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INDIAN ELECTRONIC GOODS INDUSTRY: NEUTRALIZING TRADE DEFICIT WITH CHINA

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EXECUTIVE SUMMARY

The electronic industry is one of the most diversified and dynamic sectors, evolving at a rapid pace with continuous innovations. There is high modularity in the electronics industry, as a result of which an electronic production cycle can be segregated into many different parts which can be finally assembled. Therefore, production can be distributed over different geographies, making the role of global supply chains pivotal for the industry.

For the purpose of analyzing trade, the electronics industry can be classified under three broad heads, viz. electronic components, sub-assembly products and final electronic goods. Final electronics goods can be further classified on the basis of their end-use into 14 sub-categories, viz. phones, fax machines and routers, computer and storage devices, television and monitors, analytical instruments, cameras and projectors, medical devices, sound projection devices, sound and video recording devices, radios and alarm clocks, radio and TV transmission, radar and radio navigation equipment, office equipment, clocks and watches, and other electronic products.

GLOBAL SCENARIO

Globally, USA remains the largest producer of electronics in terms of value added, accounting for a share of 29.2 percent of the world production in 2012, up from 27.0 percent in 2007. China consolidated its position as the second largest producer with its share nearly doubling from 15.3 percent in 2005 to 26.7 percent in 2012. On the contrary, share of Japan almost halved – from 14.1 percent to 8.6 percent during the same period. The major players remained more or less the same, save for the entry of Brazil into the list, displacing France among the top ten.

Global exports of electronic goods were valued at US$ 2149 billion in 2012, registering a y-o-y decline of 0.5 percent, after recording two years of positive growth. Global

exports are more than twice the global value added in the production of electronics goods. This may seem inflated essentially on account of the industry being characterized by a large presence of established global value chains, implying that the component and sub-assemblies are moving either vertically or horizontally in the value chain[1]. Exports of both final electronic goods and electronic components declined marginally, but that of subassembly products recorded a moderate increase of 0.9 percent in 2012. However, over the period 2008 to 2012 the industry's trade performance was relatively better, with exports registering a CAGR of 2.7 percent.

Trade data in value added terms is significantly different than gross trade data. In the category of electrical and optical instruments, countries like the Netherlands and Mexico had gross trade surplus in 2009, but had deficit in value added terms. Moreover, countries like China, Japan, Republic of Korea, Germany, and Singapore had substantially lower trade balance in value added terms, as compared to the gross trade balance. Other countries like USA, Canada, Australia, France and United Kingdom had lower trade deficit in value added terms than in gross terms. The VAX ratio (ratio of value added exports to gross exports) for Philippines and Thailand was greater than one, indicative of the fact that electronics industry is extensively used in other export-oriented sectors.

India's trade deficit was much narrower in value added terms, amounting to merely 22.1 percent of the gross trade deficit. On the contrary, China's trade surplus in value added terms was 47.6 percent of its gross trade surplus. The VAX ratio for electronics exports from India was 0.79 i.e., India's exports in value added terms was 79.2 percent of its gross exports. India's valued added imports of electronics were also significantly lower than its gross imports (amounting to 43 percent of the gross imports).

SCENARIO IN INDIA

Although there has been significant increase in production of electronics,

[1]Thus for instance, consider that country A exports US$ 10 million of goods to B, to which value of US$ 10 million is additionally added by country B before finally exporting it to country C at a value of US$ 20 million. Although total exports by conventional measures amount to US$ 30 million in this example (US$ 10 million by Country A and US$ 20 million by Country B), the actual value added production is only US$ 20 million. Moreover, exports in value added terms will have two components – direct and indirect exports . Indirect exports are essential in accounting as conventional trade statistics do not present a true picture of trade relations. For example, in the above case, conventional trade statistics will not show any trade relation between A and C, even though A benefits extensively on account of demand from C.

there remains large unmet demand which is currently being met by imports. Majority of the electronic production in India is intended for the domestic market. Export intensity of sales in electronics industry has grown in 2000s. However, there has been a marked decline in the export intensity in post-2008-09 period.

The growth in India's exports and imports of electronic goods had peaked in 2010-11, but has witnessed moderation since then. The moderation has been starker in the case of exports, where y-o-y growth moderated from 52.1 percent in 2010-11 to 7.4 percent in 2011-12 before recording successive years of negative growths of (-) 7.8 percent and (-) 8.0 percent in 2012-13 and 2013-14, respectively. In absolute terms, exports of electronics declined from US$ 8.2 bn in 2010-11 to US$ 7.5 bn in 2013-14. As far as imports of electronics are concerned, during 2013-14, they were valued at US$ 30.97 billion, registering a y-o-y decline of (-) 1.5 percent.

India is a net importer of electronic goods and had a huge trade deficit of US$ 23.5 billion in 2013-14, primarily on account of huge imports from China whose share in India's total trade deficit in electronic products stood at 66.7 percent in 2013-14. China's share in India's trade deficit of electronic goods is largest in the category of final electronic goods. In 2013-14, China accounted for 73 percent of India's trade deficit of final electronic goods. In the segments of subassembly products and electronic component as well, the share was as high as 58 percent and 55 percent, respectively.

SCENARIO IN CHINA

China's performance in the electronics industry has been nothing short of phenomenal. The development of electronic capabilities in the country has to a large extent been possible due to the articulation and successful achievement of goals in its five year plans, which are the planning mechanism adopted in the country.

Import-substituting and export-driven foreign direct investment played an important role in China's electronics industry. While the former was largely a result of the sheer potential of China's market, the latter was ensured through regulations such as setting of export ratios for FDI (Zhongxiu Zhao et al, 2007)[2]. The mandatory export ratio was usually 70 percent for export-oriented FDI.

[2]Zhongxiu Zhao et al (2007), China's Industrial Policy in Relation to Electronics Manufacturing.

According to G Long (2005), China's FDI policies regarding exports can be categorized into: compulsory, neutral and voluntary. Compulsory policies required that "FDI shall be able to keep a balance of exchanges, or make sure the proportion of their domestically made products in the total number of products reach a certain benchmark, or a certain percentage of their products must be exported." Interested foreign investors had to meet this condition before receiving approval for investing in the country. However, after China's membership in the WTO, most of the compulsory requirements were eliminated in order to satisfy the TRIMs agreement. Neutral policies were aimed at creating favourable scenario for exports to compete internationally. Tariff and VAT exemptions were provided on imports of input for re-exports. Voluntary policies of the government included incentives like 50 percent cut in corporate income tax for enterprises with 70 percent of export products[3].

China is a net exporter of electronic goods with exports in 2012 amounting to US$ 598.4 bn and imports amounting to US$ 416.3 bn. Although, exports and imports of electronic goods from China have been rising since 2009, growth rates have moderated from 2009 onwards.

FDI outflows from China in the electronics industry during the first half of 2000s was low, but has increased substantially in the recent past. In 2012, capital investments made by Chinese companies in overseas electronics industry were US$ 2563 million. This came down to a lower, yet sizeable, level of US$ 1928.8 million in 2013.

NEUTRALIZING THE TRADE DEFICIT

India has substantial trade deficit with China in the electronics segment. However, Chinese products are not necessarily more competitive than those supplied by Indian players. Empirical findings in a recent study by RIS have found India's imports from China to be uncompetitive in the Vinerian sense, i.e. on the basis of comparative cost advantage. Nearly 16.2 percent of the total imports from China in 2012 in the Machinery and Mechanical Appliances segment have been found to be uncompetitive in the study[4].

Substantial complementarities have been found in the trade baskets of

[3]Guoqiang Long (2005), China's Policies on FDI: Review and Evaulation.
[4]Mohanty, S.K. (2014), India-China Bilateral Trade Relationship, Research and Information System for Developing Countries.

India and China. Basket of imports by China from India, and of the exports of India to world is similar to a large extent, indicative of strong signals of complementarities. Many products which rank high among products exported by China to the world also feature among the basket of major products imported by India from China. Especially in the subassembly products category, the top three products exported by China to the world are also the top three products imported by India from China.

The purpose of analysing trade complementarities is twofold- identifying areas where China's imports are substantial, indicative of the demand for those products, and suggesting strategies for developing domestic capabilities in those areas, and identifying areas where there is scope for attracting FDI from China on account of substantial demand by India.

IDENTIFICATION OF ELECTRONIC PRODUCTS FOR COOPERATION WITH CHINA

Identification of Electronic Sub-Sectors for Attracting FDI from China to India

At the six digit HS code level, three major points have been considered while identifying the products where India can attract investment from China:

- China's outward investment in electronics sector has been increasing. As per data from FDI Markets, outward FDI (capital investment) from China in electronics industry increased from US$ 575 mn in 2008 to US$ 2563 mn in 2012 before moderating to US$ 1928.8 mn in 2013. Outward investment from China in the electronics industry accounted for 13.8 percent and 8.5 percent of the total outward investments from the country in 2012 and 2013, respectively. Quite a few of these investments were horizontal and were envisaged with the objective of serving the local Chinese market (import platform investment)[5]. Hence, an analysis of Chinese electronic imports becomes important.

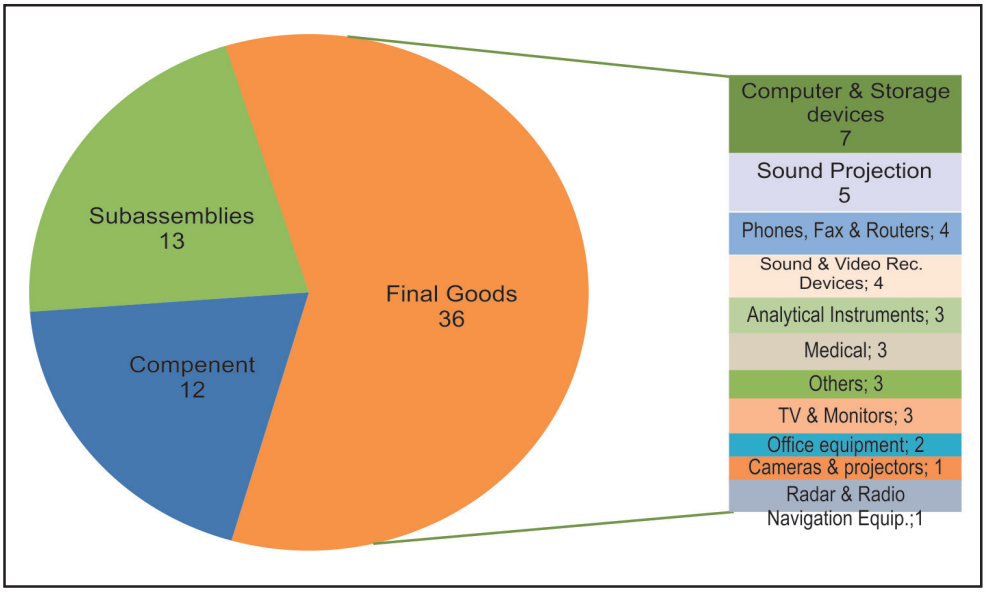
- However, when it comes to investments into India in the electronics goods sector by Chinese firms, Chinese firms have cited market seeking investment as a major reason for investment. This implies that India's import demand would be a key parameter for the identification process.

[5]Alon, Molodtsova & Zhang (2012), Macroeconomic Prospects for China's outward FDI.

- From the above two, a case can be made for identifying products where trade structures of India and China are complementary. If India's exports are complementary to China's imports, import platform investment can be attracted. If China's exports are complementary to India's imports, market seeking investment can be attracted.

The intersection of the three sets – a) where India and China have complementary trade pattern (i.e. where Trade Specialization index (TSI)[6] for the product is at variance for India and China – positive for one and negative for the other, and vice versa); b) where India has significant imports (minimum threshold level of US$ 10 million) and; c) where China's imports are above a threshold level

Exhibit 1: Electronic Segments Where Investment from China could be Attracted (Total: 61 products)



Source: UNCOMTRADE, EXIM Bank Analysis

[6]Trade specialization index (TSI) is used to measure the degree of net exportation by a country in a particular commodity. It basically compares the net flow of goods with the total flow of goods, thereby removing any bias due to re-export activities, if any. It thus helps in identification of real producers of a commodity and not merely traders. The range of TSI is +1 to -1, where +1 indicates complete specialization and -1 indicates no specialization. Algebraically, it can be written as-

$$TSI = \frac{X-M}{X+M}$$

(at least US$ 50 million) is derived as the required set of electronic products where FDI could be attracted from China by India. Based on the above methodology, sixty one such products have been identified, accounting for 19.8 percent of China's total electronics imports, and 69.7 percent of India's total electronics imports in 2012. Most of these products are in the final electronic goods segment. Within the final goods segment, computer and storage devices is the most important sub-category where investment can be attracted (Exhibit 1).

Identification of Electronic Product Categories for Enhancing Exports from India to China

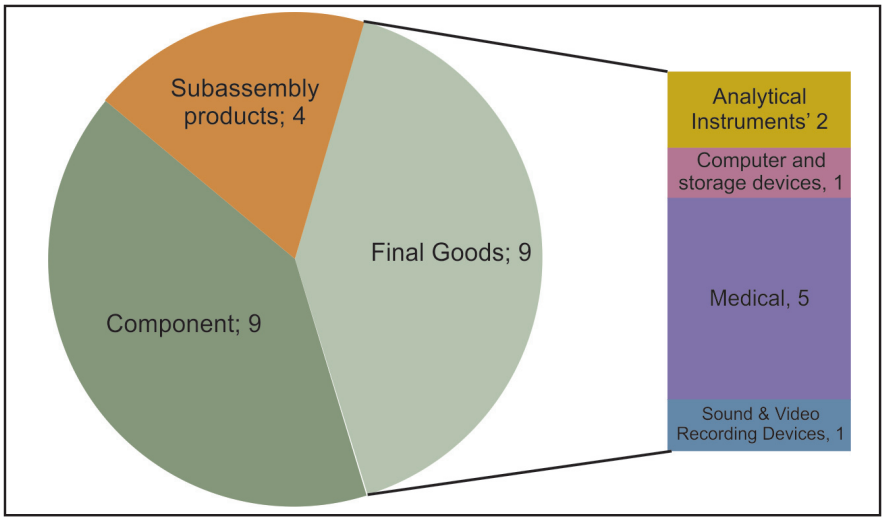
India can also strive towards enhancing its export capabilities in the identified electronic goods. These would include products where:

- China is not a real producer currently, and has got significant import demand (>US$ 50 million). Whether China is a real producer can be identified from the TSI index. China will not be a real producer in all those goods where TSI is negative.

- India has got a certain minimum amount of exports (>US$ 10 million), indicative of some production capabilities available in the country.

Twenty two such products have been identified, largely from the segments of medical devices and components. These products in total account

Exhibit 2: Product Categories for Enhancing Exports from India to China



Source: UNCOMTRADE, EXIM Bank Analysis

for 50.4 percent of total imports by China. These products accounted for 15.9 percent of India's total electronics exports and 17.3 percent of India's total electronics imports in 2012 (Exhibit 2).

Identification of Sub-Segments for Establishing Joint Ventures between India and China in the Electronic Sector of India

While looking for a potential JV partner, companies look into various aspects like financial security, resource and management capabilities, production performance, reputation, etc. Hence, JVs can be attracted successfully only in those areas where Indian companies already have a critical mass and experience. For the purpose of identifying such areas, an analysis of Indian companies which have achieved operating success, and thus are attractive JV partners can be undertaken.

This study takes net profit as a proxy for operating success of a company. List of companies engaged in electronic production was obtained from the CMIE's Prowess database. Taking 2011-12 as the reference period, those companies have been selected where the profit after tax was positive[7]. The list of major products produced by these firms, and hence suitable far establishing joint ventures is given in Table 1.

Identification of Sub-Segments for the Development of Software Industry to Meet the Requirements of Chinese Market

ERP and SCM are important segments in China's enterprise application market. In the ERP segment, Indian software companies need to provide more customized products and should also try to provide on-site delivery which is an important consideration for the Chinese customers. Indian players will also have to familiarize with the Chinese business culture and language as it is another important factor to tap the Chinese ERP demand. Moreover, the business process-related functions of ERP system (like SCM) are more in demand in the Chinese market. So emphasis on this particular segment should be the highest.

Other Areas for Attracting Investment from China

Benefits from Regional Trade Agreements: List of electronic products can be identified where India has access to preferential duties, while China doesn't. These areas would be attractive for Chinese firms to invest

[7]The companies for which 2012-13 data was available were few. Hence, 2011-12 data has been considered for the present analysis.

Table 1: Main Product Groups where JVs can be Formed

Medical equipments	Line printers
Analytical instruments	Control valves
Printed circuit boards	LED lamps
Uninterrupted power supplies	Other diodes & transitors
Control instrumentation & industrial electronics	Diodes & transistors
Therapy equipments	Level controllers
Microwave passive components	Industrial fans, blowers, etc.
Weighing system, load cell	Other automation electronics equipment
Filters	Crystals
Electro cardio graphics	Electronic lighters
Defence communication equipments	Computer systems
Strategic electronics equipments	Solar modules
Connectors	Instrument cooling fans
Surgical equipments	Industrial ultrasonic equipment
Piezo electric elements	Semiconductor devices
Other testing & measuring instruments	Integrated circuits
Thermal analysis equipments	Computer peripherals
Soft ferrites	Electronic components
VHF radio systems	Reed switches
Solar appliances	Switch mode power supply systems
Transmission equipments	Process controllers
Electronics	Integrated circuits, nec
Process control equipments	Ph analysis equipments and ph meters
Electronic buzzers	Television receivers, colour
Electrolytic capacitors	Telephone components
Temperature controllers	Computer terminals
Antennae for radios & TVs	Communication & broadcasting equipments
Rotary switches	Television receivers
Control panels	

Source: CMIE Prowess, EXIM Bank Analysis

in order to access wider market. India has concluded agreements with some countries/regions where China has not been able to gain preferential access. These agreements are crucial from the point of view of attracting market-seeking investment from China. Even in countries where both India and China have FTA, some areas can be identified where the FTA partner countries have put electronic items under sensitive list for China, but not for India.

A Preferential Trade Agreement was signed between India and MERCOSUR in 2005 wherein the latter provided concession in 452 products. Of these 452 products, 30 are electronic products. Maximum preference is allowed by MERCOSUR in the medical electronics products category wherein four product categories benefit from 100 percent margin of preference. These are lithotripters operating by shock waves (HS code: 90189031), computerized microwave apparatus for intra-urethra (HS code: 90189093), endoscopes (HS code: 90189094), and clamps and clips, applicators and extractors there (HS code: 90189095).

Both India and China have entered into trade agreement with ASEAN. However, some of the products which are in the sensitive list of ASEAN countries for China are under the Normal Track-1 and Normal Track-2 list for India. Twenty three such products have been identified at the six digit level.

SAFTA is a free trade agreement between the countries of Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka. Out of these countries, China has FTA only with Pakistan. However, even in Pakistan, China has margin of preference in only 21 products at HS 6-digit level. Investment in India will give Chinese companies access to the markets of SAARC countries. Although the market size of individual countries within SAARC might be small, collectively it is an attractive export destination.

Benefits from Investment in Areas where Chinese Firms Face Trade Barriers: India can also attract investment in those sectors where China faces anti-dumping duties, countervailing duties and safeguards from other countries and hence would like to circumvent these trade barriers. The scope of barriers is fairly large and includes wide array of non-tariff barriers as well. For the purpose of our analysis we have taken three significant trade barriers- anti-dumping duties, countervailing duties, and safeguards. Twenty seven products in six different countries/ regions (including European Union)

have been identified where China faces these trade barriers. However, import by some of the countries placing import-restrictions on electronic products is low, thereby limiting the prospects of investment in those commodities.

Products featuring under monitors and projectors, not incorporating television reception apparatus; reception apparatus for television, whether or not incorporating radio-broadcast receivers or sound or video recording or reproducing apparatus (HS code: 8528, Category: Television & Monitors) has witnessed significant import-restricting actions from across the globe. Under this category, imports from China have been banned by countries such as Argentina, EU, Turkey and USA. All these countries are also significant importers of the product, with total imports from these four countries under this HS code amounting to US$ 13,754.13 million in 2012. Hence, investments in this area can be attracted.

Within the sound and video recording devices segment, magnetic media for the recording of sound/of other phenomena, but excluding products of Chapters 37, other than cards incorporating a magnetic stripe (HS code: 852329) and optical media for the recording of sound/of other phenomena, but excluding products of Chapters 37 (HS code: 852340) are important categories where China faces anti-dumping and countervailing duties from European Union. Total imports under these two HS codes by European Union were US$ 1,381.44 million in 2012. China also faces barriers from Argentina and European Union in the category of microwave ovens (HS code: 851650).

Within the electronic components segment, China faces maximum trade barrier on account of these measures in the category of other permanent magnets and articles intended to become permanent magnets after magnetisation (HS code: 850519). Both Brazil and USA have placed import-restricting duties on China in this category. Total import for this product by both the countries amounted to US$ 48.18 million in 2012.

STRATEGIES FOR DEVELOPING DOMESTIC CAPABILITIES

Developing the Electronic Components Category: Electronic components are the building blocks of a successful electronics industry. Its growth has been frail in India. Like India, Brazil also has seen a surge in the electronic components import. An influential effort was taken by the Brazilian government in the form of Integrated Circuits Brazil

(CI Brasil) program, from which cue can be taken by India. Established in 2007, this program has established training centers in ICT clusters and many semiconductor designers have graduated under this program. Such training help develop domestic technical pool. It is not that India is aloof from such kind of initiatives. KarMic Training Centre, in India, is a rural VLSI training institute which offers specialized semiconductor design training to graduate engineers to prepare them for absorption into the design sector. Interestingly, it was a private initiative wherein students were absorbed into the company upon graduation.

Tax Related Incentives for Semiconductor Industry: Tax related incentives also go a long way in developing the electronics industry. Brazil started the Program for the Development of the Semiconductor and Display Industry (PADIS) which provides incentive for manufacture of semiconductor electronic devices, crystal and plasma displays and on-board chip systems. PADIS allows for several incentives, including zero percent corporate income tax for development and design, testing and packaging, and diffusion (physical/ chemical) processes. Countries like Japan, China and Taiwan also provide tax subsidy for manufacturing in the electronics and semiconductor manufacturing category, which is not provided in the Indian case. Japan provided subsidies and tax benefit under two laws- Machinery Industry Law (1956) and Electronics Industry Law (1957). Subsidies for R&D and loans, along with tax incentives were provided under these laws for firms that developed or used advanced production technologies. In this direction, India recently provided for reimbursement of central taxes and duties in select high-tech units like fabs under the M-SIPS scheme. More such incentives along with simplification of tax structure are required.

Venture Capital (VC) Investment: In India, VC investment has more than doubled from US$ 600 million to US$ 1.4 billion between 2006 and 2012, principally driven by regulatory changes, including the elimination of tax on capital gains and the relaxation of rules preventing foreign investment. However, bulk of the VC investment has been in the consumer services sector[8]. Although VC firms might seem skeptical about their involvements in the electronics sector and might see these investments as high risk, low yield and unstable

[8]Global Venture Capital Insights and Trends 2014, Ernst and Young

returns, the government backing can help build trust in the sector. In Europe, the government supports VC in several ways. In Germany, the High-Tech Gründerfonds invests directly in emerging businesses which fund technology start-ups. The European Investment Fund, which is funded by member states of European Union, also plays a key role through investment in VC growth funds.

Setting Up of Clusters for Mobile Telecom: State of cluster development is considered as strength in the Indian case, among all other ways to promote innovation linkages[9]. It is essential to promote the concept of cluster development for mobile telecom in India, as the country has substantial prowess in the model of cluster development.

Finland's "wireless valley" is an example of mobile telecom cluster which was a major component of "Mona" – a Finnish mobile services development program. The cluster comprised several related players, with terminal manufacturers (producing mobile phones) and network manufacturers (producing equipment needed for mobile networks) being a part of the core industries. A cluster for mobile telecom on similar lines could be set up in India.

Development of Industrial Clusters for Medical Devices: Similarly, development of industrial clusters specifically for the medical devices industry would provide an impetus to the sector. In this regard, Gujarat Government has taken some initiatives. The State Government intends to develop a specialized pharmaceutical machinery cluster in the State. More such Central and the State Government initiatives would help improve Indian capabilities in the segment.

Guidance for Product Development in Medical Devices: US-FDA and European Medicines Agency give guidance to their national industry about product development. In a case study by Szymon Jarosławski and Gayatri Saberwal (2013), lack of guidance and dialogue regarding product specifications has come out as a major challenge for product innovations. The firms found it essential to engage with foreign regulatory agencies for their guidance, distinguishing their innovative products from other substandard ones, and also to access global

[9]Global Innovation Report 2013

[10]Szymon Jarosławski and Gayatri Saberwal (2013), Case studies of innovative medical device companies from India: barriers and enablers to development.

markets[10]. Such guidance needs to be provided by national regulatory agencies.

Greater and More Transparent Procurement of Innovative Medical Devices: Share of general government expenditure on health as percentage of total expenditure on health in India has risen steadily over the years and is expected to continue to rise. Given this trend, promotion of innovative technologies through government procurement is going to gain significance.

Szymon Jarosławski and Gayatri Saberwal (2013) suggested greater government procurement of innovative devices in the Indian case to encourage product innovations. The process of such procurement should also be made more transparent through the use of evidence-based decision making[11]. Evidence based pratice is the use of the best available incidence together with a clinician's expertise and a patient's value and preference in making health decision. Agencies in many European and Asian countries (like, Japan, Singapore and Malaysia) appraise technologies and advise on their financing from public sources.

Separate Regulatory Environment for Medical Devices: Under the Drugs and Cosmetics Act, many medical devices have been currently notified as drugs. The difference between drugs and devices is stark. While drugs are based on chemistry and pharmacology, devices are based on engineering. While drug is regulated by licensing system, device is regulated by notified bodies in most countries. While in the case of a drug, the issue may be that of dosage, in the case of device, it may be of the size, especially in implantable devices. Moreover, the latter would be more risky than a drug, especially in later-phase trials. Industry and regulatory authorities have for long felt that provisions related to drugs can't be applicable entirely for medical devices. Currently, not all medical devices have been classified as drugs. Those which are not considered as "drugs" only require import or manufacturing license and no quality check system exists for them. Hence, the Drugs and Cosmetics (Amendment) Bill, 2013 is an attempt towards specifying provisions specific to medical devices. For example, conditions have been specified under which medical devices shall be deemed to be misbranded, adulterated, and spurious. The Bill needs speedy implementation.

Stronger Linkages between Academia and Industry: In promoting partnerships between industry

[11]Ibid.

and academia, India can take inspiration from the Innovation law and Good law of Brazil. These laws allowed automatic use of fiscal benefits for investment in R&D, without any need for a formal request.

Innovation Law has been enacted to strengthen the university-industry research relationship, promoting the shared use of science and technology infrastructure by research institutions and firms, allowing direct government grants for innovation in firms, and stimulating the mobility of researchers within the S&T system. The Law permitted the creation of the Economic Subsidy Program, created in 2006 and coordinated by FINEP, which provides resources for R&D activities undertaken by industrial firms. Under this umbrella programme, four sub-programmes provide grants viz.: a) nationally competitive grants to firms of any size to develop new products and processes; b) grants to firms to hire researchers holding masters or PhD degrees; c) state-level competitive grants for innovation to small firms, to be implemented through partnerships of business federation, micro and small enterprises agency, etc.; and d) locally competitive milestone-based small grants to start-ups.

Good Law has been enacted in Brazil for authorizing the automatic use of fiscal benefits for companies that invest in R&D. The significant incentives under this Law include: deductions from income tax and social contributions on net profits from expenses on R&D (between 60 percent and 100 percent); reductions in the tax on industrial products for purchasing machines and equipment for R&D (50 percent); economic subsidies for scholarships of researchers in companies; and exemption from the Contribution for Intervention in the Economic Domain (CIDE) carried to payments of patent deposits. The Law also included provisions for funding firms which hire employees with Masters Degrees and Ph.Ds.

Creation of a Fund for Promotion of Innovation in Analytical Instrument Category: A Fund can be created to support the premier science and technology related educational and research institutes in the country for the development of scientific instruments. Since, the amount of funding can be quite large in case of some scientific instruments, programs of joint funding requirements can be established with like-minded countries. Joint funding in analytical instruments can strengthen the scientific and technological capabilities of countries, leading to discovery and development of new knowledge, product, process or services, or improvement in existing ones.

Motivation can be taken from the PRODEX program, which was a joint funding of European Union. It began in 1986 with the objective of providing funds "for the industrial development of scientific instruments or experiments, proposed by Institutes or Universities in the Participating States that have been selected by European Space Agency (ESA) for one of its programs in the various fields of space research (science, microgravity, earth observation, etc)."

Creation of a Fund for Computer Hardware Component Production: In 2012-13, imported raw materials accounted for 78.73 percent of the total raw materials consumed by the computer hardware industry, as per the sample of companies taken from CMIE Prowess database. The ratio was higher in comparison to the ratio in other sub-categories of communication equipment and other electronics. Around 46.13 percent of operating expenses incurred by this industry category has been on account of raw materials, stores and spares, which is indicative of immense potential which exists for electronic component producers.

