nam (2.0 per cent to 8.7 per cent), (Athukorala, 2005). It is not clear as to how much of those incremental exports were driven by intra-firm trade on the basis of this data.

in 1992/93 to 56 per cent in 2006/07**.** On the import side, the increase was from 55.9 per cent in 1992/93 to to 84.4 per cent in 2006/07. The study estimated the share of P&C goods in manufacturing exports and imports to be more than four-fifths in Singapore, Malaysia, and the Philippines and over two-thirds in Thailand, with the Republic of Korea and Taiwan (Chinese Taipei) also involved in sizeable P&C manufacturing trade during this period. Athukorala (2005, 2010) confirmed that analyzing trade flows on a disaggregated basis of P&C is crucial to track the role of IPNs and the importance of intra-regional trade versus global trade for growth dynamism in Asia. Athukorala (2010) further concluded that the primary determinants of the success of Asian IPNs have been relative wage differentials, low trade barriers and trade costs, with significant evidence of emergence of industrial agglomeration, as argued by Kimura (2007), being observed for South-East Asian countries. In the case of India, Athukorala (2010) estimated that the share of P&C exports in total manufacturing trade increased from 3 per cent to 10.4 per cent between 1992/93 and 2006/07, with the share of P&C imports increasing from 17.5 per cent to 22.9 per cent over the same period. This suggests that, in contrast to the rest of Asia, India was more involved in procuring imported P&C goods for manufacturing of final goods rather than establishing itself as a global production base for the export of these goods.

In the Indian context, Veeramani (2002) analyzed trends in India's overall intra-industry trade with its 51 trading partners for three years: 1988, 1995 and 2000. The study estimated IIT using 4-digit data based on the International Standard Industrial Classification (ISIC).[9] The Grubel-Lloyd (G-L) index and an additional measure of marginal IIT, as suggested by Brulhart (1994), were used to understand changes in levels of India's IIT. Veeramani (2002) found that India's IIT grew significantly and responded positively to the economic reforms that have unleashed a series of trade and investment liberalization measures since the 1990s.[10] Furthermore, in order to analyze the effect of FDI on IIT, Veeramani (2009) analyzed the effect of trade barriers and multinationals on India's IIT in 75 industries, using the same classification, over the period between 1988 and 1999 through panel regressions. The analysis suggested that reduced trade barriers do have a positive influence on IIT and that India's IIT was being negatively influenced by the market-seeking nature of its inward FDI.[11] This view of market-seeking motives driving Indian FDI in manufacturing has been empirically established in several other studies, including Aggarwal (2001), Kumar (1990), Kumar and Siddharthan (1994), Pailwar (2001) and Pant (1993 and 1995). Kumar (2003) noted that the reforms prompted foreign multinationals to begin exploring, in a modest manner, the potential of India as an export-production platform. Srivastava (2007) observed

[9] The ISIC is a United Nations system for classifying economic data. It classifies data according to types of economic activity. The ISIC code groups together enterprises if they produce the same type of goods or service or if they use similar processes (i.e. the same raw materials, process of production, skills or technology).

[10] Veeramani (2002) analysed trends in India's overall intra-industry trade (IIT) and with its 51 trading partners in three years: 1988, 1995 and 2000.

[11] Veeramani (2009) analysed the effect of trade barriers and multinationals on India's IIT in 75 industries through panel regressions. The study estimated IIT using 4-digit data based on the ISIC.

that India was indeed becoming attractive to export-oriented FDI, with greater potential in services than in the manufacturing sector.

The above suggests that India's current participation in Asian IPNs in the manufacturing sector is likely to be low and perhaps only emerging in certain industries. A recent study of the auto-components industry in Asia by Nag (2011a) observes that P&C trade is dominant in overall intra-regional trade in the automotive sector in Asia, and that India, in spite of lowering tariff barriers and liberalizing its economy, has been mostly left out of Asian IPNs, which confirms the trend described above. Nag (2011a) notes that this trend is in spite of Indian automotive firms possessing capabilities to move up the value chain. Some of the reasons for this are high trade costs and the complexities involved in dealing with multiple rules of origin (RoO) in PTAs. The study points to serious policy challenges relating to India's participation in Asian IPNs.

3. India's participation in IPNs: Trends and patterns

3.1. Composition of India's trade in manufacturing

Tables 1 and 2 present an aggregate view of the composition of manufacturing trade in India over two sub-periods: 1994 to 2004 and 2005 to 2008. During these two sub-periods, the manufacturing sector constituted about three quarters of India's total merchandise exports and about half of India's merchandise imports. Manufactured goods (SITC 6) include textiles, leather products, gems and jewellery. A trend can be observed towards an increase in the share of manufacturing exports, with moderate expansion in the share in some of the product categories that involve trade in parts and components (viz. machinery and transport equipment), with the share of manufacturing exports in India's total merchandise exports declining over the period between 2005 and 2008 (Table 2). Machinery and Transport Equipment (SITC 7), consisting of parts and components of electronic products and electrical machinery and parts of transport vehicles and equipment, increased its share in total manufacturing exports, rising from 9.5 per cent to 13.6 per cent between 1994 and 2008. This category consisted of about 42 per cent of India's total manufacturing imports in 2004, however, indicating a larger share of parts and components being sourced as intermediate inputs from the global market. The import share of SITC 7 declined significantly over the period between 2005 and 2008, with a modest increase in its export share over the same period. The above data is highly aggregated, however, and therefore a detailed analysis of trends and patterns, at a disaggregated product level, is required to estimate the actual extent of India's participation in IPNs in manufacturing trade.

Table 1. India: Composition of manufacturing trade, 1994-2004

		1994	1999	2004	1994	1999	2004
SITC CODE		**Exports, USD billions (% share in manufacturing exports)**			**Imports, USD billions (% share in manufacturing imports)**		
5	Chemicals, Related Products, NES*	2.16 (10.81)	3.68 (12.68)	9.14 (15.8)	4.21 (29.28)	5.75 (25.23)	9.78 (19.09)
6	Manufactured Goods	10.51 (52.58)	15.22 (52.45)	28.38 (49.05)	4.82 (33.52)	9.28 (40.72)	17.72 (34.58)
68	Non-Ferrous Metals	0.18 (0.90)	0.25 (0.86)	1.21 (2.0)	0.97 (6.75)	1.14 (5.0)	1.87 (3.65)
7	Machinery and Transport Equipment	1.89 (9.45)	2.54 (8.75)	7.77 (13.43)	5.45 (37.90)	7.15 (31.37)	21.57 (42.10)
8	Miscellaneous Manufactured Articles	5.61 (28.06)	7.83 (26.98)	13.78 (23.82)	0.88 (6.12)	1.75 (7.68)	4.03 (7.86)
9	Goods Not Classified By Kind	0.45 (2.25)	0.8 (2.76)	0.86 (1.49)	2.38 (16.55)	5.23 (22.95)	11.18 (21.82)
	Manufacturing Sector (SITC 5-9 minus 68)	19.99 (100.00)	29.02 (100.00)	57.86 (100.00)	14.38 (100.00)	22.79 (100.00)	51.24 (100.00)
	Total	**26.33**	**36.67**	**79.85**	**28.65**	**49.71**	**108.26**
	Share of total manufacturing (%)	75.9	79.15	72.46	50.2	45.85	47.33

Note: *NES refers to not included elsewhere. Figures in parentheses represent share in total.
Source: Calculated from United Nations, 2010.

Table 2. India: Composition of manufacturing trade, 2005-2008

		2005	2006	2007	2008	2005	2006	2007	2008
SITC CODE		**Exports (USD billions) (% share in manufacturing exports)**				**Imports (USD billions) (% share in manufacturing imports)**			
5	Chemicals, Related Products, NES*	11.39 (11.39)	14.11 (11.64)	16.36 (11.21)	20.45 (11.24)	13.56 (9.63)	16.09 (9.03)	20.6 (9.44)	34.38 (10.89)
6	Manufactured Goods	33.61 (33.61)	36.82 (30.38)	43.13 (29.56)	49.76 (27.36)	22.75 (16.15)	21.92 (12.30)	29.20 (13.33)	38.17 (12.09)
68	Non-Ferrous Metals	1.67 (1.67)	3.76 (3.10)	3.92 (2.69)	3.48 (1.91)	2.53 (1.80)	2.56 (1.44)	4.4 (2.0)	5.9 (1.87)
7	Machinery and Transport Equipment	10.53 (10.53)	13.24 (10.92)	16.47 (11.29)	24.67 (13.57)	28.22 (20.03)	40.79 (22.89)	47.9 (21.89)	64.65 (20.48)
8	Miscellaneous Manufactured Articles	16.75 (16.75)	19.33 (15.95)	20.93 (14.35)	21.80 (11.99)	5.21 (3.70)	6.41 (3.6)	8.1 (3.72)	7.90 (2.5)
9	Goods not Classified by Kind	1.13 (1.13)	1.28 (1.06)	1.69 (1.16)	2.87 (1.58)	13.04 (9.26)	15.56 (8.73)	19.7 (9.0)	31.38 (9.94)
	Manufacturing Sector (SITC 5-9 minus 68)	71.74 (100)	81.02 (100)	94.67 (100)	116.06 (100)	80.24 (100)	98.21 (100)	121.1 (100)	170.57 (100)
	Total	**100.35**	**121.2**	**145.9**	**181.86**	**140.86**	**178.2**	**218.6**	**315.71**
	Share of total manufacturing (%)	71.50	66.84	64.89	63.82	56.96	55.11	55.39	54.03

Note: *NES refers to not included elsewhere. Figures in parentheses represents share in total
Source: Calculated from United Nations, 2010.

3.2. Production fragmentation in India's manufacturing trade

In order to have meaningful estimates of production fragmentation and, hence, of participation in IPNs, it is necessary to qualify why the data on parts and components (the proxy for production fragmentation) needs to be separated out from the reported trade data. Athukorala and Yamashita (2005) highlighted two important reasons for such separation: first, production fragmentation may lead to double-counting of trade data when the same parts and components counted as inputs for the final good cross multiple international borders during each production stage. Second, as a consequence, the calculated trade share can provide incorrect inferences as to the relative importance of a "region" vis-à-vis the rest of the world.[12] This has been observed to be particularly significant in the case of East Asia where trade in parts and components and trade in final goods did not follow the same patterns.[13] This also holds relevance in the context of this study; analysis of India's integration with Asian and global IPNs since 2009 found that 52 per cent of India's non-fuel exports and 73 per cent of its non-fuel imports constituted of intermediate goods (IDE-JETRO and WTO, 2011). Furthermore, Athukorala and Yamashita (2005) noted that there are important data caveats involved when analyzing production fragmentation in international trade.

Although comprehensive trade data at the product level is available from the United Nations Comtrade database, the choice of classification is important. In general, the SITC Rev. 3[14] and the Harmonized System (HS) classification at six-digit level of parts and components are widely used. The HS classification was revised twice: in 1996 and then in 2002. In order to maintain consistency of classification across product categories during the period of this study, the SITC classification was chosen. There are several nuances to take note of when using the SITC Rev. 3 classification, however. First, the SITC Rev. 3 data does not cover the entire range of sectors involving production fragmentation, apart from products in Machinery and Transport Equipment (SITC 7). In the category of miscellaneous goods (SITC 8) many products, such as clothing, furniture, and leather products, that are increasingly experiencing fragmentation do not separate these components from the final product. Furthermore, international production fragmentation is not limited to SITC 7 and 8, but is also prevalent in pharmaceutical and chemical products (SITC 5) and manufactured products (SITC 6), as well as in the assembly of software trade (which is often lumped with the category of "special transactions" under SITC 9).[15] Therefore, one can infer that estimates of trade in parts and components that emerge from SITC Rev. 3 data will very likely be downwardly biased.[16]

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[12] See Figure 7, p. 84 in IDE-JETRO and WTO, 2011 for an illustration of the importance of trade in intermediate goods in global trade.

[13] Literature such as Borrus, 1997; Dobson and Chia, 1997; McKendrick, Doner and Haggards, 2000 suggest that in East Asia while P & C trade has largely been intra-regional in nature, that of final goods has been extra-regional.

[14] Revision 3 data improves upon the system of SITC classification by including parts and components of trade involved in SITC 8 categories.

[15] See Athukorala and Yamashita, 2005.

[16] Product level trade data is also available from through the Harmonized System classification at six-digit level into their parts and components.

This analysis compares patterns of trade in P&C by India for 1994, 1999, 2004 and 2005-2008. Following the definition and methodology of Athukorala (2005), parts and components are defined at the 5-digit SITC Rev. 3. Data were downloaded from the United Nations COMTRADE database. The dataset for this study contains 231 products from SITC 7 and 8, i.e. 172 products belonging to SITC 7 (machinery and transport equipment) and 59 belonging to SITC 8 (miscellaneous manufactured articles).

Table 3a presents the top 10 items of Parts and Components in India's manufacturing exports (henceforth referred to as P&C exports) over the period between 1994 and 2008. This constituted about two-thirds or more of total P&C exports in categories SITC 7 and 8 from India. Parts and accessories of automobiles and other vehicles (categories 784 and 785 in SITC Rev. 3) constituted the bulk of India's P&C exports, followed by parts and components for electrical, electronic and telecommunications equipment (categories SITC 75 to 77). Appendix 1 presents the detailed commodity classification for the top 10 items of Parts and Components in India's manufacturing exports and imports.

Total P&C exports expanded in volume by nearly five-fold, rising from USD 636 million to USD 3,028 million over the period between 1994 and 2004, at a compound annual growth rate (CAGR) of 16.9 per cent, and increasing in the share of India's total manufacturing exports from 3.2 per cent in 1994 to about 5.2 per cent by 2004. In the next three years, between 2005 and 2008, it more than doubled, reaching USD 8.5 billion by 2008, at a CAGR of 31 per cent (Table 4b). In 2008, global P&C exports were worth USD 1,118 billion. India's contribution to global exports was only about 0.8 per cent, however, which is quite insignificant when compared with other developing economies in East and South-East Asia.[17] It is important to note, however, that the growth of India's P&C exports has been significantly higher than that of India's total merchandise exports, as well as its manufacturing exports (except for the years 2006 and 2008), indicating an increasing importance of P&C in India's exports over the past decade (Figure 4). In spite of the slowdown in world growth with the onset of the global economic crisis in 2008, India registered a phenomenal growth rate of 44.4 per cent in its P&C exports between 2007 and 2008, while its total manufacturing exports registered negative growth of 1.6 per cent during the same period.

[17] See Athukorala, 2010.

`Table 3a. India: Exports of top 10 items of manufacturing parts and components, 1994-2004

Exports (1994)			Exports (1999)			Exports (2004)		
Commodity Code	**Value (USD millions)**	**Share in Total P&C Exports (%)**	**Commodity Code**	**Value (USD millions)**	**Share in Total P&C Exports (%)**	**Commodity Code**	**Value (USD millions)**	**Share in Total P&C Exports (%)**
78537	101.2	15.9	78436	164.0	14.9	78439	529.7	17.5
78439	100.4	15.8	78536	145.4	13.2	75997	221.1	7.3
75997	66.2	10.4	75995	84.6	7.7	71392	162.5	5.4
71392	33.6	5.3	77885	66.8	6.1	78537	139.1	4.6
71391	28.0	4.4	71392	47.6	4.3	72855	133.1	4.4
77249	13.5	2.1	71391	32.0	2.9	71391	111.3	3.7
78431	13.2	2.1	79293	26.1	2.4	89410	87.1	2.9
74291	12.9	2.0	76499	25.1	2.3	77637	85.0	2.8
72855	12.2	1.9	72449	22.9	2.1	78431	82.7	2.7
72449	12.1	1.9	72855	21.6	2.0	77611	80.3	2.7
Top 10 P&C	393.2	61.8	Top 10 P&C	636.1	57.9	Top 10 P&C	1631.9	53.9
Total P&C	636.5		Total P&C	1098.4		Total P&C	3027.8	
Share of P&C Exports in Total Mfg. Exports (%)	3.2		Share of P&C Exports in Total Mfg. Exports (%)	3.8		Share of P&C Exports in Total Mfg. Exports (%)	5.2	

Source: Calculated from United Nations, 2010. Note: Please see Appendix 1 for detailed commodity description.

Table 3b. India: Exports of top 10 items of manufacturing parts and components, 2005-2008

Exports (2005)			Exports (2006)			Exports (2007)			Exports (2008)		
Commodity Code	**Value (USD millions)**	**Share in Total P&C Exports (%)**	**Commodity Code**	**Value (USD millions)**	**Share in Total P&C Exports (%)**	**Commodity Code**	**Value (USD millions)**	**Share in Total P&C Exports (%)**	**Commodity Code**	**Value (USD millions)**	**Share in Total P&C Exports (%)**
78439	778.3	20.5	78439	880.0	18.8	78439	919.5	15.6	79295	1119.4	13.1
71392	229.3	6.0	71392	327.0	7.0	71392	423.5	7.2	78439	1085.1	12.7
75997	221.3	5.8	75997	200.6	4.3	79295	288.6	4.9	77637	528.8	6.2
72855	155.5	4.1	72855	164.4	3.5	77637	212.8	3.6	71392	505.7	5.9
78537	148.8	3.9	78537	160.7	3.4	76493	193.4	3.3	79297	242.8	2.9
71391	138.3	3.6	78431	150.0	3.2	72855	167.0	2.8	77282	233.9	2.7
78431	113.0	3.0	71391	143.5	3.1	77282	141.2	2.4	78434	206.9	2.4
77637	93.7	2.5	77637	133.9	2.9	71391	137.5	2.3	78537	184.4	2.2
73591	82.8	2.2	76493	122.0	2.6	78431	136.9	2.3	76493	175.4	2.1
78434	78.9	2.1	78434	112.6	2.4	78434	124.6	2.1	72855	158.0	1.9
Top 10 P&C	2039.6	53.8	Top 10 P&C	2394.6	51.2	Top 10 P&C	2745.1	46.5	Top 10 P&C	4440.5	52.1
Total P&C	3795.0		Total P&C	4673.8		Total P&C	5905.0		Total P&C	8526.6	
Share of P&C Exports in Total Mfg. Exports (%)	5.3		Share of P&C Exports in Total Mfg. Exports (%)	5.8		Share of P&C Exports in Total Mfg. Exports (%)	6.2		Share of P&C Exports in Total Mfg. Exports (%)	7.3	

Source: Calculated from United Nations, 2010.
Note: Please see Appendix 1 for detailed commodity description

Table 4a presents the top 10 items of Parts and Components in India's manufacturing imports (henceforth referred to as P&C imports) over the decade between 1994 and 2004. This constituted about 60 per cent or more of total P&C imports in categories SITC 7 and 8 by India. Parts and accessories for data processing machines (SITC 75997) have been among the most important items in P&C imports by India. Parts and accessories of motor vehicles of groups 722, 781, 782 (SITC 78439) have also been among the largest P&C imports. These two products alone constituted for about a quarter of India's total P&C imports in 2004 and about 20 per cent of the total in 2008. Apart from these, parts of electrical, electronic and telecommunication equipment (products belonging to sub-categories SITC 71, 72, 75 to 77) have constituted the bulk of P&C imports in India's manufacturing sector over the decade.