According to Prathap (2013), value added in the electronics industry of India is merely 5-10 percent, with electronic giants like Samsung, Dell and Hewlett Packard importing nearly 90 percent of their electronic components[12]. There is a need to increase the value added production of electronics in India. Boosting production of electronic components and subassembly products gains greater significance in this context as substantial value addition happens at the components and subassembly stage of an electronics manufacturing process, contrary to other manufacturing activities. Many of the processes at these initial stages are capital and skill intensive. Hence, for lowering the import intensity in this category and increasing the domestic value added production, promotion of production of computer hardware components is crucial.

Inspiration can be taken from Electronics Industry Development Fund (EIDF) which was set up in China in 1986. It was first set up to support R&D and production of four key electronic products: integrated circuits, computers, software and program-controlled switching devices. Producers who were eligible to apply for support from the Fund had to meet the criteria of state-owned status and high local content of their products.

[12]Surendra Pratap (2013), Workers in the Supply Chain of Electronics Industry in India: The Case of Samsung.

The Fund later enlarged its support to include all major electronic products, components, and to include non-state owned firms[13].

STRATEGIES FOR ATTRACTING FDI FROM CHINA

Development of Infrastructural Facilities: Infrastructure is an important element for attracting investments. This is especially important in the case of electronics industry because of large presence of global value chains which require swift movement of goods across nations. However, the current state of infrastructure and logistic services in India is grossly inadequate. According to the World Bank's Logistics Performance Index, India is ranked 45th in 2012 which reflects the relatively poor state of infrastructure and logistics. Holding other factors constant, Kumar (2001) had shown that infrastructure availability contributes to the FDI attractiveness of a country, and also that export orientation of production of investing firms is significantly related to the infrastructure of the country[14]. Countries like Singapore and Hong Kong which rank highest on the logistics performance index have attracted large investments in their electronics industries and established an important presence in the global value chain for electronics. Hence, infrastructure development will have a crucial role to play in attracting FDI in the industry.

Human Resource Development: Electronics companies require workforce with diverse knowledge and skills, and as the industry moves on a path with greater technological innovations, the worker profile needs greater education and training. In light of this, education standards in India become a major constraint, with only 9.8 percent of the labor force having tertiary education in 2010. As per a Report by NSDC on Human Resource and Skill Requirements in the Electronics and IT Hardware Industry, the incremental requirement in India for level-2 and level-3, which require technical knowledge and long drawn preparations in the industry will be the highest at 25-27 percent, and 49-50 percent, respectively, in 2022. In order to attract investment into this industry, workforce need to be trained as per the industry requirements.

One major problem which has emerged out of the studies concerning the education sector has been the

[13]Zhongxiu Zhao et al. / 33 - 51, Vol. 15, N0. 3, 2007

[14]Nagesh Kumar (2001), Infrastructure Availability, Foreign Direct Investment Inflows and Their Export-orientation: A Cross-Country Exploration.

presence of significant regulatory impediments like limitations on entry by foreign universities, and collaboration of Indian university with foreign players. These regulatory hurdles need to be addressed, especially since the role of private players in higher education has been growing at a rapid pace.

Favorable Duty Structure for Final Electronics Exports: The duty structure should be such that it should favor the production of final electronics goods over electronic components and subassembly products, and also to support the domestic production over imports. China had established an export processing policy wherein raw materials such as parts and components and other intermediate imported goods did not have any duty imposed, as long as they are used to produce export goods. However, in the Indian case, there exists no such enabling environment.

While there is no import duty on finished products, the Government has put tariff barriers on electronic components required to manufacture telecom hardware (Chattopadhyay, 2013)[15]. For example, while most of the six final electronics products in the category of phones, fax machines, and routers do not face basic custom duty (average effective rate of duty: 18.1 percent), electronic integrated circuits: Other (Hs code: 85423900) faces basic customs duty of 7.5 percent (effective rate of duty: 21.6 percent). Simplifying the tax structure and aligning the taxes in favor of domestic manufacturing is essential. Preferential laws for usage of domestic products can also help incentivize investments.

Creating Greater Market for Analytical Instruments through R&D Promotion: India ranks fairly low in gross expenditure on R&D (ranked 44th) and only 33.9 percent of it is financed by business enterprises. China on the other hand has 71.7 percent of its R&D by business enterprises. R&D promotion will serve the dual purpose of creating robust innovation base in India and also of creating a greater market for analytical instruments in India.

Israel which ranks topmost in GERD had come up with novel ways to encourage R&D in the economy. India has already taken many steps to

[15]Utpal Chattopadhyay (2013), Making India a Telecom Manufacturing Hub: Emerging Issues and Challenges.

promote R&D in the country, but need to focus more on incentivizing the business enterprises and promoting collaborations among institutions.

In Israel, Life Sciences Fund was created to bring about growth in the biotechnology industry. The government had selected a private healthcare investment firm, Orbimed Partners Israel in an open tender to become the Fund's general partner and its manager. The Fund was structured as a standard venture capital fund and capital commitments in a limited way was made by the Israeli Government as a minority partner. Another initiative by the Israeli Government was setting up of Tnufa which is a national pre-seed fund. It assists individual inventors and nascent start-up companies during the earliest stages of their projects. This includes evaluation of the technological and commercial potential of a project, filing for a patent, building a prototype, drafting a business plan and initial business development.

Apart from these, BIRD - Bi-national Industrial R&D Foundation for joint R&D between American and Israeli companies has also been set up. Under this, one Israeli and one American company can jointly apply for BIRD support as long as they have combined capability and infrastructure to define, develop, manufacture, market, sell and support an innovative product based on industrial R&D. The BIRD Foundation offers conditional grants for joint development of projects on a risk-sharing basis. The Foundation funds up to 50 percent of each company's R&D expenses associated with the joint project. Repayments are due only if commercial revenues are generated as a direct result of the project. Israel has also set up other bi-national funds like SIIRD (Singapore), CIIRDF (Canada), KORIL-RDF (Korea) and US-Israel Science & Technology Commission and Foundation.

Enlarging the Technical Pool Required for Medical Devices: The number of colleges offering biomedical engineering/ bio-engineering courses in India is not much. Biomedical engineering is an interdisciplinary subject in which engineering and technology is applied to medicine, surgery and healthcare of humans and other higher forms of life. It mainly involves bio-instrumentation, biomaterials, imaging, and biomedical devices. Such programs need to be promoted

in more number of institutions, so that the skill set required for manufacture of medical electronics is enhanced.

SUM UP

In the context of India's electronics industry, perhaps the quote "China is a threat, China is a customer, and China is an opportunity"[16], suits perfectly well. China is a threat considering the burgeoning trade deficit in the electronic goods sector. India's rising trade deficit with China makes it imperative to think on the lines of improving production facilities in the electronics category and also get access to latest technologies for production. China is a customer for it is a large economy with an enormous appetite. It has a large and growing demand for medical devices. China is an opportunity as FDI outflows from the country has been growing in the electronics industry. Foreign Direct Investment from China can propel electronics production in India and aid the ailing industry.

Several steps have been taken towards the improvement of electronics industry in recent times by the Government of India, including the seminal National Electronics Policy 2012, which envisages achieving a turnover of about US$ 400 billion by 2020. These policies should move in tandem with exploring opportunities presented by the electronics market in China, and attracting Chinese investors.

Going forward, rapid urbanization, rising personal disposable income, adoption of high-end technology devices, high technology obsolescence and product innovation, competitive pricing of products, easy financing schemes, expansion of organized retail and distribution networks, and several government initiatives are going to be major drivers for the growth of the electronics industry in India. On the back of these, there exists huge opportunity for the domestic manufacturers.

Select strategies for development of domestic capabilities and encouragement of FDI like establishment of training centres for electronic components production; promoting venture capital investment; development of dedicated clusters on the lines of Finnish mobile telecom cluster; guidance for product development, and strengthening

[16]The World is Flat, Thomas Friedman.

of regulatory environment in the category of medical devices; development of stronger linkages between academia and industry; incentivizing innovative products through Government procurement as in the case of several countries like Japan, Singapore, European countries and Malaysia; engagement in international co-operations on R&D and electronics production; and streamlining tax structure, can help create an enabling environment for the domestic manufacturing

1. GLOBAL SCENARIO OF ELECTRONICS INDUSTRY

The discovery of transistor effect was a watershed development in the history of electronics industry. From then on, electronics has entered every sphere, right from medicine to warfare. Currently, it is one of the most diversified and dynamic sectors, evolving at a rapid pace with continuous innovations. Most electronics manufacturing is extremely automated and the quality standards in the global circuit are demanding.

Electronics industry played a crucial role in the export-oriented industrialization of the East Asian countries. American, European and Japanese firms identified other firms in East Asia as suppliers, transferred skills and technologies to them, invested in them and finally bought them. This process of developing a supply base, tuned to serving advanced economy firms, has been referred to as "supplier-oriented industrial upgrading"[17]. These countries served as a low cost base for the advanced countries.

Although the success of electronics industry in China and East Asia has been phenomenal, countries like USA, Western Europe and Japan are still significantly important players at the international level. Several factors make these countries conducive for the development of the electronics industry. These countries rank high in terms of number of patent applications filed by residents at the national patent office (per billion PPP$ GDP), which can be used as a proxy for innovation. They also rank above in high-tech output (as percent of total manufactured output)[18]. Moreover, many important firms in the electronics industry landscape are from these countries and have significant market power.

GLOBAL VALUE ADDED PRODUCTION

The global production (in terms of value added[19]) of electronics was estimated to have reached US$ 958 bn in 2012, up from

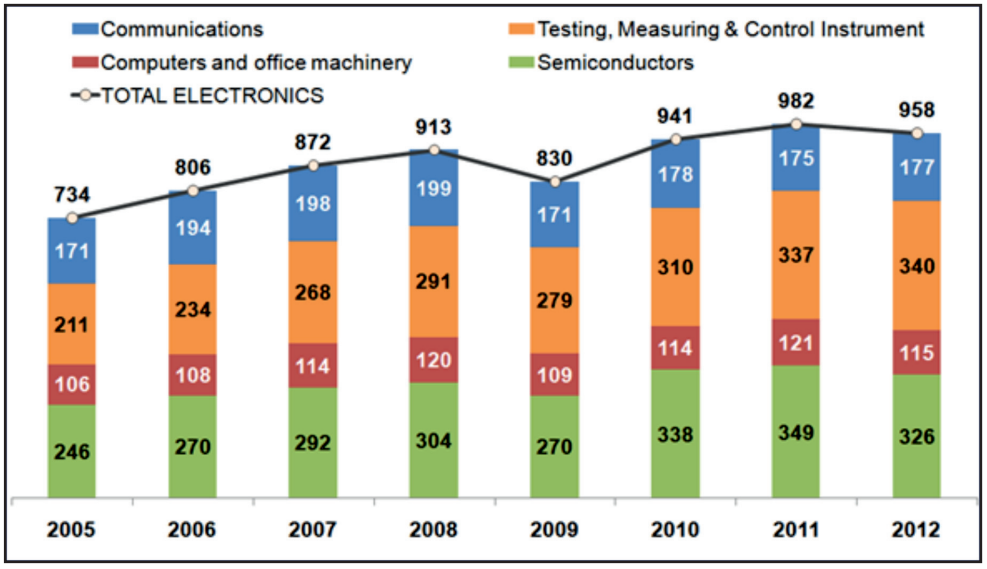
[17]Sturgeon, Timothy and Richard Lester. (2004), "The New Global Supply-base: New Challenges for Local Suppliers in East Asia."
[18]Global Innovation Index Report 2013.
[19]Value added is the amount contributed by a country, firm, or other entity to the value of a good or service and excludes purchases of domestic and imported materials and inputs.

US$ 734 bn in 2005, thereby recording a CAGR of 3.9 percent during the period. Four electronic segments have been categorized by the National Science Foundation, USA namely, Testing, Measuring and Control Instrument; Communications; Semiconductors; and Computers and Office Machinery. Of these, the latter three segments are characterized by complex global value chains. Global production had declined in two years between 2005 and 2012 (Exhibit 3). The decline in 2009 can largely be attributed to the crisis of 2008-09, with production declining across all the four segments. Global production had dipped slightly in 2012 on account of decline in production of computers and office machinery, and semiconductors.

The growth in the global electronics industry has been led by the robust performance of Testing, Measuring and Control Instruments, which recorded a CAGR of 7.1 percent during 2005-2012 to touch US$ 340 bn, making it the largest contributor to the electronics industry among the aforementioned four segments in 2012. Performance of semiconductors was also relatively healthy with global value added increasing from US$ 246 bn to US$ 326 bn, registering a CAGR of 4.1 percent during this period.

Semiconductor production in 2012 had declined for all the top ten producers, other than China. Value added production of semiconductors in China surged by 14.8 percent in 2012, as compared to the previous year. In

Exhibit 3: Global Value Added in Electronics: A Segmented Trend (US$ bn)



Source: Derived from National Science Foundation, EXIM Bank Analysis

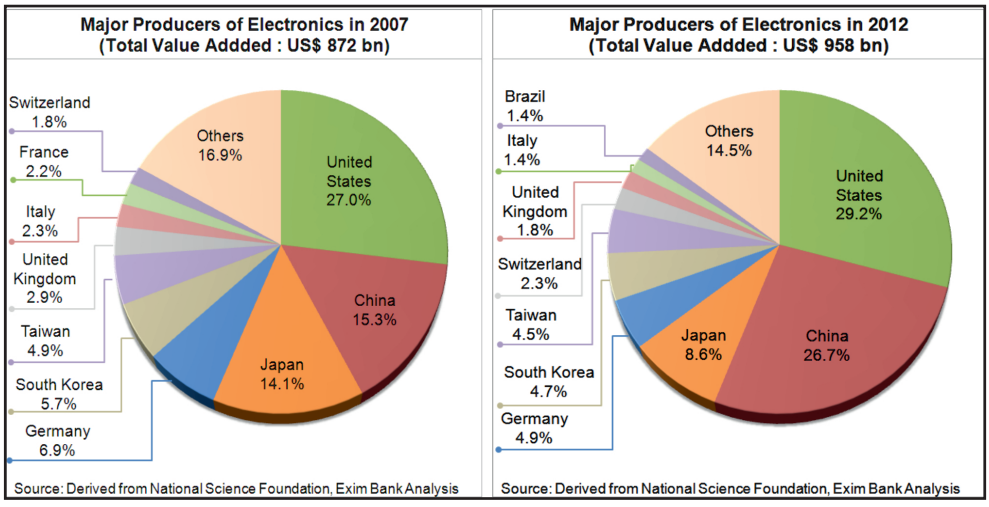
the same year, production of testing, measuring and control instrument had witnessed a major year-on-year (y-o-y) decline of 7 percent in the EU which is an important producer of these electronic products.

The USA remains the largest producer of electronics in terms of value added, accounting for a share of 29.2 percent of the world production in 2012, up from 27.0 percent in 2007. China consolidated its position as the second largest producer with its share nearly doubling from 15.3 percent in 2005 to 26.7 percent in 2012. On the contrary, share of Japan almost halved – from 14.1 percent to 8.6 percent during the same period. The major players remained more or less the same, save for the entry of Brazil as one of the leading producers of electronics, displacing France among the top ten (Exhibit 4).

An interesting point to note is that the shares of all the top ten producers except the USA, China and Switzerland declined in terms of value added during this period. Significant decline in share of Japan can be attributed to the country's economic stagnation, financial difficulties of its domestic firms, and off-shoring of electronics production to low cost locations like China. India's share over the same period increased marginally from 0.34 percent to 0.46 percent.

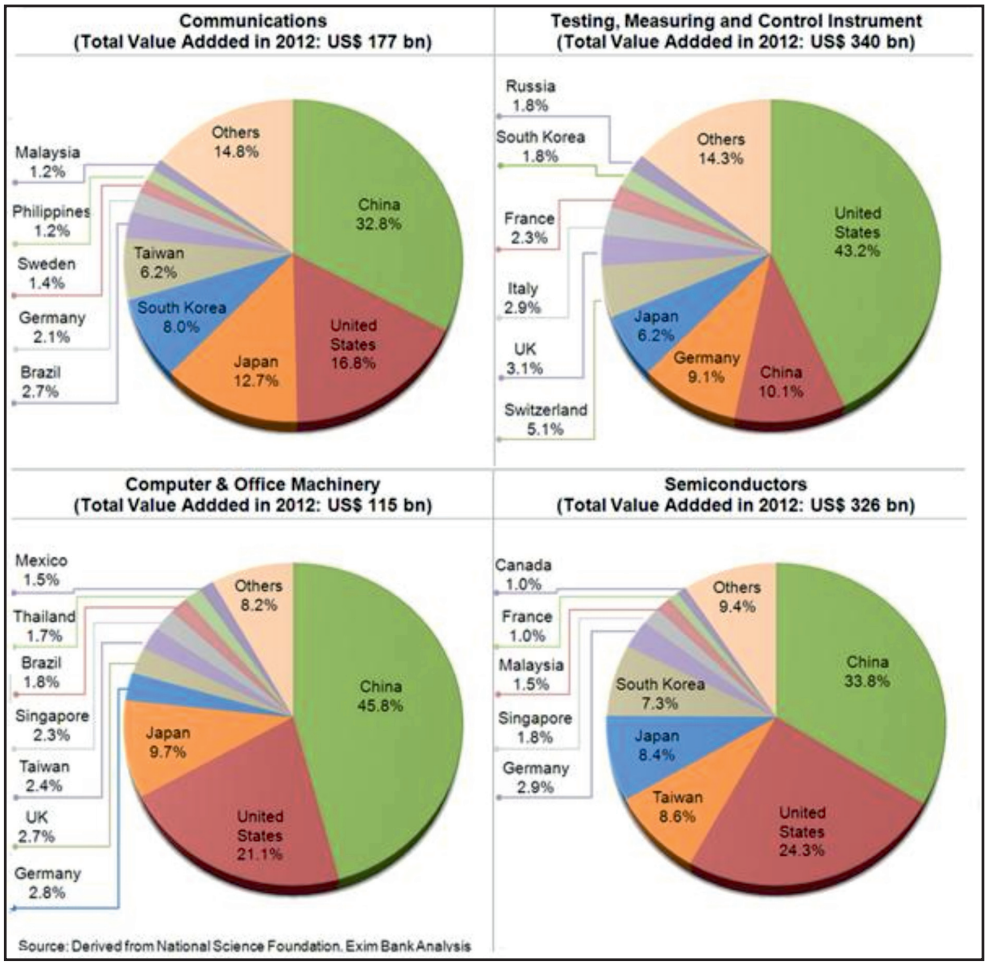
China was the largest producer of electronics in terms of value addition under three of the four segments identified by the National

Exhibit 4: Major Producers of Electronics in 2007 and 2012



Science Foundation, the USA. The country accounted for 33 percent of communications production, 46 percent of computer and office machinery production and 34 percent of semiconductors production at the global level. In the category of testing, measuring and control instruments, the United States was the largest producer, accounting for 43 percent of the global value added in production in 2012 (Exhibit 5). These results reflect the fact that China is a dominant player in those segments of electronics production where global value chains are well established. In segments like testing, measuring, and control instruments, global integration is relatively low. Production in this segment is largely located in developed countries.

Exhibit 5: Category-wise Major Producers of Electronics



MAJOR PLAYERS IN THE GLOBAL ELECTRONICS LANDSCAPE

The United States, China, Japan and the European Union countries are important players in the global electronics industry. It is worthwhile to analyse the performance of electronics industry in these countries in recent years. The electronics industry of China holds special significance for the Indian industry from the point of view of trade and investment, and solicits an in-depth analysis. This has been undertaken in the later sections.

Scenario in the United States

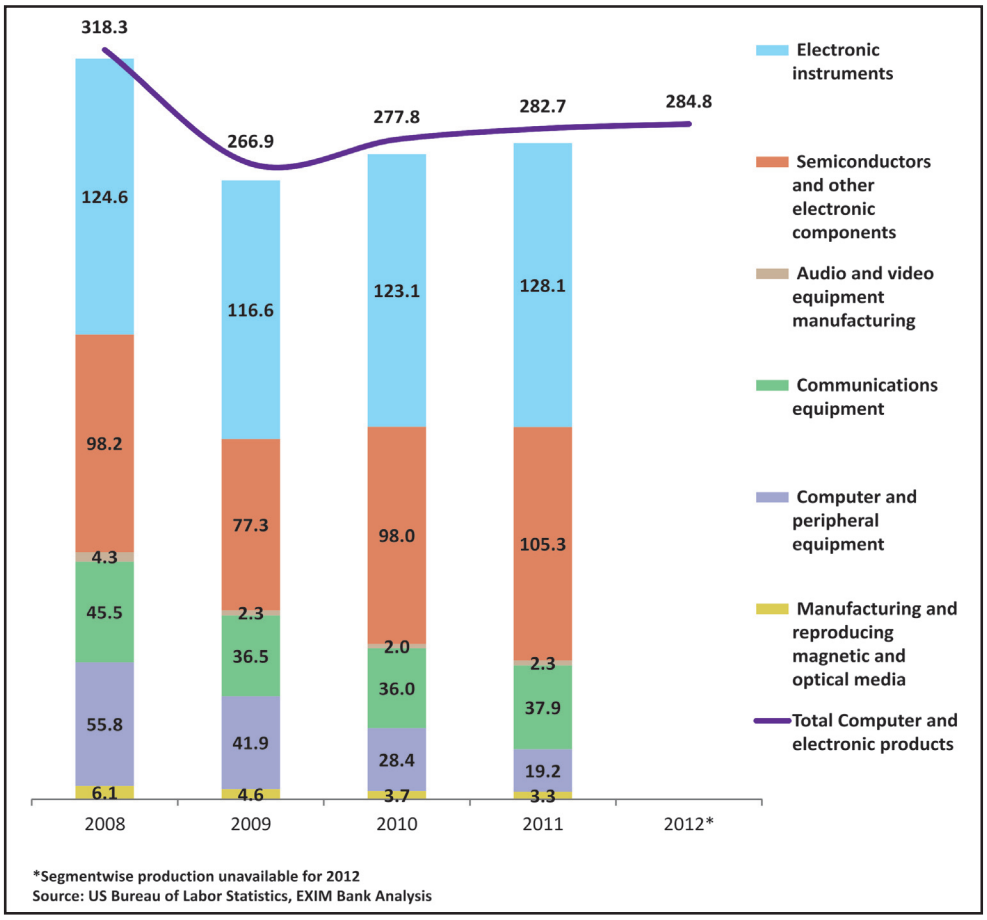
Notwithstanding its leadership in market size, the USA, which is an important producer of electronic products, has still not been able to achieve the pre-crisis level of electronics production in value terms. There has been significant moderations in y-o-y growth rates of value of computer and electronic production in the country during 2011 and 2012, after witnessing a fair growth in 2010 (although relatively higher growth rates in 2010 could be attributed partly to the base effect). The total value of electronic production in USA amounted to US$ 284.8 bn in 2012, recording a marginal y-o-y growth of 0.7 percent (Exhibit 6).

Electronic instrument was the largest category of electronics production in the USA and had recovered fairly well (after a major decline in production witnessed in 2009) to amount to US$ 128.1 bn in 2011[20]. Production of computer and peripheral equipment, on the other hand, declined continuously over the four year period between 2008 and 2011, with the value of production in 2011 reducing to US$ 19.2 bn – one-third of the value in 2008. Production of semiconductor and other electronic components, which was the second largest category of electronics production, grew at a robust pace after 2009 to reach US$ 105.3 bn in 2011 (Exhibit 6).

Share of electronic instruments, and semiconductors and other electronic components – the two largest categories of electronics production in the USA, has expanded over the period 2008-2011. While the share of the former increased by 6 percentage points (from 37 percent to 43 percent), the share of the latter increased by 7 percentage points (from 29 percent to 36 percent). Share of computer and peripheral equipment on the other hand has contracted significantly from 17 percent to merely 6 percent of the total production, on the back of falling production under this segment (Exhibit 7).

[20]Disaggregated segment-wise data for production is available only till 2011

Exhibit 6: Production of Electronics in USA (Value in US$ bn)

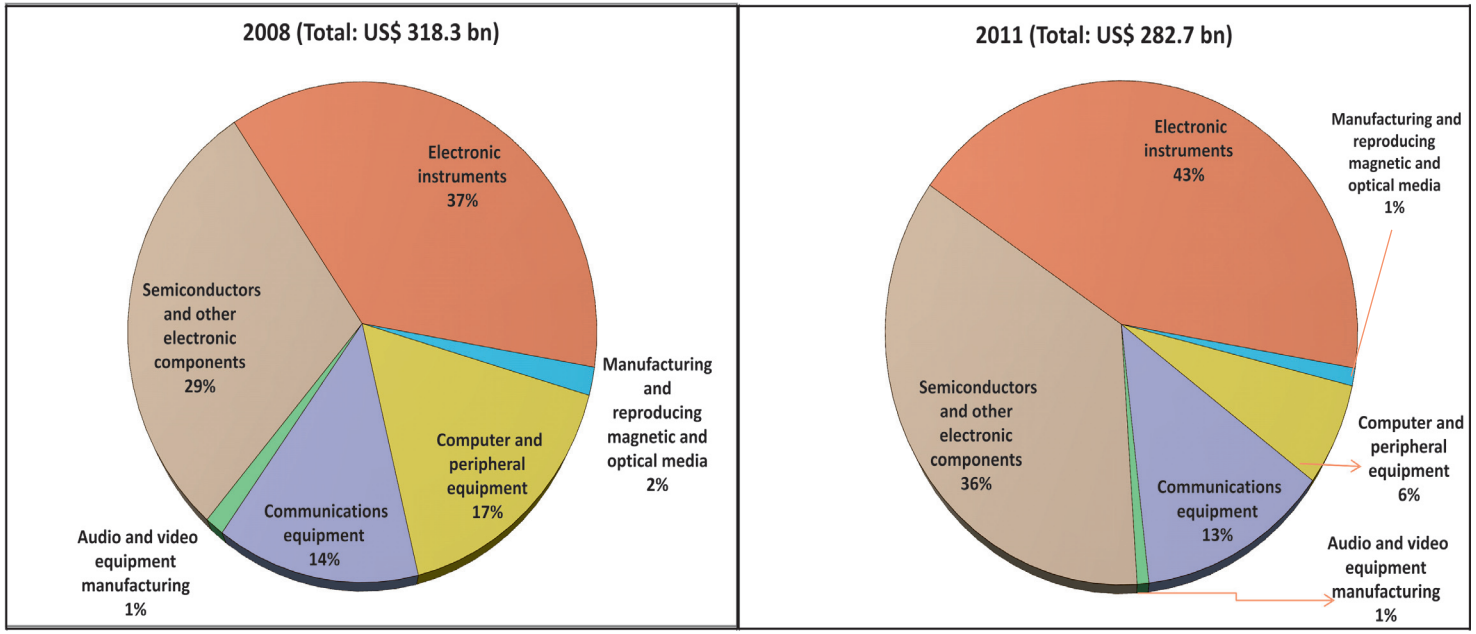


*Segmentwise production unavailable for 2012
Source: US Bureau of Labor Statistics, EXIM Bank Analysis

According to the 'US Industrial Outlook' by Manufacturers Alliance for Productivity and Innovation (MAPI), production of computer and electronics products bounced back in 2013 with y-o-y growth in the industry being 4.4 percent. Such strong growth rates in 2013 have been attributed to declining prices and the quality adjustment for processing speed. MAPI further expects the growth rates to be 6.8 percent and 7.2 percent in 2014 and 2015, respectively. Production of medical equipment is expected to improve on the back of aging population and the Affordable Care Act[21]. Aerospace production is also expected to improve and thus

[21]Affordable Care Act has brought about reforms in health insurance, thereby expanding coverage, holding insurance companies accountable and lowering health care costs. Expansion of coverage is expected to create more demand for medical products.

Exhibit 7: Segment-wise Share in Total Electronics Production of USA



Source: U.S. Bureau of Labour Statistics, EXIM Bank Analysis

provide impetus to the electronics industry.

Scenario in Japan

Japan currently accounts for 15 percent of the total global electronics and IT markets[22]. It was also the seventh largest exporter in 2012. Japan had invested in the electronics industries of other Asian countries, largely to benefit from their cost advantage. However, in the year 2013, the share of asian countries like China, Thailand, Vietnam, Taiwan, Singapore and Malaysia in total FDI projects from Japan declined. On the other hand, an increase in share was witnessed by the countries like the United States, Germany and the UK. In 2013, the United States received the highest number of FDI projects from Japan, accounting for 16.82 percent of total FDI projects originating from Japan. India has also received substantial FDI into this industry from Japan, primarily in the consumer electronics segment.

The value of production of electronics in Japan amounted to an estimated US$ 114.2 bn in 2013, a significant fall from US$ 185.3 bn in 2008. Depreciation in the exchange rate of Japanese yen vis-a-vis US dollar in 2013 benefitted the electronics industry. While the average exchange rate (bid rate) for 1 JPY (Vs. USD) in 2011 and 2012 was 0.01255 and 0.01254, respectively, it depreciated to 0.01026 in 2013[23]. This was on account of a combination of fiscal policy, monetary policy and growth strategies, popularly referred to as Abenomics. However, the industry had to put up with falling prices, slump in the domestic demand and intensified competition in digital equipment. Consequently, fall in domestic production of electronics was substantial in 2013 (25 percent y-o-y decline), with production declining across all the segments (Exhibit 8).

Semiconductors and electronic components continued to remain the largest category of electronics production in 2013, with their share in total electronics production rising during 2008-2013 by 2 percentage points (from 23 percent to 25 percent) and 4 percentage points (from 17 percent to 21 percent), respectively. Share of display devices have also gone up during this period from 12 percent to 14 percent. On the

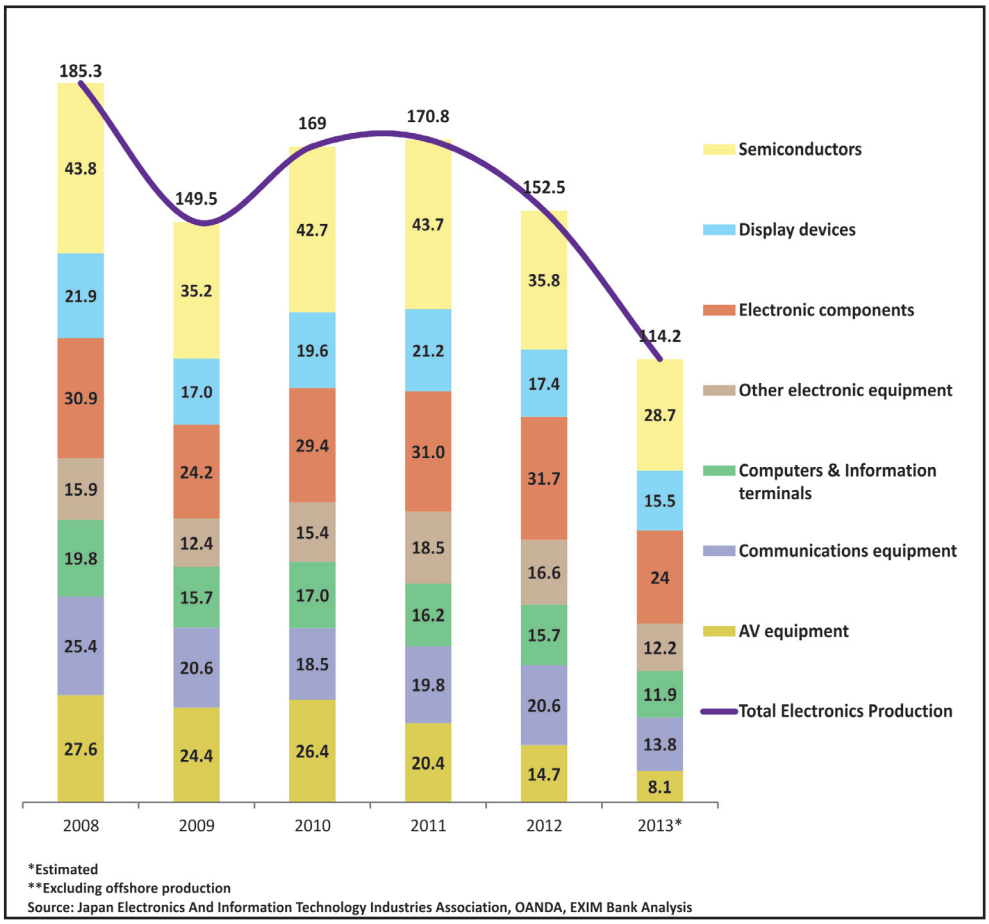
[22]Japan Electronics and Information Technology Industries Association
[23]Bid rate is the ceiling, while ask rate is the floor in case of foreign exchange. Average yearly data sourced from OANDA.

other hand, shares of audio video (AV) equipment, communications equipment, and computer and information terminals have gone down during this period (Exhibit 9).

Scenario in the European Union

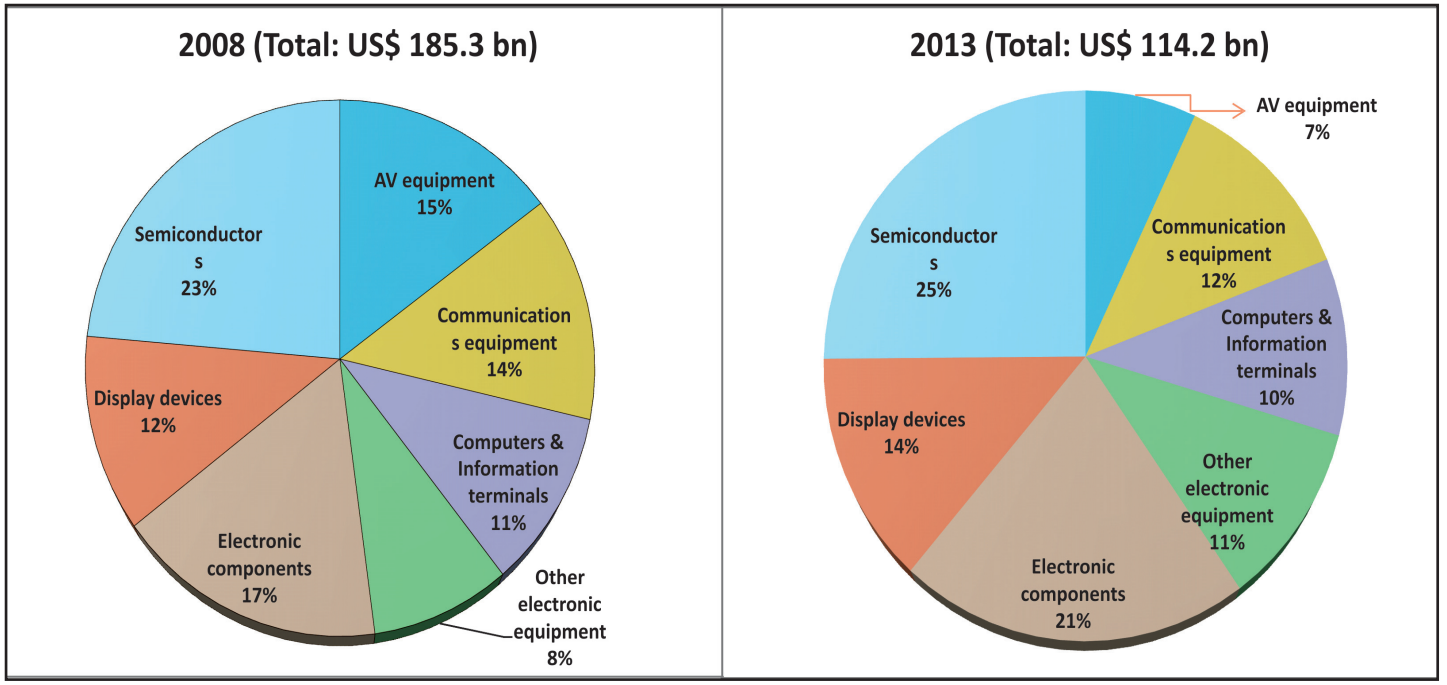
In 2012, the total production of computer, electronic and optical products in the European Union (EU-27) stood at US$ 224.4 billion. Production witnessed a drastic decline in the period 2008-2012. The CAGR for production during this period was -6.7 percent, with maximum decline recorded in the categories of computers and peripheral equipment (-13.3 percent) and communication equipment (-11.8 percent). After the precipitous decline of 20.4 percent in the production in 2009, the electronics industry in the EU witnessed positive growth rates in production for the

Exhibit 8: Production of Electronics in Japan (Value in US$ bn)



*Estimated
**Excluding offshore production
Source: Japan Electronics And Information Technology Industries Association, OANDA, EXIM Bank Analysis

Exhibit 9: Segment-wise Share in Total Electronics Production of Japan

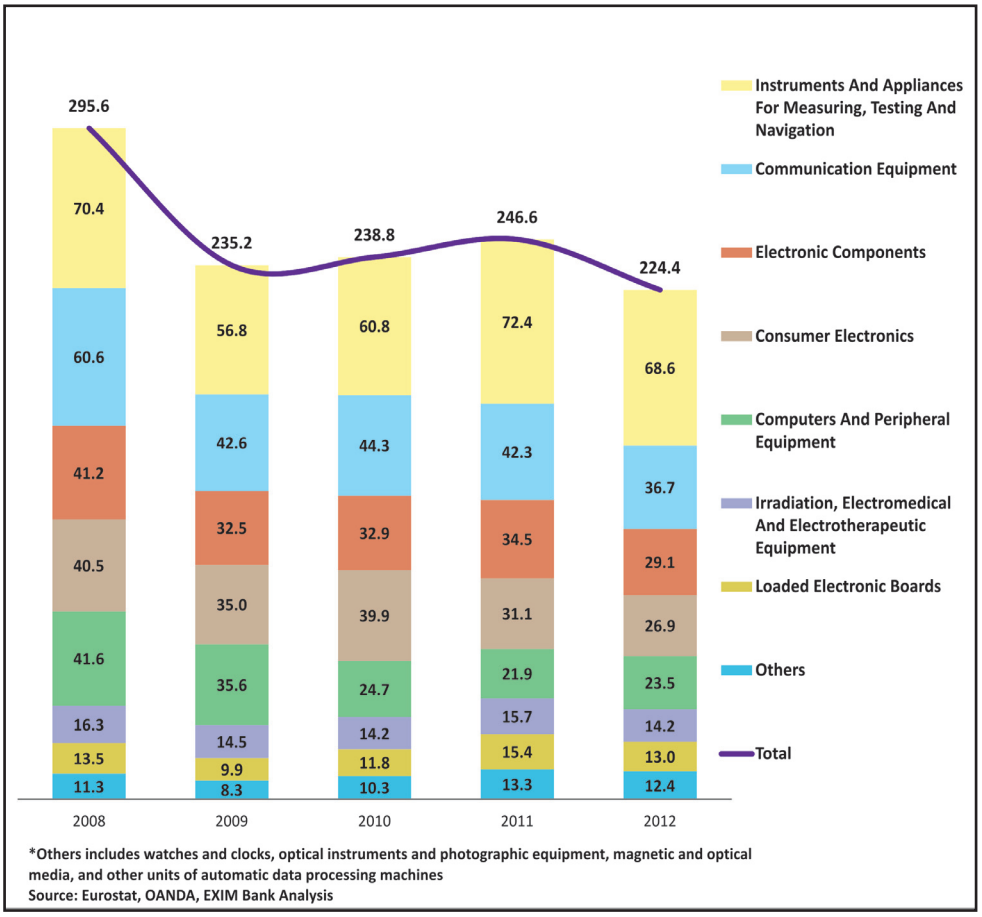


Source: Japan Electronics and Information Technology Industries Association, EXIM Bank Analysis

next two years. However, production again declined by (-) 9.0 percent in 2012, as compared to the previous year. All categories of electronics production other than computers and peripheral equipment (which grew by 7.3 percent) witnessed y-o-y declines in 2012 (Exhibit 10).

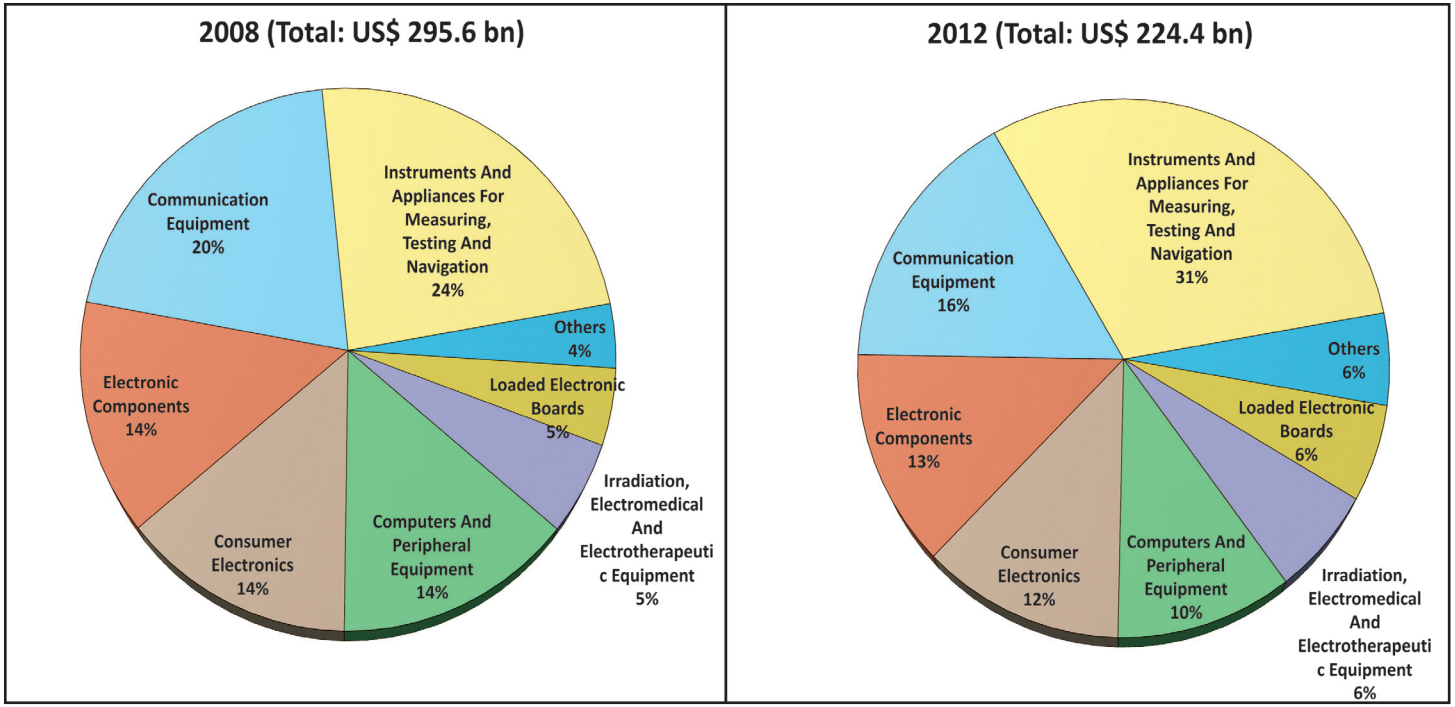
Instruments and appliances for measuring, testing and navigation was the largest category of electronic production in the European Union, accounting for 31 percent of the total electronics production in 2012, up from 24 percent in 2008. Share of many other major segments declined over this period. Communications equipment remained the second largest category of electronics production in 2012, but its share in the total production declined by 4 percentage points during 2008-2012 (Exhibit 11).

Exhibit 10: Production of Electronics in European Union (Value in US$ bn)



*Others includes watches and clocks, optical instruments and photographic equipment, magnetic and optical media, and other units of automatic data processing machines
Source: Eurostat, OANDA, EXIM Bank Analysis

Exhibit 11: Segment-wise Share in Total Electronics Production of EU



Source: Eurostat, EXIM Bank Analysis

Some of the important producers of electronics in the EU are Germany, the Netherlands, France, the United Kingdom and Czech Republic. Central and Eastern Europe countries like Hungary, Poland and Czech Republic have also emerged as the low cost producers and exporters of electronics. In the EU, Germany has the largest electronics industry, as well as the largest electronics market. Automotive electronics is the largest segment of the German electronics industry, with the segment accounting for 39.6 percent of the total semiconductor revenue in the country.

There is significant R&D investment in Germany and 40 percent of electronics and microtechnology products in the country are less than three years old[24]. Germany's government is also committed towards the growth of the industry. It had launched the 'High-Tech Strategy 2020' in 2010 which aims to establish the country as a lead provider of science and technolgy (S&T) based solutions in the fields of climate, health, mobility, security and communication. Out of the eight key technologies defined under this Strategy, three are related to the electronics industry. These are microsystems technology, optics and micro and nanotechnology.

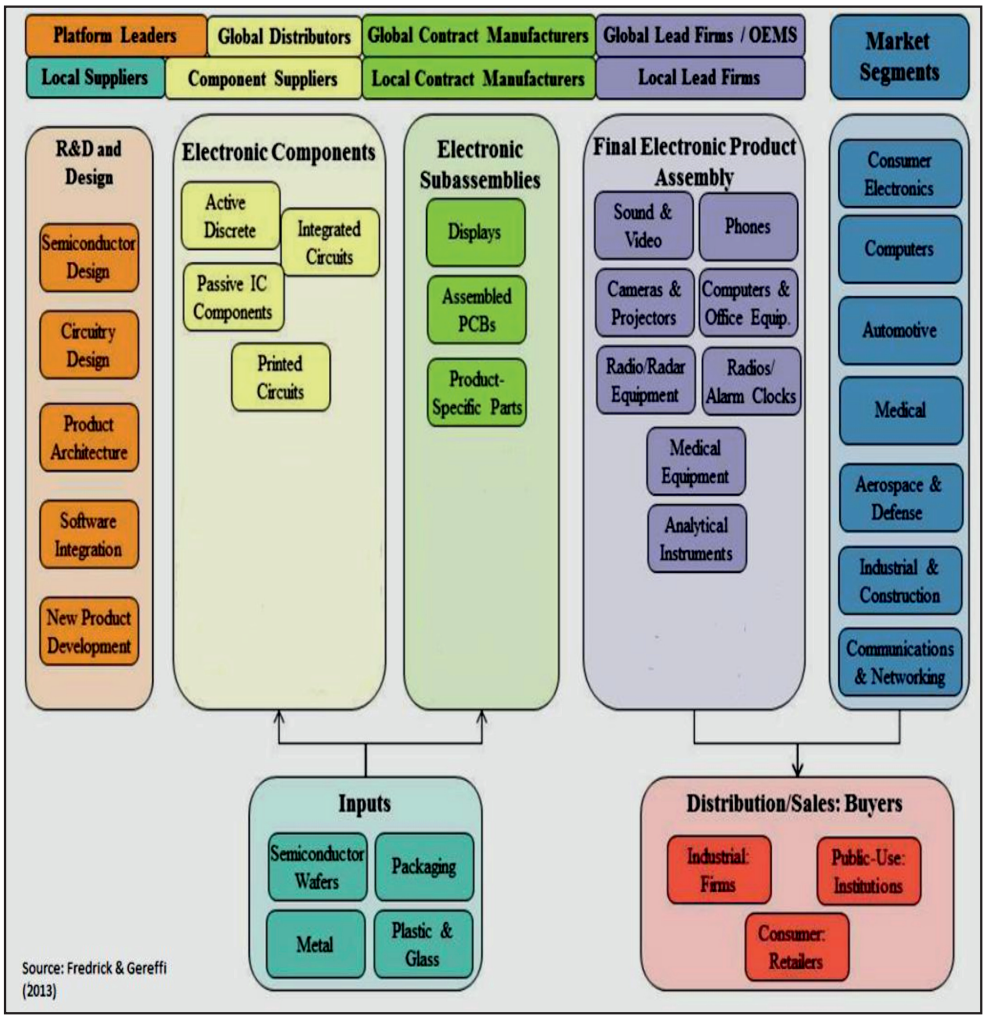
[24]Germany Trade & Invest

ELECTRONICS GLOBAL VALUE CHAIN

There is high modularity in the electronics industry, as a result of which an electronic production cycle can be segregated into many different parts which can be finally assembled. Therefore, production can be distributed over different geographies.

According to Fredrick and Gereffi (2013), the electronics global value chain comprises raw materials and inputs to electronic components, electronic components, subassemblies, final product assembly for a variety of end market segments, and the ultimate buyers of final products (Exhibit 12). The value chain also includes several activities that add value to final products outside the manufacturing process related to research, product and process development, design, marketing and after-sales services. Some of these activities, like product development, circuitry and semiconductor design, and software integration are most profitable activities in the chain, but they are also least likely to be performed in offshore locations, and are largely controlled by original equipment manufacturers or leading component suppliers.

Exhibit 12: Global Value Chain in Electronics



For the purpose of analyzing trade, electronics industry can be classified under three broad heads, viz. electronic components, subassembly products and final goods. Electronic components are basic electronic elements with two or more connecting leads or metallic pads intended to be connected together, usually by soldering to a printed circuit board, to create an electronic (integrated) circuit. Subassembly product can be defined as a unit assembled to be incorporated with other units into a final electronic product. Some of these goods are product specific like parts of telephone sets, telephones for cellular networks or for other data

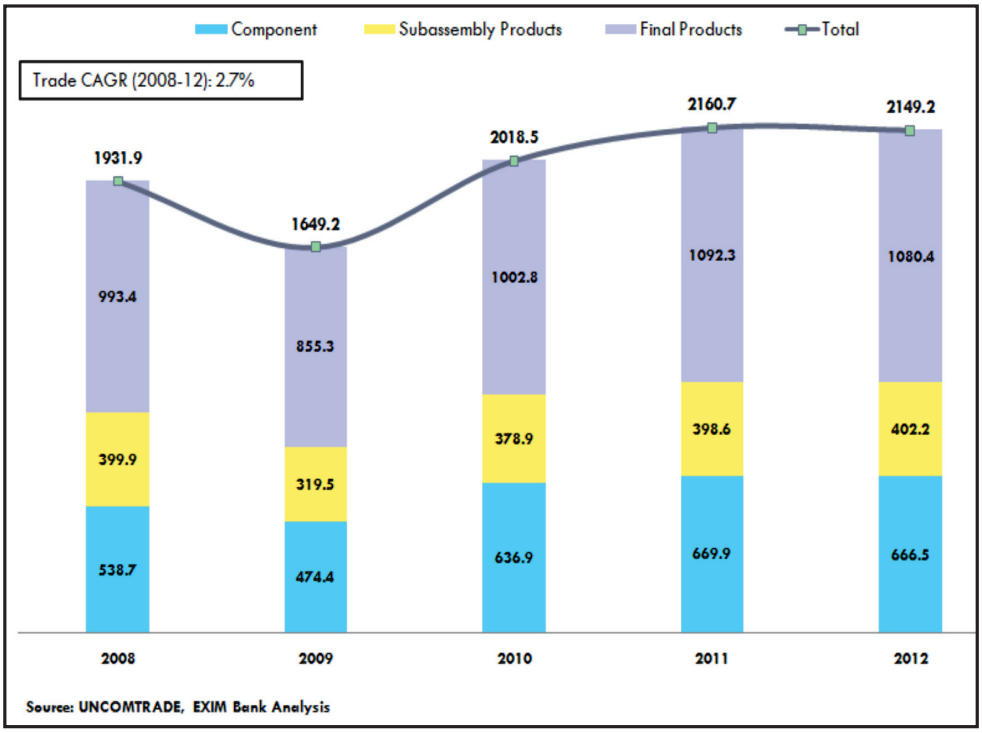
(HS: 851770), while some are found in several electronics products (like displays and assembled PCBs). Final electronics products are those which are used directly by the end-user. Final electronics goods can be further classified on the basis of their end-use into 14 sub-categories, viz. phones, fax machines and routers; computer and storage devices; television and monitors; analytical instruments; cameras and projectors; medical devices; sound projection; sound and video recording devices; radios and alarm clocks; radio and TV transmission; radar and radio navigation equipment; office equipment; clocks and watches; and other electronic products (Annexure 1).

INTERNATIONAL TRADE

Global exports of electronic goods were valued at US$ 2149 billion in 2012, registering a y-o-y decline of 0.5 percent, after recording two continuous years of positive growth. Global exports are more than twice the global value added in the production of electronics goods. This may seem inflated essentially on account of the industry being characterized by a large presence of established global value chains, implying that the component and subassembly products are moving either vertically or horizontally in the value chain. While vertical movement is for further value addition at the next stage of production, horizontal movement refers to re-exports, especially from countries like Hong Kong and Singapore which are core distribution and logistics hubs in Asian production and trade networks. Exports of both final electronic goods and electronic components declined marginally, but that of subassembly products recorded a slight increase of 0.9 percent in 2012. However, over the period 2008 to 2012, the industry's trade performance fared relatively better with exports registering a CAGR of 2.7 percent (Exhibit 13).

China was the largest exporter and importer of electronic products in the world, accounting for 27.8 percent of the global electronic exports and 17.6 percent of the global electronic imports in 2012. The top five countries – China, Hong Kong, USA, Singapore and Germany, accounted for 59.6 percent of total electronic exports while the top ten accounted for 80.3 percent of total electronics exports in 2012. Except for Malaysia, all the countries which feature on the list of top ten exporters are also among the top ten importers of electronic products (Table 2). This peculiarity can be ascribed to the high presence

Exhibit 13: Global Trade in Electronics (Value in US$ bn)



of global value chains in this industry. This characteristic of electronic production also leads to enormous "double counting" of exports[25].

In 2012, China was the largest exporter in all the three categories of electronics exports, viz. electronic components, subassembly products and final goods. In 2008, it was the largest exporter in the latter two categories. In the electronic components category, Singapore was the topmost exporter in 2008, but its share declined thereafter, resulting in it being relegated to the third place in 2012. On the other hand, China's exports of electronic components have recorded a CAGR of 14.6 percent during the period 2008-2012, thereby making it the biggest exporter in 2012. Integrated circuit (IC) production in China was considered a weak link, but several government incentives have provided a boost to IC production in the recent

[25]According to World Investment Report 2013, about 28% or US $ 5 trillion of the US $ 19 trillion in global gross exports in 2010 was double counted on account of global value chains.

Table 2: Top Exporters & Importers of Electronic Products in 2012 (Value in US$ bn)

Top Exporters	Value	Share%	Top Importers	Value	Share%
China	598.4	27.8%	China	416.3	17.6%
Hong Kong	234.3	10.9%	USA	357.8	15.1%
USA	198.3	9.2%	Hong Kong	250.6	10.6%
Singapore	132.9	6.2%	Germany	117.1	4.9%
Germany	116.8	5.4%	Japan	106.5	4.5%
Rep. of Korea	112.9	5.3%	Singapore	100.5	4.2%
Japan	112.0	5.2%	Mexico	76.8	3.2%
Mexico	76.1	3.5%	Netherlands	71.2	3.0%
Malaysia	74.1	3.4%	Rep. of Korea	68.2	2.9%
Netherlands	70.1	3.3%	United Kingdom	62.6	2.6%
World	**2149.2**	**100.0%**	**World**	**2371.6**	**100.0%**

Source: UNCOMTRADE, EXIM Bank Analysis

years. Hence, electronic component production as well as exports from the country have grown significantly. Republic of Korea has also enlarged its share in the global electronic component exports from 6 percent in 2008 to 9 percent in 2012 (Exhibit 14).

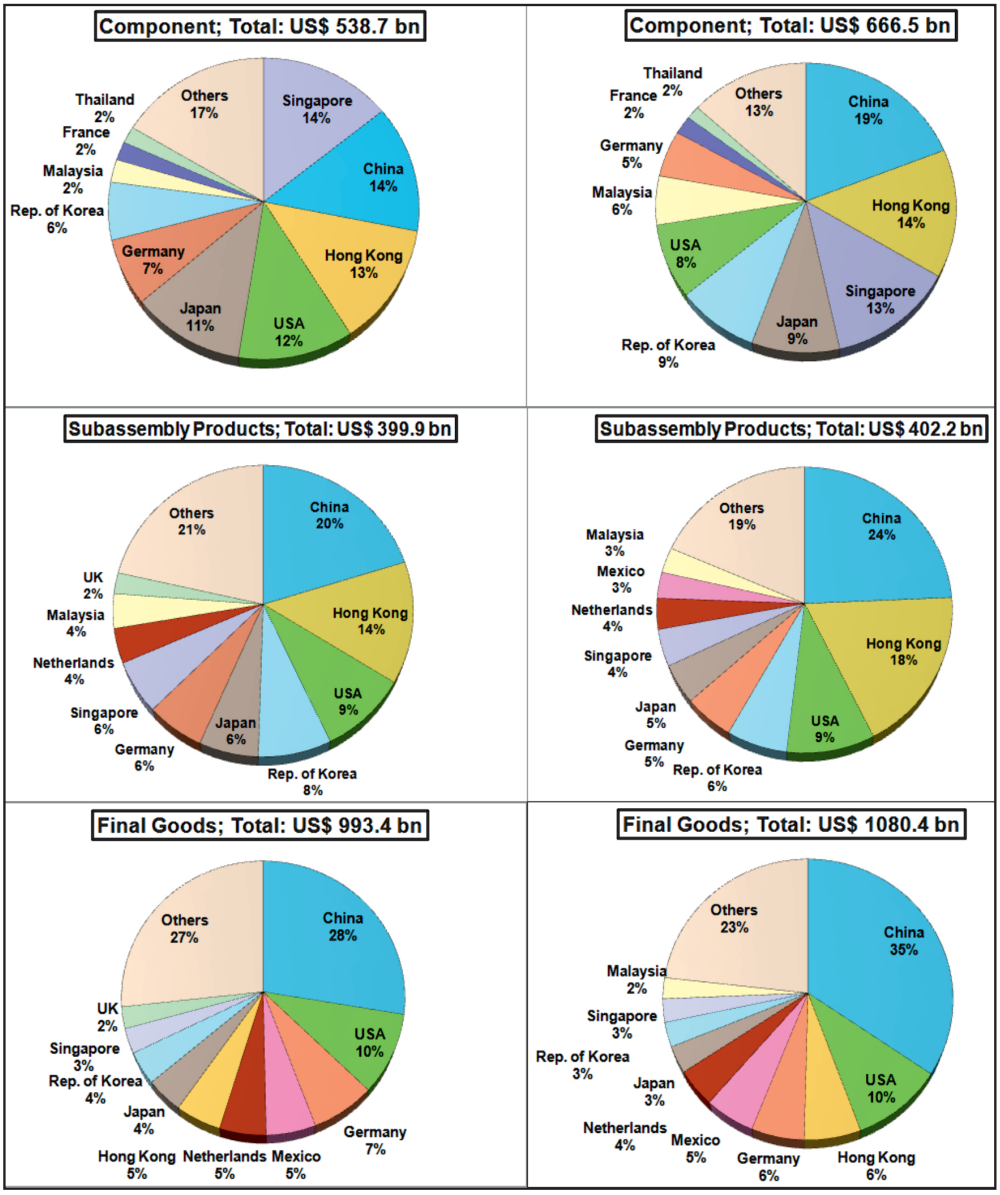
China's position as the largest importer of electronics is largely due to its overwhelming share in the global imports of components and subassembly products. China's share in global electronic components imports amounted to 32 percent in 2012, while its share in global subassembly products imports amounted to 18 percent during the same year. Its share in global imports in both these segments has expanded over the period 2008-2012. In the final electronic goods category, USA was the largest importer accounting for 23 percent share in global imports of these products in 2012. China's share has grown in final electronic products from 5 percent in 2008 (rank 4) to 7 percent in 2012 (rank 2) (Exhibit 15).