Between 1994 and 2004, total P&C imports nearly tripled in volume, rising from USD 2.3 billion to USD 7.0 billion, at a CAGR of 11.6 per cent. In the next three years, between 2005 and 2008, P&C imports nearly doubled, rising to USD 16.2 billion by 2008, at a CAGR of 23 per cent .The growth of P&C imports was higher than total imports between 1994 and 2004, but slowed down over the period between 2004 and 2008 (Figure 5). Given that world imports of these P&C imports in 2008 was worth USD 1,110 billion, it can be inferred that India's contribution to world P&C imports (about 1.5 per cent) has been quite insignificant.

Table 4a. India: Imports of top 10 items of manufacturing parts and components, 1994-2004

Imports (1994)			Imports (1999)			Imports (2004)		
Commodity Code	**Value (USD millions)**	**Share in Total P&C Imports (%)**	**Commodity Code**	**Value (USD millions)**	**Share in Total P&C Imports (%)**	**Commodity Code**	**Value (USD millions)**	**Share in Total P&C Imports (%)**
79295	292.1	12.4	75997	428.3	14.2	75997	1064.5	15.2
78439	156.9	6.7	78439	309.9	10.3	78439	546.6	7.8
75997	129.2	5.5	77641	202.8	6.7	76493	445.2	6.3
71499	123.1	5.2	76493	138.0	4.6	79295	396.3	5.6
76493	75.5	3.2	71392	104.7	3.5	76491	292.8	4.2
72449	73.2	3.1	76491	77.9	2.6	77643	226.1	3.2
77643	67.3	2.9	71391	69.5	2.3	77282	172.6	2.5
71392	66.2	2.8	74291	54.2	1.8	72399	139.5	2.0
78431	64.5	2.8	71499	54.1	1.8	71392	133.1	1.9
74494	60.5	2.6	79295	53.1	1.8	72393	133.0	1.9
Top 10 P&C	1108.5	47.2	Top 10 P&C	1492.5	49.5	Top 10 P&C	3549.6	50.5
Total P&C	2349.9		Total P&C	3017.6		Total P&C	7028.0	
Share of P&C Imports in Total Mfg. Imports (%)	16.3		Share of P&C Imports in Total Mfg. Imports (%)	13.2		Share of P&C Imports in Total Mfg. Imports(%)	13.7	

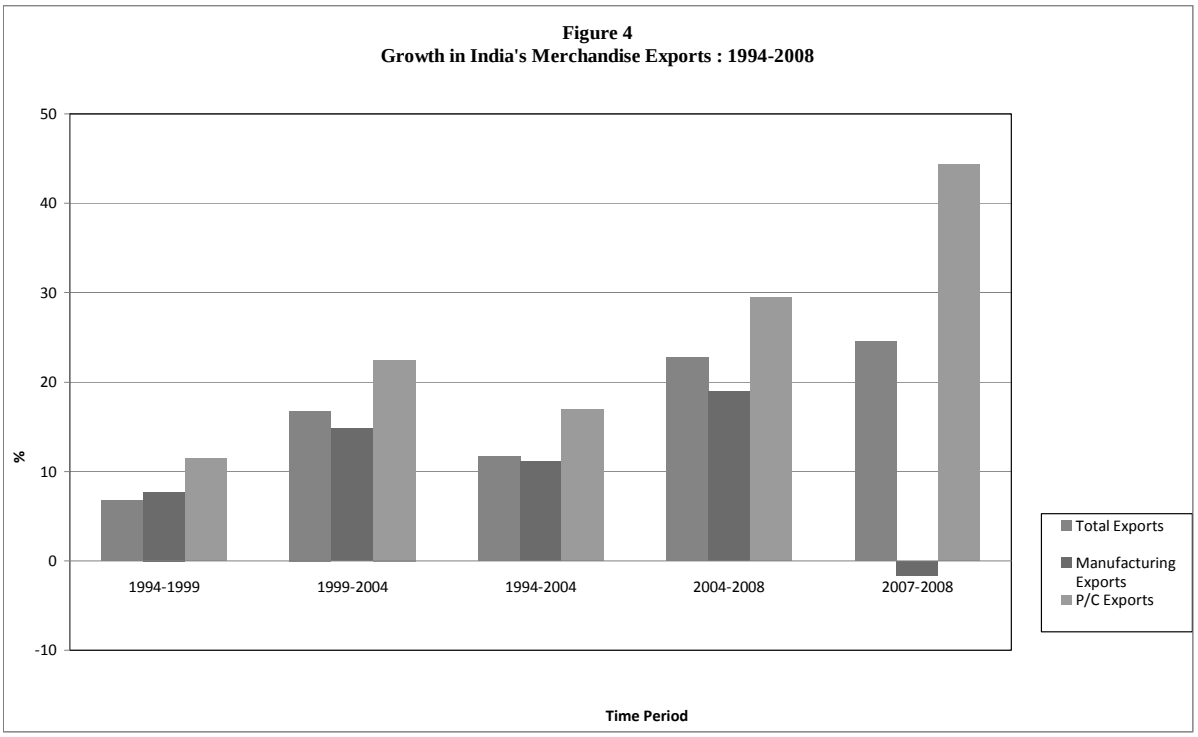
Source: Calculated from United Nations, 2010.
Note: Please see Appendix 1 for detailed commodity description

Table 4b. India: Imports of top 10 items of manufacturing parts and components, 2005-2008

Imports (2005)			Imports (2006)			Imports (2007)			Imports (2008)		
Commodity Code	**Value (USD million)**	**Share in Total P&C Imports (%)**	**Commodity Code**	**Value (USD million)**	**Share in Total P&C Imports (%)**	**Commodity Code**	**Value (USD million)**	**Share in Total P&C Imports (%)**	**Commodity Code**	**Value (USD million)**	**Share in Total P&C Imports (%)**
75997	1287.6	14.7	75997	1413.5	12.7	75997	1231.5	8.8	78439	1834.3	11.3
79295	636.2	7.3	79295	800.9	7.2	78439	931.3	6.6	75997	1242.8	7.7
78439	624.5	7.1	76493	784.4	7.1	79295	859.3	6.1	76493	878.8	5.4
76493	499.7	5.7	78439	760.3	6.8	76493	785.1	5.6	79295	647.5	4.0
76491	323.8	3.7	76491	443.8	4.0	76491	649.8	4.6	77282	503.7	3.1
77643	272.6	3.1	77643	361.4	3.3	77282	438.3	3.1	72399	446.6	2.8
77282	253.5	2.9	77282	344.1	3.1	77643	414.6	3.0	77637	420.0	2.6
72399	186.2	2.1	72399	284.3	2.6	72399	356.4	2.5	71392	370.5	2.3
71392	174.5	2.0	72855	217.8	2.0	72393	277.6	2.0	77812	355.9	2.2
72855	145.8	1.7	71392	170.0	1.5	72699	274.4	2.0	73729	350.6	2.2
Top 10 P&C	4404.3	50.2	Top 10 P&C	5580.5	50.2	Top 10 P&C	6218.3	44.2	Top 10 P&C	7050.6	43.4
Total P&C	8767.7		Total P&C	11113.8		Total P&C	14076.8		Total P&C	16233.5	
Share of P&C Imports in Total Mfg. Imports (%)	10.9		Share of P&C Imports in Total Mfg. Imports (%)	11.3		Share of P&C Imports in Total Mfg. Imports (%)	11.6		Share of P&C Imports in Total Mfg. Imports (%)	9.5	

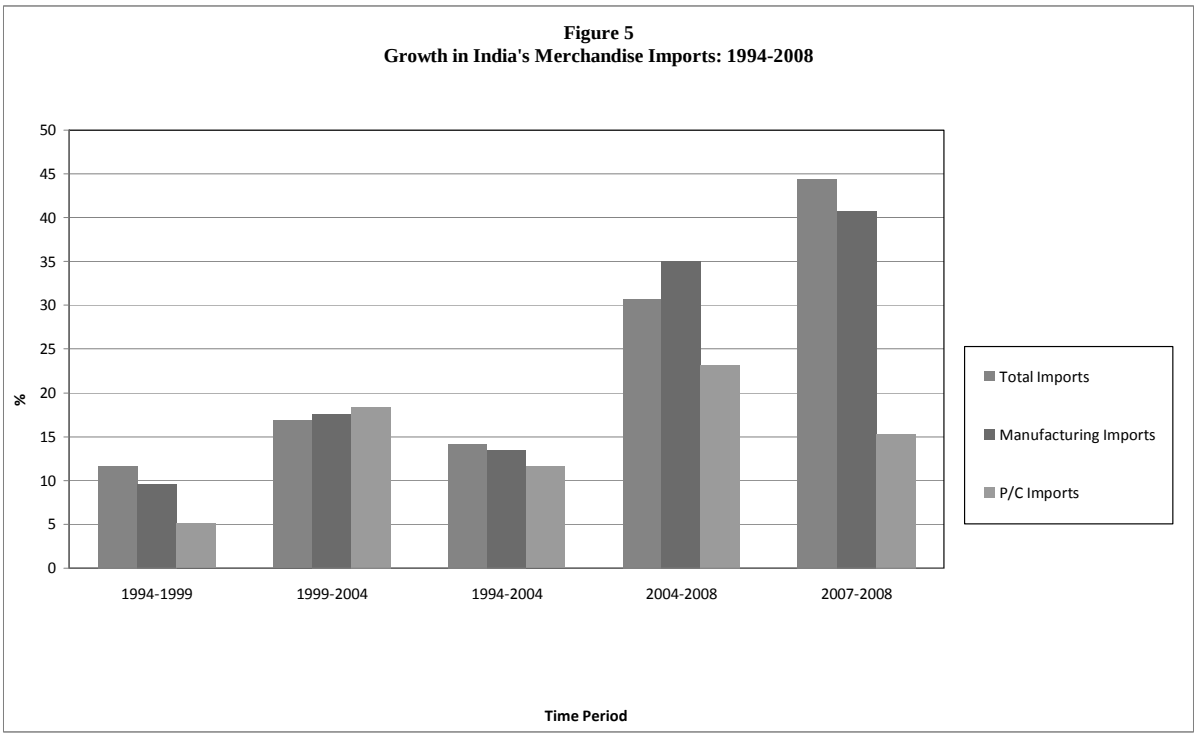
Source: Calculated from United Nations, 2010.
Note: Please see Appendix 1 for detailed commodity description

Figure 4
Growth in India's Merchandise Exports : 1994-2008



Source: Computed from United Nations, 2010.

Figure 5
Growth in India's Merchandise Imports: 1994-2008



Source: Computed from United Nations, 2010.

Comparing Tables 3a and 4a, and 3b and 4b it is observed that there are several products in which the Parts and Components are both imported by and exported from India, which were also above average in size and growth compared to the other P&C products traded. In 1994, these included five products out of the top 10 P&C exports and imports, viz. SITC 78439, 75997, 71392, 78431, and 72449. In 2008, two of these products (SITC 78439 and 71392) continued to rank among the top 10 P&C products exported and imported, with three new P&C products (SITC 79295, 77282 and 77637) also emerging among these rankings (Tables 3b and 4b). This is indicative of intra-industry trade taking place in the trade of these product components and accessories. Since these constitute machinery, electronics and auto-parts and vehicle components, it is evident that product fragmentation is indeed emerging in these sectors in the Indian economy.

While it is evident that impacts of evolving international production fragmentation in India are starting to be felt through a changing pattern of its manufacturing trade, as observed above, it is important to further analyze the extent to which such trade is being facilitated by multinationals that engage in cross-border IIT. This is because parts and components trade involving higher degrees and levels of IIT are likely to be the result of intra-firm trade involving multinationals (Gereffi, 2001). The next section therefore estimates the degree and level of intra-industry trade in India's manufacturing trade in parts and components, which provides useful insights on the magnitude of product fragmentation and the role of FDI in India's trade flows.

3.3. Estimates of intra-industry trade in India's P&C manufacturing products

Fontagne and Freudenberg (1997) proposed that the theories of imperfect competition that incorporate the possibilities of product differentiation and increasing returns to scale provide a new dimension to the debate on intra-industry trade and its explanations. The empirical work on IIT was further refined by distinguishing between horizontally and vertically differentiated products.[18] Although several empirical studies have attempted to make this fine distinction in the East Asian context, this paper does not make such a distinction, with the volume of India's P&C trade as a share of total trade being significantly lesser in magnitude (See Tables 3a and b and 4a and b).

IIT has generally been estimated in the empirical literature using the Grubel-Lloyd index,[19] which has been modified in its later versions to improve upon the downward bias inherent in the index.[20] It is important to note, however, that the G-L index is a measure of only the degree of IIT, and not of the actual volume or level of IIT involved. It is also important to ascertain whether the change in trade volumes in these P&C manufacturing products over the time periods analyzed are due more to intra-industry or to inter-industry

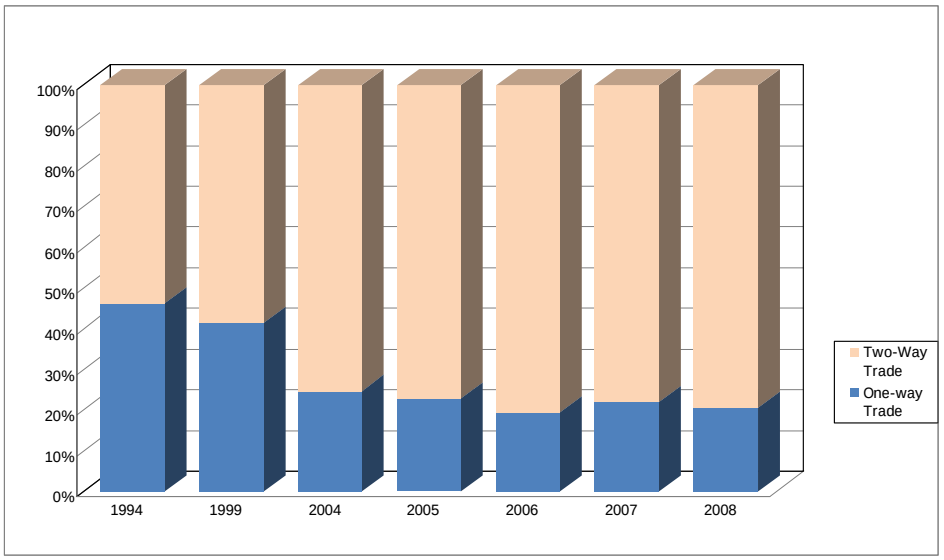
[18] See Helpman and Krugman (1985) and Falvey (1981).
[19] See Grubel and Lloyd (1975) for a discussion on the G-L index.
[20] See Rajan (1996) for a discussion of this bias.

trade. The measure, known as the marginal IIT, is a transposition of the G-L index using first differences of trade flows as, analysed by Brülhart (1994).

The method for estimating IIT in P&C trade in India involves three steps, following Srivastava and Sen (2011). The first step separates India's total P&C trade into one-way trade (inter-industry trade explained by the traditional comparative advantage theory) and two-way trade (IIT), which implies that trade might involve fragmented production chains. This facilitates separation of the P&C products that are either only exported from or imported by India, from those that involve product fragmentation due to intra-industry trade. The second step is an estimate both of the value of IIT as well as the G-L index, which measure the degree of IIT of those products. The third step is an analysis of the estimates of marginal IIT (MIIT), as suggested by Brülhart (1994), to ascertain whether the change in trade volumes in these parts and components during the periods analysed are due more to intra-industry or to inter-industry trade. The derivations and interpretations of these indices are presented in Appendix 2.

In the first step, the method applied is that of Abd-el Rahman (1991) and Ando (2006), which breaks down India's total P&C trade into one-way trade and two-way trade. Figure 6 provides the results of this break-down for the period between 1994 and 2004. It is observed that out of 231 products, nearly 174 products involved two-way trade (intra-industry trade) in 2004 and 183 in 2008, as opposed to 124 in 1994, providing evidence of evolving international production fragmentation in India. The share of two-way trade, which represents IIT, increased from 53.7 per cent to 79.4 per cent over the period between 1994 and 2008.