Of the 14 categories of final electronic products, China was the topmost exporter in 11 categories. In the remainig 3 categories, viz., medical

Exhibit 14

Category-wise Top Exporters of Electronics

2008 **2012**

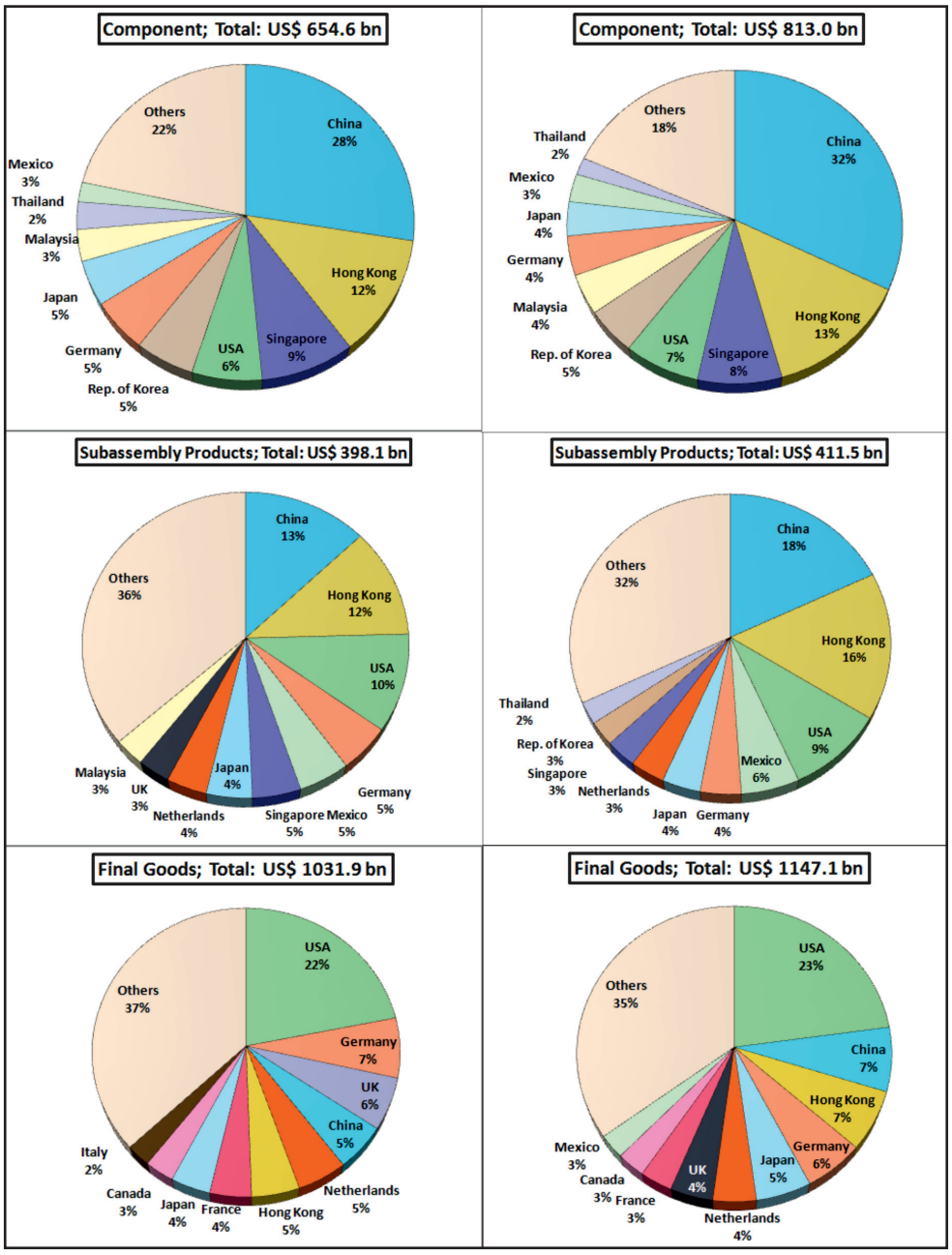


Source: UNCOMTRADE, EXIM Bank Analysis

Exhibit 15

Category-wise Top Importers of Electronics

2008 **2012**



Source: UNCOMTRADE, EXIM Bank Analysis

devices, radio and TV transmission and analytical instruments, USA was the topmost exporter, accounting for 23.0 percent, 33.2 percent and 15.2 percent of global exports, respectively. USA was the topmost importer in 11 of these final electronics goods categories (Table 3). This, perhaps is an outcome of the fact that the final assembling of the electronic products typically occurs in a relatively lower cost economy. This aspect of the global electronics production has been elucidated in the next section.

Table 3: Category-wise Top Exporters and Importers of Final Electronic Products (Value in US$ mn)

Category	Top Exporters	Exports	Share %	Top Importers	Imports	Share %
Analytical Instruments	**World**	**87098.0**	**100.0%**	**World**	**89079.6**	**100.0%**
	USA	13255.4	15.2%	USA	14283.0	16.0 %
	Germany	12065.1	13.9%	China	12494.3	14.0%
	China	11707.9	13.4%	Germany	5742.8	6.4%
	Japan	8566.7	9.8%	Japan	4761.9	5.3%
	United Kingdom	4049.9	4.6%	Rep. of Korea	4257.7	4.8%
	Rep. of Korea	3794.7	4.4%	United Kingdom	4015.0	4.5%
	Mexico	3522.3	4.0%	Thailand	3265.2	3.7%
	Hong Kong	3143.0	3.6%	Canada	3203.7	3.6%
	France	3116.7	3.6%	Mexico	2997.4	3.4%
	Malaysia	2976.2	3.4%	Hong Kong	2953.6	3.3%
Cameras & Projectors	**World**	**48401.9**	**100.0%**	**World**	**54776.4**	**100.0%**
	China	15042.9	31.1%	China	9994.2	18.2%
	Japan	9756.9	20.2%	USA	9107.6	16.6%
	Netherlands	3989.4	8.2%	Hong Kong	5135.4	9.4%
	Hong Kong	3769.5	7.8%	Netherlands	3443.5	6.3%
	Germany	2437.8	5.0%	Germany	3408.7	6.2%
	Thailand	2309.1	4.8%	Japan	2285.8	4.2%
	USA	2265.4	4.7%	United Kingdom	1771.5	3.2%
	Singapore	1141.8	2.4%	Russian Federation	1683.5	3.1%
	United Kingdom	772.0	1.6%	Singapore	1445.1	2.6%
	Rep. of Korea	760.6	1.6%	France	1406.3	2.6%

Clocks & Watches	**World**	**2978.0**	**100.0%**	**World**	**2767.3**	**100.0%**
	China	1527.8	51.3%	Hong Kong	771.0	27.9%
	Hong Kong	717.4	24.1%	USA	461.4	16.7%
	Germany	129.4	4.3%	Japan	292.5	10.6%
	France	85.8	2.9%	Germany	200.0	7.2%
	USA	79.6	2.7%	France	114.4	4.1%
	Switzerland	73.8	2.5%	United Kingdom	101.0	3.6%
	Netherlands	69.0	2.3%	Spain	58.0	2.1%
	Japan	49.1	1.6%	Italy	57.8	2.1%
	Singapore	43.7	1.5%	China	53.6	1.9%
	Belgium	34.3	1.2%	Canada	52.6	1.9%
Computer & Storage Devices	**World**	**340939.7**	**100.0%**	**World**	**345989.8**	**100.0%**
	China	163436.8	47.9%	USA	85716.2	24.8%
	USA	27784.8	8.1%	China	34885.6	10.1%
	Hong Kong	18716.9	5.5%	Hong Kong	22526.9	6.5%
	Mexico	18438.7	5.4%	Germany	18705.6	5.4%
	Netherlands	15543.6	4.6%	Netherlands	17531.6	5.1%
	Thailand	13711.6	4.0%	Japan	16997.1	4.9%
	Germany	11281.1	3.3%	United Kingdom	14308.8	4.1%
	Czech Rep.	10283.8	3.0%	France	9954.0	2.9%
	Malaysia	9733.7	2.9%	Canada	9213.3	2.7%
	Singapore	9411.7	2.8%	Mexico	8338.8	2.4%
Medical Devices	**World**	**93578.9**	**100.0%**	**World**	**92680.6**	**100.0%**
	USA	21500.2	23.0%	USA	18009.9	19.4%
	Germany	15191.1	16.2%	Germany	7085.4	7.6%
	Netherlands	7171.2	7.7%	China	6682.6	7.2%
	Japan	4867.5	5.2%	Japan	5442.3	5.9%
	France	4668.6	5.0%	Netherlands	5158.3	5.6%
	China	4215.1	4.5%	France	4853.6	5.2%
	Switzerland	3499.8	3.7%	Russian Federation	3872.1	4.2%
	Singapore	3185.1	3.4%	United Kingdom	3448.6	3.7%
	Belgium	3112.6	3.3%	Belgium	3140.2	3.4%
	United Kingdom	3058.2	3.3%	Italy	2512.3	2.7%

Office equipment	**World**	**3147.0**	**100.0%**	**World**	**3727.7**	**100.0%**
	China	1310.7	41.6%	USA	701.6	18.8%
	USA	358.6	11.4%	Hong Kong	303.5	8.1%
	Singapore	285.1	9.1%	Germany	221.4	5.9%
	Hong Kong	237.9	7.6%	United Kingdom	203.4	5.5%
	Germany	195.3	6.2%	Singapore	184.3	4.9%
	Malaysia	127.1	4.0%	France	158.8	4.3%
	Rep. of Korea	96.6	3.1%	Canada	130.5	3.5%
	Hungary	85.4	2.7%	Japan	120.5	3.2%
	United Kingdom	72.0	2.3%	Australia	114.9	3.1%
	Netherlands	44.3	1.4%	Italy	111.1	3.0%
Others Electron-ics	**World**	**17681.9**	**100.0%**	**World**	**19613.6**	**100.0%**
	China	4552.0	25.7%	USA	3333.6	17.0%
	USA	1475.6	8.3%	Germany	1667.4	8.5%
	Rep. of Korea	1424.7	8.1%	Malaysia	1481.7	7.6%
	Philippines	1321.5	7.5%	Rep. of Korea	1234.4	6.3%
	Germany	1282.3	7.3%	Turkey	1074.9	5.5%
	Hong Kong	849.9	4.8%	United Kingdom	787.9	4.0%
	United Kingdom	784.6	4.4%	Japan	767.2	3.9%
	Malaysia	619.3	3.5%	France	764.2	3.9%
	Thailand	584.4	3.3%	Hong Kong	694.9	3.5%
	Netherlands	430.4	2.4%	Thailand	589.2	3.0%
Phones, Fax Machines & Routers	**World**	**284802.8**	**100.0%**	**World**	**326666.3**	**100.0%**
	China	113591.0	39.9%	USA	75539.7	23.1%
	Hong Kong	26621.6	9.3%	Hong Kong	30591.6	9.4%
	USA	24739.8	8.7%	Japan	21720.0	6.6%
	Rep. of Korea	13749.2	4.8%	Germany	15682.8	4.8%
	Netherlands	11690.4	4.1%	United Kingdom	14808.5	4.5%
	Mexico	11064.4	3.9%	Netherlands	13303.6	4.1%
	Viet Nam	10815.8	3.8%	France	9775.7	3.0%
	Germany	10026.7	3.5%	Mexico	9597.3	2.9%
	Singapore	7753.4	2.7%	Singapore	8956.1	2.7%
	Hungary	6556.9	2.3%	Canada	8232.1	2.5%

Radar & Radio Navigation Equipment	**World**	**16215.8**	**100.0%**	**World**	**17794.3**	**100.0%**
	China	2279.8	14.1%	USA	4518.0	25.4%
	Germany	2099.3	12.9%	Germany	2438.8	13.7%
	Japan	2055.7	12.7%	Japan	1369.8	7.7%
	USA	1989.5	12.3%	United Kingdom	821.9	4.6%
	Netherlands	812.6	5.0%	Canada	761.5	4.3%
	Mexico	720.5	4.4%	China	744.4	4.2%
	France	713.4	4.4%	France	634.6	3.6%
	United Kingdom	649.2	4.0%	Singapore	532.4	3.0%
	Hong Kong	507.9	3.1%	Hong Kong	480.8	2.7%
	Russian Federation	454.8	2.8%	Netherlands	474.5	2.7%
Radio & TV Transmission	**World**	**6166.7**	**100.0%**	**World**	**8392.1**	**100.0%**
	USA	2048.0	33.2%	USA	4192.1	50.0%
	Canada	775.3	12.6%	Canada	617.1	7.4%
	United Kingdom	583.9	9.5%	United Kingdom	402.9	4.8%
	Malaysia	358.7	5.8%	Australia	254.3	3.0%
	Singapore	308.0	5.0%	Mexico	205.8	2.5%
	Hong Kong	260.2	4.2%	Singapore	205.1	2.4%
	Italy	207.9	3.4%	Hong Kong	179.0	2.1%
	Mexico	188.7	3.1%	France	146.5	1.7%
	France	161.1	2.6%	Netherlands	144.3	1.7%
	Germany	131.4	2.1%	Saudi Arabia	116.8	1.4%
Radios & Alarm Clocks	**World**	**16411.0**	**100.0%**	**World**	**17811.8**	**100.0%**
	China	4781.6	29.1%	USA	5249.6	29.5%
	USA	1456.8	8.9%	Germany	1410.2	7.9%
	Malaysia	1429.4	8.7%	Japan	1096.4	6.2%
	Mexico	1129.5	6.9%	Canada	1082.2	6.1%
	Thailand	1091.5	6.7%	Hong Kong	755.5	4.2%
	Hong Kong	1009.2	6.1%	United Kingdom	711.8	4.0%
	Portugal	995.4	6.1%	Belgium	664.2	3.7%
	Germany	701.2	4.3%	Russian Federation	546.3	3.1%
	Czech Rep.	647.3	3.9%	Mexico	522.6	2.9%
	Belgium	478.0	2.9%	France	487.7	2.7%

Sound & Video Recording Devices	**World**	**42658.4**	**100.0%**	**World**	**48079.9**	**100.0%**
	China	12998.8	30.5%	Hong Kong	6320.8	13.1%
	Hong Kong	4482.6	10.5%	USA	6110.7	12.7%
	Singapore	3787.0	8.9%	China	4420.2	9.2%
	USA	2616.5	6.1%	Japan	2945.1	6.1%
	Japan	2097.1	4.9%	Germany	2487.8	5.2%
	Malaysia	2088.2	4.9%	Netherlands	2145.1	4.5%
	Netherlands	1924.3	4.5%	United Kingdom	1949.6	4.1%
	Germany	1820.9	4.3%	France	1669.2	3.5%
	United Kingdom	1291.2	3.0%	Thailand	1614.7	3.4%
	Rep. of Korea	1188.3	2.8%	India	1608.6	3.3%
Sound Projection	**World**	**27164.8**	**100.0%**	**World**	**27796.5**	**100.0%**
	China	11832.3	43.6%	USA	5093.5	18.3%
	Hong Kong	3319.0	12.2%	Hong Kong	3165.6	11.4%
	USA	2117.1	7.8%	China	3083.1	11.1%
	Mexico	1434.2	5.3%	Germany	1803.0	6.5%
	Germany	1388.1	5.1%	Japan	1428.9	5.1%
	Viet Nam	764.1	2.8%	Mexico	1075.8	3.9%
	Belgium	643.3	2.4%	United Kingdom	966.4	3.5%
	Malaysia	600.9	2.2%	Canada	928.8	3.3%
	United Kingdom	491.4	1.8%	Rep. of Korea	789.5	2.8%
	Netherlands	450.8	1.7%	France	745.4	2.7%
Television & Monitors	**World**	**93185.7**	**100.0%**	**World**	**91970.8**	**100.0%**
	China	25435.1	27.3%	USA	29375.5	31.9%
	Mexico	17762.4	19.1%	Germany	6960.8	7.6%
	Slovakia	6552.9	7.0%	United Kingdom	4206.2	4.6%
	Poland	4882.0	5.2%	Netherlands	3346.7	3.6%
	USA	4556.5	4.9%	Japan	3336.8	3.6%
	Malaysia	3943.8	4.2%	France	3268.0	3.6%
	Hungary	3828.0	4.1%	Canada	2939.3	3.2%
	Rep. of Korea	3012.9	3.2%	Mexico	2846.8	3.1%
	Netherlands	2565.5	2.8%	Italy	2182.7	2.4%
	Czech Rep.	2549.7	2.7%	Australia	1866.3	2.0%

Source: UNCOMTRADE, EXIM Bank Analysis

GLOBAL TRADE IN VALUE ADDED

As was indicated earlier, global data on trade, in sectors where prodcution value chains are spread across geographies, are largely overestimations. Problem of double counting in case of trade data has been attempted to be addressed by WTO through the Trade in Value Added Initiative (TiVA). This problem of double counting can be explained in terms of an example. Consider that country A exports US$ 10 million of goods to country B, which adds an additional value of US$ 10 million before finally exporting it to country C at a value of US$ 20 million. Although total global trade by conventional measures amount to US$ 30 million in this example, the actual value added is only US$ 20 million. Moreover, conventional trade statistics will also not show any trade relation between countries A and C, even though country A benefits extensively on account of demand from country C.

According to WTO, TiVA helps as it "measures flows related to the value that is added (labor compensation, taxes and profits) by a country in the production of any good or service that is exported." In order to analyse trade in value added for the purpose of current analysis, the category of 'Electrical and Optical Instrument' has been considered. This includes office, accounting and computing machinery, electrical machinery and apparatus nec, radio, television and communication equipment, and medical, precision and optical instruments. This category broadly corresponds to the whole of electrical and electronics industry. In the absence of data at a more granular level, the analysis has been restricted to this level. The data released in May 2013 provides an estimate of trade in value added in 2009.

As per this data, the exports of value added in the electrical and optical instruments category in 2009 amounted to US$ 694.6 billion, with China being the topmost country with a share of 17.2 percent, followed by the United States (15.9 percent), Japan (9.4 percent), Germany (7.5 percent) and Korea (5.2 percent). India ranked 17th in terms of this measure, accounting for 1.2 percent of the global exports of value added in the electrical and optical instruments category. Many countries like Hong Kong, Singapore, Malaysia and Mexico do not feature in the top ten exporters list once the value added aspect of exports is taken into account, indicating relatively lesser production in value added terms in these countries than is reflected in actual trade data

Table 4: Top Countries in Terms of 'Exports of Value Added' in Electrical and Optical Instruments, 2009

Rank	Exporting Country	Exports of Value Added* (US$ mn)	Share %
1	China	119731.6	17.2%
2	United States	110492.2	15.9%
3	Japan	65248.0	9.4%
4	Germany	52139.7	7.5%
5	Korea	36390.5	5.2%
6	Chinese Taipei	35534.2	5.1%
7	United Kingdom	21324.2	3.1%
8	Thailand	18660.6	2.7%
9	Italy	17097.0	2.5%
10	Switzerland	16860.9	2.4%
17	India	8537.1	1.2%
	World	**694553.7**	**100.0%**

*Export of value added refers to Value-Added embodied in Foreign Final Domestic Demand. This shows how industries export value both through direct final exports and via indirect exports of intermediates through other countries to foreign final consumers (households, charities, government, and as investment). They reflect how industries (upstream in a value-chain) are connected to consumers in other countries, even where no direct trade relationship exists. The indicator illustrates therefore the full upstream impact of final demand in foreign markets to domestic output.

Source: OECD-WTO Trade in Value Added (TiVA) - May 2013, EXIM Bank Analysis

(Table 4). Interestingly, in the case of China, major destinations for exports in value added terms are also significantly different from those in gross exports terms, with fewer Asian economies featuring in the top ten list in the former case.

In terms of imports of value added in the electrical and optical instruments, the United States was the leading country, accounting for 19.5 percent of the total value added in 2009, followed by China (7.6 percent), Germany (6.0 percent), Japan (5.7 percent) and the United Kingdom (4.6 percent). As in the case of exports of value added, even in this list, some countries like Singapore, Mexico and Republic of Korea are absent which feature prominently in the top ten gross importers list. Moreover, unlike the top gross importers list, countries like Australia, Canada, France and Italy feature in the list of top importers in value added term (Table 5). India was the 14th largest importer accounting for 1.8 percent of total world imports of value added in the electrical and optical instruments category. Top source countries for imports of value added by China is somewhat similar to the gross import source countries. Here as well, many Asian countries feature in the top import source list. Only aberration is Vietnam, which was the 9th largest import source in gross terms, but holds a place significantly lower in value added terms.

Trade balance in value added also varies significantly from the gross trade balance of countries in the electrical and optical instruments. To compare estimates of value-added trade with conventional estimates of gross trade, it is also useful to construct an indicator known as the VAX ratio (ratio of value-added exports to gross exports). The VAX ratio for a sector can be less than one if intermediate inputs from other sectors, or from imports, contribute more to the value of the sector's exports than it contributes to the exports of other sectors. Conversely, the VAX ratio for a sector can be greater than one if the sector contributes more as an intermediate input to the value of exports of other sectors than those sectors contribute to the value of its own exports[26].

In the category of electrical and optical instruments, countries like the Netherlands and Mexico had gross trade surplus in 2009, but had deficit in value added terms. Moreover,

[26] Gerard Kelly and Gianni La Cava, Value-added Trade and the Australian Economy, Reserve Bank of Australia

Table 5: Top Countries in Terms of 'Imports of Value Added' in Electrical and Optical Instrument, 2009

Rank	Importing Country	Imports of Value Added* (US$ mn)	Share %
1	United States	135190.7	19.5%
2	China	52825.9	7.6%
3	Germany	41969.4	6.0%
4	Japan	39463.1	5.7%
5	United Kingdom	31734.0	4.6%
6	France	30591.2	4.4%
7	Canada	28566.4	4.1%
8	Mexico	23745.4	3.4%
9	Italy	21623.3	3.1%
10	Australia	17017.8	2.5%
14	India	12633.2	1.8%
	World	**694179.9**	**100.0%**

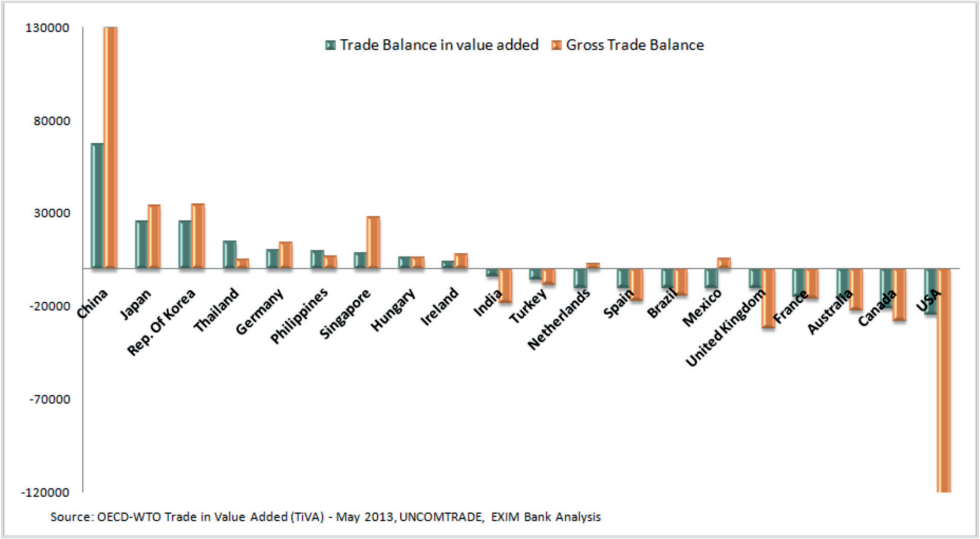
*Import of value added refers to Foreign Value-Added embodied in Final Domestic Demand. This shows for a final good or service (purchased by households, government, non-profit institutions serving households, or as investment) where foreign value-added originates. It shows how industries abroad (upstream in a value-chain) are connected to consumers at home, even where no direct trade relationship exists.

Source: OECD-WTO Trade in Value Added (TiVA) - May 2013, EXIM Bank Analysis

countries like China, Japan, Republic of Korea, Germany, Singapore had substantially lower trade balance in value added terms, as compared to the gross trade balance. Other countries like the USA, Canada, Australia, France and the United Kingdom had lower trade deficit in value added terms than in gross terms (Exhibit 16). The VAX ratio for the Philippines and Thailand was greater than one, indicative of the fact that the electronics industry in these countries is extensively used in other export-oriented sectors.

India's trade deficit was much narrower in value added terms, amounting to merely 22.1 percent of the gross trade deficit. On the contrary, China's trade surplus in value added terms was 47.6 percent of its gross trade surplus. The VAX ratio for electronics exports from India was 0.79 i.e., India's exports in value added terms was 79.2 percent of its gross exports. India's value

Exhibit 16: Trade Balance in Value Added vs Gross Trade Balance for Countries in Electrical and Optical Instruments (2009; Value in US$ mn)



added imports of electronics was also significantly lower than its gross imports (amounting to 43 percent of the gross imports).

Since there is high presence of global value chain in the electronic industry owing to high modularity in the industry, it would be interesting to look at the stage of product which the top trading countries are producing. Ideally, a high share of subassembly products imports and component products imports, and a high share of final electronics exports, places the country higher in the value chain, and vise versa. Thus, intuitively, one can expect developed countries like the US, the EU countries and Japan to exhibit such a pattern and the vice versa case would hold for the economies of the East Asian region.

Countries in the East Asian region like Singapore, Republic of Korea and Malaysia largely export electronic components. They also export relatively lower, yet significant amount of final electronic products. Interestingly, the East Asian countries also have a high share of electronic components in its imports.

On the other hand, quite expectedly, developed economies like the USA, Germany and the Netherlands have major share of final electronics in their exports, while their import basket have a large share of subassembly products. Mexico has the highest

share of final electronics export of 76 percent, among the top ten exporting economies. On the import side, 70 percent of its imports comprises components and subassembly products.