Figure 6. Patterns of India's parts and components trade, 1994-2008



Source: Author's Calculations based on UNCOMTRADE data

The estimates for the top 10 P&C products involving product fragmentation due to IIT over the period between 1994 and 2004 are presented in Table 5a, and those for the period between 2005 and 2008 are presented in Table 5b. It is observed that most of these products are identical to those in Tables 3a and b, indicating that the products that constitute the bulk of India's P&C exports have also been the ones experiencing maximum production fragmentation due to IIT. In 2004, the top three products that involved a high amount of IIT were SITC 78439, 75997 and 71392 (auto-parts, parts of data processing machines and parts of power generating machinery), which were also ranked the same in 1994. By 2008, this composition had changed, however, with the top three products involving a high amount of IIT being SITC 78439, 79295 and 77637 (auto-parts, aircraft parts, and photosensitive semiconductor devices). Furthermore, it is observed that the amount of IIT in SITC 78439, rose from USD 200.8 million in 1994 to USD 1059.4 million by 2004, and more than doubled to USD 2170 million by 2008 (Tables 5a and b). A similar increase was also noted for SITC 71392. The IIT involving SITC 75997 (computer parts) decreased over the period between 2004 and 2008 period, while that involving aircraft parts (SITC 79295) rose.[21] Overall, it is observed that parts of machinery and electronic products as well as automobile and other vehicle parts increased their amount of IIT over the past decade, indicating an increase in levels of production fragmentation in these products, in spite of the global economic crisis of 2008/09.

Table 5a. Estimates of intra-industry trade in India's top 10 products involving P&C trade, 1994-2004

1994			1999			2004		
Commodity Code	IIT (USD millions)	G-L Index	Commodity Code	IIT (USD millions)	G-L Index	Commodity Code	IIT (USD millions)	G-L Index
78439	200.8	78.1	71392	95.2	62.5	78439	1059.4	98.4
75997	132.4	67.8	71391	64.1	63.1	75997	442.1	34.4
71392	67.1	67.3	76499	50.2	87.1	71392	266.2	90.0
71391	28.8	67.9	72449	45.9	90.5	72855	201.9	86.3
78431	26.4	33.9	72855	43.2	74.9	77611	160.7	86.2
74291	25.8	54.2	73591	39.7	98.4	71391	127.8	72.9
72855	24.3	43.8	77811	22.1	97.4	77429	108.0	88.5
72449	24.1	28.3	77252	21.3	93.0	73591	103.2	96.9
73591	20.1	81.7	87469	21.2	56.4	77637	89.6	69.0
78535	17.9	94.5	77833	20.5	80.8	74291	88.6	63.9

Source: Calculated from United Nations, 2010.
Note: Please see Appendix 1 for detailed commodity description

[21] This was largely because of the relaxation of the restrictions involving imports of reconditioned or second-hand aircraft spare parts into India by both domestic and foreign airlines announced over 2006-2008.

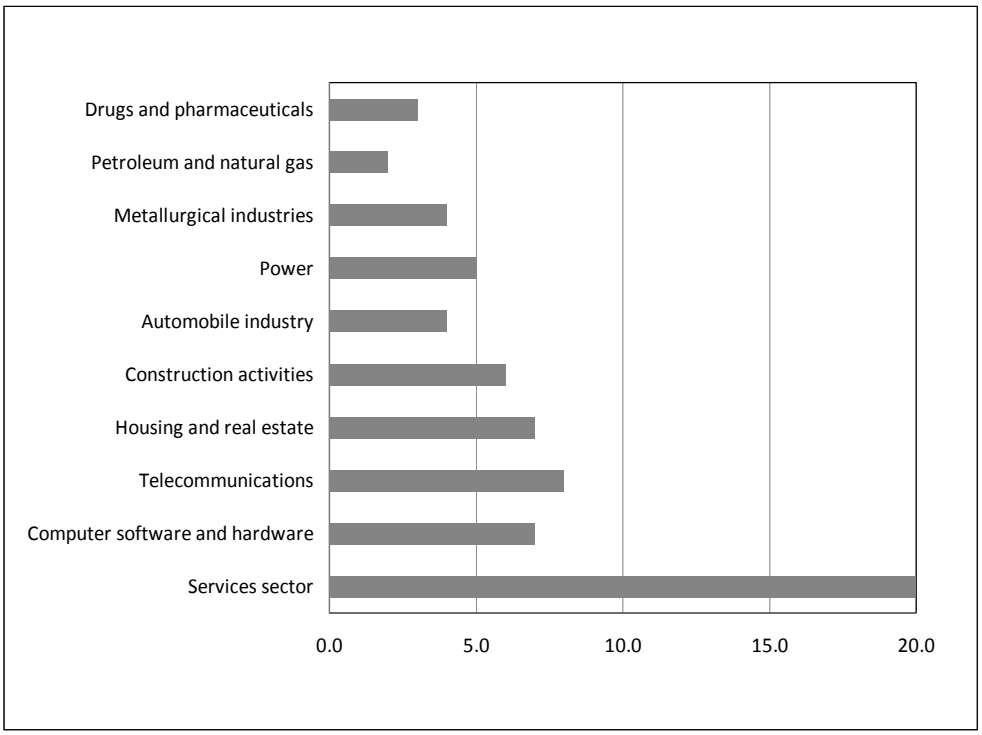
Table 5b. Estimates of intra-industry trade in India's top 10 products involving P&C trade, 2005-08

2005			2006			2007			2008		
Commodity Code	IIT (USD millions)	G-L Index	Commodity Code	IIT (USD millions)	G-L Index	Commodity Code	IIT (USD millions)	G-L Index	Commodity Code	IIT (USD millions)	G-L Index
78439	1249.1	89.0	78439	1520.6	92.7	78439	1838.9	99.4	78439	2170.2	74.3
75997	442.5	29.3	75997	401.1	24.9	79295	577.1	50.3	79295	1295.0	73.3
71392	349.0	86.4	71392	340.0	68.4	71392	481.7	72.5	77637	840.1	88.5
72855	291.6	96.8	72855	328.8	86.0	76493	386.9	39.5	71392	741.0	84.6
73591	151.2	95.4	76493	244.0	26.9	77637	337.8	88.5	77282	467.9	63.4
77259	134.1	75.9	78537	229.0	83.2	72855	334.0	76.8	78434	380.9	95.9
71391	124.5	62.1	77637	209.6	87.8	77282	282.3	48.7	76493	350.8	33.3
77429	117.2	93.5	71391	194.7	80.8	71391	275.0	94.2	78537	318.6	92.7
74291	111.8	57.5	77129	157.5	95.8	75997	247.0	18.2	72855	316.0	65.0
77129	109.6	83.1	77259	154.4	67.4	72839	220.0	86.9	71391	303.4	88.7

Source: Calculated from United Nations, 2010.
Note: Please see Appendix 1 for detailed commodity description.

Figure 7 presents the share of cumulative FDI inflows in the top 10 industrial sectors of India between April 2000 and September 2011. Unlike in most East Asian countries, such as in China where the manufacturing sector attracted more than half of the inward FDI inflows, in India the services sector (including financial and non-financial services) is the largest FDI-recipient sector, attracting nearly 20 per cent of India's FDI inflow. In India, the automobile industry (including automobile parts and components manufactures) was the seventh largest sector in terms of attracting inward FDI in India (constituting just 4 per cent of the share of FDI equity inflows over this period) and the electronics industry was not even among the top 10 industry sectors attracting FDI inflows during this period. This suggests that while the role of FDI in the process of international production fragmentation is emerging in automobiles and electronics components, it is still insignificant, compared to other modes, viz. arms-length transactions.

Figure 7. India's share of FDI inflows in the top 10 sectors, April 2000-Sept 2011



Source: Department of Industrial Policy and Promotion (2011); FDI sectoral data revalidated in line with Reserve Bank of India data that reflect minor changes in the FDI figures compared with sectoral data published earlier.

According to Banik and Gilbert (2010), one of the major reasons that IPNs have not yet flourished in South Asia is that the manufacturing activities of countries in this subregion place an emphasis on low-level technology and labour-intensive exports, such as textiles and leather products, in which there is little scope for production fragmentation. If India is to participate in global and Asian IPNs, diversification towards exporting parts and components of vertically-fragmented final products is essential.

The above trends point to the fact that India's participation in global IPNs and in those involving Asia is very low and is perhaps only emerging in a few P&C manufacturing sectors, such as parts for automobiles, electronic goods and aircraft. To ascertain the actual state of participation of these industries in IPNs, case studies need to be analyzed.

4. Indian industries in IPNs: Case studies

The previous section suggests that product fragmentation may be emerging in some automotive components and electronics sectors in India. Anecdotal evidence shows that automobile MNCs from Europe, Japan, the Republic of Korea and the United States (such as Daimler-Chrysler-Fiat, Ford, General Motors, Honda, Hyundai, Mitsubishi, Skoda, Suzuki, Toyota, Volvo and Yamaha) have increasingly exported auto-components from India to

global markets. In the area of consumer electronics, MNCs such as LG, Nokia, Philips and Samsung are strengthening their presence in India, and increasingly outsourcing parts and components from their Indian suppliers (India Brand Equity Foundation, 2011). India's participation in Asian IPNs in these industries is analysed below.

4.1 Auto-components sector

The Indian auto-components sector of the automobile industry has been growing at 20 per cent annually since 2000 and is projected to maintain high growth of 15 to 20 per cent until 2015. In 2009/10, the value of the auto-components sector was estimated at USD 22 billion, growing at CAGR of 20.4 per cent since 2004/05, with the industry expected to grow beyond USD 110 billion by 2020.

Technological developments in the Indian automobile industry have been the key drivers of growth and innovation in recent years. Indian automobiles are now more compliant with international environmental norms and emission standards and India's first electric car, the Reva, launched in 2001, and the TATA Nano, launched in 2009, have demonstrated India's ability to innovate and design new car models at low costs involving investment in research and development (R&D). Rising domestic demand has been another major factor driving the strong growth in the automobile industry.

India is expected to increasingly deploy information technology (IT) enabled automobile support systems that will further promote innovation in this industry, such as global positioning systems, anti-lock braking systems and automatic speech recognition and safety systems. Furthermore India's process-engineering expertise, applied to re-designing of production processes, has resulted in the reduction in manufacturing costs of components. As a result, India is emerging as a hub for engine components. Global original equipment manufacturers (OEMs) have been setting up engine manufacturing units in the country. The growth of global OEM sourcing from India and the increased indigenization of global OEMs, along with the availability of low-cost skilled labour, is making the country a preferred manufacturing base and is attracting investment by foreign OEMs in India. According to the India Brand Equity Foundation (IBEF) (2011), there are approximately 400,000 engineering graduates each year in India, and the cost of entry-level engineers is as low as USD 8,000 per year. Recently, the government provided investment incentives, such as lower excise duties and realization of value-added tax, and have allowed FDI up to 100 per cent, which have strongly contributed to the growth of this industry (ACMA, 2011).

The auto-components sector has witnessed a CAGR of 21 per cent in its exports since 2003/04, with exports rising from a value of USD 1.3 billion in 2003/04 to a value of USD 5.2 billion in 2010/11, and exports are expected to grow by between 20 and 25 per cent in 2011/12. During 2010/11, India exported about 12 per cent of its auto-components, Principal export items included replacement parts, tractor parts, motorcycle parts, piston rings, gaskets, engine

valves, fuel pump nozzles, fuel injection parts, filter and filter elements, radiators, gears, leaf springs, brake assemblies and bearings, clutch facings, head lamps, auto bulbs and halogen bulbs, spark plugs and body parts (ACMA, 2011). Europe was the main destination for Indian auto-component exports in 2010/11 with a share of 36 per cent. North America accounted for nearly 24 per cent of these exports, while the share of Asia was 28 per cent. The majority of exports to Europe have comprised sourcing of auto-parts by European-based automobile OEMs such as BMW, Fiat Renault, Mercedes Benz and Volkswagen. During the same period, 54 per cent of India's auto-component imports were from Asia, followed by Europe (36 per cent) and North America (8 per cent), suggesting that India is currently a net importer of auto-components from Asia, while being a net exporter to Europe and North America.

Large Indian auto-component manufacturers are in the process of substantially investing in capacity expansion, establishing partnerships in India and abroad, acquiring companies in foreign countries and establishing greenfield ventures, R&D facilities and design capabilities. This has been facilitated by favourable policy initiatives such as encouraging low-emission auto technologies and increasing the availability of appropriate auto fuels, with provisions for the automatic approval of foreign equity investment for up to 100 per cent for the manufacture of auto-components. Furthermore, manufacturing and imports in this sector are now free from licensing and approvals.

The Automotive Mission Plan (AMP) 2006-2016 of the Ministry of Heavy Industries and Public Enterprises aims to increase the auto-industry output from USD 34 billion (in 2006) to USD 160 billion by 2016, increasing export revenues to USD 35 billion by 2016, from USD 5 billion in 2010/11.[22] The AMP has recommended setting up a technology-modernization fund, with special emphasis on small and medium enterprises and encouragement to establish development centres, besides streamlining training research institutions around auto hubs. As part of the National Automotive Testing and R&D Infrastructure Project (NATRiP), the government also plans to set up an R&D fund for the industry at a cost of USD 388.5 million, to enable the industry to adopt and implement global standards of vehicular safety, emission and performance standards. The recent Union Budget of 2010/11 has given further impetus to the automotive industry by increasing weighted income tax deductions for in-house R&D from 150 per cent to 200 per cent, and for outsourced R&D from 125 per cent to 175 per cent, which is expected to reduce the upgrading costs of companies. Furthermore, the reduction of excise duty on smaller passenger vehicles and of the duty levied on raw material to between 5 and 7.5 per cent, from 10 per cent, is expected to reduce tariff escalation and reduce effective rates of protection, improving the competitiveness of the industry.

The auto-component industry recorded a total investment of USD 9 billion in 2009/10, compared with USD 3.8 billion in 2004/05. In 2000/11, the automobile industry

[22] See ACMA. http://acmainfo.com/docmgr/Status_of_Auto_Industry/Status_Indian_Auto_Industry.pdf

(including auto-components) was the sixth-largest recipient of FDI equity inflows into India, receiving a cumulative FDI inflow worth USD 6.4 billion between April 2000 and September 2011, constituting a 4 per cent share of total FDI (Department of Industrial Policy and Promotion, 2011). According to the Automotive Component Manufacturers Association (ACMA) (2011), investment in the industry (both domestic and foreign) is expected to reach USD 35 billion by 2020.

Data are unavailable for the contribution of MNCs in the automobile industry by country of origin, which makes it impossible to ascertain whether Asian or non-Asian MNCs are playing the dominant role in FDI in this industry, and more particularly in the auto-components sector. The current structure of the industry suggests, however, that in 2010 the organized sector of this industry contributed to 58 per cent of total production, with large Indian firms[23] contributing 43 per cent of total production. MNCs such as Magna, Visteon, Federal-Mogul Corporation (North American-based), Valeo, Bosch (European-based) and Denso (Japan-based) contributed only 15 per cent of the production in the Indian auto-components market, with the remaining contributed by the unorganized sector, suggesting that compared to the role of Asian MNCs in South-East and East Asia, the role of Asian MNCs in India's auto-components industry has been minimal (IBEF, 2011).

Nag (2009) and (2011) analyzed the growth in the auto-components sector in Asia and the potential for India to integrate with existing IPNs in Asia. Nag (2009) observed that globalization of the auto-components sector and its liberalization has had a positive impact on growth of the automobile industry in Asia. He estimated that between 1995 and 2006 India's exports of auto-components increased from USD 0.28 billion to USD 1.38 billion, while China's auto-components exports increased from USD 0.38 billion to USD 8.93 billion. From this, he concluded that India's scale of production has been growing, but at a much lower scale than China's. The study further observed that government support has been encouraging the growth of this industry sector across Asia. Furthermore, while India and China have seen growth in the domestic components sector, involving indigenous companies, in most South-East Asian countries the industry has been heavily export-oriented.

Table 6 presents the top 10 export destinations for seven Indian auto-components in 2008, identified at the SITC 5-digit product level. With the exception of the Republic of Korea and Thailand, no East or South-East Asian country ranked among the top three destinations for auto-component exports during that year. The majority of India's auto-component exports were destined for European countries, North America, Middle Eastern countries, Bangladesh and Sri Lanka. This contrasts strongly with the pattern of exports of auto-components from other Asian economies, such as Thailand, Malaysia, Indonesia, which export auto-components mainly to China, Japan and Taiwan, reflecting strong participation in Asian IPNs in this industry. Nag (2011a) noted that while the majority of India's auto-exports

[23] These include firms such as Bharat Forge Ltd, Sundaram Fasteners Ltd.,Lucas-TVS Ltd, Rico Auto, Pricol Ltd and Shriram Piston and Rings Ltd.(IBEF, 2011).

were not destined for Asia, India was increasingly sourcing a significant amount of auto-components from Asia. This suggests that India's level of participation in Asian IPNs involves more one-way than two-way trade in auto-components.

This is further confirmed by an analysis by Nag (2011a) of IIT in auto-parts for India at the HS eight digit classification involving member countries of the Organisation for Economic Co-operation and Development (OECD), such as the United States (US), Germany, United Kingdom (UK) and Italy, and Asian economies, viz. China, Indonesia, Malaysia and Thailand, wherein bilateral IIT in auto-components of India was higher for trade with the US and Germany than with any Asian country.

Table 7 presents the trends in India's automobile P&C exports to major Asian countries involved in automotive IPNs between 1994 and 2008. The share of India's automobile P&C exports to eight major auto-component producers in Asia increased from 6.3 per cent in 1994 to 10.8 per cent in 2008. The table shows rapid expansion rates in exports to China, Japan, the Republic of Korea and Thailand. This indicates that while India's exports of automobile P&C products to Asia has increased since the economic reforms, its current scale of participation in Asian IPNs is quite low, but there is a distinct potential for future expansion.

Table 6. Major destinations and export shares for selected auto-parts from India, 2008

78425		78431		78432		78433		78434		78436		78439	
Export destination	**Share (%)**	**Export destination**	**Share (%)**	**Export destination**	**Share (%)**	**Export destination**	**Share (%)**	**Export destination**	**Share (%)**	**Export destination**	**Share (%)**	**Export destination**	**Share (%)**
Senegal	19.14	USA	28.9	Republic of Korea	41.0	United Kingdom	26.1	Hungary	27.9	Italy	40.5	USA	28.4
United Arab Emirates	17.1	Mexico	11.7	USA	16.5	USA	21.6	Thailand	14.3	Turkey	15.6	Italy	9.7
France	7.6	France	4.9	Germany	9.1	Mexico	11.9	South Africa	13.9	Sweden	15.2	Germany	6.7
Japan	5.7	China	4.4	United Arab Emirates	5.4	Italy	6.7	Argentina	13.7	France	7.9	United Kingdom	5.5
Australia	5.2	Italy	4.4	Australia	3.3	Egypt	4.6	Singapore	6	Germany	7.8	United Arab Emirates	3.5
Israel	5.1	United Kingdom	4.3	Spain	2.7	Poland	3	Germany	5.9	United Kingdom	6.5	Belgium	3.5
Guinea	4.5	Germany	3.7	United Kingdom	2.4	Netherlands	2.9	USA	5.0	USA	2.9	Republic of Korea	2.8
Bahrain	4.5	South Africa	3.4	Saudi Arabia	1.9	China	2.6	Italy	4.3	Indonesia	1.3	Turkey	2.6
Nepal	3.2	Poland	2.9	Slovakia	1.4	United Arab Emirates	2.4	China	2.1	Cameroon	1.0	France	2.6
Sri Lanka	3.2	Spain	2.8	Egypt	1.3	Japan	2.2	United Kingdom	0.9	Sri Lanka	0.5	South Africa	2.1

Source: Calculated from United Nations, 2010.
Note: Please see Appendix 1 for detailed commodity description

Table 7. India's exports of auto-parts to major countries involved in Asian IPNs, 1994-2008

	1994		1999		2004		2008	
	Value (USD millions)	Share in Total (%)	Value (USD millions)	Share in Total (%)	Value (USD millions)	Share in Total (%)	Value (USD millions)	Share in Total (%)
China	0.1	0.0	0.5	0.2	12.4	1.7	22.9	1.3
Hong Kong	0.5	0.2	1.7	0.7	0.8	0.1	0.6	0.0
Indonesia	3.9	1.6	2.7	1.1	5.7	0.8	12.3	0.7
Japan	0.9	0.4	3.8	1.5	7.6	1.1	18.6	1.1
Korea	0.1	0.0	6.6	2.6	7.2	1.0	69.9	4.0
Malaysia	2.9	1.1	2.8	1.1	11.5	1.6	11.7	0.7
Singapore	7.1	2.8	2.0	0.8	2.8	0.4	4.4	0.3
Thailand	0.8	0.3	0.4	0.2	10.8	1.5	50.1	2.8
Viet Nam	0.0	0.0	0.1	0.0	0.7	0.1	0.6	0.0
World	251.4	6.5	253.0	8.1	709.9	8.4	1765.5	10.8

Source: Calculated from United Nations, 2010.

Nag (2011b) analyzes the potential effect of trade liberalization on India's participation in IPNs in this industry in greater detail. Nag observed that the economic reforms since the 1990s have opened up significant opportunities for investment and technology transfer in this industry. India's low labour costs and high availability of management and engineering skills have also maintained the competitiveness of domestic auto companies and made it an attractive location for direct manufacturing investors. India's tariffs on imported auto-components decreased from 35 per cent to 10 per cent between 2001 and 2008, thereby enhancing opportunities for Indian and India-based global auto-manufacturers to source bigger and cheaper components more efficiently. Nag argues, however, that while the Indian auto-component industry is growing up the value chain, its scale of production is quite low compared to China (as also observed in Table 9) and India is yet to leverage upon its move to the higher strata of value chain.

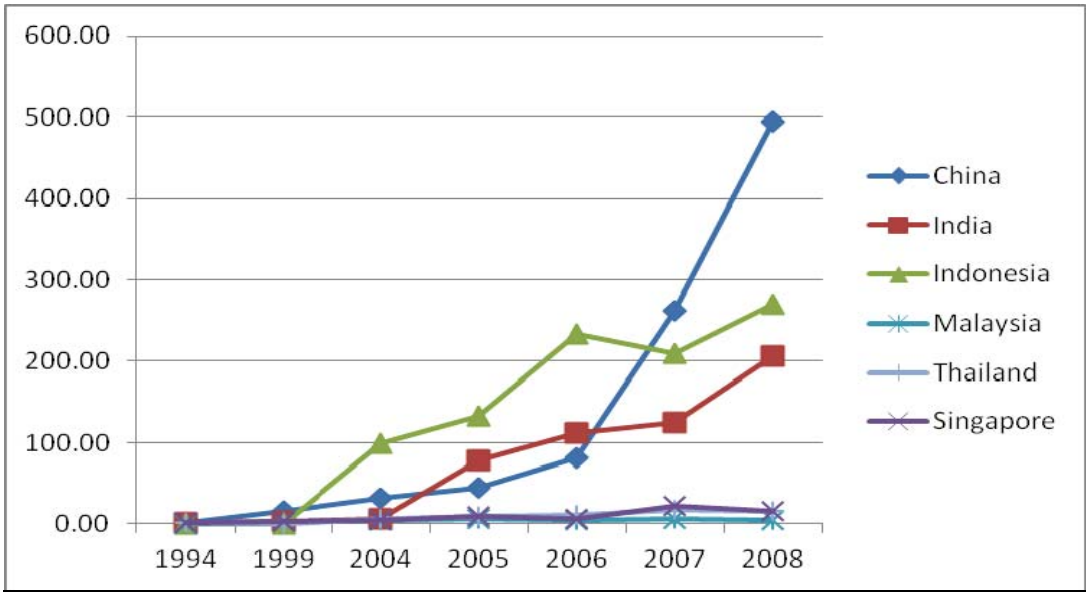
While arguing that ASEAN countries have still not yet been major destinations for Indian auto-components, with the exception of Thailand, a case study by Nag (2011b) points out that some leading MNEs have begun choosing India as an export platform for some auto-parts, and hence it is likely that the potential for India to have stronger participation in Asian IPNs in the near future is growing.

Toyota Kirloskar Auto Parts (TKAP), a joint-venture between Toyota and a local manufacturer, has been exporting gearboxes from India to its assembly plants in different parts of the world, including Thailand, since 2004. With this investment, TKAP has joined in a select group of Toyota manufacturing bases in the ASEAN region, South Africa and Argentina that manufacture components and vehicles for Europe, Asia, and Central and South

America (Nag, 2011b). Thus, Toyota Indonesia, which specializes in production of multipurpose passenger vehicles (MPVs), has integrated its production system in this segment with that in India, with India importing engine components from Indonesia and exporting gear boxes and other auto-parts. In this manner, Toyota has included India as a part of the firm's international multipurpose vehicle project, which is a part of building and strengthening its IPNs in Asia. Nag's (2011b) study observes that exporting gear boxes is just the beginning of Toyota's strategy to integrate India into its Asian IPNs, and there could be possibilities for Toyota and other global automobile manufacturers to source automotive hardware such as forged parts, metal components and sub-assemblies as well as software from their Indian operations.

Figure 8 shows the trends in the export of SITC 78434 (gearboxes of the motor vehicles of groups 722, 781, 782 and 783) from India over the period between 1994 and 2008. India's exports of this P&C product grew rapidly, rising from USD 6 million in 2004 to USD 207 million in 2008, at a CAGR of 140 per cent, while that of China increased from USD 32 million to USD 495 million at a CAGR of 98 per cent.

Figure 8. Exports of gearboxes (SITC 78434) from selected Asian countries,1994-2008



Source: Computed from United Nations, 2010.

Suzuki India has developed a global sourcing policy and is trying to procure components from its suppliers throughout the world by integrating them into its Asian IPNs (Nag, 2011); this is expected to increase two-way trade of auto-components between China, India and Indonesia, where Suzuki's plants are located.

In the case of two-wheelers, Nag (2011) observes that Indian companies such as TVS and Bajaj Auto are beginning to show a strong presence in Asian markets, particularly in Indonesia. These two companies recorded export growth of more than 50 per cent in 2006 and recently expanded their manufacturing capacity in Asia, with TVS investing USD 55 million in establishing an assembly plant in Indonesia. Thus, Nag concludes that exports are playing an increasing role in India's automobile industry, with manufacturers such as Hyundai (which has already made India the world source for the i10), Renault-Nissan (which is using India as a supply hub for small cars), Chevrolet, Ford, Honda, Toyota and Volkswagen are investing in new capacity for supplying local and overseas markets. The study concludes that while Indian component manufacturers have the potential to supply good quality products efficiently, this potential is untapped due to slow transfer of technology, and most Indian companies have to enter into joint ventures to increase their exports. An important issue that emerges from Nag's qualitative analysis is that Indian companies find themselves constrained if the joint venture partner is an Asian OEM, as they end up supplying to the parent OEM mainly, with limited options to supply to other Tier 1 suppliers that already exist in Europe and North America. This probably explains why Indian companies prefer to link with European or American companies rather than with Asian companies, as they see a greater opportunity to supply to a wide range of firms, not all of which are OEMs.

The above analysis demonstrates that India has significant potential for attracting investment and technology in the automobile industry to facilitate its growth up the value chain and expand its exports and imports of auto-parts from Asia. The current level of participation of India in Asian IPNs in this industry is low, but promising, with more Asian MNEs, such as Toyota, Hyundai, Suzuki and others, expected to utilize India's potential as a global export platform and integrate it strongly into Asian IPNs.

The effects of the global economic slowdown since 2008 and the debt crisis in Europe are likely to have an adverse impact on Indian auto-component suppliers, however, as Europe and North America together account for over 60 per cent of India's auto-component exports, and continued weak demand in these markets implies that utilization rates of capacities at Indian suppliers' end will be sub-optimal, affecting profitability.[24] Increased competition from other countries, uncertainty arising from currency volatility and inability to acquire capabilities in tune with technological advancements could also be potential constraints for future integration of India into IPNs and development of IPNs in this industry.

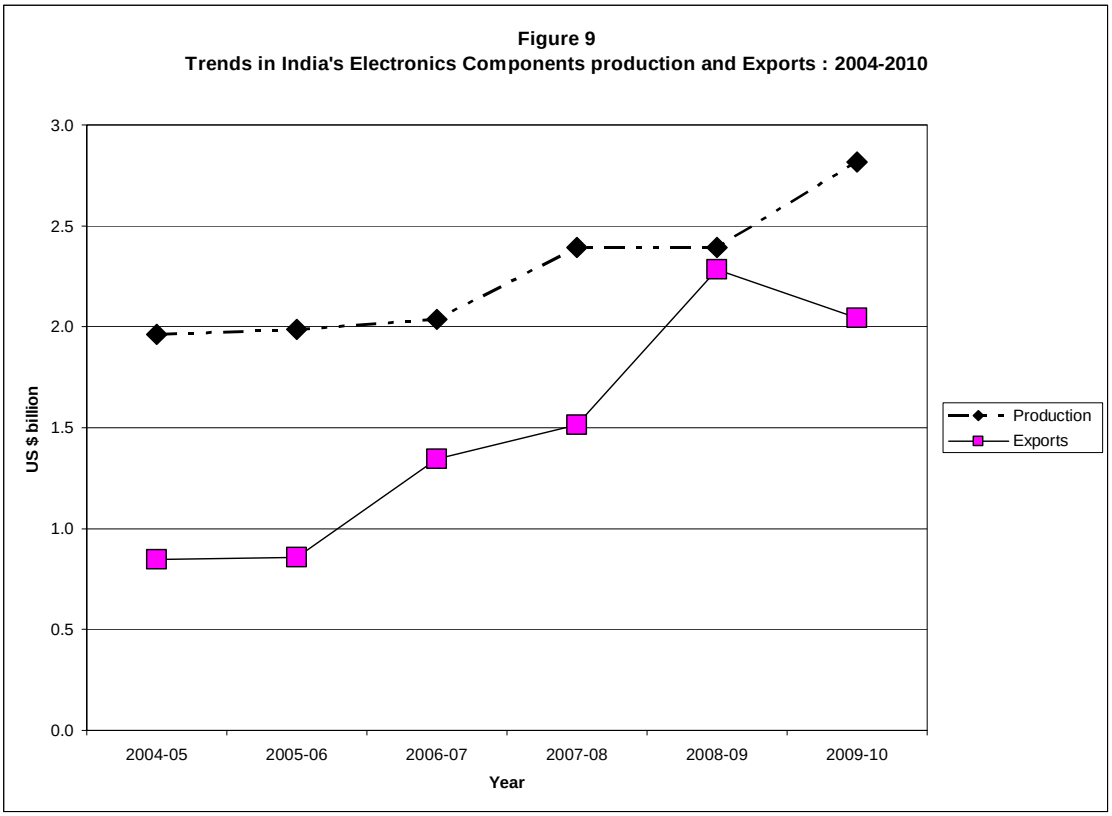
4.2. Electronic components sector

The electronic components sector of the electronics industry caters to the requirements of the consumer electronics, telecom, defence and information technology sectors. Some examples

[24] See Ghosh et.al (2010)

of electronic parts and components exported from India are television screens, monitor screens, diodes and transistors, power devices, integrated circuits, hybrid microcircuits, resistors, capacitors (plastic film, electrolytic, tantalum and ceramic), connectors, switches, relays, magnetic heads, printed circuit boards, crystals and loudspeakers. This industry experienced a CAGR of 7.5 per cent over the period between 2005 and 2010, with the production of electronic components increasing in value from nearly USD 2 billion in 2005/06 to USD 2.8 billion in 2009/10 (Figure 9). Production of electronic components registered a growth of 17.7 per cent between 2008/09 and 2009/10, in spite of the global economic crisis. It is observed that exports of electronic components grew even more rapidly over the period between 2004 and 2010, with its shares of electronic components in total production increasing from an average of 43 per cent in 2004/05 to 72 per cent in 2009/10.

Figure 9 Trends in India's electronics components production and exports: 2004-2012



Source: Electronics and Software Exports Promotion Council, 2011.

Foreign investment in the electronic components sector has been facilitated by India's export promotion scheme, which allows foreign investment of up to 100 per cent in production, exclusively for exports. The units set up under these programmes are bonded factories that are eligible to import their entire requirements of capital goods, raw materials and components, spares and consumables, office equipment etc. free of import tariffs. As in the case of the auto-parts sector, the electronic components sector has benefited from

economic reforms, reductions and elimination of tariff barriers and the creation of Special Economic Zones (SEZs) for electronics firms to manufacture for export purposes as well as for the domestic market. In addition, tax incentives in SEZs, such as (a) total income tax exemption on export profits for five years, (b) 50 per cent tax exemption for the subsequent five years and (c) 50 per cent tax exemption on ploughed-back profits for five years thereafter, have encouraged the growth and exports of this sector.

Between 2000 and 2011, the electronics industry was the twenty-fifth largest recipient of FDI equity inflows into India, receiving a cumulative FDI inflow worth USD 1.1 billion between April 2000 and September 2011, constituting a share of 0.7 per cent of the total FDI inflow (Department of Industrial Policy and Promotion, 2011). As in the case of the automobile industry, data are unavailable on the contribution of MNCs, by country of origin, in the electronics industry. This makes it impossible to ascertain whether Asian or non-Asian MNCs have been playing the dominant role in FDI in this industry, and more particularly in the subsector of electronic components.[25] The small amount of cumulative FDI inflows over the past decade suggests that MNCs have not played a significant role yet in the development of this sector as a manufacturing hub, however, and the key players in the export market have been Indian firms, with large Asian MNEs such as LG and Samsung involved in catering to the rapidly growing domestic demand for electronics. (IBEF, 2011).

The rapid growth of India's electronic components sector has mainly been driven by growth in demand for consumer electronics. The demand for electronic components such as printed circuit boards, semiconductor devices, connectors, wound components and antennas has increased due to demand from indigenous manufacturers of mobile phones, set top boxes, DVD players, etc. Most of the top global semiconductor companies have set up chip design centres in India. With the introduction of the Special Incentive Package Scheme, announced by the government in 2007, it is expected that chip manufacturing will start in the near future.

According to the Electronics and Software Exports Promotion Council (ESC) (2011), the growth in electronic components exports have also been accompanied by an increase in their shares to Japan, Republic of Korea and other East Asian countries, which registered a growth of 101.4 per cent over the two-year period between 2008/09 and 2009/10, with the value increasing from USD 108 million to USD 217 million in a single year (ESC, 2011).