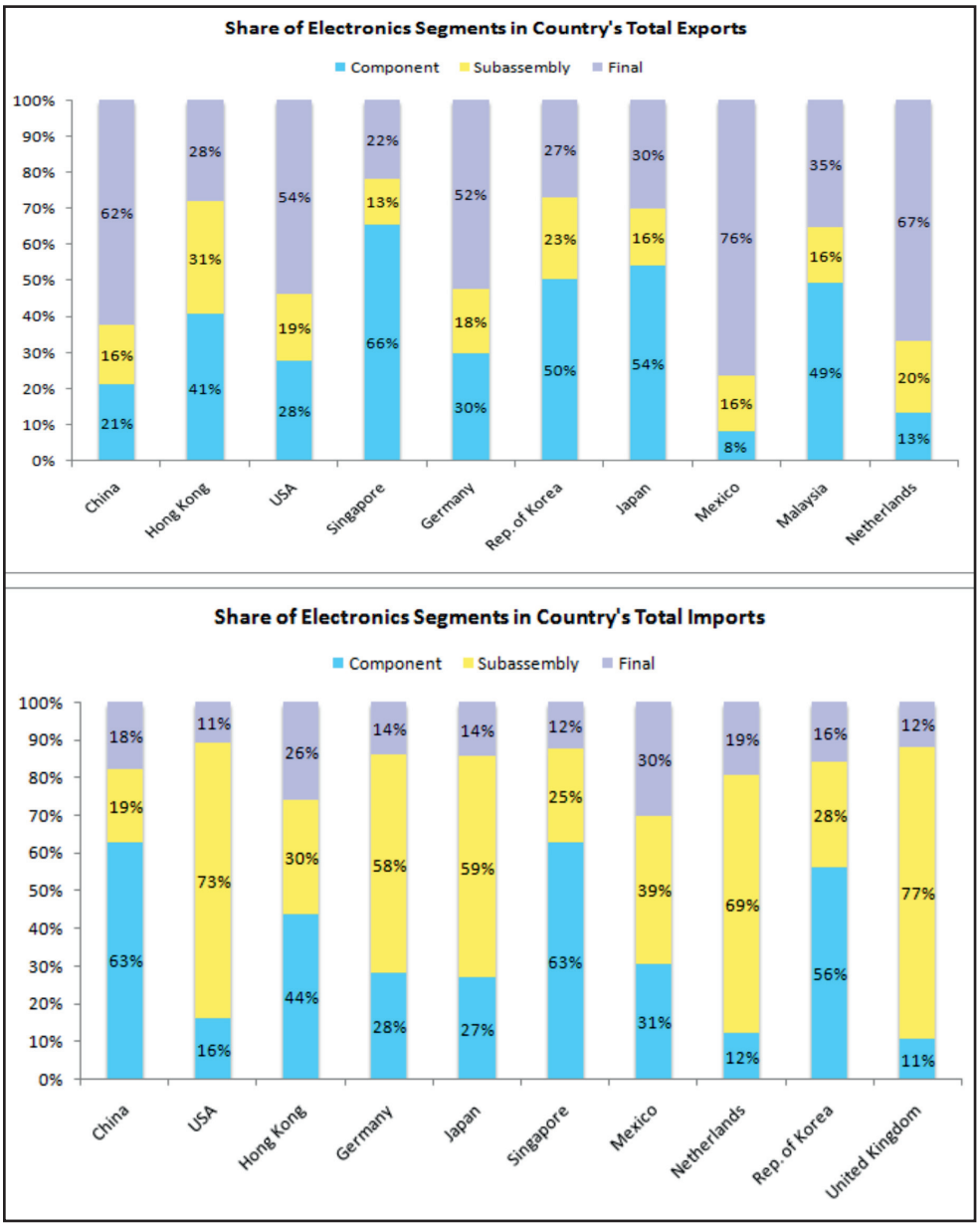
Japan has a significantly high share of subassembly products imports, accounting for 59 percent of its total electronic imports. Although final electronics exports account for only 30 percent of the share of Japan's total electronics export, the country is the fifth largest exporter of final electronics products, as against an overall rank of seventh in the total electronics exports (Exhibit 17). Hence, the high share of electronic components in Japan's total exports should not obscure the picture of its overall standing in the global value chain.

The reason for the East Asian region having both high share in export and import of electronic components has been provided by Gangnes and Assche (2010). Countries of Hong Kong, Singapore, Republic of Korea and Taiwan source relatively unsophisticated components from lower wage Asian economies and produce more sophisticated components. Higher component export in the case of Japan is also largely due to the production and export of sophisticated components. These sophisticated components are then supplied to China and other low wage Asian economies for final assembly[27].

A similar argument can be applied to the Mexican case. It imports electronic subassembly products and components, and provides assembling services at low cost, thereby having a high share of final electronics goods in its exports. This also explains the earlier observation that while gross trade balance for the country in 2009 was high, in value added terms there was a trade deficit.

[27]Byron Gangnes and Ari Van Assche, 2010. "Global Production Networks in Electronics and Intra-Asian Trade."

Exhibit 17: Share of Electronics Segments in Countries' Exports and Imports (2009)



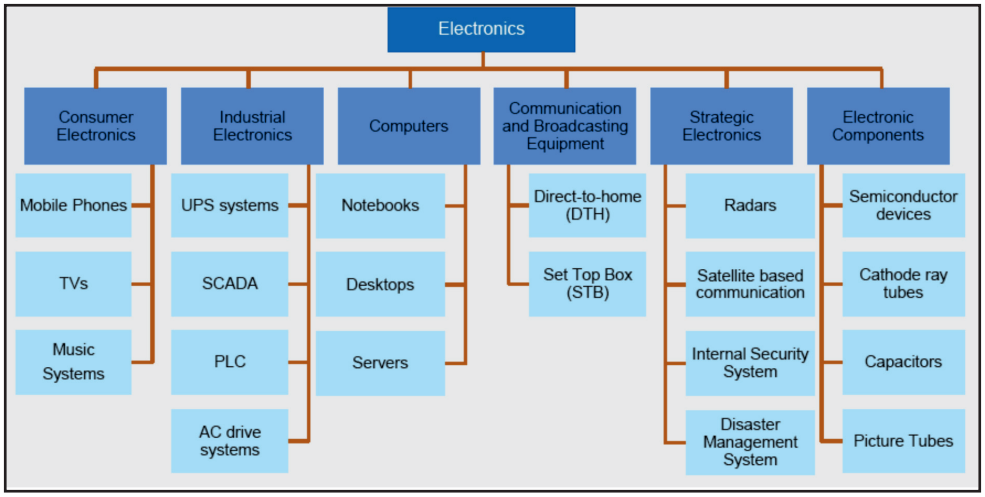
Source: UNCOMTRADE, EXIM Bank Analysis

2. SCENARIO OF ELECTRONICS INDUSTRY IN INDIA

The Indian Electronics and IT Hardware sector has 6 key segments, namely Consumer Electronics, Industrial Electronics, IT Hardware, Telecommunication Equipment, Electronic Components, and Strategic Electronics. The commencement of Indian electronics industry could be traced back to the sixties, when the Government took initiatives in the manufacturing of space and defence electronic products. This was followed by developments in consumer electronics, mainly the manufacturing of transistor radios, black and white TVs, calculators and other audio products; later in 1980s, manufacture of colour televisions also started.

The 1980s, witnessed the golden period of the electronics sector when several noteworthy developments occurred including the advent of computers and telecom products and digital exchanges. However, the success of 1980s couldn't be carried

Exhibit 18: Segments of Indian Electronics and IT Hardware Sector



Source: Indian Brand Equity Foundation

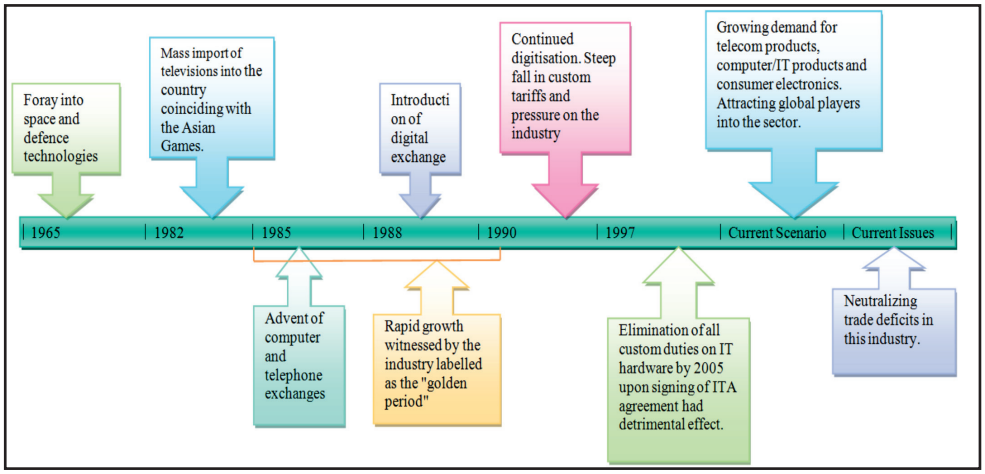
forward to the next decade. Following the software boom, since the middle of 1990s, India's focus shifted to software related electronic products. Further, the steep fall in import tariffs in the country rendered the hardware sector open to international competition. This was aggravated by the elimination of custom duties in 1997 when India became signatory to the International Technology Agreement (ITA).

DEMAND-SUPPLY SCENARIO

Demand for communication and broadcast equipment in India has been robust and the country has emerged as one of the fastest growing telecom markets in the world. The number of telecom connections in the country has increased from 429.72 million in 2008-09 to 898.02 million in 2012-13[28]. Consumption of computers has also grown in the Indian market and the household segment's share in total consumption has grown remarkably. Within the business segment, growth in consumption of computer has been led by telecom, banking and financial sectors, education and households segments. Demand for consumer electronics is also growing as a result of rising disposable incomes, growing electrification of rural areas and relatively easier access to credit. Industrial electronics is also increasingly being used in industries like steel, textiles, cement, power, chemical and refineries.

From the supply perspective, India's total production of electronics has recorded a CAGR of 14.4 percent

Exhibit 19: Timeline of Developments in the Indian Electronics Industry



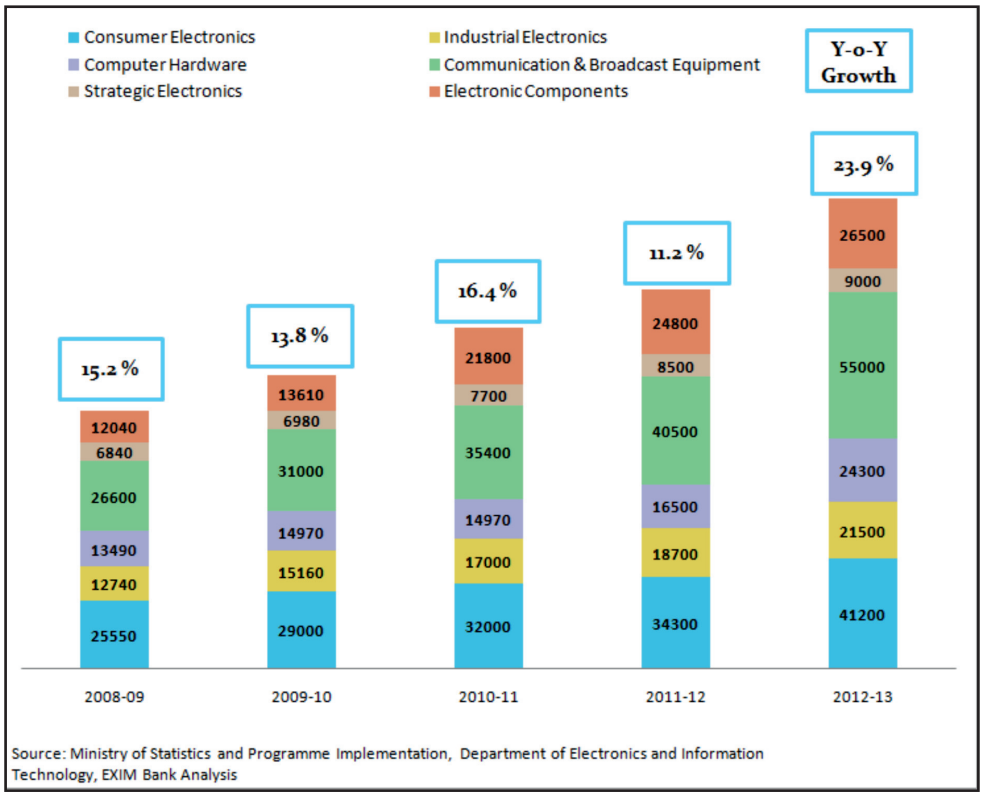
Source: EXIM Bank Analysis

[28]Telecom Regulatory Authority of India

during the period 1995-96 to 2012-13. India's total production of electronics recorded double digit y-o-y growths over the period 2008-09 to 2012-13, with growth in 2012-13 being a significant 23.9 percent (Exhibit 20). Overall, the value of production of Indian electronic industry amounted to Rs. 1,77,500 crore (approx. US$ 32 bn) in 2012-13. Production of electronic components has witnessed the largest increase over the period FY09 to FY13, registering a CAGR of 21.8 percent. However, the CAGR of production for this segment over the longer period of FY96 to FY13 was merely 12.6 percent, which was lower than the average CAGR of production for the electronic industry as a whole.

Propelled by the vibrant demand from the telecommunications sector, production of communication and broadcast equipment recorded a CAGR of 19.9 percent during FY09 to FY13. Retaining its position as the largest category of electronics production in India, the share of communication and broadcast equipment has grown from 27 percent

Exhibit 20: Segment-wise Electronics Production (FY09-FY13, Value in Rs. Crore)



Source: Ministry of Statistics and Programme Implementation, Department of Electronics and Information Technology, EXIM Bank Analysis

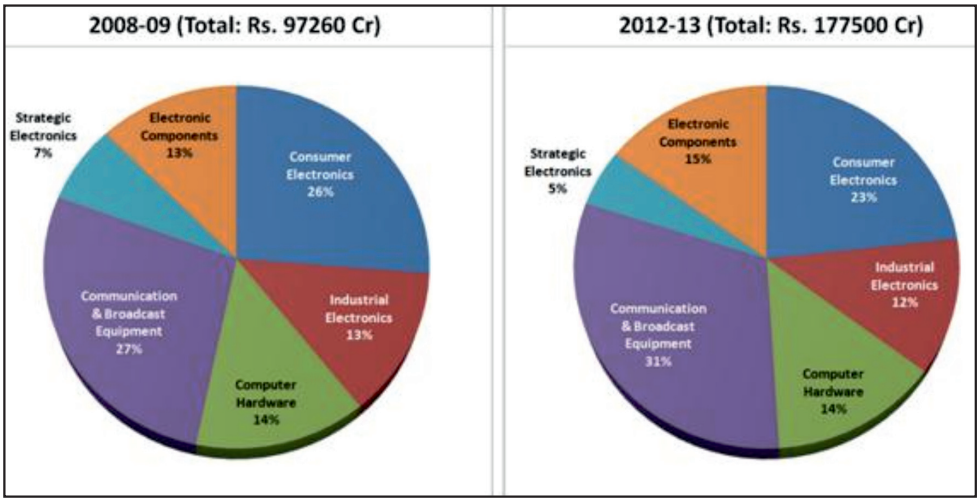
in FY09 to 31 percent in FY13. On the other hand, the shares of strategic electronics, consumer electronics and industrial electronics in India's total electronics production receded during this period. Consumer electronics, which is the second largest category of electronics production in India, witnessed the maximum decline in share over the period under consideration (Exhibit 21).

Although there has been significant increase in the production of electronics, there remains large unmet demand which is currently being met by imports. Hence, production of electronics needs to increase at a considerable pace if this demand-supply gap is to be bridged.

EXTERNAL TRANSACTIONS

Majority of the electronics production in India is intended for the domestic market. Export intensity of sales in electronics industry has grown in 2000s. However, there has been a marked decline in the export intensity in the post-2008-09 period. Export intensity of computer, peripherals and storage devices has been the highest among all other categories and had reached the level of 50.6 percent in 2005-06. However, since then, there was a consistent decline in the export intensity till 2010-11. Encouragingly, export intensity in 2011-12 bounced back and further improved in 2012-13 to 46.61 percent. The category of other electronic products had

Exhibit 21: Share of Segments in Total Electronics Production of India

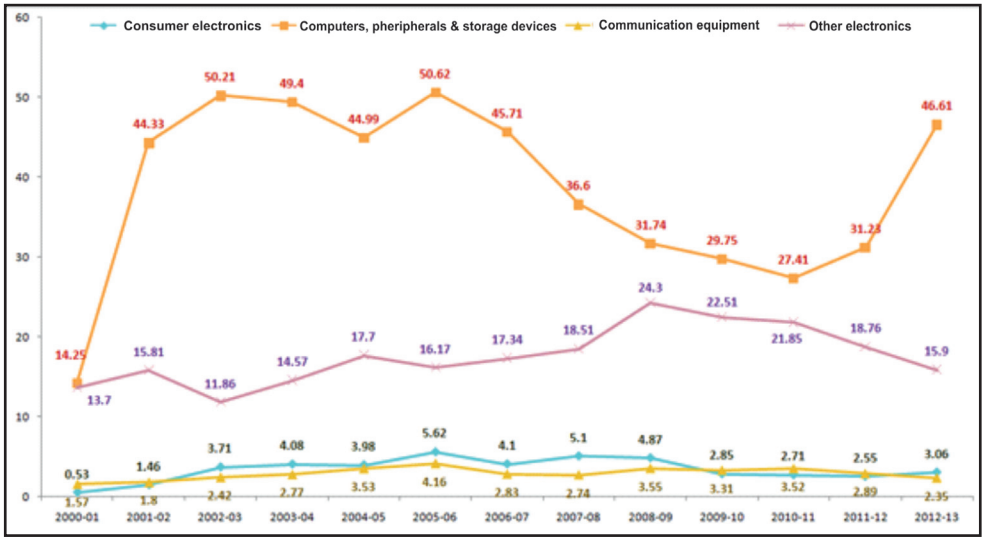


Source: Ministry of Statistics and Programme Implementation, Department of Electronics and Information Technology, EXIM Bank Analysis

generally witnessed an increasing trend in export intensity during the period 2002-03 to 2008-09, peaking at 24.3 percent in 2008-09, but declining thereafter. As against the previous two categories, export intensity of consumer electronics and communication equipment has remained significantly low, at 3.1 percent and 2.3 percent, respectively in 2012-13 (Exhibit 22).

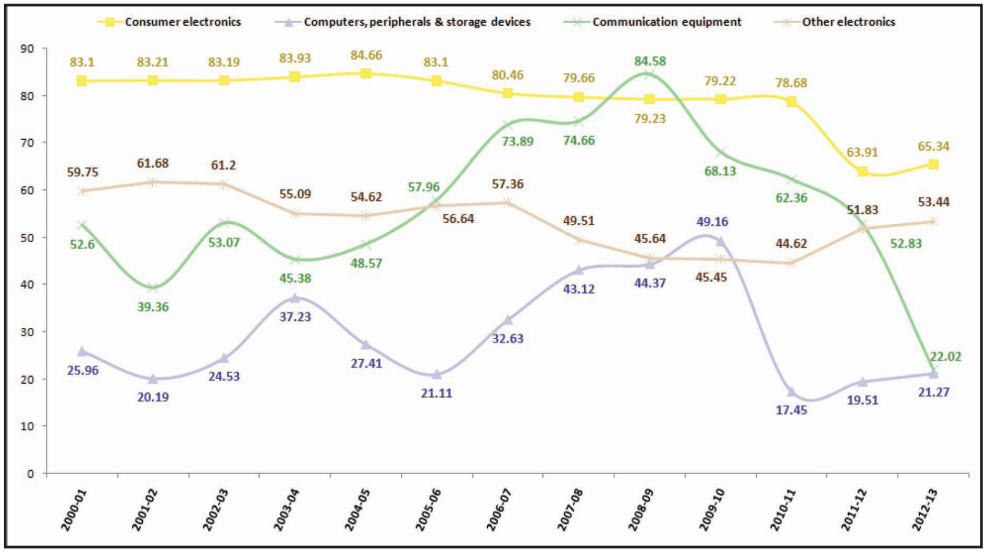
A particularly alarming trend has been observed in the indigenous raw materials consumed by the electronics industry. While indigenous sourcing has been the highest in the category of consumer electronics (65.34 percent in 2012-13), the share of indigenous raw materials in total raw materials consumed has fallen over the years. It has also fallen sharply for the computers, peripherals and storage devices segment, where the indigenous raw material intensity in 2012-13 stood at 21.27 percent, down from the peak value of 49.16 percent in 2009-10 (Exhibit 23). Communication equipment category has also witnessed a precipitous decline with indigenous raw material intensity declining from a high of 84.58 percent in 2008-09 to 22.02 percent in 2012-13. This category has shown the maximum variance in indigenous raw material usage intensity during the period 2000-01 to 2011-12, of 182.6 (and so has the category of computers, peripherals and storage devices with a variance of 118.2). On the other hand, variance is low

Exhibit 22: Export Intensity of Sales in Electronics Industry (%)



Source: CMIE Prowess, EXIM Bank Analysis

Exhibit 23: Indigenous Raw Materials Consumed by the Industry as % of Total Raw Materials Consumed



Source: CMIE Prowess, EXIM Bank Analysis

for other electronics and consumer electronics category, where the trend has been more or less stable. This low sourcing from indigenous suppliers coincides with the relatively lower production growth (CAGR) of electronic components industry during the period FY96 to FY13. This builds a case for increased focus on the electronic components category.

TRADE

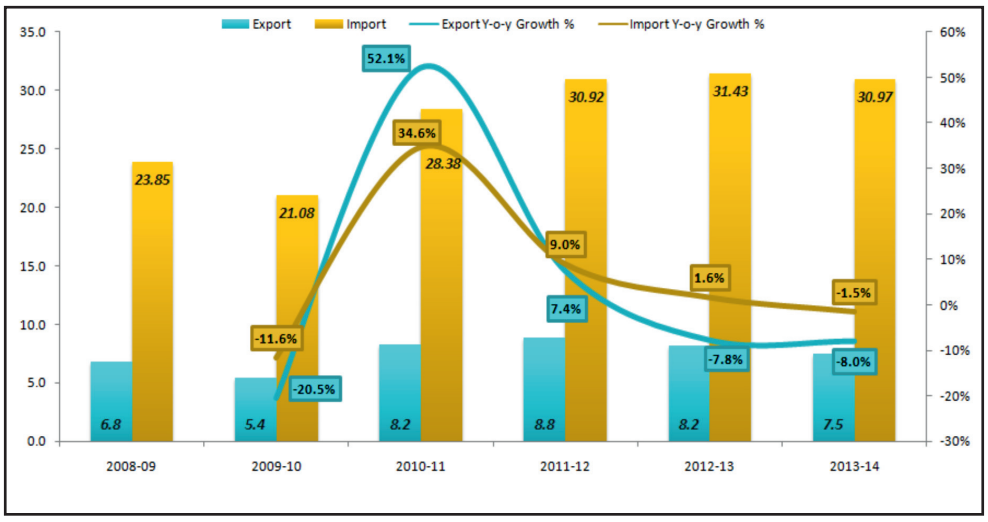
The growth in India's exports and imports of electronic goods had peaked in 2010-11, but has witnessed moderation since then. The moderation has been starker in the case of exports, where y-o-y growth moderated from 52.1 percent in 2010-11 to 7.4 percent in 2011-12 before recording successive years of negative growths of (-) 7 .8 percent and (-) 8.0 percent in 2012-13 and 2013-14, respectively. In absolute terms, exports of electronics declined from US$ 8.2 bn in 2010-11 to US$ 7.5 bn in 2013-14. As far as imports of electronics are concerned, during 2013-14, they were valued at US$ 30.97 billion, registering a y-o-y decline of (-) 1.5 percent (Exhibit 24).

India is a net importer of electronic goods and had a huge trade deficit of US$ 23.5 billion in 2013-14, primarily on account of huge imports from China whose share in India's total trade deficit in electronic products stood at 66.7 percent in 2013-14.

Exports of subassembly products have shown the maximum vibrancy, recording a CAGR of 15.5 percent during the period FY09-FY14. Both final electronic goods and electronic components witnessed marginal declines in CAGR of (-) 0.7 percent each, during this period. Imports of electronic components, on the other hand have risen significantly during the six year period 2008-09 to 2013-14 recording a CAGR of 5.2 percent. Growth in imports of two of the three segments, viz. components and final goods, has significantly outpaced the growth in exports (Table 6).

Phones, fax machines and routers accounted for 62.2 percent of the total exports of final electronic goods from India in 2013-14. Sub-segments of final electronics goods where exports have witnessed robust double digit growths include: cameras and projectors, clocks and watches, radar and radio navigation equipment, radios and alarm clocks, and sound projection. In all these sub-segments and additionally in analytical instruments, growth in exports has surpassed growth in imports, although the value of import dwarfs the value of exports for most of these sub-segments.

Exhibit 24: Export and Import Trend of India's Electronics Goods (Value in US$ bn)



Source: DGCI&S, EXIM Bank Analysis

Table 6: Category-wise Trade of India in Electronic Products (Value in US$ mn)

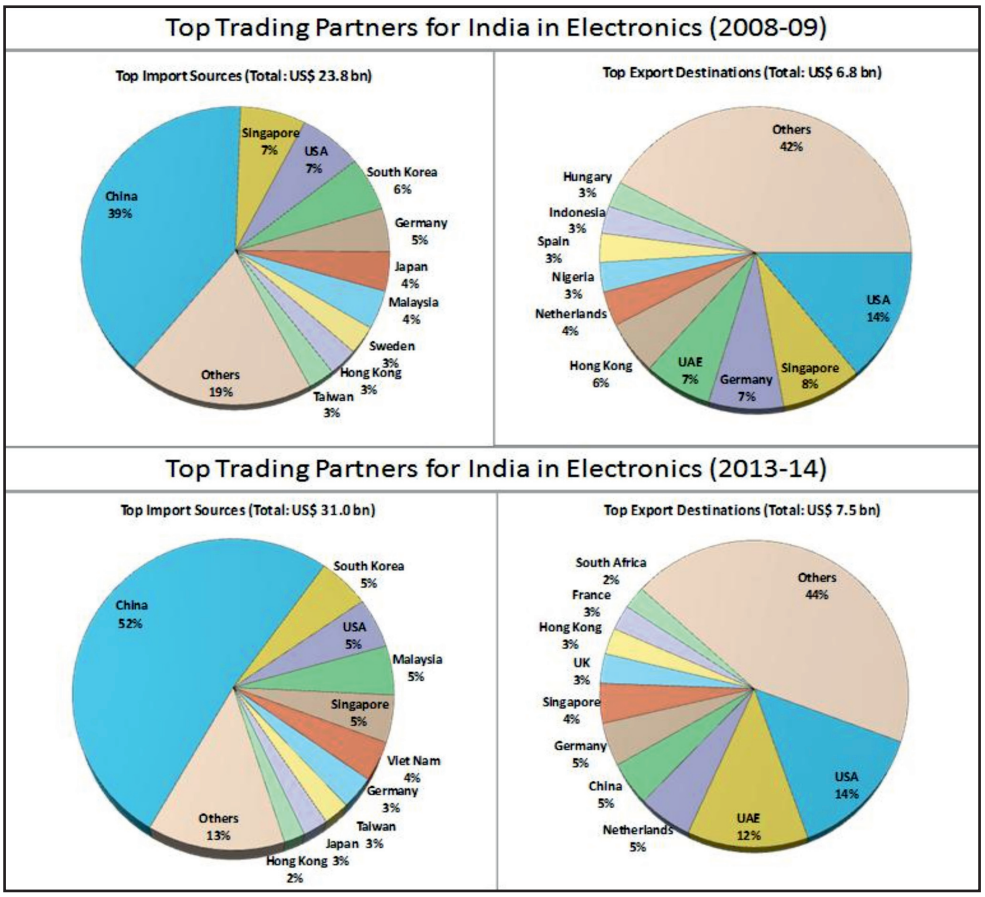
Category	Imports by India			Exports from India		
	2008-09	2013-14	CAGR %	2008-09	2013-14	CAGR %
Component	4689.1	6055.2	5.2%	1978.9	1910.5	-0.7%
Subassemblies	5597.1	6759.2	3.8%	861.2	1770.1	15.5%
Final Goods	13559.8	18160.2	6.0%	3962.8	3820.2	-0.7%
Analytical Instruments	810.4	927.9	2.7%	139.8	177.5	4.9%
Cameras and projectors	258.5	606.5	18.6%	2.8	55.3	81.5%
Clocks & Watches	4.8	2.3	-13.5%	2.1	5.6	22.1%
Computer and storage devices	2253.1	4372.7	14.2%	236.2	244.4	0.7%
Medical	607.2	798.3	5.6%	270.7	336.5	4.5%
Office equipment	15.5	43.8	23.1%	3.7	1.1	-21.6%
Others	107.4	146.2	6.4%	9.8	13.0	5.8%
Phones, Fax Machines, & Routers	6699.8	8272.4	4.3%	2519.1	2377.2	-1.2%
Radar & Radio Navigation Equipment	67.4	53.8	-4.4%	5.6	22.1	31.5%
Radio & TV Transmission	659.8	44.5	-41.7%	140.2	28.2	-27.5%
Radios & Alarm Clocks	121.5	167.3	6.6%	4.4	8.4	14.1%
Sound & Video Recording Devices	669.5	783.3	3.2%	340.0	197.5	-10.3%
Sound projection	270.0	441.8	10.4%	35.1	90.7	20.9%
Television & Monitors	1015.1	1499.4	8.1%	253.4	262.7	0.7%

Source: DGC&IS, EXIM Bank Analysis

The USA was the largest export destination for India's electronic exports, accounting for 14 percent of the total exports in 2013-14, while China was, by far, the largest import source, with a share of 52 percent in India's total electronic imports. China's share in India's electronics imports has grown stupendously from 39 percent in FY09 to 52 percent in FY14. On the other hand, share of Singapore, the USA and South Korea in electronics imports of India has declined over this period (Exhibit 25).

The UAE has emerged as the second largest export destination for India, with its share in India's total exports rising by 5 percentage points, from 7 percent in 2008-09 to 12 percent in 2013-14. China was also among the top ten export destinations in

Exhibit 25: Top Trading Partners for India in Electronics



Source: DGCI&S, Exim Bank Analysis

2013-14, with a share of 5 percent in total electronics exports of India. The country did not feature among the top ten export destinations in 2008-09 and its share has increased considerably over the period FY09 to FY14. On the other hand, share of Germany and Singapore in electronics exports of India witnessed significant declines over the period under consideration.