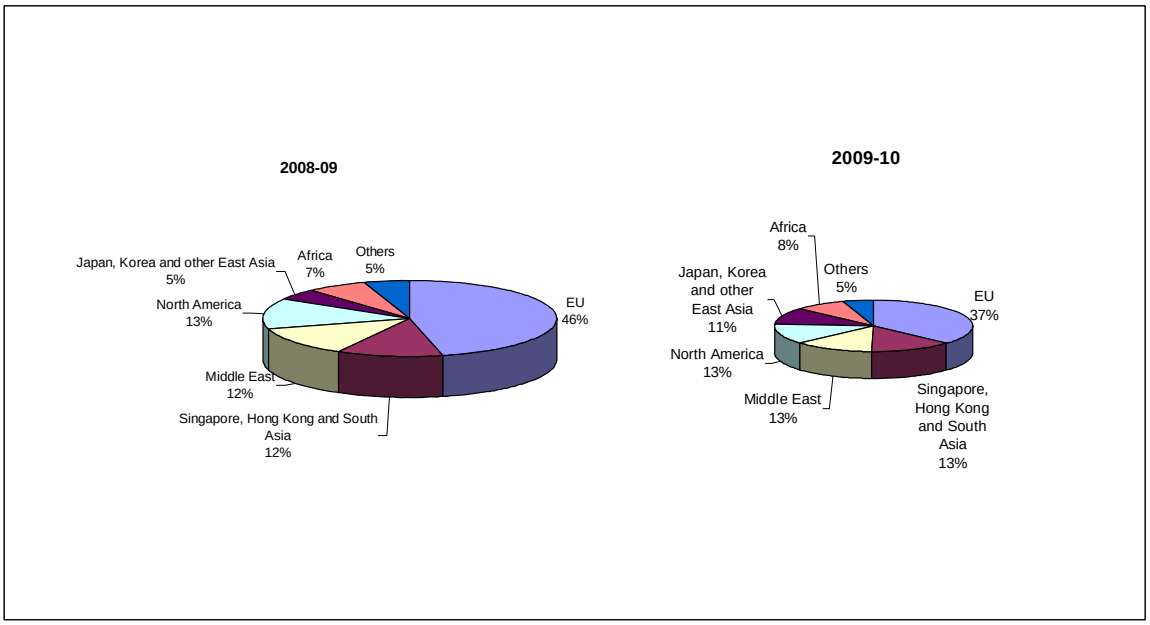
Figure 10 suggests that in response to the onset of the global economic crisis in 2008/09, the share of India's electronics components exports to the EU and North America declined in 2009/10, while that of Hong Kong, Japan, Korea, Singapore and South Asian countries increased. Table 8 presents the export values and shares of major export destinations of the top 10 items of India's electronic components exports in 2010, which also corresponds to the SITC 77 broad product category in the trade data. The bulk of these

[25] Monthly FDI statistics published by the Department of Industrial Policy and Promotion, Government of India, provides detailed data on aggregate country FDI equity inflows, or by industrial sectors, but not both.

electronic components exports were destined for OECD countries, particularly the United States and Germany. This suggests that India's links with Asian IPNs on the export side in this industry are also not so strong, but are visible and emerging.

It is evident that, as in case of auto-components subsector, the current global economic slowdown and debt crisis in Europe could be potential risk factors for exports of Indian electronics component suppliers, continued weak demand in these markets, increased competition from other Asian countries and uncertainty arising from currency volatility, as well as affecting the ability to acquire capabilities in tune with technological advancements. These factors could emerge as potential constraints on the future development of IPNs in this industry. Contract manufacturing and sourcing of electronic components is where India is currently playing a role in global IPNs, but the industry needs to move up the value chain and acquire capabilities as a manufacturing base to further strengthen its role in IPNs involving Asian countries.

Figure 10. Shares of major destinations of India's electronics component exports, 2008 – 2010



Source: Electronics and Software Exports Promotion Council, 2011.

Table 8. India's exports of electronic-parts: Value and share in major destinations, 2009/10

Electronic components	Export value in 2009/10 (USD millions)	Major destinations in 2009/10 with approximate percentage share of items in total export value
Boards, Panels, Consoles, Desks, Cabinets etc.	454.1	USA (11%), Germany (10%), UAE (9%), UK(6%), China (4%), Others (60%)
Solar Cells	320.2	Germany (55%), Netherlands (12%), Italy (7%), Spain (4%), Australia (4%),Others (18%)
Populated P&CB	204.6	China (23%), UAE (19%), USA (17%), Netherlands (10%), HK (5%), Others (26%)
Transformers	142.8	Ethiopia (12%), Nigeria (9%), Kenya (8%), Djibouti (7%), UK (6%), Others (58%)
Printed Circuits Boards – Blank	94.1	USA (26%), Austria (21%), China (10%), Germany (7%), Spain (6%), Others (30%)
Antennas	91.9	Germany (24%), Netherlands (15%), Russia (10%), China (9%), HK (6%), Others (36%)
Parts of Transformers	66.3	USA (10%), Iran (8%), UAE (8%), Germany (5%), Turkey (5%), Others (64%)
Capacitors	61.6	Germany (26%), HK (10%), Nigeria (9%), USA (9%), Czech (7%), Others (39%)
Diodes	46.1	Germany (38%), Spain (10%), Italy (7%),Singapore (6%), USA (6%), Others (33%)
Parts of Meters	40.7	Bahrain (72%), USA (20%), Singapore(1%), Mauritius (1%), Nigeria (1%),Others (5%)

Source: Electronics and Software Exports Promotion Council, 2011.

5. Improving India's participation in Asian IPNs: The policy challenges

The question is, how can India strengthen its participation in Asian IPNs and enhance its presence in the manufacturing of P&C products in Asia? Kimura (2009) and Hew, Das and Sen (2009) contend that there are a significant number of policy challenges for a country to be able to successfully integrate its industries into IPNs. Creating a competitive and business-friendly investment climate is the first step, followed by improvements in physical infrastructure to reduce trade costs and allow industrial agglomeration, and thus forge links with the production blocks. Bilateral and regional PTAs, involving tariff and non-tariff barrier reductions, regulatory reforms and reducing transaction and trade costs in an IPN are also significant steps.

In the Indian context there are four policy challenges to effectively plugging into global and Asian IPNs: the need for continued unilateral trade and investment liberalization, with emphasis on regulatory reforms; the need for reduction of transaction costs of trade and improvement of physical and institutional infrastructure; the need to addressing factor market rigidities and making labour laws flexible; and the need to utilize PTAs effectively with countries that are already part of Asian IPNs and support the PTAs with unilateral "second-generation"

reforms. The significance of each of these policy challenges and India's position vis-à-vis South-East and East Asian developing countries is analysed in detail in the following sections.

5.1. Unilateral trade and investment liberalization

India's trade policy objectives are stipulated in its foreign trade policy (FTP). As a part of the unilateral trade liberalization in India since the first generation of economic reforms of 1991, Indian policymakers have highlighted the need to expand the volume of trade and use trade expansion as a policy tool to promote economic growth and employment. This indicates that over the past two decades India's development strategy has moved away from an inward-looking one, towards a global and outward-oriented strategy. In India's latest FTP, of 2009-2014, the goal is to achieve annual export growth of 15 per cent, with the long term objective being to accelerate export growth to 25 per cent per annum and double India's share in global trade by 2020 (WTO, 2011c). One of the major objectives of the new FTP is to enhance the process of diversification of India's export products and markets.

The shift to non-traditional markets has been actively aided by offering a range of incentives to exporters to explore 39 new markets: 26 under the focus market scheme and 13 under market-linked focus product schemes.[26] The focus market scheme primarily aims to offset the high freight costs involved in trade with selected international markets in order to enhance India's export competitiveness in those countries. Measures include providing credit for payment of import duties and other forms of export financial assistance for exporters – ranging from 2.5 per cent to 3 per cent of the value of exports. Under the focus product scheme, a number of products (including automobiles and other engineering products) have been given incentives. The objective is to encourage production and exports of products that possess high employment elasticity.[27]

As a result of policy shifts towards outward orientation, India's simple average applied MFN tariff rate declined from 15.1 per cent in 2006/07 to 12 per cent in 2010/11. The largest proportion of lines (8,042, i.e. 71 per cent) was subject to a tariff rate of between 5 and 10 per cent, while 12.8 per cent of total lines were subject to a tariff rate greater than zero but lower than 5 per cent. This is a major shift from 2006/07, when 65 per cent of all tariff lines were within the 10 to 15 per cent range, followed by 10.4 per cent of lines at 25 to 30 per cent. Overall, India is estimated to have reduced its applied tariffs by an average of 19.5 per cent in the period between 2001 and 2009 (IDE-JETRO and WTO, 2011; and WTO, 2011b). These tariff reductions have narrowed the gap between the levels of India's trade protection and those of ASEAN and China. India's trade-weighted MFN tariff, at 6 per cent in 2012, is lower than those of Brazil and the Russian Federation, and is not far from the Chinese and ASEAN levels (Sally, 2011). Table 9 shows that compared to other developing countries in East and South-East Asia, however, India's tariff structure still has room for further liberalization to make it more competitive and, thus, for

[26] See Rajan and Gopalan, 2011, and WTO, 2011c.
[27] See Rajan and Gopalan, 2011.

MNEs to consider developing Indian operations as a global export platform for manufacturing activities, similar to that achieved by Toyota Kirloskar Auto Parts.

Table 9. Tariff structure of non-agricultural goods in India and selected developing Asian economies

Tariff lines, 2009, %								
	Duty-free	**0 <= 5**	**5 <= 10**	**10 <= 15**	**15 <= 25**	**25 <= 50**	**50 <= 100**	**> 100**
India	2.4	12.7	76.3	1.1	2.2	4.4	0.6	0.0
China	7.8	19.9	46.5	14.3	10.5	1.0	0.0	0.0
Indonesia	23.7	41.6	17.0	15.7	1.4	0.5	0.0	0.0
Malaysia	56.9	7.7	8.5	3.6	16.3	6.9	0.0	0.0
Singapore	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Thailand	24.2	43.0	15.2	0.2	6.2	10.8	0.4	0.0
Philippines	2.6	59.9	22.7	13.2	1.0	0.6	0.0	0.0
Viet Nam	37.8	19.6	7.3	9.3	11.5	13.6	0.3	0.0
Import values, 2008, %								
	Duty-free	**0 <= 5**	**5 <= 10**	**10 <= 15**	**15 <= 25**	**25 <= 50**	**50 <= 100**	**> 100**
India	14.3	48.6	36.7	0.0	0.1	0.1	0.1	0.0
China	48.4	18.2	27.8	2.9	2.5	0.2	0.0	0.0
Indonesia	61.2	20.0	8.7	8.3	0.6	0.7	0.5	0.0
Malaysia	64.6	14.6	2.1	5.0	6.7	7.0	0.0	0.0
Singapore	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Thailand	50.8	29.6	14.7	0.0	1.3	3.3	0.3	0.0
Philippines	22.2	60.8	9.1	4.5	0.7	2.6	0.0	0.0
Viet Nam	44.6	23.5	10.8	10.2	3.9	6.3	0.7	0.0

Source: WTO, 2011b.

Table 10 presents the average MFN applied tariffs, in 2009, of India and other developing Asian economies in selected manufacturing sectors that constitute the bulk of traded parts and components. This suggests that scope exists for India to reduce tariffs further, especially in the transport equipment sectors, to match the Chinese level.[28] These are, however, sectoral averages and do not represent the actual levels of protection existing in the automobile industry in India. A recent study by Badri Narayan and Vashisht (2008) observed that the calculated effective rates of protection in 2006/07 were much lower for auto-parts (10 per cent) compared to 12.5 per cent for Commercial Vehicles (CVs) and 183 per cent for automobiles[29] excluding CVs and including two-wheelers, further suggesting the presence of a high overall degree of protection for this industry, and a tendency towards tariff escalation,[30] which has

[28] These are sectoral averages.
[29] This has been since reduced in recent years in line with the objectives of the Automotive Mission Plan for 2006-2016.
[30] This refers to the practice of increasing tariffs on the final good when it involves a greater share of imported intermediate inputs.

been common in other developing countries. When compared with East Asian countries in 2009, tariff escalation levels were generally higher in India on raw materials and semi-processed goods, but in comparison with Thailand and Viet Nam, India's tariff escalation levels are lower for processed goods (IDE-JETRO and WTO, 2011, Figure 8, p.44).

Table 10. Average MFN applied tariffs by selected product groups of India and selected developing Asian economies in the non-agricultural sector, 2009

	Non-electrical machinery	Electrical machinery	Transport equipment	Manufactures, NES
India	7.3	7.2	20.7	8.9
China	7.8	8	11.5	11.9
Indonesia	2.3	5.8	10.6	6.9
Malaysia	3.6	4.3	11.6	4.8
Singapore	0.0	0.0	0.0	0.0
Thailand	4.1	7.5	20.3	10.2
Philippines	2.3	4	9.1	4.9
Viet Nam	4.0	10.9	18.9	12.1

Source: WTO, 2011b.

There is concern that while tariff barriers may have declined drastically in India over the past decade, significant non-tariff barriers persist. These include licensing requirements, provisional anti-dumping and safeguard duties and tight standards restrictions. These non-tariff measures continue to affect the trade and investment relations of India with its major trading partners, including those in Asia. Elements of such non-tariff barriers include: complex and often non-transparent administrative requirements as well as para-tariff measures involving customs surcharges, additional charges, decreed customs valuation and internal taxes and charges levied on imports.[31]

In the area of industrial and FDI policy, India has pursued unilateral liberalization measures towards outward-orientation by abolishing industrial licensing in most industries. This has encouraged private sector participation and opened up most industries to inward FDI, while encouraging Indian companies to invest abroad (Srivastava, 2007). This has, in turn, strengthened India's position as an attractive destination for inward FDI. Following the implementation of liberalization measures, the FDI attractiveness of India tended to increase. From being ranked sixth in 2003 in the A.T. Kearney Inc. FDI confidence ranking, in 2010 India was ranked third after China and the United States.[32] This index ranks 64 countries on the basis of their FDI attractiveness (A.T. Kearney Inc., 2010), as computed from a survey

[31] The Research and Information Systems for Developing Countries institution (2004) estimated that for India-Bangladesh border trade, a consignment needs at least 22 documents, involving 55 signatures and 116 copies for final approval.

[32] This index ranks 64 countries on the basis of their FDI attractiveness, computed from a survey that tracks investor confidence among global executives to determine their order of preferences (A.T. Kearney Inc., 2010).

that tracks investor confidence among global executives to determine their order of preferences. Studies indicate, however, that much of the inward FDI in India's manufacturing sectors has been undertaken as "market-seeking" FDI, to serve the large and growing domestic market in India, rather than the "efficiency-seeking" FDI that will link India with Asian IPNs in China, Thailand, Malaysia, Singapore and other Asian countries.[33] Sally (2011) estimated that although in terms of overall FDI regulatory restrictiveness India is on a par with China, Indian service sectors, such as insurance, aviation, construction, retail and distribution, face higher levels of protection.

Ahluwalia (2002) emphasizes that the state governments in India also need to play their part if they are to attract efficiency-seeking investment that links them to Asian IPNs. He noted that India's economic reforms created a more competitive environment, and the payoff from pursuing good policies is very high, with those states that create an investor friendly business environment attracting the majority of inward FDI. Sally (2011) observed that the process of India's unilateral trade liberalization of trade and FDI, focusing on domestic regulatory reforms to make it attractive for MNEs to plug it into global IPNs remains a major challenge for Indian trade policymakers.

This study observes that India's unilateral trade liberalization was largely witnessed in two reform bursts of 1991-1993 and 1998-2004, after which it slowed. The slowdown and stalling of multilateral liberalization through the World Trade Organization (WTO) and rapid proliferation of "new regionalism" in Asia has further diverted the energies of Indian trade policymakers away from unilateral liberalization and domestic reforms.[34]

While India possesses the advantage of having widespread availability of skilled and low-cost labour, which is critical for the development of IPNs, the challenge will be to create the proper institutions to support such development. Hence, the importance of improving the regulatory environment and reducing behind-the-border restrictions on international trade and investment cannot be underestimated. Indeed, when compared with developing countries in Asia that are already well connected with global IPNs, through the enabling trade index, which measures factors, policies and services that facilitate the trade in goods across borders and to destination,[35] in 2010 India's performance was only better than the Philippines, and lagged behind China in aspects of market access, border administration, transport and communications infrastructure and the business environment (Table 11). This indicates that while the Indian economy may have become outward-oriented, the perception of India, among trading partners, as a preferred trade and investment partner, needs to improve further.

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[33] See Aggarwal (2001), Kumar and Siddharthan (1994), Kumar (1990), Pant (1993 and 1995) and Pailwar (2001).
[34] See Rajan, Sen and Siregar, 2001; and Rajan and Sen, 2004.
[35] This index is made up of four sub-indexes measuring the degree of market access, border administration, transport and communications infrastructure and business environment that assesses the overall environment created by a country to enable its trading partners to trade and invest more among them (WEF, 2010).

The above indicates that while unilateral liberalization of trade and FDI has been progressing and is likely to be sustained, these policies alone are unlikely to create the momentum for Indian industries to plug themselves into Asian IPNs, unless regulatory reforms for institutional development are pursued and the business environment improves, for which reduction of trade costs and infrastructure improvement are also crucial factors.

5.2. Reduce transaction costs and improve infrastructure

Brooks and Stone (2010) observe that while the rapid expansion of intra-regional trade has been a significant factor behind market driven integration and emergence of production networks in Asia, development of trade related infrastructure and reducing trade costs remain formidable challenges for many Asian economies, including India. The study argues that East Asian and Pacific countries have been able to attract multinationals and build regional production networks due to their ability to reduce border costs much more significantly compared to the rest of the world. To plug into IPNs, there is not only a need to reduce transport costs at the border but also the costs of information and communication technology (ICT) services, which provide complementary support to the growth of physical infrastructure such as roads, railways and ports.

Banik and Gilbert (2010) noted that India has one of the highest logistics costs, at 13 per cent of GDP, arising from low quality infrastructure involving inefficient ports and airports, very complicated bureaucratic procedures, frequent electricity outages and high transportation costs. This complex business environment not only hampers trade but also creates a fertile environment for corruption. They observe that if the South Asian Association for Regional Cooperation (SAARC) countries were to improve trade facilitation to half of the East Asian levels, intraregional trade in South Asia could be increased by as much as 60 per cent of current intra-regional trade. In the South Asian subregion, port efficiency, customs environment, regulatory environment and service sector infrastructure need urgent attention if intra-regional trade is to be increased.

According to the World Bank (2010), the average cost of exports in India was USD 945 per container, comprised mainly of the costs of export related documentation. The report estimated that in 2010 trade-related transaction costs in India amounted to approximately USD 17 billion, or 10 per cent of the value of the nation's exports. As observed in Table 13, India ranks behind most developing Asian economies in terms of transportation and communications infrastructure. India’s infrastructure development is at comparable levels with Indonesia and Philippines, and far behind China. Physical (“hard”) infrastructure is absolutely crucial for MNCs when considering efficiency-seeking FDI in manufacturing. Sally (2011) notes that improvements are needed in both India’s “hard” infrastructure as well as its “soft” regulatory infrastructure.

Table 11. Enabling Trade Index: Comparisons of India and selected Asian developing economies

	Overall Market		Market Access		Border Administration		Transport and Communications Infrastructure		Business Environment	
	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score
Singapore	1	6.1	1	6.0	1	6.6	7	5.7	2	6.0
China	48	4.3	79	3.9	48	4.5	43	4.1	41	4.7
India	84	3.8	115	3.4	68	4.0	81	3.3	58	4.5
Indonesia	68	4.0	60	4.2	67	4.0	85	3.3	60	4.4
Malaysia	30	4.7	31	4.7	44	4.6	24	5.0	51	4.6
Philippines	92	3.7	64	4.1	74	3.8	83	3.3	103	3.6
Viet Nam	71	4.0	50	4.4	88	3.5	68	3.6	64	4.3
Thailand	60	4.1	113	3.5	41	4.6	40	4.2	71	4.2

Source: World Economic Forum, 2010.

Table 12 compares India with other developing Asian countries involved in IPNs, based on the World Bank (2012) "Ease of Doing Business Index Indicators", where a smaller number indicates a better performance on each sub-indicator and a higher ranking related to the creation of a business-friendly environment. It is observed that India is ranked below China for all measures of the ease of doing business except for electricity supply and protection of investors. India's scores were particularly low in the measures of starting and closing a business, dealing with construction permits, paying taxes, trading across borders and enforcing contracts, all of which are critical to reducing transaction costs of trade. Sally (2011) noted, however, that given the size of the Indian economy, there was a need to further observe the considerable variation among the performance of Indian States, and that if only the top 10 performing States were counted, India would potentially jump 55 places in the ease-of-doing-business rankings, making it almost comparable to China. Since these are important elements of the soft "institutional" infrastructure that supports the development of IPNs, it is evident that Indian policymakers will need to focus attention on reducing transaction costs of doing business and to address regional disparities if India is to emerge as the next assembly centre, when compared to China, in the near future.

Efforts have already been made in recent years to introduce reforms, and these have improved India's business environment. In the 2011 rankings, India was ranked 139 overall in terms of doing business, but in 2012 India jumped up seven places to 132.[36] This was mainly due to some second-generation reforms introduced between 2009 and 2011 in the areas of opening and closing a business, paying taxes and trading across borders (Table 13).

The Indian Government acknowledged the importance of minimizing high transaction costs by creating a task force in October 2009 to identify ways of improving "the functioning

[36] During this period, China slipped four places from 87 in 2010 to 91 in2011.

of export processes, and reducing time and money spent in export transactions, with a view to enhancing the competitiveness of Indian exports".[37] This task force has proposed measures such as round-the-clock customs clearance at selected ports, reductions in levies and electronic message exchange between the customs authority and the director-general for foreign trade to facilitate faster clearances. These are expected to reduce export transaction costs by around USD 460 million. Other key proposals in line for implementation include the integration of all trade-related agencies through a "single window e-trade initiative" and the development of port-related infrastructure. This demonstrates the commitment to further reforms aimed at reducing transaction costs, but such reforms need to be speeded up and pursued with greater conviction, as emphasized by Rajan and Gopalan (2011).

[37] See Rajan and Gopalan, 2011.

Table 12. Doing Business Index 2012: Comparisons of India and selected Asian developing economies

Economy	Ease of Doing Business Rank	Starting a Business	Dealing with Construction Permits	Getting Electricity	Registering Property	Getting Credit	Protecting Investors	Paying Taxes	Trading Across Borders	Enforcing Contracts	Resolving Insolvency
Singapore	1	4	3	5	14	8	2	4	1	12	2
Thailand	17	78	14	9	28	67	13	100	17	24	51
Malaysia	18	50	113	59	59	1	4	41	29	31	47
China	91	151	179	115	40	67	97	122	60	16	75
VietNam	98	103	67	135	47	24	166	151	68	30	142
Indonesia	129	155	71	161	99	126	46	131	39	156	146
India	132	166	181	98	97	40	46	147	109	182	128
Philippines	136	158	102	54	117	126	133	136	51	112	163

Source: World Bank, 2012.

Table 13. Recent regulatory reforms undertaken by India to improve its business environment rankings

Year	Reform	Area
2011	Eased Business Start up by establishing an online Value Added Tax registration system and replacing the physical stamp previously required with an online version.	Starting a Business
2010	Procedures under 2002 Securitization Act have become more effective, easing the processes and time required to close a business.	Resolving Insolvency
2011/12	Reduced administrative burden of paying taxes by abolishing fringe benefit tax and improving electronic payment, and later by making electronic filing and payment of value added tax mandatory.	Paying taxes
2009	Electronic data interchange implemented, allowing exporters to submit documents to customs online. This system also enables customs to automatically assess export documents, making customs clearance more efficient, reducing time needed to export.	Trading Across borders

Source: Compiled from World Bank, 2012.

5.3. Address labour market rigidities

While most of the countries involved in Asian IPNs have witnessed massive structural changes, with significant shifts in employment from the agricultural sector to the manufacturing sectors as their economies grew, India has been a bit of an exception to this phenomenon. According to Basu (2005), this is because labour market rigidities,[38] through existing legislation, have resulted in India failing to deploy her large labour resources to compete more strongly in the domestic and international markets. Relative to India, the East Asian and South-East Asian countries appear to have fewer protective laws.

As suggested by Virmani and Hashim (2009), India's manufacturing sector holds unique importance, mainly for two reasons. First, the ability of this sector to provide large-scale employment and to be a driver of structural change as a developing economy such as India grows is increasing because the contribution of the agricultural sector to GDP is shrinking. Second, the sector can facilitate growth through forward and backward linkages with other sectors of the economy, particularly the services sector, which is currently the driver of economic growth in India.

Existing rigidities constrain the effective redeployment of labour in response to changes in demand and technology, however, and are acting as a disincentive to employing workers, thereby resulting in jobless growth in organized manufacturing as well as increasing use of contract and temporary workers.[39] This also leads to capital-intensive methods in the organized sector and adversely affects the manufacturing sector's long-term demand for labour. In the Indian context, state-level labour regulations are also an important determinant of industrial performance. Therefore, labour market reforms both at national and state levels are essential if India is to witness growth in productivity through labour-intensive manufacturing and move away from the less productive agriculture sector.

Jha and Golder (2008) analysed the links between labour market reforms and economic performance, and argued that policymakers needed to devote attention to four main aspects of labour market reform. First, they need to simplify and streamline existing laws.[40] Second, there is a need to design these laws to encourage investment in human capital, such as training and skills development of workers. Third, there is a need to improve the social safety net, especially for unorganized workers. Fourth, the implementation mechanism has to be strong, and dispute resolution should be quick and transparent as this will facilitate enforcement of contracts, which is currently weak. All these reforms should be implemented in parallel with a long-term strategy to create a more

[38] These pertain to setting minimum wages above market clearing levels – especially in the organized sector .
[39] See Ahsan and Pagés, 2008, Dutta, 2003, Gupta, Hasan and Kumar, 2008, Ramaswamy, 2003, and Sharma, 2006.
[40] Chandra (2006) stated that close to 50 central laws and about 175 state laws existed that were related directly to labour, most of which were poorly designed and implemented.

competitive skilled-labour market in India, in order to bring about strong integration of Indian industries into existing IPNs in Asia.

The draft NMP, approved by the government in 2011, aims to increase the share of manufacturing in the GDP to 25 per cent by 2025 from the current share of 16 per cent. The government has included labour market reforms and exit policy as part of the policy's objectives[41] and seeks to introduce policy measures to facilitate the expeditious redeployment of assets belonging to "sick" or non-performing units, while giving full protection to the interests of the employees, with a focus on making it easy to close a business and provide appropriate insurance for job losses.

The NMP aims to increase manufacturing sector growth to between 12 and 14 per cent in the medium term in order to (a) make it the growth engine of the economy; (b) create 100 million additional jobs by 2022; (c) create appropriate skill sets among the rural migrant and urban poor to make growth inclusive; (d) increase domestic value addition and technological depth in manufacturing; (e) enhance the global competitiveness of Indian manufacturing, particularly in the case of SMEs, through appropriate policy support; and (f) ensure sustainability, particularly with regard to environmental factors, including energy efficiency, optimal utilization of natural resources and restoration of damaged or degraded eco-systems. The policymakers also plan to reduce the compliance burden on industry, and to improve and simplify procedural and regulatory formalities in order to make it easier for manufacturing industries to be technologically competitive and globally innovative (Department of Industrial Policy and Promotion, 2011).[42]

5.4. Effectively utilize PTAs as a tool to plug into global and Asian IPNs

The deadlock in multilateral trade negotiations and rise of new regionalism in Asia has prompted Asian and Pacific countries, including India, to become very active in negotiating and entering into bilateral and regional PTAs. As of June 2011, India had implemented 12 PTAs and was negotiating or proposing many more such agreements (UNESCAP, 2011a and b).[43] Thus, India's PTA activity is comparable with that of Asian countries that are strongholds of IPNs, viz. China and Japan.

Can India's PTAs influence policies for supporting the formation of production networks that provide links to other existing Asian IPNs? Since policies that impact upon the costs of building an IPN relate to removing cross-border barriers, as well as reducing behind-the-border impediments to trade and investment, it can be argued that the impact of PTAs on

[41] See http://www.indianexpress.com/news/govt-oks-national-manufacturing-policy/865186/
[42] See http://dipp.gov.in/English/Discuss_paper/NMP_DiscussionPaper_2010.pdf
[43] India already has enforced regional PTAs involving ASEAN, MERCOSUR and SAARC and bilateral PTAs with Chile, Singapore and Korea; it is a member of Asia-Pacific Trade Agreement (APTA) and is currently negotiating a PTA with the European Union with proposed PTAs with China and the United States in the near future. See http://www.unescap.org/tid/aptiad/agg_db.aspx

policies affecting the participation of countries in production networks is very much dependent on the extent of the coverage of a PTA and its focus on areas that would deepen regional integration through production networks (Hew, Das and Sen, 2009 and Orefice and Rocha, 2011). Thus, PTAs that emphasize only liberalizing trade in goods and tariff reductions are likely to impact positively on policies to overcome geographical distance and border effects, and thereby reduce service-link costs in production network, but will not be able to reduce network set up or production costs (Table 14).

In the context of India, this implies that it is PTAs with Asian IPN members (viz. ASEAN countries and China, Japan and Korea), when fully implemented, that can potentially facilitate lower service-link costs and thereby enhance India's participation in Asian manufacturing production networks. India can do so by taking advantage of its relative abundance of unskilled labour as compared to more developed Asian IPN member countries. Table 14 indicates that this may be a necessary, but not sufficient, condition for firms to set up production blocks in India. This is because trade and investment facilitation, by improving customs clearance and procedures that have a stronger impact on the policy mix, is absolutely crucial for reduction of overall costs to encourage production networks, as argued in the previous section. Trade facilitation initiatives in a PTA not only affect policies that overcome geographical distance and border effects, but also policies that strengthen location advantages and facilitate the establishment of an economic environment that reduces set-up costs of arm's length transactions. This, in turn, has an impact on reducing all three types of costs involved in setting up a production network.

The inclusion of Most Favoured Nation (MFN) and National Treatment obligations in a PTA are also likely to have a favourable impact, as they can lead to the reduction of investment costs, strengthen the competitiveness of potential business partners and overcome geographical distance and border effects. Such obligations are also likely to significantly reduce network-set up costs and service link costs within a production network. In the Indian context of PTAs, the efforts towards this are yet to gather momentum. Most of India's PTAs have so far also not substantially liberalized movement of professionals, which also has a substantial impact on reducing service link costs in a production network. Furthermore, competition policy and intellectual property protection, which have a favourable impact on reducing production costs, have also not been tackled so far in the PTA context for India.

Table 14. FTA provisions and their policy impact on the development of production networks

Key FTA provisions	Policy areas and possible impact	Type of policy	Impact on cost type
Tariff reduction and/or elimination on trade in goods.	Reduction or removal of trade barriers such as tariffs.	Various policies to overcome geographical distance and border effects.	Service link costs.
Trade facilitation (improvement in customs procedures and customs clearance) including mutual recognition and harmonization of product standards.	Trade facilitation including simplification and improved efficiency in custom clearance / procedures. Trade and investment facilitation. Policies to reduce costs of information gathering on potential business partners.	Various policies to overcome geographical distance and border effects. Various policies to strengthen location advantages. Establishment of economic environment to reduce set-up costs of arm's length transactions.	Network-set up, Service link and production costs per se.
MFN and national treatment in trade in services and investment.	Improvement in stability, transparency, and predictability of investment-related policies. Investment facilitation in FDI hosting agencies and industrial estates. Hosting and fostering various types of business partners, including foreign and indigenous firms. Strengthening supporting industries. Various policies to promote the formation of agglomeration.	Various policies to reduce investment costs. Various policies to strengthen competitiveness of potential business partners.	Network-set up costs and production costs per se.
Liberalization of trade in services	Liberalization and development in financial services related to capital investment. Improved efficiency in financial services related to operation and capital movements.	Various policies to reduce investment costs. Various policies to overcome geographical distance and border effects.	Network-set up costs and service link costs.
Dispute settlement mechanism for investments	Improvement in legal system and economic institutions to activate dispute settlement mechanism.	Development of institutional environment to reduce the cost of implementing arm's length transactions.	Service link up and network-set up costs.
Liberalizing movement of professionals	Reduction in costs of coordination between remote places by facilitation of the movement of natural persons.	Various policies to overcome geographical distance and border effects.	Service-link costs.
Strengthening the intellectual property regime	Establishment of stable and effective institutions to secure intellectual property rights.	Establishment of economic environment to reduce set-up costs of arm's length transactions	Production costs per se.
Competition policy	Establishment of economic system to allow co-existence of various business partners as well as making various types of contracts, various policies to reduce costs of information gathering on potential business partners, securing fairness, stability, and efficiency in contracts.	Establishment of economic environment to reduce set-up costs of arm's length transactions.	Production costs per se.

Source: Hew et al., 2009

The analysis by Orefice and Rocha (2011) of 200 countries over the period between 1987 and 2007 confirmed that trade through IPNs was fostered by agreements that aimed for deeper integration. Their study found that deeper integration can be captured through five measures. Two of the measures are WTO+ in nature and therefore aim for strengthening discipline on rules related to state trading enterprises and Trade Related Intellectual Property, while the other three (competition policy, intellectual property protection and movement of capital) are WTO-X in nature and are therefore not currently under negotiation in the WTO. Orefice and Rocha argued that inclusion of deep integration measures was more likely in PTA partnerships involving both developed and developing countries rather than in those involving only developing countries.

In the context of Indian PTAs, the potential benefits for encouraging India's participation in IPNs might be limited. India's PTAs with most Asian IPN members have mainly served as a tool for foreign policy rather than trade policy, and have been a "trade-light approach to liberalization". India's PTAs with South Asian countries currently focus only on tariff reduction, and do not cover comprehensive liberalization in services, investment and other non-border market-access issues. More than half of intra-regional trade is excluded through "sensitive lists", restrictive rules of origin and assorted NTBs. This "trade-light" approach to PTAs means that those PTAs are unlikely to spur any IPN activity, as they do not include the deepening of regulatory measures related to the five measures as identified by Orefice and Rocha. India's recent bilateral PTAs with Japan, the Republic of Korea, Malaysia and Singapore, as well as its regional PTA with ASEAN, are aimed at greater comprehensiveness, including services and investments, but most of these PTAs have not reached the stage of full implementation and are not supported by strong regulatory measures for strengthening intra-regional trade through IPNs. While tariffs are being eliminated in some cases, for close to 90 per cent of products, there are long transition periods and restrictive RoO. As an example, India's recently concluded PTA with the Republic of Korea covers only 66 per cent of Indian tariff lines that are subject to duty elimination during an eight-year transition period, with agreements on services and investment being weaker when compared to what has been agreed upon by these countries in the WTO. Sally (2011) noted that fear of Chinese competition was one of the main factors driving product exemptions and restrictive RoO in India's PTAs, resulting in partial liberalization commitments that are unlikely to spur IPN activity, particularly on the export side.

Studies in the auto-component sector by Nag (2011b) and Ghosh, Ray and Makkar (2010) found that PTAs between India and Asian countries do not seem to enhance greater participation by Indian companies in Asian auto-parts IPNs. Ghosh, Ray and Makkar (2010) studied trade agreements between India and ASEAN, the Republic of Korea, the European Union, and Japan. Their findings indicate that PTA could harm Indian the auto-part sector. This is evident as India continues to be a net importer of auto-components with its trade deficit for auto-components increasing to USD 4.4 billion in 2009/10 from USD 210 million in 2004/05. The study cautions that even PTAs between other nations where India is not a

party could have adverse implications for the growth of the Indian auto-components industry.[44] Overall, while PTAs may bring down the cost of certain raw materials and intermediate inputs for the Indian auto-components industry, there could be a risk of future trade diversions from new PTAs.

As of 2012, all that Indian PTAs seem to have achieved is to lower the costs of imports of parts due to tariff reduction, but as analyzed earlier, they clearly are not tackling behind-the border issues and regulatory measures as yet, which are crucial for India if it is to attract export-platform investment and become a global manufacturing base for P&C products and, hence, an integral part of Asian IPNs.