In the final electronic goods category, India exported significantly to the Middle East and African countries. The UAE was the largest export destination in this segment, accounting for 20 percent of India's total exports in 2013-14, followed by the USA (13 percent), Singapore (5 percent), South Africa (4 percent) and Russia (3 percent). The Netherlands was the largest export destination for India in the subassembly products category, accounting for 15 percent of total exports in 2013-14, followed by the USA (15 percent), China (9 percent), Israel (6 percent) and the UAE (5 percent). In the components category, the USA was the largest export destination accounting for 15 percent of total exports from India, followed by Germany (10 percent), the UK (8 percent), France (5 percent) and the Netherlands (5 percent) (Table 7).

India has significant exports to the USA and the European Union in the electronic components category. China is among the top ten export destinations in the categories of subassembly products and components (Table 7).

Table 7: Top Destinations for Export of Electronics from India (Value in US$ mn; 2013-14)

Final Goods	Value	Share %	Subassem-bly products	Value	Share %	Component	Value	Share %
World	**3820.2**	**100%**	**World**	**1770.1**	**100%**	**World**	**1910.5**	**100%**
UAE	746.3	20%	Netherlands	271.5	15%	USA	292.2	15%
USA	493.9	13%	USA	261.0	15%	Germany	200.3	10%
Singapore	190.3	5%	China	164.4	9%	UK	144.8	8%
S. Africa	140.0	4%	Israel	98.8	6%	France	100.2	5%
Russia	123.8	3%	UAE	94.6	5%	Netherlands	98.9	5%
Hong Kong	110.7	3%	Singapore	69.1	4%	China	85.1	4%
Nigeria	107.7	3%	Indonesia	64.4	4%	UAE	81.8	4%
Argentina	95.1	2%	Germany	58.1	3%	Hong Kong	61.3	3%
Egypt	93.6	2%	Malaysia	44.6	3%	Singapore	54.2	3%
Saudi Arabia	92.4	2%	Hong Kong	37.5	2%	Saudi Arabia	32.1	2%

Source: DGCI&S, EXIM Bank Analysis

In terms of imports, China was, by far, the largest import source for all the three categories of electronic goods imports by India, with its share in India's imports as high as 58 percent, 45 percent and 39 percent in the final electronic goods, subassembly products and component categories, respectively (Table 8).

China accounts for 66.7 percent of India's trade deficit with the world in electronic goods. China's share in India's trade deficit of electronic goods is largest in the category of final electronic goods. In 2013-14, China accounted for 73 percent of India's trade deficit of final electronic goods. In the segments of subassembly products and components as well, the share was as high as 58 percent and 55 percent, respectively (Exhibit 26).

Within final electronics category, India had negative trade balance with China in all sub-categories. Maximum trade deficits were in the categories of computer and storage devices, and phones, fax machines and routers. In 2008-09, India had trade surplus with China in the final electronic categories of analytical instruments, clocks and watches, medical devices, radar and radio navigation equipment, radio and TV transmission, and sound and video recording devices. However, by 2013-14, trade balance with China in all these categories turned negative (Table 9).

Table 8: Top Sources for Import of Electronics from India (Value in US$ mn; 2013-14)

Final Goods	Value	Share %	Subassem-bly products	Value	Share %	Compo-nent	Value	Share %
World	**18160.2**	**100%**	**World**	**6759.2**	**100%**	**World**	**6055.2**	**100%**
China	10581.0	58%	China	3039.4	45%	China	2373.9	39%
USA	1021.9	6%	Repulic of Korea	876.2	13%	Singapore	478.1	8%
Viet Nam	1015.6	6%	Malaysia	460.1	7%	Germany	418.8	7%
Singapore	873.1	5%	USA	365.8	5%	Repulic of Korea	372.2	6%
Malaysia	870.0	5%	Germany	265.0	4%	Japan	320.6	5%
Thailand	451.4	2%	Viet Nam	228.9	3%	Taiwan	297.2	5%
Repulic of Korea	432.8	2%	Singapore	162.7	2%	Malaysia	257.1	4%
Hong Kong	418.4	2%	Japan	162.4	2%	USA	239.7	4%
Taiwan	371.1	2%	Taiwan	108.9	2%	France	149.1	2%
Germany	341.2	2%	Finland	95.8	1%	Hong Kong	115.1	2%

Source: DGCI&S, EXIM Bank Analysis

Exhibit 26: China's Share in India's Trade Deficit of Electronic Goods (2013-14)

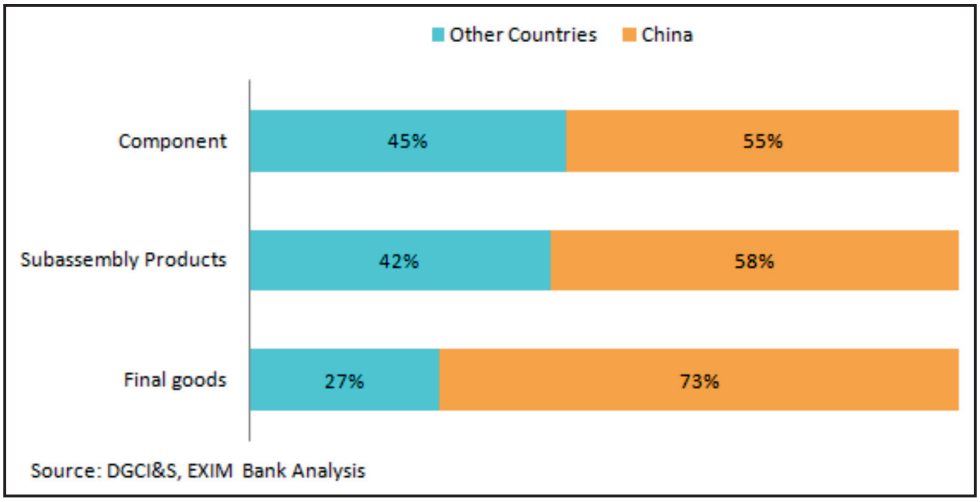


Table 9: Balance of India's Trade with China in Final Electronic Categories (Value in US$ mn)

Category	2008-09	2012-13
Analytical Instruments	63.80	-92.41
Cameras and projectors	-113.5	-310.46
Clocks & Watches	0.08	-1.34
Computer and storage devices	-642.41	-2751.86
Medical devices	223.42	-76.01
Office equipment	-9.28	-27.43
Others	-37.00	-73.12
Phones, Fax Machines, & Routers	-1502.31	-5703.35
Radar & Radio Navigation Equipment	3.54	-3.95
Radio & TV Transmission	13.07	-4.04
Radios & Alarm Clocks	-83.67	-47.12
Sound & Video Recording Devices	125.37	-378.82
Sound projection	-99.30	-289.94
Television & Monitors	-304.50	-729.01

Source: DGCI&S, EXIM Bank Analysis

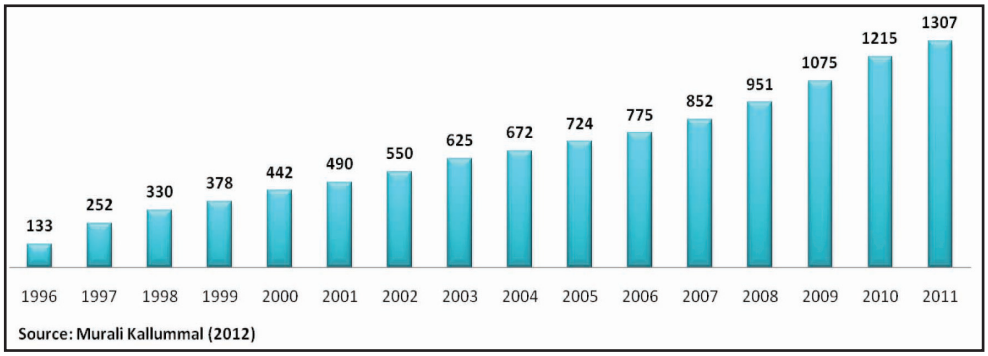
ANALYSING THE IMPACT OF ITA-I

According to the Ministry of Commerce, Government of India, the Information Technology Agreement (ITA) is a plurilateral agreement within the WTO, which "aims to expand world trade in information technology products considering the key role this trade plays in development of information based industries, and the dynamic expansion of the world economy, while recognizing the goal of raising the standards of living and expanding the production of, and trade in goods." Under the ITA, participants are required to completely eliminate duties on IT products covered by the Agreement. India joined the ITA on 25th March 1997 and had bound 217 lines in all (including expositions), of which 95 lines were to be reduced to zero by 2000, 4 lines in 2000, 2 lines in 2004 and 116 lines in 2005, making 2000 and 2005 watershed years for the industry.

An analysis of the export intensity of Indian firms (Exhibit 22) reveals that immediately after the first phase in 2000, a marked increase was witnessed in the export intensity during the period 2001-02. This coincided with sales of Indian electronics goods firms declining in 2001-02, which implies a significant displacement of domestic market for domestic producers and greater dependence on exports revenues. However, eventually sales as a whole increased along with a continued increase in export intensity. So, while the immediate impact as seen by the domestic sales of these companies was certainly negative, the industry later thrived on account of high export intensity.

This analysis however doesn't go for the large mass of unlisted and MSME companies who are engaged in electronics production, especially the lower end production of electronic components. Sourcing by large listed companies from indigenous firms, many of which are MSMEs, has never been able to reach the 1999-2000 level of 63.7 percent, post the removal of duties. Production of electronic components has also not been able to grow at the pace of other categories due to lack of forward linkages for MSMEs on account of easy availability of imports. Access to markets of other countries has also not sufficiently increased as tariff barriers have now been replaced by non-tariff barriers. Technical barriers to trade (TBT) have been increasingly used by the WTO members, annulling the impact of reduction in tariffs (Exhibit 27). Nearly 82 percent of these TBT notifications have been issued by the ITA signatories, suggesting that there has been increased protectionism by

Exhibit 27: Cumulative TBT notifications under the ITA HS lines



way of domestic regulations, thereby creating market access barriers[29].

As a result of the ITA, it has been noted that only a few firms dominate the industry, and the level of competition has been declining in the industry. There are huge barriers that exist for new entrants into the manufacturing space with the level of competition having significantly declined. This is reflected in the rise in Herfindahl-Hirschman Index (HHI) index, which is a measure of the size of firms in relation to the industry and an indicator of the amount of competition among them. Thus, for instance, in the case of "computers and its peripherals of all types", HHI increased from 0.1 in 1999-2000 to 0.24 in 2010-11. Similarly, private automatic branch exchange, audio equipment and television receiver categories also witnessed increase in concentration. Some other categories like capacitor and medical equipment witnessed marginal increase in concentration. On the other hand, transmission equipment and telephone instruments category have gradually become less concentrated over time (Table 10).

FOREIGN DIRECT INVESTMENT

In India, 100 percent FDI is permitted in the electronics hardware manufacturing sector under the automatic route. A large number of empirical studies on the role of FDI in host countries suggest that FDI is an important source of capital, complements domestic private investment, is usually associated with new job opportunities and enhancement of technology transfer, and boosts overall economic growth in host countries[30].

[29]Murali Kallummal (2012), Process of Trade Liberalization under the Information Technology Agreement (ITA): The Indian Experience.
[30]Abdur Chowdhury and George Mavrotas (2005), FDI and Growth: A Causal Relationship.

Table 10: HHI Index for Categories of Electronics Industry

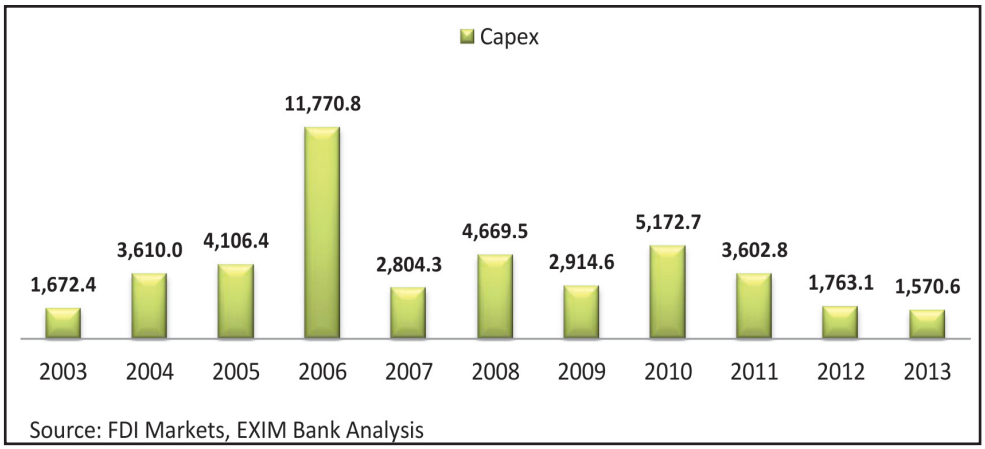
Categories	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11
Computers and Its Peripheral of all Types	0.10	0.08	0.08	0.09	0.12	0.15	0.16	0.18	0.19	0.22	0.17	0.24
Transmission Equipment	0.10	0.05	0.05	0.02	0.01	0.00	0.00	0.00	0.01	0.08	0.06	0.06
Private Automatic Branch Exchange	0.21	0.24	0.28	0.28	0.37	0.40	0.45	0.43	0.44	0.35	0.33	0.37
Telephone instruments	0.07	0.08	0.07	0.06	0.21	0.20	0.15	0.31	0.09	0.02	0.01	0.01
Television Picture Tubes	0.18	0.18	0.2	0.25	0.23	0.26	0.22	0.22	0.21	0.27	0.26	0.18
Medical Equipments	0.01	0.01	0.01	0.01	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.02
Process Control Equipment	0.10	0.09	0.08	0.06	0.07	0.07	0.09	0.08	0.08	0.08	0.09	0.10
Capacitor	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.06	0.02	0.05	0.05
Printed Circuit Boards	0.05	0.06	0.05	0.06	0.05	0.05	0.06	0.06	0.07	0.01	0.03	0.02
Audio Equipment	0.34	0.34	0.34	0.39	0.43	0.45	0.63	0.68	0.68	0.71	0.77	0.81
Television Receivers (incl. TV Spares & Kits)	0.11	0.11	0.10	0.10	0.09	0.07	0.17	0.18	0.21	0.18	0.21	0.17

Source: CMIE

For the purpose of the following analysis, data from Financial Times' FDI Markets has been used. The definition of electronics in FDI Markets database is wider than the one defined by the Department of Industrial Policy and Promotion (DIPP), which excludes categories like computer hardware, scientific instruments, etc[31]. According to FDI Markets database, FDI in the electronics industry of India peaked in 2006 to US$ 11.77 billion[32] after which it showed a fluctuating trend. But since 2010, it has witnessed a constant declining trend. In 2013, the industry received FDI worth only US$ 1.6 billion (Exhibit 28). This data may not match with the DIPP data on FDI inflows into India. The primary reason would be that many such investments are routed through tax haven economies e.g. Mauritius.

United States had the largest number of FDI projects in the country, accounting for 35 percent of total FDI projects during the period January 2003-March 2014, followed by Japan (12 percent), Germany (7 percent), UK (5 percent) and South Korea

Exhibit 28: FDI in India's Electronics Industry (US$ mn)



Source: FDI Markets, EXIM Bank Analysis

[31]Electronics data from FDI markets includes capital expenditure in the sub-sectors of: all other electrical equipment & components, Audio & video equipment, Communication & energy wires & cables, Communications equipment, Computer & peripheral equipment, Electrical equipment, Electromedical and Electrotherapeutic Apparatus, Household appliances, Magnetic & optical media, Measuring & control instruments, Medical equipment & supplies, Navigational instruments, Other (Consumer Electronics), Power transmission equipment, Semiconductor machinery, Semiconductors & other electronic components, Ventilation, heating, air conditioning, and commercial refrigeration equipment manufacturing

[32]In terms of capital expenditure

Table 11: Major Source Countries for FDI into Indian Electronics Industry

Source Country	No. of Projects	Share %
United States	378	35%
Japan	128	12%
Germany	73	7%
UK	57	5%
South Korea	55	5%
Taiwan	45	4%
Switzerland	43	4%
Finland	42	4%
China	39	4%
France	32	3%
Total	**1070**	**100%**

Source: FDI Markets, EXIM Bank Analysis

Table 12: Destination States for FDI into Indian Electronics Industry

Destination State	No. of Projects	Share %
Karnataka	236	22%
Maharashtra	181	17%
Tamil Nadu	128	12%
Delhi	86	8%
Andhra Pradesh	66	6%
Haryana	46	4%
Uttar Pradesh	34	3%
Gujarat	32	3%
West Bengal	18	2%
Uttarakhand	12	1%
Total	**1070**	**100%**

Source: FDI Markets, EXIM Bank Analysis

(5 percent). China accounted for 4 percent of total FDI projects (Table 11). Within India, Karnataka was the state which got the maximum number of FDI projects, accounting for 22 percent of the total, followed by Maharashtra (17 percent), Tamil Nadu (12 percent) and Delhi (8 percent). While capital expenditure in Karnataka and Maharashtra has started to decline in the recent years, Andhra Pradesh has emerged as a major hub for foreign capital in the electronics sector (Table 12).

NATIONAL ELECTRONICS POLICY 2012

The National Electronics Policy, 2012, was formed with the vision to "create a globally competitive electronics design and manufacturing industry to meet the country's needs and serve the international market". The major initiatives under this Policy, considered to be a key government initiative for the electronic goods sector, include:

- Modified SIPS (M-SIPS): Under this scheme, subsidy is provided for investment in all verticals of the Electronic System Design and Manufacturing (ESDM) sector. Capital expenditure subsidy of 25 percent is available in non-SEZ and 20 percent within SEZ for 10 years. CVD/excise duty on capital equipment is reimbursed for non-SEZ units. Central taxes and duties are reimbursed for 10 years in select high-tech units.

- Electronics Manufacturing Clusters (EMC): Under this, assistance for brownfield and greenfield EMCs are available. Assistance for the former is to a maximum extent of 75 percent of project cost subject to ceiling of Rs. 50 crore, while in the case of the latter, assistance is 50 percent of the project cost, with a ceiling of Rs. 50 crore for the first 100 acres.

- Preferential market access: This provides for preference to notified domestically manufactured electronic goods for government procurement and also for procurement of Managed Service Providers which have security implications.

- Semiconductor Wafer Fab: Government has approved two semiconductor wafer fabrication units. Various incentives are provided under this including various forms of viability gap funding.

- Electronic Development Fund: A fund is proposed to be setup, which comprises "daughter funds" of varying size which in turn will

provide risk capital to company developing new technology in specified areas. These are intended to promote innovation, R&D, product commercialization, etc. in ESDM, nano-electronics and IT sector. The corpus of a daughter fund may be determined by market requirements and the capacity of its fund manager.

- Mandating safety standards: Fifteen electronic products were notified under safety standards on October 3, 2012. BIS accredited labs are supposed to test the goods.

- Human Resource Development: To develop requisite human resource for the electronics industry, Electronics and Telecom Sector Skill Council has been set up. Special Manpower Development Programme-Phase III has been started in the area of very large scale integration design and related software.

LOOKING AHEAD

In the context of India's electronics industry, perhaps the quote "China is a threat, China is a customer, and China is an opportunity"[33], suits perfectly well. China is a threat considering the burgeoning trade deficit in the electronic goods sector. India's rising trade deficit with China makes it imperative to think on the lines of improving production facilities in the electronics category and also getting access to latest technologies for production. China is a customer as it is a large economy with an enormous appetite. It has a large and growing demand for medical devices. China is an opportunity as FDI outflows from the country has been growing in the electronics industry. Foreign Direct Investment from China can propel electronics production in India and aid the ailing industry. Through FDI production capabilities in categories of computer and storage devices, phones, fax machines and routers, and television and monitors need to be developed, as these are the largest categories of trade deficit with respect to China. FDI also needs to be attracted in the electronic components category where India received only 1.5 percent of the total FDI outflows from China during Jan 2003 – Mar 2014. To boost the production capabilities in the electronics category, electronic components category needs to be developed as share of indigenous raw materials has substantially declined in the electronics industry. Absence of local fab has made reliance on imports crucial.

[33]The World is Flat, Thomas Friedman

3. SCENARIO OF ELECTRONICS INDUSTRY IN CHINA

China's performance in the electronics industry has been nothing short of phenomenal. The development of electronic capabilities in the country has, to a large extent, been possible due to the articulation and successful achievement of goals in its Five Year Plans, which are the planning mechanism adopted in the country. The first two Plan periods had seen significant amount of the erstwhile Soviet assistance in China's electronics foray. The first two Plans were also largely focused on the electronics industry from the point of view of the country's national defence. Later Five Year Plans have seen a constant changing of the structure of the industry into a more sophisticated one and geared towards developing scientific acumen in the field. Many national projects like Golden Projects, 909 semiconductor manufacturing projects, air traffic control system project, etc have been instrumental in driving the electronics industry towards higher growth path. China's success in achieving the goals of its five year plans is reflected in the country becoming the largest producer in the world in many electronic categories and also achieving a net exporter status by the Eighth Five Year Plan.

FDI has played an important role in jumpstarting China's ICT production and exports. In 1990s, preferential treatments were offered in China, which enabled transnational capital to integrate China's expanding manufacturing capacities into transnational production networks. Many FDI-driven export oriented manufacturing clusters emerged in China, making it the leading ICT manufacturing powerhouse in the world. A qualitative breakthrough came about in the Eleventh Five Year Plan, with domestic firms outperforming the foreign-invested firms on many scales (Hong, 2001)[34].

[34]Yu Hong (2008), Class formation in high-tech information and communications as an aspect of China's reintegration into transnational capitalism.

Box 1: Development of China's Electronics Industry over the Plan Periods

FIRST FYP (1953-1957)

- Dual objectives of modernisation and strengthening of radio and communication aspect of national defence, and setting up of automatic telephone switchboard factories for civilian networks.
- Erstwhile Soviet Union provided assistance in nine electronics projects.
- Establishment of scientific research and development institutions.

SECOND FYP (1958-1965)

- Goals related to three defence oriented areas: Development and construction of electronic equipment for a ballistic missile capability; supporting atomic energy and aviation development; and establishing of factories for electronic measuring instruments and specialized atomic energy and aviation development.

THIRD & FOURTH FYP (1966-1975)

- Cultural Revolution deflected economic development.

FIFTH & SIXTH FYP (1976-1985)

- End of Cultural Revolution.
- Production structures were revised and military factories began producing both military and civilian products.
- Ministry of Electronics Industry was established.
- Lead group focussed on electronics industry was formed within the State Council.

SEVENTH FYP (1986-1990)

- Production levels accelerated. Exports started to become important. Total exports for electronics products during this plan period were US$ 10.5 billion.
- For the first time, projects to tackle key science and technology problems were included.
- There were five large projects in electronics during this period: very large scale integration technology, computer systems, computer software, communication technology and electronic materials.
- Development of significant number of indigenous devices and systems.

EIGHTH FYP (1991-1995)

- Value of electronic imports surpassed the value of electronics exports in this period, for the first time. While exports amounted to US$ 16.5 billion, imports were slightly lower at US$ 16.1 billion in 1995.
- China became the largest producer of products like colour televisions, radios, audio cassette recorders and some other electronic components. Mass production of goods like large digital switchers began locally.
- Structure also witnessed increased sophistication with the presence of large electronic companies.
- Enhancement of scientific research and technology development programs resulted in significant progress with some mainframe and microcomputers beginning to achieve international technology levels.

- ❖ Three Golden Projects were launched[35].
- ❖ Government allocated US$ 110 million to support 17 major electronic projects launched to tackle key problems in science and technology. These projects involved participation of 8000 scientists and technicians.

NINTH FYP (1996-2000)

- ❖ Goal was to place China among top five electronics producing nations of the world.
- ❖ Worked to restructure the electronics industry into a more complex, multi-tiered modern supply chain, with large companies playing the leading role.
- ❖ Emphasis in this period was on integrated circuits, electronic device and components, computers and software, and telecommunication and information technology.
- ❖ Golden Projects were still underway.

TENTH FYP (2001-2005)

- ❖ Telecom industry created a network close to accepted international standards. Scale of fixed telephone and cellular network became second largest in the world.
- ❖ China became the top manufacturer of program controlled switchboards, cellular phones, display devices and monitors.
- ❖ Ministry of Information Industry placed fostering China's IT manufacturing and software industry, and promoting dissemination of national economic and scientific information on top priority.
- ❖ By 2005, China had 3 to 7 million fibre optic broadband users and similar number of digital subscriber line users. Mobile phone subscribers reached 390 million in November 2005. Cable TV broadband users reached 120 million in 2005.

ELEVENTH FYP (2006-2010)

- ❖ Proclaimed to "strengthen the nation by electronics and telecommunication".
- ❖ For the first time, growth of domestic firms outpaced that of foreign invested counterparts in terms of profit, value added, investment, export and R&D input.
- ❖ Policy priority to quality rather than quantity of FDI. Focus was more on inducing large MNCs to transfer their technology and high value added processing facilities and R&D capacities to China.
- ❖ China became the world's largest export processing centre of consumer electronic products. It also made backward linkages to manufacture more intermediate goods.

Source: Pecht, M. (2006), China's Electronics Industry, EXIM Bank Analysis

[35]Golden Projects were implemented to modernize China's IT infrastructure and support local industries. These include Golden Bridge Project for nationwide public economic information processing network, Golden Card Project for electronic monetary and modern payment system, Golden Customs Project for foreign trade information source network, Golden Taxation Project for electronic taxation system, Golden Enterprises Project for industrial production and circulation information network, Golden Intellectual Project for education and research network, Golden Agriculture Project for agricultural management and services network, and the Golden Policy Project for national economic micro-policymaking support system. The first three were launched in the Eighth FYP period.

DEMAND-SUPPLY SCENARIO

From the demand perspective, growing urbanization in China has propelled the demand for electronics in the country. Government programs like "Home Appliance to the Countryside" and "Home Appliance Replacement" program have increased consumption of consumer electronics. "Home Appliances to the Countryside" program provided a 13 percent subsidy to rural consumers on purchase of home appliances. The "Household Appliance Replacement" program also offered subsidies for new purchases. However, several of such subsidies ended in May 2013.

Going forward, rising disposable incomes and shorter replacement cycles is expected to continue to drive the growth in the consumption of consumer electronics in China. Industrial electronics has also witnessed significant growth in demand, largely from the segments of medical electronics and factory automation. China was the second largest spender and influencer on the design of industrial electronics chips in 2013, after the United States[36].

From the supply perspective, during the period 2008-2012, China's production in most categories of electronic goods has grown, in some cases quite exceptionally. Microcomputer equipment category witnessed the maximum CAGR of 26.9 percent during the period 2008-2012. All consumer electronics products witnessed positive CAGR during the five year period. Products witnessing a decline in production over the period included program-controlled switchboards, telephone sets, fax machines, display and cameras (Table 13).

Integrated Circuit (IC) production was considered the weakest link in China's electronics production. It remained so in spite of heavy investment from the government to set up IC foundries through the 908 and 909 projects[37]. IC production is capital and technology intensive and domestic producers in China are mostly medium sized or small enterprises with limited funds and technology. According to China Semiconductor Industry Association, China has also faced challenges in boosting this sector on account of outdated equipment. Steps have been taken since 2000, which have reaped benefits for this segment.

'Policies for Encouraging the Development of Software and IC

[36]IHS Technology

[37]908 and 909 projects led to the formation of Huajing Electronic Group and Huahong Electronic Group, both of which are among the top IC manufacturers in China.

industry' was enacted in 2000 which provided wide range of measures to support the IC industry. This included subsidized loans, direct investment by the government, tax reduction and development funds. Significant increase in output and sales was witnessed in the 2000-2005 period as a result of these preferential policies. Although, tax reduction provided under this was finally withdrawn in 2005 on account of claims by the US government of the policy being against WTO rules, other incentives remained effective. More recently, the Circular on 'Certain Policies for Further Encouragement to the Development of Software Industry and Integrated Circuit Industry', released in 2011, further encourages to develop production of IC. Under this, companies get preferential tax treatment and for companies that invest more than RMB 8 billion, or manufacture ICs with line-width less than 0.25 mu, more favourable tax concessions are granted. As a result, the production of IC has continued to witness a consistent increase.

TRADE

China is a net exporter of electronic goods with exports in 2012 amounting to US$ 598.4 bn and imports amounting to US$ 416.3 bn. Although, exports and imports of electronic goods from China have been rising since 2009, growth rates have moderated in 2011 and 2012 (Exhibit 29).

In terms of segmentation, China's exports of components have increased substantially over the five year period 2008-2012 (CAGR: 14.6 percent). As far as imports are concerned, final products have witnessed the maximum increase during the five year period 2008-2012, of 10.8 percent. CAGR of import of final electronic goods and subassembly products during the period 2008-2012 outpaced the CAGR of export in these categories (Table 14). In terms of values, final goods were the largest category of electronic exports from China in 2012 (US$ 372.7 billion), while components were the largest category of electronic imports by the country (US$ 261.9 billion).

Although imports of final electronic goods by China has recorded a robust CAGR of 10.8 percent during 2008-2012, many sub-categories within the segment of final electronics goods witnessed negative CAGRs. Import of cameras and projectors and medical devices by China has witnessed significant growth during this period (Table 14).

Table 13: China's Production of Select Electronic Goods

Item		2008	2009	2010	2011	2012	CAGR %
Home Refrigerators	(10 000 sets)	4756.9	5930.5	7295.7	8699.2	8427.0	15.4
Air Conditioners	(10 000 sets)	8230.9	8078.3	10887.5	13912.5	13281.1	12.7
Home Washing Machines	(10 000 sets)	4231.2	4973.6	6247.7	6715.9	6791.1	12.6
Vacuum Cleaners	(10 000 sets)	6367.5	6534.7	7669.4	8400.5	8145.1	6.3
Program-controlled Switchboards	(10 000 lines)	4584	4152.5	3138.0	3034.0	2829.1	-11.4
Telephone Sets	(10 000 units)	16688	14537.7	16769.7	14017.9	12773.8	-6.5
Fax Machines	(10 000 units)	769.91	683.5	181.1	268.1	263.6	-23.5
Mobile Telephones	(10 000 sets)	55964	68193.4	99827.4	113257.7	118154.6	20.5
Micro Computer Equipment	(10 000 units)	13667	18215.1	24584.5	32036.9	35411.0	26.9
Notebook PCs	(10 000 units)	10859	15009.5	18584.1	23897.4	25289.4	23.5
Display	(10 000 units)	13365	13123.5	13927.0	12680.5	12713.3	-1.2
Integrated Circuits	(100 million units)	417.14	414.4	652.5	719.5	823.3	18.5
Colour Television Sets	(10 000 sets)	9033.1	9898.8	11830.0	12231.3	12823.5	9.2
Hi-Fi Stereo Component Players	(10 000 sets)	7297.2	9879.0	11613.8	15491.8	13145.6	15.9
Cameras	(10 000 sets)	8900	8457.8	9327.7	8241.3	8801.7	-0.3
Xerox & Hectograph Printing Equip.	(10 000 sets)	517.7	421.0	534.8	655.1	687.3	7.3

Source: National Bureau of Statistics of China, EXIM Bank Analysis

Even though imports of cameras and projectors by China have grown significantly, faster than the exports of these products, the country still remains a net exporter of these products. On the other hand, in the medical devices category, China is a net importer. Local companies in China largely manufacture low-end medical devices while mid and high-end devices are imported into the country. China's aging population, growing urbanization and emergence of lifestyle related diseases is expected to drive the demand for medical devices in the country. China is also a net importer of analytical instruments, and radio and TV transmission equipments. Focus on scientific research and development has led to large imports of analytical instruments.

Japan was the largest import source for China in 2008 with a share of 14 percent in China's total imports, but its share declined to 10 percent in 2012. Republic of Korea emerged as the topmost import source for China with its share in the country's total imports rising from 13 percent in 2008 to 16 percent in 2012. Hong Kong remained the largest export destination in 2012, with its share in China's total exports expanding from 24 percent in 2008 to 29 percent in 2012 (Exhibit 29).

Exhibit 29: Export and Import Trend of China's Electronics Goods (Value in US$ bn)

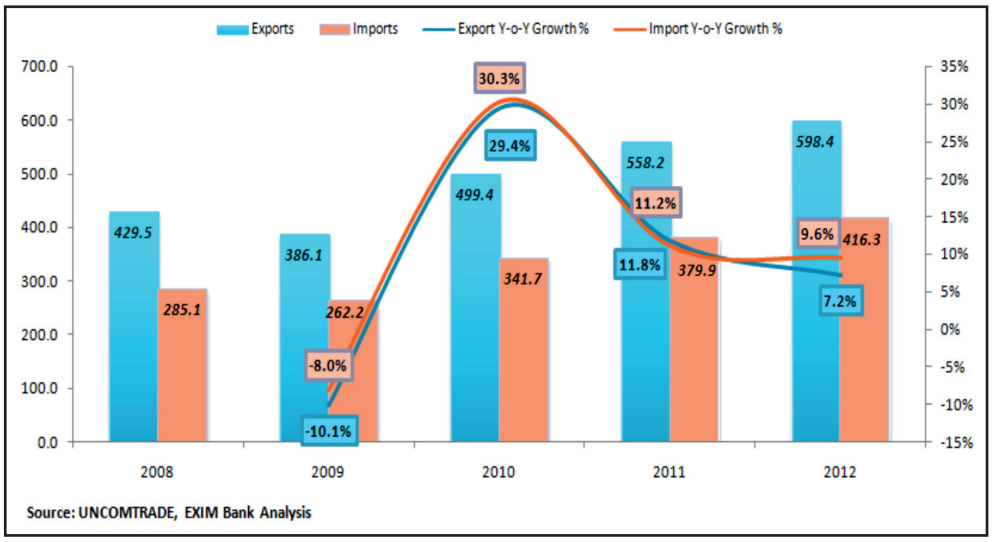
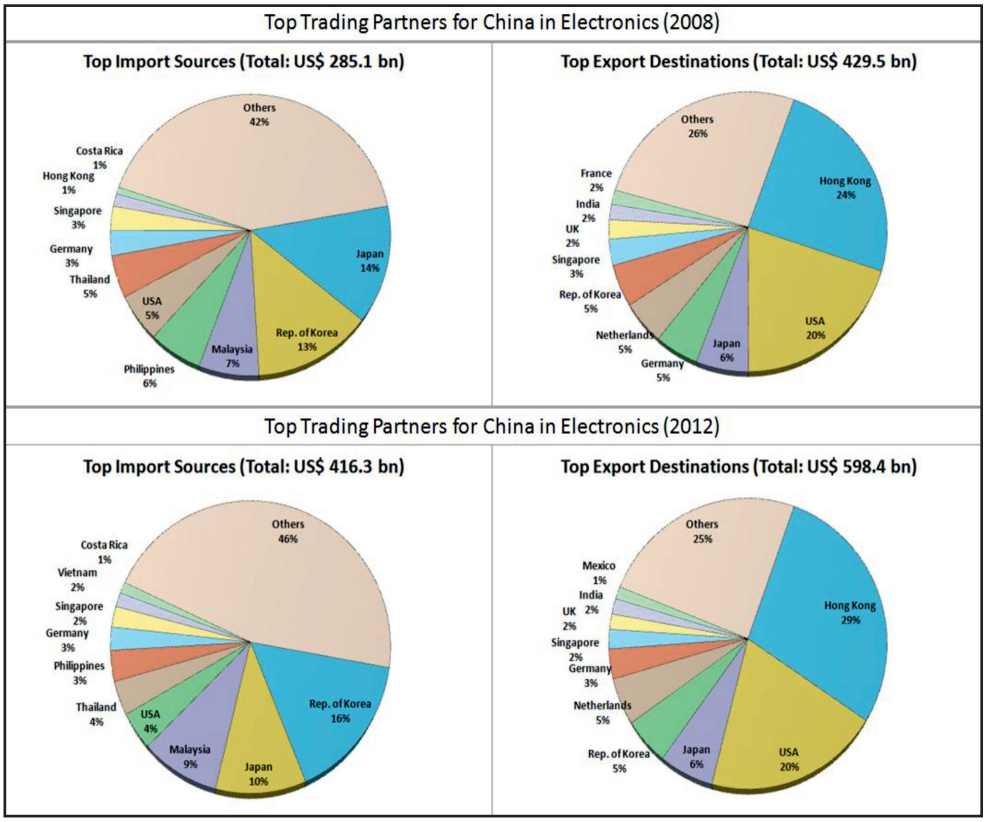


Table 14: Category-wise Trade of China in Electronic Products (Value in US$ mn)

Category	Imports by China			Exports from China		
	2008	2012	CAGR %	2008	2012	CAGR %
Electronic Component	180512.5	261921.4	9.8%	74090.1	127805.0	14.6%
Subassembly Products	51351.0	74031.5	9.6%	81004.7	97842.9	4.8%
Final Electronic Goods	53274.5	80371.5	10.8%	274447.9	372749.5	8.0%
Analytical Instruments	7502.4	12494.3	13.6%	7013.1	11707.9	13.7%
Cameras and projectors	3214.9	9994.2	32.8%	13011.0	15042.9	3.7%
Clocks & Watches	66.7	53.6	-5.3%	753.5	1527.8	19.3%
Computer and storage devices	22847.3	34885.6	11.2%	105652.4	163436.8	11.5%
Medical devices	3074.7	6682.6	21.4%	2617.0	4215.1	12.7%
Office equipment	182.0	91.1	-15.9%	1348.6	1310.7	-0.7%
Others	859.3	473.9	-13.8%	12093.3	4552.0	-21.7%
Phones, Fax Machines, & Routers	5315.9	6667.5	5.8%	65310.5	113591.0	14.8%
Radar & Radio Navigation Equipment	585.4	744.4	6.2%	2104.3	2279.8	2.0%
Radio & TV Transmission	82.3	42.6	-15.2%	29.6	37.7	6.2%
Radios & Alarm Clocks	254.5	216.8	-3.9%	4450.3	4781.6	1.8%
Sound & Video Recording Devices	5870.2	4420.2	-6.8%	19612.4	12998.8	-9.8%
Sound projection	1863.0	3083.1	13.4%	7411.5	11832.3	12.4%
Television & Monitors	1556.0	521.5	-23.9%	33040.2	25435.1	-6.3%

Source: UNCOMTRADE, EXIM Bank Analysis

Exhibit 30: Top Trading Partners for China in Electronics



Source: UNCOMTRADE, EXIM Bank Analysis

In the final electronic goods category, the USA was the largest export destination in 2012, accounting for 27 percent of China's total exports of final electronics goods. In the category of subassembly products and electronic component, Hong Kong was, by far, the largest export destination with shares of 38 percent and 46 percent, respectively. India was among the top ten export destinations in all the categories (Table 15). As far as imports are concerned, Thailand was the largest import source for China in the category of final electronic goods, accounting for 11 percent of China's total imports of these products in 2012. In the categories of subassembly products and electronic component, Republic of Korea was the largest import source with shares of 18 percent in each of the two categories (Table 16).

Table 15: Top Destinations for Export of Electronics from China (Value in US$ mn; 2012)

Final Goods	Value	Share %	Subassembly products	Value	Share %	Component	Value	Share %
World	**372749.5**	**100%**	**World**	**97842.9**	**100%**	**World**	**127805.0**	**100%**
USA	99304.9	27%	Hong Kong	37106.3	38%	Hong Kong	59256.2	46%
Hong Kong	75652.6	20%	USA	10732.7	11%	USA	8117.2	6%
The Netherlands	24224.9	6%	Rep. of Korea	9347.1	10%	Rep. of Korea	7072.6	6%
Japan	24146.3	6%	Japan	6288.1	6%	Japan	6510.5	5%
Rep. of Korea	14511.0	4%	Mexico	2600.5	3%	Singapore	5114.0	4%
Germany	14040.7	4%	Brazil	2480.5	3%	The Nether-lands	5068.6	4%
UK	8822.2	2%	Thailand	2347.1	2%	Germany	4282.4	3%
India	6560.1	2%	India	2083.9	2%	Malaysia	3002.2	2%
Singapore	6093.3	2%	Hungary	1920.9	2%	India	1642.2	1%
Australia	5977.2	2%	Viet Nam	1751.0	2%	Viet Nam	1321.1	1%

Source: UNCOMTRADE, EXIM Bank Analysis

Table 16: Top Sources for Import of Electronics by China (Value in US$ mn; 2012)

Final Goods	Value	Share %	Subassembly products	Value	Share %	Component	Value	Share %
World	**80371.5**	**100%**	**World**	**74031.5**	**100%**	**World**	**261921.4**	**100%**
Thailand	8865.6	11%	Rep. of Korea	13334.6	18%	Rep. of Korea	47678.8	18%
Japan	7192.6	9%	Japan	6492.9	9%	Malaysia	30741.8	12%
USA	6602.8	8%	Thailand	2877.1	4%	Japan	28526.9	11%
Rep. of Korea	5548.8	7%	Philippines	2755.0	4%	USA	8812.1	3%
Malaysia	4743.4	6%	USA	2003.0	3%	Philippines	7260.3	3%
Germany	4668.4	6%	Germany	1737.8	2%	Singapore	6367.6	2%
Philippines	4276.4	5%	Malaysia	1301.8	2%	Costa Rica	5129.1	2%
Viet Nam	2292.9	3%	Singapore	1005.6	1%	Germany	4198.6	2%
Singapore	2220.8	3%	Viet Nam	876.4	1%	Thailand	3914.5	1%
UK	778.1	1%	Hong Kong	821.7	1%	Viet Nam	3383.7	1%

Source: UNCOMTRADE, EXIM Bank Analysis

FOREIGN DIRECT INVESTMENT

Inward FDI

Import-substituting and export-driven foreign direct investment played an important role in China's electronics industry. While the former was largely a result of the sheer potential of China's market, the latter was ensured through regulations such as setting of export ratios for FDI (Zhongxiu Zhao et al, 2007)[38]. The mandatory export ratio was usually 70 percent for export-oriented FDI.

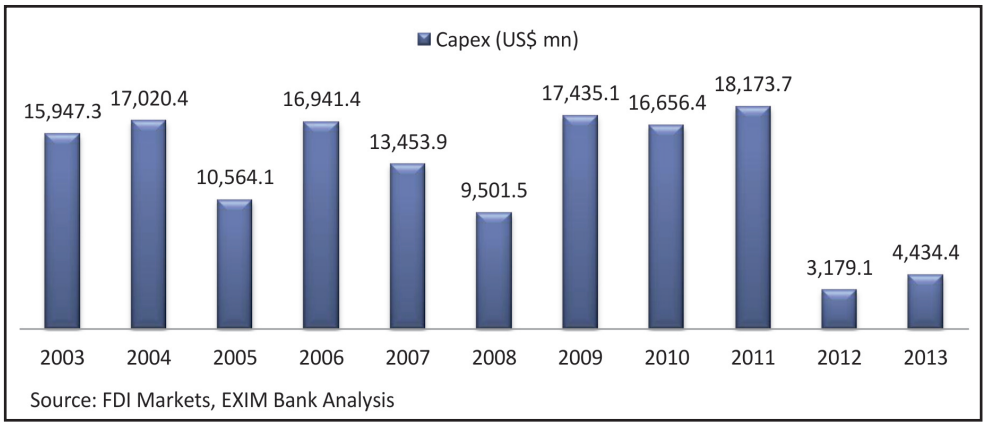
According to G Long (2005), China's FDI policies with regard to exports can be categorized into: compulsory, neutral and voluntary. Compulsory policies required that "FDI shall be able to keep a balance of exchanges, or make sure the proportion of their domestically made products in the total number of products reach a certain benchmark, or a certain percentage of their products must be exported." Interested foreign investors had to meet this condition before receiving approval for investing in the country. However, after China's membership in the WTO, most of the compulsory requirements were eliminated in order to satisfy the TRIMs agreement. Neutral policies were aimed at creating favourable scenario for exports to compete internationally. Tariff and VAT exemptions were provided on input imports for re-exports. Voluntary policies of the government included incentives like 50 percent cut in corporate income tax for enterprises with 70 percent of export products[39].

In 2012, FDI in China's electronics industry had reduced significantly to US$ 3179.1 million, the lowest level achieved since 2003 (Exhibit 32). According to Global Investment Trends Monitor, UNCTAD, FDI flows to China as a whole witnessed a strong downward pressure in 2012 on account of rising production costs and weakening export markets. Although, capital investments surged to US$ 4,434.4 million in 2013, it still remained lower than the pre-2012 period (Exhibit 31).

The United States was the largest source country for capital investments in China in terms of number of projects during January 2003 to March 2014, accounting for 33 percent of all FDI projects in the electronics industry of the country, followed by Japan (18 percent), Taiwan (12 percent), Germany (6 percent) and the UK (4 percent) (Table 17). Domestic market growth potential and proximity to

[38]Zhongxiu Zhao et. al. (2007), China's Industrial Policy in Relation to Electronics Manufacturing.
[39]Guoqiang Long (2005), China's Policies on FDI: Review and Evaulation.

Exhibit 31: Foreign Direct Investment in China's Electronics Industry



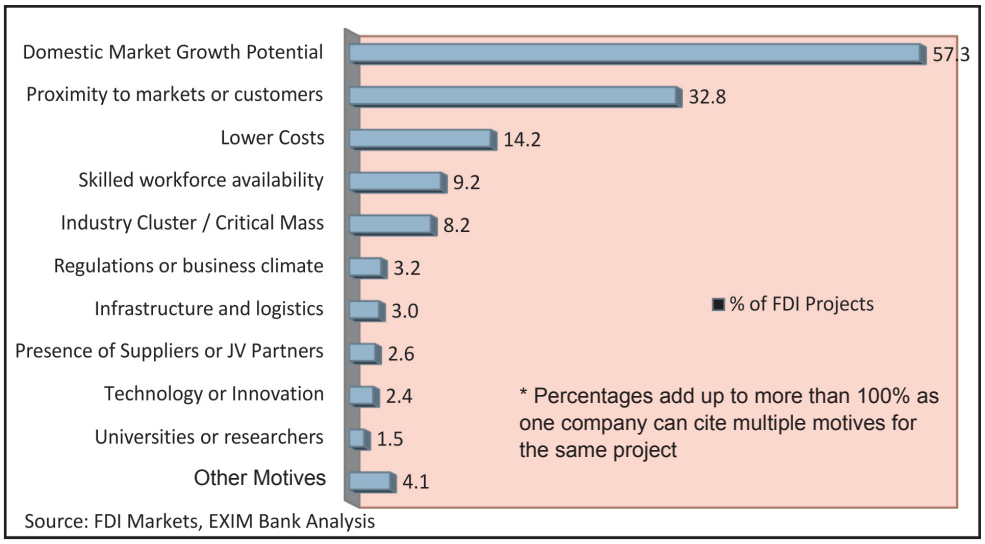
markets or customers have been cited as the major motives for investment by companies investing in China's electronics industry, indicative of market seeking investment motive. Citing of domestic market growth potential has been especially higher than the average in the case of projects by the US-based investing companies. Lower costs have also been cited as a major motive in 14.2 percent of FDI projects, largely by investing companies of the United States and Japan (Exhibit 32). However, China's labour cost has been increasing and the relevance of this criterion is limited under the present scenario.

Table 17: Top Countries Investing in China's Electronics Industry (Jan 2003-March 2014)

Source country	No. of projects	Share %
The United States	717	33%
Japan	389	18%
Taiwan	269	12%
Germany	133	6%
The UK	94	4%
South Korea	89	4%
Switzerland	63	3%
France	52	2%
Sweden	42	2%
Hong Kong	40	2%
Total	**2,202**	**100%**

Source: FDI Markets, EXIM Bank Analysis

Exhibit 32: Major FDI Motives Cited by Companies Investing in China's Electronics Industry (January '03 - March '14)



Hon Hai Precision Industry, a Taiwan based company is the top investing company in China's electronics industry, with 40 of its 83 global projects in China. The latest project by the company in China was in October 2013 in the electronics component category. The top ten investing companies account for 10.4 percent of all FDI projects in China's electronics industry during Jan 2003 – Mar 2014 period (Table 18).

Outward FDI

FDI outflows from China in the electronics industry during the first half of 2000s was low, but has increased substantially in the recent past. In 2012, capital investments made by Chinese companies in the overseas electronics industry were US$ 2563 million. This came down to a lower, yet sizeable level of US$ 1928.8 million in 2013 (Exhibit 33). China's outward FDI flows with reference to electronics industry have largely been in the Asia Pacific region, which accounted for 42.7 percent of the country's capital investments in overseas electronic industries during Jan 2003 - Mar 2014.

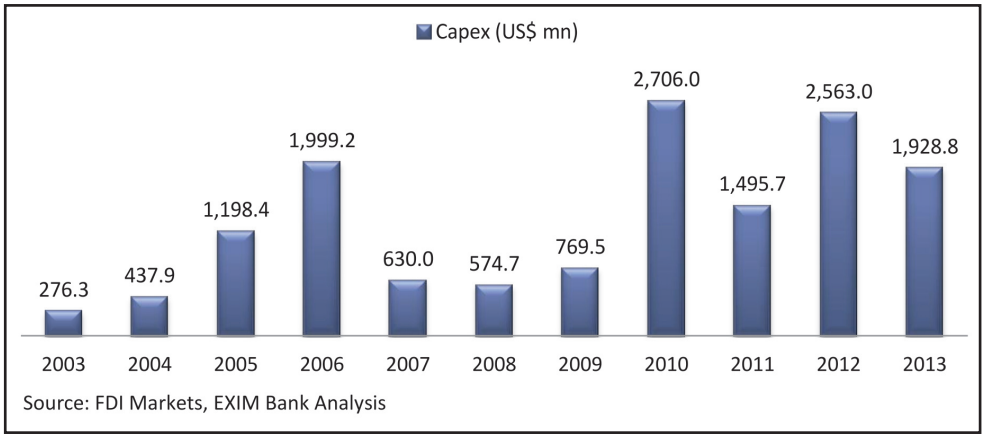
India was the largest recipient of capital investments in the electronics industry from China, accounting for 15.0 percent of total value of outward FDI projects from China in the electronics industry during January

Table 18: Top Ten Companies Investing in China's Electronics Industry (Jan 2003-Mar 2014)

Company Name	Source country	No of projects	Global projects	% of global projects
Hon Hai Precision Industry	Taiwan	40	83	48.1
Siemens	Germany	30	400	7.5
Samsung	South Korea	27	340	7.9
Intel	United States	26	164	15.8
Panasonic (Matsushita)	Japan	21	165	12.7
General Electric (GE)	United States	20	481	4.1
Hitachi	Japan	18	203	8.8
Hewlett-Packard (HP)	United States	17	304	5.5
Nokia	Finland	16	179	8.9
Royal Philips Electronics	Netherlands	15	131	11.4

Source: FDI Markets, Exim Bank Analysis

Exhibit 33: FDI Outflows from China in Electronics Industry



2003 to March 2014, followed by Bulgaria (8.4 percent), Malaysia (7.1 percent), Singapore (6.7 percent) and Turkey (6.0 percent) (Table 19).

Market seeking investments were the topmost motives cited by Chinese companies while investing in the electronics industry overseas. Regulations or business climate, infrastructure and logistics, and investment promotion authority or government support also appeared as important motives for FDI projects, indicative of the importance of government's role in the destination countries. Regulation or business climate was a prominent motive for Chinese companies investing in the electronics industry in Singapore.

Foreign Direct Investment can be of two types - horizontal or vertical. While in the horizontal FDI, a foreign firm produces the same type of commodity as produced by it at home; in vertical FDI, production process is fragmented and intermediate products produced in the country go for further processing at a different location. Alon et al. (2012) in a recent article have supported the theory that China's investment abroad is largely horizontal in nature and designed to serve the Chinese local market (import platform investment)[40].

Table 19: Top Destinations for China's FDI Projects in Electronics Industry (Jan 2003-March 2014)

Destination Country	Capital Investment* (US$ mn)	Share %
India	2,294.9	15.0%
Bulgaria	1,286.4	8.4%
Malaysia	1,079.8	7.1%
Singapore	1,015.8	6.7%
Turkey	908.9	6.0%
United States	805.5	5.3%
UK	531.5	3.5%
Romania	531.0	3.5%
Australia	427.6	2.8%
Japan	394.5	2.6%
Total	**15,271.1**	**100.0%**

*This data may not match with the DIPP data on FDI inflows into India. The primary reason would be that many such investments are routed through tax haven economies e.g. Mauritius.
Source: FDI Markets, EXIM Bank Analysis

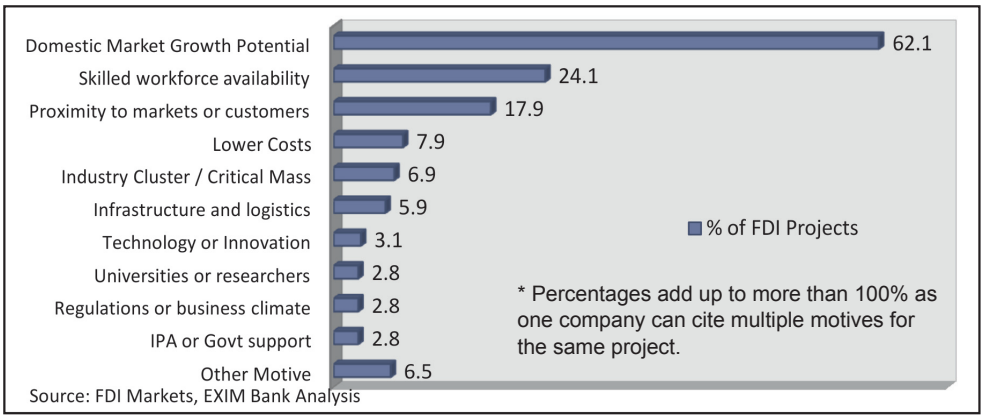
[40]Alon et al (2012), Macroeconomic Prospects for China's Outward FDI.

4. NEUTRALIZING INDIA'S TRADE DEFICIT

ATTRACTING MARKET SEEKING INVESTMENT

Dunning (1993) provides four different motivations for outward FDI from a country: a) market seeking investment for accessing new markets, b) resource seeking investment for specific resources found in the foreign territories, c) strategic asset seeking investment for expanding the set of firm's proprietary resources, and d) efficiency seeking investment with a view to reduce cost. During January 2003 and March 2014, 62.1 percent of all companies citing reasons for investment in Indian electronics sector cited domestic market growth potential as a motive, making market seeking as the major reason for investment in the electronics category. Proximity to markets or customers was also cited as a reason by 17.9 percent of investors, strengthening the argument of market seeking investment in India. Apart from this, resource seeking investment is a major determinant, with 24.1 percent of companies stating skilled workforce

Exhibit 34: Major FDI Motives Cited by Companies Investing in Indian Electronics Projects (January '03 - March '14)



Source: FDI Markets, EXIM Bank Analysis

availability as a motive. Efficiency seeking investment also emerges as a motive, as 7.9 percent of investors also cited lower costs as a determinant (Exhibit 34).

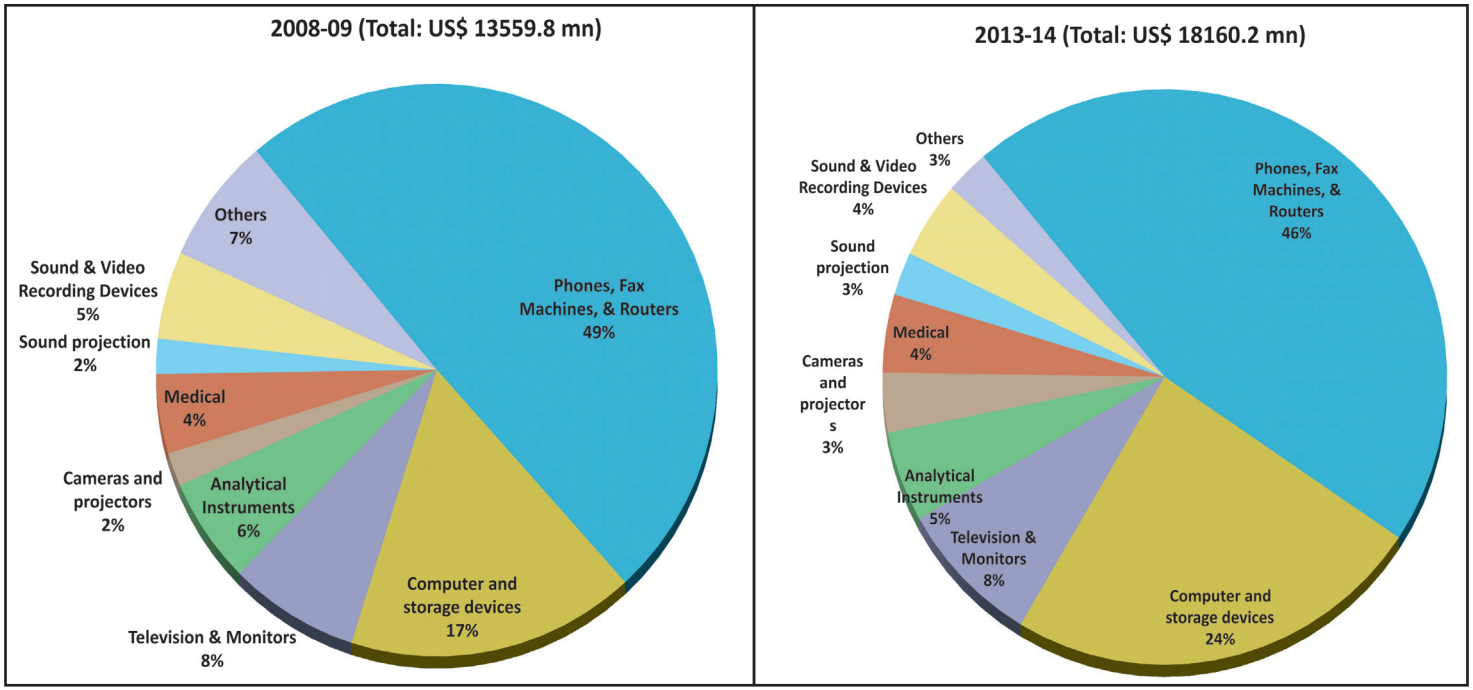
Since market seeking investment emerges as a major motive for FDI inflows in the electronics category of India, it will be useful to analyze the import pattern and find areas where India can look forward to attract FDI from the world. Since nearly 63 percent of India's trade deficit is in the final electronic goods category, the present analysis is restricted to only final electronics goods import. Product categories at HS- 6 digit level have been identified where imports are significant (greater than US$ 10 million) and have been witnessing strong growth rates (greater than 5 percent). FDI in these segments can be attracted.