The above implies that India's PTAs in the long run would need to be more broad-based in their approach to liberalization, improve on the policy environment in the area of liberalizing services and investment and strengthen existing institutions and infrastructure to promote agglomeration and development of vertical production chains among the industries, supported by strong domestic reforms. This approach will address the policy challenges identified in previous sections, and therefore enable India to successfully evolve as the next assembly centre, after China, in Asia.

The above notwithstanding, there are also several policy concerns regarding the effect of competition among PTA hubs in Asia, the impact of the restrictive RoO in India's PTAs and, last but not least, the actual utilization of these PTAs by businesses. In the ASEAN context, Hew et.al (2009) observe that the creation of a complex hubs-and-spokes network of overlapping PTAs creates potential for trade diversion away from the spokes towards the emerging hubs of these PTAs. There is no single hub for ASEAN PTAs, with the ASEAN members as a group, as well as individually, Singapore, Thailand and others creating multiple PTA hubs. India, China, Korea are also creating their own PTA hubs, creating a multitude of PTA hubs wherein a spoke country in one PTA is becoming a hub in another. Further, varieties of Rules of Origin to determine preferential treatment for non-originating goods have been applied or are currently being negotiated across Asian PTAs, including those of India. There is also a great deal of overlapping among the PTA partners of India and the individual member countries. Thus, while Singapore has already implemented its agreements with India, it is also a negotiating member in the ASEAN-India PTA. Similarly, Malaysia and Thailand are also negotiating bilateral agreements with India but are also part of the ASEAN-wide negotiations with the same set of countries.

The application of a variety of rules of origin with respect to preferential trade liberalization in goods in this hub-and-spoke network of PTAs makes it costly for businesses

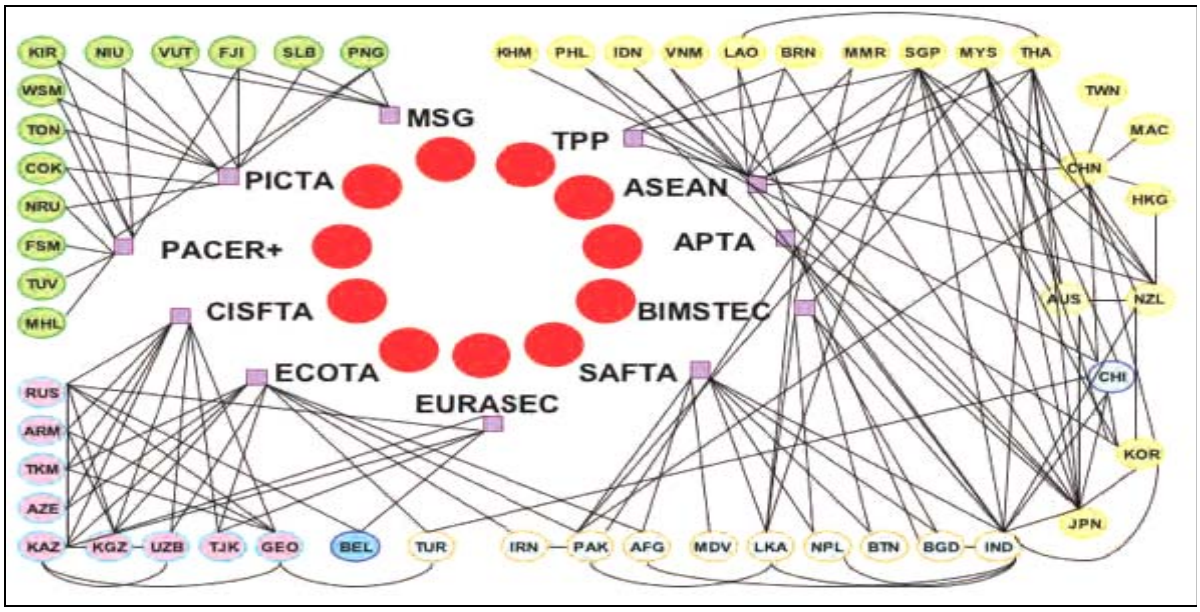
[44] Ghosh, Ray and Makkar (2010) point that the proposed PTA between Korea and the European Union has prompted Hyundai Motor India Limited to suggest that the company may look to shift part of its production meant for export to the European Union from India to the Republic of Korea and this could imply significant decline in exports for suppliers based in India.

to comply with and implement, thus negating the very purpose of a PTA, which is to reduce business costs. Nag and De (2011) analysed the impact of RoO on the development of IPNs. They concluded that simpler RoO work better for parts and components and intra-industry trade in an IPN, even if tariffs may not be lowered significantly in a PTA.[45] Complex RoO provide increased avenues for corruption, since customs officials can exercise significant discretion in deciding on which tariff or rules to apply to a certain product (Newfarmer, 2005). Referred to as the "spaghetti-bowl" argument in Bhagwati (1995) and also in Krueger (1997), this manifests itself more seriously as a far more complex "Asian noodle bowl", wherein businesses have to either consider using these PTAs and therefore adjust their strategies for compliance, or else continue to pay MFN tariffs for their goods, ignoring PTA preferences. If the utilization of these restrictive RoO preferences adversely affects any of the three types of costs involved in participation in a production network, India's PTAs could actually end up adversely affecting its prospects for integrating into production networks in the ASEAN region and in East Asia, which has largely been market-driven.

The above relates to the question of utilization of these PTAs, which is another important concern in establishing the usefulness of PTAs for strengthening trade through IPNs. Several studies, such as UNESCAP (2011c), have argued that the design and implementation of these PTAs have a significant impact on their effectiveness, and business survey evidence such as the study by Kawai and Wignaraja (2011) is needed on understanding how businesses in Asia are likely to respond to these PTAs. Interestingly, Kawai and Wignaraja (2011) note in their report of a survey involving 841 manufacturing firms (based in China, Japan, Korea, the Philippines, Singapore and Thailand) that Chinese firms tend to have the highest current rate of PTA utilization, with Singapore firms having the lowest rate.[46] In particular, they observe that large multinationals report more difficulty with multiple RoO than smaller firms, as they tend to export to multiple markets and are more likely to complain about issues stemming from restrictive RoO, resulting in lower utilization. Nag and De (2011) counter this view, however, and argue that since small firms or SMEs do not supply many players and operate on small margins, they are likely to also be negatively affected by restrictive and strict RoO. An analysis of improving the usage of PTAs in the Asia-Pacific region by UNESCAP (2011c) also confirms that restrictive RoO are a significant reason for low utilization of PTAs and emphasise that the challenge is to improve coordination and linkages between the existing noodle-bowl of PTAs in the Asia-Pacific region (Figure 11), which is currently fragmented into the three sub-regions: the Pacific, Central Asia and the rest of Asia (South, South-East and East Asia).

[45] This study analyzes sectoral impact of RoO on integrated circuits, auto-components and textiles and observes that ASEAN PTAs having simple RoO have benefitted intra-industry trade in these products.
[46] See Table 2 in Kawai and Wignaraja (2010).

Figure 11. The Asian noodle bowl of PTAs, 2011



Source: UNESCAP, 2011c.

More research is therefore warranted in the Indian context to further understand how Indian firms and India-based MNEs might be responding to these PTAs, and how they can be better utilized. With new PTAs proliferating every year in India and each PTA being different, requiring different conditions for compliance, businesses have to devise new strategies to utilize them. As an exporter, they need to comply with RoO and match the requirements for each PTA partner, if exporting to multiple countries. As a service provider, they need to fulfil the entry requirements and conditions for granting temporary entry of professionals and national treatment for investments. These have significant adjustment costs associated with them and require proper implementation to ensure that businesses find it cost-effective in utilizing PTAs for trading and investment purposes.[47] These costs are likely to be higher for countries like India that need to get into regional production networks in Asia and, in the process, comply with the currently restrictive and different RoO for each PTA. An overarching East Asia-wide comprehensive regional PTA would have greater potential to improve coordination and linkages than individual bilateral PTAs, and perhaps reduce the costs of compliance for the user, if simpler region-based RoO are designed (ESCAP, 2011c).

Thus, while PTAs could be a very effective policy tool for India in promoting regional economic development by increasing the participation by Indian industries in production networks, the current design, coverage and implementation of PTAs proliferating in India and in East Asia may not necessarily have a significant positive impact on regional

[47] These could include PTA outreach activities for businesses such as seminars and one to one sessions, a role currently played by International Enterprise IE Singapore for encouraging Singapore businesses to utilize Singapore's bilateral and regional PTAs. More information on such activities is available at www.fta.gov.sg.

economic development. Indeed, if not properly implemented and designed, these agreements could have potentially adverse welfare consequences, especially if they lead to trade diversion, a major concern for Indian policymakers, particularly in the context of its intra-regional trade in South Asia. Furthermore, PTA initiatives in India, as in the rest of Asia, will need to be supported by unilateral liberalization and important domestic economic reforms, as argued by Sally and Sen (2011). The engine of liberalization and regulatory reform in India and the rest of South Asia have to be home-driven, with PTAs playing, at best, a supportive role. It will also need to be supported by institutional and infrastructural development, which is critical for the development of regional production networks involving India and East and South-East Asia.

Some policy constraints are probably better addressed unilaterally through domestic reforms than bilaterally through PTAs. These include policies relating to institutional development for improving the business environment and policies to develop infrastructure to support the same. Establishment of educational and occupational institutions for personnel training, to secure various types of human resources; establishment of stable and elastic labour-related laws and institutions; reduction in the cost of infrastructure services such as electricity and other energy; industrial estates services; and the establishment of economic institutions, such as investment rules and intellectual property rights, are examples of areas wherein domestic reforms would be crucial to support a business friendly environment.

6. Conclusions and policy recommendations

In conclusion, the Indian economy, while embarking on an outward-oriented growth strategy nearly a decade later than South-East and East Asia, has been catching up rapidly in terms of its integration with the world economy and has transformed itself into one of the world's fastest growing emerging economies, in spite of the global economic crisis. This has been largely driven by strong domestic demand and a globally competitive private sector, supported by strong first-generation measures for unilateral trade and investment liberalization undertaken by the government. As a result, policymakers have been committed to reducing tariff barriers to South-East Asian levels and aiming to expand India's share in global merchandise trade, with a focus on providing impetus to the manufacturing sector as the driver of growth, which is key towards integrating Indian industries with global and Asian IPNs. Strong commitment and conviction is required to effectively implement second-generation reforms, whose pace has slowed in the wake of the slowdown of the global economy and the breakdown of multilateral trade talks.

The analysis in this study has demonstrated that India has reoriented its growth strategy, towards an outward orientation, during the past two decades, but the pace of its reform has not caught up with this paradigm shift. As a result, the level of participation by Indian industries in global and in Asian IPNs is low. Most of India's exports comprise low-

technology, labour-intensive goods that do not involve much fragmentation, such as textiles, gems and jewellery and animal and leather products. There is emerging potential for India to be more strongly integrated in global and Asian IPNs, as observed in the case studies of the auto-parts and electronic components sectors. The business environment needs improvement in several areas, however, in order to encourage MNCs and Indian SMEs to integrate further into global and Asian IPNs.

Five key policy recommendations are proposed, based on the current state of India's participation in IPNs and the associated policy challenges. These are:

- Step up the pace of unilateral trade and investment liberalization and strive towards further reducing trade and investment barriers.

In particular, actions should be taken in the area of reducing behind-the border restrictions on international trade and investment, with a focus on improving domestic regulations. This should facilitate reduction of service link costs, network set-up costs and production costs involved in setting up an IPN in India.

- Reduce transaction costs of cross-border trade as soon as possible.

A task force was formed in October 2009 to formulate appropriate policies for the purpose. This can be done by improving customs clearance, developing port-related infrastructure for faster customs clearance and creating a single window e-trade initiative that integrates all agencies responsible for trade facilitation with complete integrity.

- Improve the current state of physical and institutional infrastructure for doing business in India.

This would have a significant impact on reducing production and service-link costs involved in setting up an IPN. Private sector participation through domestic and foreign companies in improving physical infrastructure needs to be strongly encouraged. Elements of soft (institutional) infrastructure that supports the development of IPNs, such as starting and closing a business, dealing with construction permits, paying taxes, trading across borders and enforcing contracts, need to be made easier by policymakers. So far, reforms in this direction are still too few.

- Develop an appropriate exit policy for labour in the manufacturing sector and address current rigidities to make it more competitive vis-à-vis South-East and East Asian countries.

Policymakers are aiming to address this challenge as part of India's NMP, which was approved in 2011. A strong commitment to achieving this objective will have to be demonstrated, however, if India is to be part of an IPN that selects it as the next global assembly centre.

- Implement comprehensive-broad based PTAs, covering services, investment and the movement of labour, and allow them to play a supportive role with ongoing unilateral liberalization.

India's existing PTAs do not appear to be designed with the objective of reducing the costs involved in setting up an IPN. A critical review is required of India's current PTAs, including more inputs from businesses, to identify specific areas of gains from PTAs in order to create a business environment that would make India a potential assembly centre for global manufacturing activities in the near future. As argued by Asher and Sen (2011), India's existing and proposed PTAs must be in line with its FTP objectives, and implementation integrity and effective utilization of PTAs involving India and member countries is also a key to whether PTAs will be successfully able to play a role in plugging India into global and Asian IPNs. In this context, Indian customs authorities at ports of entry will have to ensure that PTAs are implemented with professionalism. Aggressive pursuit of PTAs and economic agreements is a new development in India's economic and strategic diplomacy, and India is still in the early stages of the learning curve, with greater organizational efficiency needed in negotiating, monitoring and evaluating the PTAs as more of them are initiated.[48] There is also a need to design RoO that are simple and which do not increase the transaction costs of trade for PTA members.

The above recommendations also hold important implications for South Asia in general, as most of the region's countries face policy challenges similar to those identified above and have yet to connect with global and Asian IPNs.

A recent initiative that has the potential for India to provide technical and financial assistance to other South Asian countries to better integrate their economies globally is the Indian Agency for Partnership in Development (IAPD), which was proposed in August 2011. According to Asher and Bhatia (2011), the IAPD is a consistent outcome of India's increasing pursuit of geo-economics, which emphasises integrating economic diplomacy in its overall external relations with different nations and regions, particularly in Asia. India has already been quietly providing economic assistance for several years in South Asia, through lines of credit, grants, technical consultancy, development projects, information technology (IT), cooperation in agriculture, health and education, capacity building and humanitarian aid. It is expected to distribute more than USD 11 billion over the next five to six years. The IAPD has provided a line of credit worth USD 1 billion to Bangladesh for developing railway infrastructure to enhance connectivity and reduce transaction costs of trade and other economic interactions, all of which are policies that help reduce the costs of developing an IPN.

The fact that India has recovered well from the global economic crisis, amid continued slowdown in the US and Euro zones, in spite of the above policy challenges, is testimony to the fact that the future looks promising for India to develop as the next assembly centre in Asia and be a partner in global and Asian IPNs. This is particularly due to recent efforts of policymakers to revive the manufacturing sector through the NMP, emphasize export growth through the FTP and reduce behind the border and cross-border transaction costs for trade

[48] See Asher, 2010

and investment. Given the size of the Indian economy, efforts to address the existing policy challenges to plug India into global and Asian IPNs will have to be pursued and coordinated at the national and state levels, making the FTP and NMP integral parts of economic management and diplomacy. Last but not least, with implementation integrity of these policies being the key to economic success, it is important that Indian policymakers do away with obsolete systems of governance and the compartmentalization mindset.[49] Recent efforts to strengthen and improve governance, such as the recommendations of the second Administrative Reform Commission and Knowledge Commission, should be given greater prominence in public policy debates, with requisite urgency placed on achieving results and outcomes. This will go a long way towards boosting India's position further in terms of its business environment and towards firmly establishing the country as one of the world's fastest-growing economies, making it an attractive location for both large and small MNCs to establish global manufacturing bases as part of an IPN.

[49] See Asher, 2009.

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Appendices

Appendix I. Lists of parts and components (based on the 5-digit SITC Revision 3)

Commodity code	Description
71191	Parts for boilers of subgroup 7111
71192	Parts for apparatus and appliances of subgroup 7112
7128	Parts for turbines of subgroup 7121
71311	Spark-ignition reciprocating or rotary internal combustion piston engines for aircraft
71319	Parts, NES, of aircraft engines of heading 71311
71321	Reciprocating piston engines of a cylinder capacity not exceeding 1,000 cc
71322	Reciprocating piston engines of a cylinder capacity not exceeding 1,000 cc
71323	Compression-ignition engines (diesel or semi-diesel engines)
71332	Other spark-ignition reciprocating or rotary engines
71333	Compression-ignition engines (diesel or semi-diesel engines)
71391	Parts, NES, suitable for use solely or principally with spark-ignition internal combustion piston engines
71392	Parts, NES, suitable for use solely or principally with compression-ignition internal combustion piston engines
71441	Turbojets
71449	Other than turbojets
71481	Turbo propellers
71489	Other gas turbines
71491	Parts for turbojets or turbo propellers
71499	Parts for gas turbines, NES
7169	Parts, NES, suitable for use solely or principally with the machines falling within group 71893
71819	Parts, including regulators, of hydraulic turbines and water/wheels
71878	Parts of nuclear reactors
71899	Parts of engines and motors of headings 71449,718191,71892 and 71893
71219	Parts of the machinery of subgroup 7221
72129	Parts of the machinery of subgroup 7221 through 72126
72139	Parts for milking machines and dairy machinery
72198	Parts of machinery of heading 72191
72199	Parts of machinery and appliances of heading 72195 and 72196
72392	Bulldozer or angle dozer blades
72393	Parts for boring or sinking machinery
72399	Parts NES, of civil engineering etc. machinery, including mining and public works machinery Parts (heading 723) and cranes etc. (heading 744.3)
72439	Parts of the machines and furniture subgroup 7243
72449	Parts and accessories of textile machinery designed for use in the preparation and

	production of textile fibres and yarns
72461	Auxiliary machinery for machines of headings 72441, 72442, 72243, 72451, 72452 and 72453
72467	Parts and accessories of weaving machines (looms) of heading 72451 or of their auxiliary machinery
72468	Parts and accessories of knitting and stitch-bonding machines, tulle, lace, embroidery, net etc. machines or their auxiliary machines
72488	Parts for machinery of subgroup 7248
72491	Parts for machinery of subgroups 7247 and 7751
72492	Parts for machinery of subgroups 7247 and 7751 for the machines of headings 72472, 72473, 72474, 77512
72591	Parts for machinery of subgroup 7251
72599	Parts for machinery of subgroup 7252
72635	Printing type, blocks, plates, cylinders and other printing components
72689	Parts for bookbinding machinery
72691	Parts for machines of heading 726.31 and subgroups 726.5 and 726.6 for the machines of heading 726.31
72699	Parts for machines of heading 726.1 and subgroups 7265 and 7266
72719	Parts for machines of headings 72127 and 72711
72729	Parts for the machinery, NES, for the industrial preparation or manufacture of food or drink
72819	Parts and accessories suitable for use solely or principally with machine tools of subgroup 7281
72839	Parts of machinery for sorting, washing, crushing or mixing earth, stone, ores etc., and for shaping solid mineral fuels, ceramic pastes etc.
72851	Parts for machines of heading 72841
72852	Parts of machinery for working rubber or plastics or manufacturing products made from rubber or plastics, NES
72853	Parts for machines of heading 72843
72855	Parts, NES, of machinery for public works etc., preparing animal or fixed vegetable fats and oils, and specialized for particular industries NES
73511	Tool holders and self-opening die-heads
73513	Work holders
73515	Dividing heads and other special attachments for machine tools
73591	Parts, NES, and accessories suitable solely or principally for use with metalworking machine tools working by removing metal or other material
73595	Parts and accessories suitable for use solely or principally in machines of group 731 for machines of group 733
73719	Foundry machine parts
73729	Rolls and other Parts for metal-rolling mills
73739	Parts for machines and apparatus of subgroup 7373
73749	Parts for machinery and apparatus of subgroup 7374
74128	Parts for burners and other articles of subgroup 7412
74135	Parts for the equipment of headings 74131 through 74134

74139	Parts for furnaces and ovens of headings 74136 through 74138
74149	Parts of refrigerators, freezers and other refrigerating or freezing equipment (electric or other)
74159	Parts for air-conditioning machines (having a motor-driven fan and elements for changing the temperature and humidity) of heading 7415
74172	Parts for generators of heading 74171
7419	Parts, NES, for machinery of headings 74173 through 74189
74291	Parts of pumps for liquids
74295	Parts of the pumps and liquid elevators of group 742, of liquid elevators
7438	Parts for pumps, compressors, fans and hoods of subgroups 7431 and 7434
74391	Parts of machines and apparatus of subgroups 7435 and 7436 of centrifuges (including centrifugal driers)
74395	Parts of filtering or purifying machinery and apparatus
74419	Parts of trucks and tractors of headings 74414 and 74415
74491	Parts suitable for use in machinery of subgroups 7442 and 7444
74492	Parts suitable for use in machinery of headings 744.1, 74412 and 74413
74493	Parts suitable for use in lifts, skip hoists or escalators
74494	Parts for lifting, handling, loading or unloading machinery, NES
74519	Parts of tools of subgroup 7451
74529	Parts of machinery of subgroup 7452 and heading 7753
74539	Weighing-machine weights of all kinds; Parts of the weighing machinery of subgroup 7453
74568	Parts of appliances of subgroup 7456
74593	cylinders and other Parts for machines of heading 74591
74597	Parts for automatic goods-vending machines (postage stamps, cigarettes, food etc.)
7461	Ball-bearings
7462	Tapered roller bearings (including cone and tapered roller assemblies)
7463	Spherical roller bearings
7464	Needle roller bearings
7465	Other cylindrical roller bearings
7468	Other ball- or roller bearings (including combined ball-/roller bearings)
74691	Balls, needles and rollers
74699	Parts of ball and roller bearings, NES
7471	Pressure-reducing valves
7472	Valves for oleo-hydraulic or pneumatic transmissions
7473	Check-valves
7474	Safety or relief valves
7478	Taps, cocks, valves and similar appliances, NES
7479	Parts for the appliances of group 747
7481	Transmission shafts (including camshafts and crankshafts) and cranks
74821	Bearing housings, incorporating ball- or roller bearings
74822	Bearing housings, not incorporating ball- or roller bearings; plain shaft bearings
74839	Parts of articulated link chain

7484	Gears and gearing and other transmission elements presented separately)
7485	Flywheels and pulleys (including pulley blocks)
7486	Clutches and shaft couplings (including universal joints)
7489	Parts, NES, for articles of group 748
7492	Gaskets and similar joints of metal sheeting combined with other materials
74991	Ships' or boats' propellers and blades
74999	Machinery Parts, not containing electrical connectors, insulators, coils, contacts or other electrical features, NES
7591	Parts and accessories of photocopying and thermo-copying apparatus of subgroup 7513
75991	Parts and accessories for machines of subgroup 7511
75993	Parts and accessories for machines of subgroup 7519
75995	Parts of calculating machines, accounting machines, cash registers. postage-franking machines and similar machines incorporating a calculating device
75997	Parts of automatic data processing machines and units thereof, magnetic or optical readers, and machines for transcribing and processing data, NES
76211	Radio broadcast receivers, incorporating sound-recording or reproducing apparatus
76212	Radio broadcast receivers, not incorporating sound-recording or reproducing apparatus
76491	Parts of electrical apparatus for line telephony or line telegraphy (including apparatus for carrier-current line systems)
76492	Parts of microphones, loudspeakers, headphones, earphones and combined microphone/speaker sets; audio-frequency electric amplifiers etc.
76493	Parts of television receivers, radio broadcast receivers, transmission apparatus for radio telephony, telegraphy, broadcasting or television etc.
76499	Parts of apparatus for sound recorders or reproducers and parts of television image and sound recorders or reproducers
77129	Parts of electric power machinery (other than rotating electric power generating machinery and equipment), and parts thereof
7722	Printed circuits
77231	Fixed carbon resistors, composition- or film-type
77232	Other fixed resistors
77233	Wire-wound variable resistors (including rheostats and potentiometers)
77235	Other variable resistors (including rheostats and potentiometers)
77238	Parts for electrical resistors of subgroup 7723
77241	Fuses
77242	Automatic circuit-breakers for voltages of less than 72.5 kv
77243	Other automatic circuit-breakers
77244	Isolating switches and make-and-break switches
77245	Lightning arresters, voltage limiters and surge suppressors for voltages exceeding 1,000 volts
77249	Electrical apparatus for switching or protecting electrical circuits, or making connections to or in electrical circuits, NES, exceeding 1,000 volts
77251	Fuses

77252	Automatic circuit-breakers for a voltage not exceeding 1,000 volts
77253	Apparatus for protecting electrical circuits, NES, not exceeding 1,000 volts
77254	Relays
77255	Other switches
77257	Lamp-holders
77258	Plugs and sockets
77259	Electrical apparatus for switching or protecting electrical circuits or making connections to or in electrical circuits, NES, not exceeding 1,000 v
77261	Switchboards etc <1000v
77262	Switchboards etc >1000v
77281	Switchboards etc unequip
77282	Switchgear parts NES
77312	Co-axial cables and other co-axial conductors
77313	Ignition wiring sets and other wiring sets of a type used in vehicles, aircraft or ships
77322	Electrical insulators of glass
77323	Electrical insulators of ceramics
77324	Electrical insulators of materials other than glass or ceramics
77423	X-ray tubes
77429	Electro-diagnostic apparatus for medical, surgical, dental or veterinary sciences and radiological apparatus, NES, including parts and accessories
77549	Parts of hair clippers
77579	Parts of food grinders and mixers (fruit or vegetable juice extractors)
77589	Parts of electro-thermic appliances of subgroup 7758
77611	Television picture tubes, colour
77612	Television picture tubes, black and white or other monochrome
77621	Television camera tubes; image converters and intensifiers; other photocathode tubes
77623	Other cathode-ray tubes
77625	Microwave tubes (excluding grid-controlled tubes)
77627	Other valves and tubes
77629	Parts of the tubes and valves of subgroups 7761 and 7762
77631	Diodes, other than photosensitive or light-emitting diodes
77632	Transistors (excluding photosensitive transistors) with a dissipation rate of less than one watt
77633	Transistors (excluding photosensitive transistors) with a dissipation rate of one watt or more
77635	Thyristors, diacs and triacs (excluding photosensitive devices)
77637	Photosensitive semiconductor devices; light emitting diodes
77639	Other semiconductor devices
77641	Digital monolithic integrated units
77643	Non-digital monolithic integrated units
77645	Hybrid integrated circuits

77649	Electronic integrated circuits and micro-assemblies, NES
77681	Piezoelectric crystals, mounted
77688	Parts of the devices of subgroup 7763 and of the mounted piezoelectric crystals of item 77681
77689	Parts of electronic integrated circuits and micro-assemblies
77811	Primary cells and primary batteries
77812	Electric accumulators (storage batteries)
77817	Parts of primary cells and primary batteries
77819	Parts of electric accumulators
77822	Discharge lamps (other than ultraviolet lamps)
77823	Sealed-beam lamp units
77824	Ultraviolet or infrared lamps; arc lamps
77829	Parts of electric filaments or discharge lamps
77831	Electrical ignition or starting equipment used for spark-ignition or compression-ignition internal combustion engines
77833	Parts of electrical ignition or starting equipment for internal combustion engines; parts of generators and cut-outs used with such engines
77834	Electrical lighting or signalling equipment, windscreen wipers etc., used for cycles or motor vehicles
77835	Parts of equipment of heading 77834
77848	Hand elec-mech tool part
77869	Parts of electrical capacitors
77879	Parts el equip of 7787
77883	Parts of the equipment of heading 77882
77885	Parts of electric sound or visual signaling apparatus, NES (including parts of indicator panels, burglar and fire alarms)
77886	Carbon electrodes, carbon brushes, lamp carbons, battery carbons and other carbon articles
77889	Electrical parts of machinery or apparatus, NES
78425	Bodies (including cabs) for tractors, trucks and special purpose motor vehicles and road motor vehicles NES
78431	Bumpers and parts thereof, for tractors, motor cars and other motor vehicles etc.
78432	Other parts and accessories of motor vehicle bodies of headings 8701 to 8705 (including cabs)
78433	Brakes and servo-brakes, and parts thereof, for tractors, motor cars and other motor vehicles etc.
78434	Gearboxes
78435	Drive axles with differential, whether or not provided with other transmission components
78436	Non-driving axles, and parts thereof, for tractors, motor cars and other motor vehicles etc.
78439	Parts and accessories NES for tractors, motor cars and other motor vehicles, trucks, public transport vehicles and road motor vehicles, NES
78535	Parts and accessories for motorcycles (including mopeds)
78536	Parts and accessories for invalid carriages

78537	Parts and accessories for bicycles and other cycles (except motorcycles and mopeds), NES
78689	Parts of trailers and semi-trailers of heading 7861, subgroup 7862 and headings 78683 and 78685
79199	Parts of railway or tramway locomotives or rolling stock railway vehicles; parts of railway or tramway coaches, vans, trucks, service vehicles etc.
79291	Propellers and rotors, and parts thereof
79293	Undercarriages and parts thereof for aircraft
79295	Parts of airplanes or helicopters, NES
79297	Other parts of goods of group 792
81219	Parts for boilers of heading 81217
8138	Parts of portable electric lamps of heading 81312 (excluding storage batteries)
81391	Parts, NES, of lamps, light fittings etc. of glass
81392	Parts, NES, of lamps, light fittings etc. of plastics
81399	Parts, NES, of lamps, light fitting etc. other
82111	Seats of a type used for aircraft
82112	Seats of a type used for motor vehicles
82119	Parts of seats of subgroup 8211
84848	Headbands, linings, covers, hat foundations, hat frames, peaks and chin-traps, for headgear
87119	Binoc/telescope part/acc
87139	Electron/etc diffr parts
87149	Microscopes parts/access
87199	Parts and accessories of liquid crystal devices, NES, lasers (other than laser diodes), and other optical appliances and instruments, NES
87319	Parts and accessories of gas, liquid or electricity meters
87329	Parts and accessories of revolution and production counters, odometers, pedometers, speedometers, tachometers, stroboscopes etc.
87412	Parts and accessories of navigational instruments and appliances
87414	Parts and accessories for articles of heading 87413
87424	Parts and accessories for articles of headings 87422 and 87423
87426	Parts and accessories for articles of heading 87425
87439	Fluid instrum parts/acc
87454	Parts and accessories for machines and appliances of heading 87453
87456	Parts and accessories for instruments of heading 87455
87469	Parts and accessories for automatic regulating or controlling instruments, and apparatus
87479	Parts and accessories for instruments and apparatus of subgroup 8747
8749	Parts and accessories for machines, appliances, instruments and apparatus, NES
88112	Flash bulbs, flash-cubes and the like
88113	Photographic flashlight apparatus (other than the discharge lamps of subgroup 7782)
88114	Parts and accessories for the photographic cameras of heading 88111
88115	Parts and accessories for photographic flashlight apparatus
88123	Parts and accessories for the cinematographic cameras of heading 82121

88124	Parts and accessories for cinematographic projectors
88134	Parts and accessories for the equipment of headings 88131 through 88133
88136	Parts and accessories for the apparatus and equipment of heading 88135
88422	Parts for frames and mountings of spectacles, goggles or the like
88431	Objective lenses for cameras, projectors or photographic enlargers or reducers
88432	Other objective lenses
88433	Filters
88439	Mounted optical elements, NES
88571	Instrument panel clocks and clocks of a similar type, for vehicles, aircraft, spacecraft or vessels
88591	Watch-cases, and parts thereof
88597	Clock cases and cases of a similar type for other goods of group 885, and parts thereof
88598	Complete watch or clock movements, unassembled or partly assembled (movement sets)
88599	Clock or watch parts, NES
89121	Cartridges for riveting or similar tools or for captive-bolt humane killers, and parts thereof
89195	Other parts of shotguns and rifles of heading 89131
89410	Baby carriages, and parts thereof, NES
89423	Parts and accessories of dolls representing only human beings
8989	Parts and accessories of musical instruments
89935	Parts of lighters, NES, other than flints or wicks
89949	Parts, trimmings and accessories of articles falling under heading 89941 or 89942
89984	Button moulds and other parts of buttons; button blanks
89986	Parts of slide fasteners
89992	Skins and other parts of birds with their feathers or down, feathers, parts of feathers, down and articles thereof
89994	Human hair, animal hair, or other textile materials, prepared for use in making wigs or the like
89997	Vacuum flasks and other vacuum vessels, complete with cases, and parts thereof (other than glass inners)

Source: Athukorala, 2010.

Appendix II. Estimating indices of trade overlap and intra-industry trade

(i) Trade overlap

Abd-el Rahman (1991) and Ando (2006) broke down the trading of commodity *j* in terms of one-way trade or intra-industry trade. Trading of commodity *j* is regarded as one-way trade when equation (1) holds, while it is regarded as intra-industry trade if otherwise and intra-industry trade otherwise:

$$Min(X_{kj}, M_{kj}) / Max(X_{kj}, M_{kj}) \leq 0.1 \quad (1)$$

where X_{kj} represents country k's exports of commodity j to the world, and M_{kj} country k 's imports of commodity j from the world.

(ii) Intra-industry trade

The Grubel-Lloyd index measures the ratio of net exports in a product category to its total trade in an index that takes values from 0 to 100. It also calculates the part of balanced trade (overlap between exports and imports) in all trade in a given industry *i*. The index is calculated by the following formula, with the G-L index for a given industry *j* denoted as

$$GL_{jx} = \frac{X_j + M_j - |X_j - M_j|}{X_j + M_j} = 1 - \frac{|X_j - M_j|}{X_j + M_j} \quad (2)$$

This index takes a value of zero if either X_i or M_i equals zero, implying no IIT, and if $Xi=Mi$, it implies a value of 100 and signifies complete IIT in that industry. However, this index is observed to measure an incorrect level of IIT, especially if trade imbalances are higher. Studies such as that by Rajan (1996) have argued that G-L is a degree of measure of IIT rather than the absolute amount. Distinction needs to be made between the level of IIT and the actual amount of IIT that takes place, and the degree or extent of IIT. Therefore the level of IIT is estimated separately for these two-way P&C manufacturing products as

$$L_i = 2 * min (X_i, M_i,) \quad (3)$$

for the *i'th* industry where Xi is the amount of exports and Mi is the amount of imports in the same industry.

Brülhart (1994) ascertained whether the change in trade volumes in these P&C manufacturing products during the periods analysed were due more to intra-industry or inter-industry trade. This measure, known as Marginal IIT (MIIT), is a transposition of the G-L index using first differences of trade flows, and is measured for the *j'th* product as

$$MIIT_{jt} = 1 - \frac{\left|\Delta X_{jt} - \Delta M_{jt}\right|}{\left|\Delta X_{jt}\right| + \left|M_{jt}\right|} \quad (4)$$

where Δ stands for the difference between the values of exports and imports in the *j'th* product over a specific period *t.* This index also takes values from 0 to 1, and in percentage terms goes from 0 to 100 as the G-L index. An MIIT value close to 100 indicates marginal trade during the periods analysed to be of the intra-industry variety, and inter-industry if the MIIT index is 0 or close to it.

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