Communication Equipment

Phones, fax machines and routers is the largest sub-category of import in India, accounting for 46 percent of total final electronics goods import by India in 2013-14 (Exhibit 35). During January 2003 to March 2014, communications equipment sub-sector accounted for 20 percent of all FDI projects in the electronics industry of India. Market seeking investment was largely responsible for the inflows as 72.1 percent of companies attributed domestic market growth potential as a major reason, as against 62.1 percent of industry-wide companies (Exhibit 36 and 34). Project volume had peaked in 2006 with 38 FDI projects coming into this segment, with total capital expenditure of US$ 1,415.1 million in the year. Significant inflows in this segment can be attributed to the telecom sector in India which has grown by leaps and bounds. The consumer base has increased considerably over the years. Telecom connections (wire-line and wireless) increased from 429.72 min 2008-09 to 898.02 mn in 2012-13[41]. There still lies immense potential for the communication electronics in India, as there is scope for telecom penetration in the rural areas. Increasing electrification will lead to spread of telecom in the rural areas. The significance of growing telecom sector in India has been acknowledged worldwide and massive FDI has flown into the category, making it one of the top FDI recipients in India[42]. On account of positive outlook for growth in telecommunications, further investment in the category can be attracted.

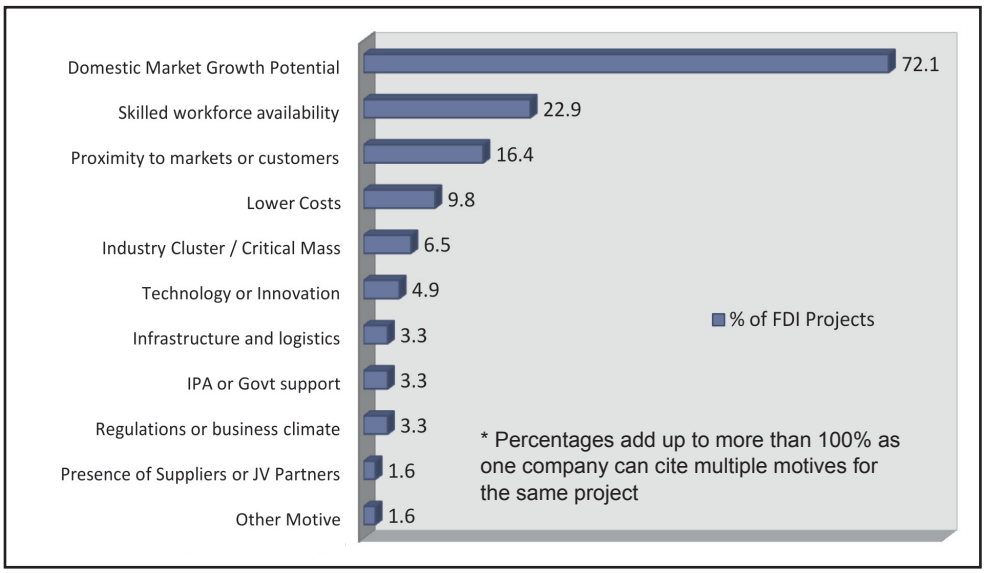
[41]Telecom Regulatory Authority of India
[42]DIPP

Exhibit 35: Share of Segments in India's Imports of Final Electronic Goods



Source: DGCI&S, EXIM Bank Analysis

Exhibit 36: Major FDI Motives Cited by Companies Investing in Indian Communication Equipments Industry (January 2003 - March 2014)



Source: FDI Markets, EXIM Bank Analysis

Although phones, fax machines and routers are the largest category of import by India, its share has declined from 49 percent in 2008-09 to 46 percent in 2013-14 in the total final electronics goods imports by India (Exhibit 35). Imports witnessed a CAGR of 4.3 percent during the period 2008-09 to 2013-14. Threshold CAGR and imports assumed for the purpose of current analysis has been witnessed only in the category of telephones for cellular networks mobile telephones or for other wireless (HS code: 851712) (Table 20).

Computer and Peripheral Equipment

Computers and storage devices sub-category's share has increased from 17 percent in 2008-09 to 24 percent in 2013-14 in the total final electronics products imports (Exhibit 35). It is also the second largest category of imports under the final electronics category by India. The USA and Japan are major source countries for FDI inflows into this category, accounting for 36 percent and 22 percent of FDI projects in the period Jan 2003- March

Table 20: Import of Phones, Fax Machines and Routers by India (Value in US$ mn)

HS Code	Description	2008-09	2013-14	CAGR %
851711	Line telephone sets with cordless handsets	39.1	40.5	0.7
851712	**Telephones for cellular networks mobile telephones or for other wireless**	**3718.8**	**5926.6**	**9.8**
851718	Telephone sets excluding line telephone sets with cordless handsets	35.6	39.9	2.3
851761	Base stations of apparatus for the transmission or reception of voice	471.2	52.3	-35.6
851762	Machines for the reception, conversion and transmission or regeneration	1642.6	1445.7	-2.5
851769	Apparatus for the transmission or reception of voice, images or other data	792.6	767.4	-0.6
Total		**6699.8**	**8272.4**	**4.3**
Note: Categories in bold are those where market seeking investment can be attracted (Value of Imports greater than US$ 10 million and CAGR greater than 5%)				

Source: DGCI&S, EXIM Bank Analysis

2014, respectively. Although market seeking is cited as a major investment motive in this category as well (57.7 percent), FDI in this area seems to be also driven significantly by efficiency seeking motives. In comparison to the industry wide average, motive of domestic market growth potential has been stated by fewer players in this sub-category. Efficiency seeking motives are more pronounced in this category as 19.2 percent of companies have attributed lower costs as a motive, as compared to the industry-wide average of 7.9 percent (Exhibit 37). Cost of production in China has risen significantly from 2006 onwards and the gap between the cost of production in China and India has widened (Exhibit 38). Hence, there is scope for attracting investments on account of efficiency seeking motives from China.

India's imports of computer and storage devices witnessed a significant upsurge with imports witnessing a CAGR of 14.2 percent during 2008-09 and 2013-14. Portable digital computers <10kg (HS code: 847130) was the largest item of import within this category from India, and was also the one to have recorded the highest CAGR of 27.4 percent during the five year period. Three products at HS-6 digit level have been identified where investment can be attracted on account of market seeking motives (Table 21).

Exhibit 37: Major FDI Motives Cited by Companies Investing in Indian Computer and Peripheral Equipments Industry (January 2003 - March 2014)

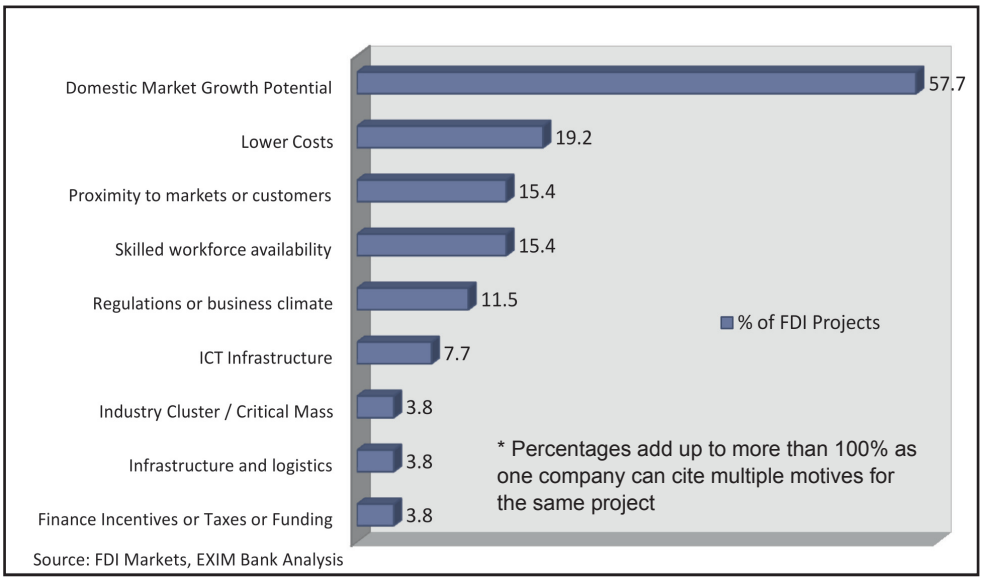
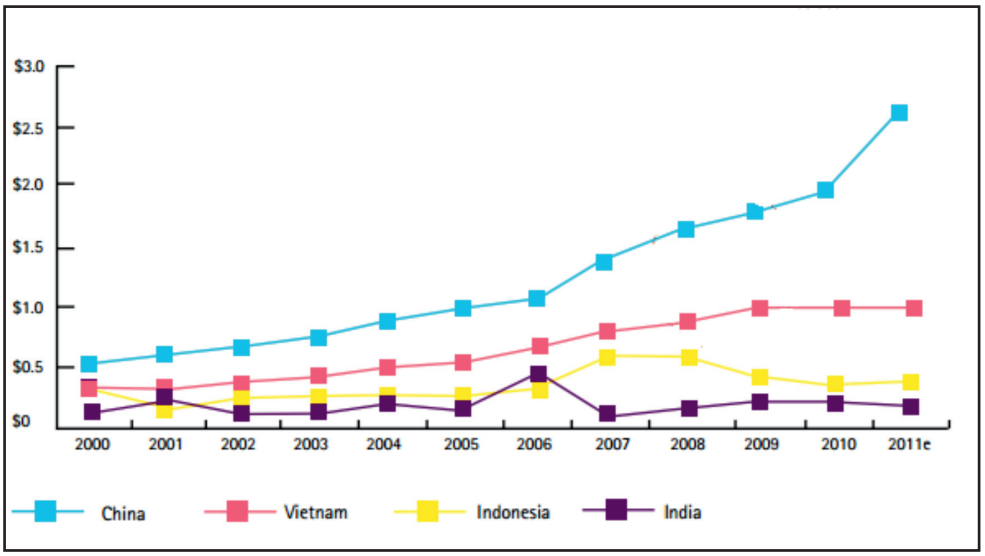


Exhibit 38: Average Hourly Wages Across Countries (in US$ per hour)



Source: Accenture

Table 21: Import of Computer and Storage Devices by India (Value in US$ mn)

HS Codes	Description	2008-09	2013-14	CAGR %
847130	**Portable digital computers <10kg**	**686.51**	**2301.98**	**27.4**
847141	Non-portable digital edp machines with processor & i/o	78.75	67.15	-3.1
847149	Digital data processing systems, nes	87.31	62.57	-6.4
847150	**Digital processing units not sold as complete systems**	**414.62**	**775.67**	**13.3**
847160	**Computer input/outputs, with/without storage**	**108.31**	**164.43**	**8.7**
847170	Computer data storage units	733.03	858.01	3.2
847180	Units of automatic data processing equipment nes	71.29	79.44	2.2
847190	Automatic data processing equipment nes	73.31	63.49	-2.8
Total		**2253.13**	**4372.74**	**14.2**
Note: Categories in bold are those where market seeking investment can be attracted (Value of Imports greater than US$ 10 million and CAGR greater than 5%)				

Source: DGCI&S, EXIM Bank Analysis

Television and Monitors

India also imports large value of products in the television and monitors category. The share of this category in India's final electronics imports remained the same at 8 percent in both 2008-09 and 2013-14 (Exhibit 35). With 146 million television households in 2011, India was the third largest television market after the the U.S. and China[43]. The subscriber base for the television industry has been growing rapidly with growing per capita income and increasing television penetration. As on 30th June 2013, reported registered DTH subscribers of 6 private service providers amounted to 58.89 million, a robust 21.5 percent y-o-y increase[44]. Television penetration is expected to increase further over the years. Digitization of cable television is likely to improve profitability of players in the category. These factors are expected to further boost the demand in this category.

Import of television and monitors registered a healthy CAGR of 8.1 percent during the period 2008-09

[43]IBEF
[44]TRAI

to 2013-14, with maximum CAGR being witnessed in monitors, not incorporating television reception apparatus (HS code: 852859) of 25.4 percent. Reception apparatus for television, color (HS code: 852872) was the largest category of import by India under this category and also witnessed robust growth over the period under consideration. Four products at HS-6 digit level have been identified where investment can be attracted on account of market seeking motives (Table 22).

Analytical Instruments

Share of analytical instruments in India's total final electronics imports declined from 6 percent in 2008-09 to 5 percent in 2013-14 (Exhibit 35). Imports registered a CAGR of 2.7 percent during the same period. Government and academia are important buyers in this category. Government provides ample incentives for import of such instruments. Research institutions and public funded research institutions in

Table 22: Import of Television and Monitors by India (Value in US$ mn)

HS Codes	Description	2008-09	2013-14	CAGR %
852841	Cathode-ray tube monitors of a kind solely or principally used in an automatic data-processing machine of heading 8471	31.49	3.06	-37.3
852849	Cathode-ray tube monitors, not incorporating television reception apparatus	9.24	4.58	-13.1
852851	Monitors of a kind solely or principally used in an automatic data-processing system	444.13	395.19	-2.3
852859	**Monitors, not incorporating television reception apparatus excluding with**	**18.62**	**57.68**	**25.4**
852871	**Reception apparatus for television, whether or not incorporating radio**	**244.79**	**464.04**	**13.6**
852872	**Reception apparatus for television, colour, whether or not incorporating radio**	**252.55**	**542.31**	**16.5**
852873	**Reception apparatus for television, black and white or other monochrome**	**14.27**	**32.58**	**18.0**
Total		**1015.09**	**1499.44**	**8.1**
Note: Categories in bold are those where market seeking investment can be attracted (Value of Imports greater than US$ 10 million and CAGR greater than 5%)				

Source: DGCI&S, EXIM Bank Analysis

India get concessional basic customs duty rate at 5 percent and full exemption from additional customs duty on import of scientific and technical equipment, apparatus and equipments. They also get exemption from excise duty on purchase of such goods. R&D project undertaken by any company having an in-house R&D unit recognized by the Department of Scientific and Industrial Research, Government of India, are provided with an exemption from basic and additional customs duty for import of equipments and instruments.

Microscopes other than optical microscopes and diffraction apparatus (HS code: 901210) includes products like electron microscope which is widely used in areas like biology and life sciences. For this product, India has considerable import appetite and its imports have witnessed a fairly decent CAGR of 5.4 percent during the period under consideration. Import demand for instruments & apparatus, specially designed for telecommunications n.e.s (HS: 903040) stood at US$ 103.07 million in 2013-14, recording a healthy CAGR of 18.0 percent. This is also an important segment where investment can be attracted. Eight products having significant and growing demand have been identified (Table 23).

Camera and Projector

Camera and projector industry in India has witnessed stupendous CAGR of 18.6 percent over the period 2008-09 to 2013-14. Share of cameras and projectors imports in total final electronics import from India has also increased from 2 percent in 2008-09 to 3 percent in 2013-14 (Exhibit 35). All categories within this industry witnessed high CAGRs over the period, and are prospective areas where investment can be attracted. Projectors, of a kind solely or principally used in an automatic data processing system of heading 8471 (HS code: 852861) witnessed the maximum CAGR of 69.0 percent in this period (Table 24).

Medical Devices

India is the fourth largest medical device market in Asia with more than 700 medical device makers, and currently ranks among the world's top 20 medical device makers[45]. The domestic industry in India is still at a nascent stage and the country is largely import dependent. Market seeking investment motive has been cited as a major reason for companies investing in the Indian medical

[45] Indian Semiconductor Association

Table 23: Import of Analytical Instruments by India (Value in US$ mn)

HS Codes	Description	2008-09	2013-14	CAGR %
854310	Electrical particle accelerators for electrons, protons, etc. excluding i	2.99	3.99	5.9
854320	**Signal generators**	**17.16**	**23.16**	**6.2**
854330	Machines & apparatus for electroplating, electrolysis or electrophoresis	59.09	33.75	-10.6
854370	Electrical machines and apparatus, having individual functions, nes	352.33	326.62	-1.5
901210	**Microscopes other than optical microscopes and diffraction apparatus**	**29.82**	**38.87**	**5.4**
901420	Instruments & appl for aeronautical/space navigation (other than compasses)	2.51	9.11	29.4
901480	Navigational instruments and appliances nes	1.07	0.67	-8.9
901580	Surveying, hydrographic, oceanographic, meteorologic/geophysical instruments nes	92.05	98.99	1.5
901600	Balances of a sensitivity of 5 cg or better with or without weights	5.21	4.45	-3.1
901720	Drawing, marking-out or mathematical calculating instruments, nes	0.7	0.23	-20.0
902519	Thermometers, not combined with other instruments, nes	1.04	3.77	29.4
903010	**Instruments & apparatus for measuring or detecting ionising radiations**	**5.17**	**15.71**	**24.9**
903020	Cathode-ray oscilloscopes and cathoderay oscillographs	15.2	19.34	4.9
903031	Multimeters	3.57	5.7	9.8
903032	Multimeters with recording device	0.65	1.24	13.8
903033	**Instruments and apparatus for measuring or checking voltage, current**	**23.21**	**41.65**	**12.4**
903039	Instruments and Apparatus, for measuring or checking voltage, current, etc without a record dev	14.81	10.31	-7.0
903040	**Instruments & apparatus, specially designed for telecommunications nes**	**45.04**	**103.07**	**18.0**
903082	Instruments for checking semiconductor wafers	3.99	4.82	3.9
903084	Instruments and appliances for measuring or checking electrical quanti	6.84	3.6	-12.0
903089	**Instruments & apparatus for measuring or checking electrical quantities nes**	**49.7**	**77.99**	**9.4**
903210	**Thermostats**	**11.33**	**21.7**	**13.9**
903220	Manostats	4.29	4.56	1.2
903281	**Hydraulic or pneumatic automatic regulating or controlling instruments & app**	**3.9**	**18.85**	**37.0**
903289	Automatic regulating or controlling instruments and apparatus, nes	58.69	55.77	-1.0
Total		**810.36**	**927.92**	**2.7**

Note: Categories in bold are those where market seeking investment can be attracted (Value of Imports greater than US$ 10 million and CAGR greater than 5%)

Source: DGCI&S, EXIM Bank Analysis

Table 24: Import of Cameras and Projectors by India (Value in US$ mn)

HS Codes	Description	2008-09	2013-14	CAGR %
852580	**Television cameras, digital cameras and video camera recorders**	**209.17**	**511.99**	**19.6**
852861	**Projectors of a kind solely or principally used in an automatic data-processing system**	**2.4**	**33.1**	**69.0**
852869	**Projectors, not incorporating television reception apparatus**	**46.93**	**61.4**	**5.5**
Total		**258.5**	**606.49**	**18.6**
Note: Categories in bold are those where market seeking investment can be attracted (Value of Imports greater than US$ 10 million in 2013-14 and CAGR greater than 5%)				

Source: DGCI&S, EXIM Bank Analysis

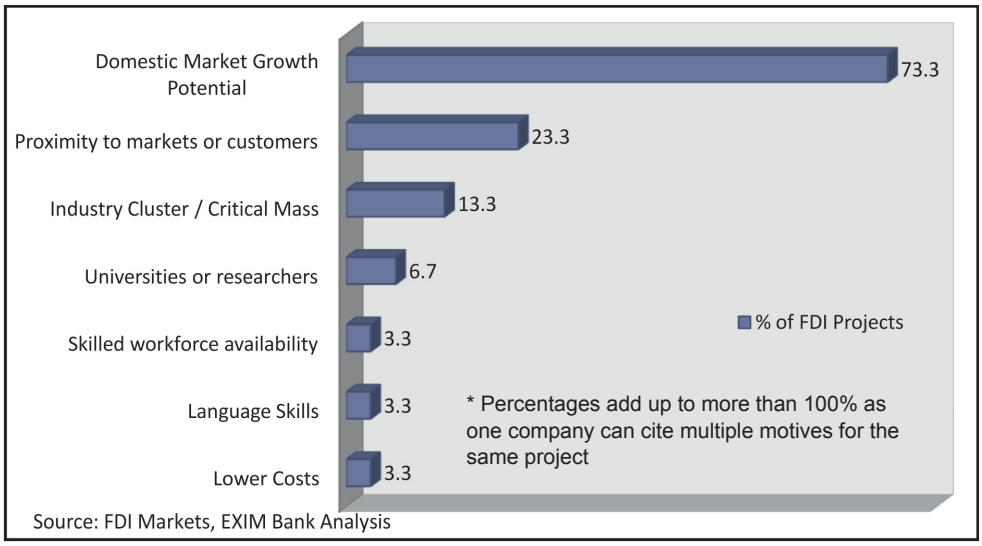
devices category, with 73.3 percent of companies citing it as a motive for investment. A reasonable percentage (6.7 percent) of companies also cited universities or researchers as a reason for investment (Exhibit 39). The United States, Germany and the UK were major investors in this category over the period January 2003 to March 2014. China had only one project out of 83 FDI projects recorded over this period in the Indian medical device category, that too not within the last five years.

Import of medical devices by India witnessed a CAGR of 5.6 percent over the period 2008-09 to 2013-14. Parts & accessories for apparatus based on the use of X-rays or other radiations (HS: 902290) was the most important segment within this category where investment can be attracted. India imported US$ 146.1 mn worth of these products in 2013-14, and their imports have registered a CAGR of 6.6 percent. Other than this, seven other products have also been identified (Table 25).

IDENTIFYING TRADE COMPLEMENTARITIES BETWEEN INDIA AND CHINA

India has substantial trade deficit with China in the electronics segment. However, Chinese products are not necessarily more competitive than those supplied by Indian players. Empirical findings in a recent study by RIS have found India's imports from China to be uncompetitive in the

Exhibit 39: Major FDI Motives Cited by Companies Investing in Indian Medical Devices Segment (January 2003 - March 2014)



Vinerian sense, i.e. on the basis of comparative cost advantage. Nearly 16.2 percent of the total imports from China in 2012 in the Machinery and Mechanical Appliances segment have been found to be uncompetitive in the study[46].

The purpose of analysing trade complementarities in the current section is twofold – identifying areas where China's imports are substantial, indicative of the demand for those products and suggesting strategies for developing domestic capabilities in those areas, and secondly, identifying areas where there is scope for attracting FDI from China on account of substantial demand by India, reflected in the ever increasing imports of those products.

Complementarities of India's Exports to China's Imports

China's import basket of final electronics products from India is preponderated by the medical devices sub-category, with four out of the top ten products being from this category. However, medical devices sub-category doesn't feature as starkly among the final electronics exports from India to the world (Table 26). Building more capacity in this

[46] Mohanty, S.K. (2014), India-China Bilateral Trade Relationship, Research and Information System for Developing Countries.

Table 25: Import of Medical Devices by India (Value in US$ mn)

HS Codes	Description	2008-09	2013-14	CAGR %
901811	Electro-cardiographs	5.4	3.57	-7.9
901812	Ultrasonic scanning apparatus	74.17	93.88	4.8
901813	**Magnetic resonance imaging apparatus**	**69.06**	**88.1**	**5.0**
901814	Scintigraphic apparatus	3.98	0.76	-28.2
901819	Electro-diagnostic apparatus, nes	127.04	107.24	-3.3
901820	Ultra-violet or infra-red ray apparatus	0.91	0.36	-16.9
901890	Instruments and appliances used in medical or veterinary sciences, nes	2.49	9.95	31.9
902140	**Hearing aids, excluding parts and accessories**	**18.79**	**49.24**	**21.2**
902150	Pacemakers for stimulating heart muscles, excluding parts & accessories	22.62	22.86	0.2
902212	**Computed tomography apparatus**	**54.71**	**83.46**	**8.8**
902213	X-rays apparatus, dental use, nes	1.34	2.51	13.4
902214	**X-rays apparatus, medical/surgical/veterinary use nes**	**35.25**	**70.33**	**14.8**
902219	**Apparatus based on the use of X-rays for other uses**	**29.69**	**38.37**	**5.3**
902221	**Apparatus basd on the use of alpha beta/ gamma radiations, for medical use**	**10.27**	**18.79**	**12.8**
902229	**Apparatus basd on the use of alpha beta/ gamma radiations, for other uses**	**11.67**	**24.87**	**16.3**
902230	X-ray tubes	33.87	37.87	2.3
902290	**Parts & accessories for apparatus based on the use of X-rays or other radiations**	**105.98**	**146.1**	**6.6**
Total		**607.24**	**798.26**	**5.6**

Note: Categories in bold are those where market seeking investment can be attracted (Value of Imports greater than US$ 10 million and CAGR greater than 5%)

Source: DGCI&S, EXIM Bank Analysis

sub-category and augmenting current exports can help establish even stronger complementarities in bilateral trade.

The development of healthcare and medical resources category in China is far behind the level of economic development achieved by the country[47].

Medical devices import into the country witnessed a CAGR of 21.4 percent during 2008-2012, largely as a result of imports of higher-end products. China's latest Five Year Plan (2011-15) has allocated US$ 41 billion to the development of new hospitals and upgrading of country's grassroots health services system, which is expected to generate more demand for products in this sub-category. India can reduce its trade deficit in the electronics category by tapping this opportunity.

Apart from this, phones, fax machines and routers is also a major category, with three out of the top ten products imported by China from India coming from this category. Phones, fax machines, and routers are also a major export commodity for India to the world. Even in the subassemblies segment, parts of telephone sets, telephones for cellular networks or for other data (HS: 851770) is the largest category of subassembly products' exports from India to the world, and the largest category of subassembly products' imports by China from India (Table 26). Greater complementarities can be established in the phones, fax machines and routers segment by further increment in the production and exports of these products.

In the subassemblies and components category, signals of complementarities are strong as the basket of imports of China from India and of exports of India to the world are similar to a large extent. In the components category, eight products feature both in the list of top ten electronic components imported by China from India and the list of top ten electronic components exported by India to the world. In subassembly products as well, complementarity is evident as nine products feature in both the lists (Table 26).

Photosensitive semiconductor devices, photovoltaic cells and light emitting devices (Hs code 854140) are an important export item for India, and although China does source a part of its import under this category from India, the amount is miniscule as compared to the country's total import from the

[47]Medtech Switzerland

rest of the world. China is aggressively pushing towards a green economy and has planned to set up 10GW of solar power in the period 2013-15 which assures further incentive to provide a boost to the category. India's own domestic requirements for such goods are expected to increase as a result of increasing focus of the government on the renewable energy category.

Complementarity of Chinese Exports to Indian Imports

Several products which rank high among products exported by China to the world also feature among the basket of major products imported by India from China. Especially in the subassembly category, the top three products exported by China

Table 26: Top Ten Electronic Products Exported by India to the World and Imported by China from India, 2012 (Value in US$ mn)

HS Code	HS Description	Value	HS Code	HS Description	Value
Components Products Imported by China from India			**Component Products Exported by India to World**		
853890	Parts for use with the apparatus of heading no. 85.35,85.36 or 85.37,nes	18.6	850440	Static converters, nes	390.8
850440	Static converters, nes	17.1	853890	Parts for use with the apparatus of heading no. 85.35,85.36 or 85.37,nes	308.6
853400	Printed circuits	5.7	853810	Boards, panels, etc for goods of heading no. 85.37,not equipped with their apparatus	164.1
853810	Boards, panels, etc for goods of heading no. 85.37,not equipped with their apparatus	4.4	850490	Parts of electrical transformers, static converters and inductors	155.1
850490	Parts of electrical transformers, static converters and inductors	3.9	853400	Printed circuits	130.2
854231	Electronic integrated circuits as processors and controllers, whether or not combined with memories	3.4	854140	Photosensitive semiconductor device, photovoltaic cells & light emit diodes	111.8
853210	Fixed capacitors designed for use in 50/60 Hz circuits (power capacitors)	2.4	850421	Liquid dielectric transformers having a power handling capacity </= 650 KVA	109.1
854140	Photosensitive semiconductor device, photovoltaic cells & light emit diodes	2.1	853225	Electrical capacitors, fixed, dielectric of paper or plastics, nes	48.5

850421	Liquid dielectric transformers having a power handling capacity </= 650 KVA	1.9	850422	Liquid dielectric transformer having a power handling cap >650 KVA but </= 10,000KVA	46.4
853225	Electrical capacitors, fixed, dielectric of paper or plastics, nes	1.7	853649	Electrical relays for a voltage exceeding 60 V but not exceeding 1,000 volts	43.7
Subassembly Products Imported by China from India			**Subassembly Products Exported by India to World**		
851770	Parts of telephone sets, telephones for cellular networks or for other data	77.1	851770	Parts of telephone sets, telephones for cellular networks or for other data	590.3
847340	Parts and accessories of other office machines, nes	25.4	903300	Parts & access nes for machines, appliances, instruments or apparatus of Chapter 90	220.6
847330	Parts & accessories of automatic data processing machines & units thereof	23.4	853710	Boards, panels, including numerical control panels, for a voltage <=1000 V	179.5
852990	Parts suitable for use solely/ principally with the apparatus of headings 85.25 to 85.28	11.3	847330	Parts & accessories of automatic data processing machines & units thereof	164.1
850110	Electric motors of an output not exceeding 37.5 W	8.7	847340	Parts and accessories of other office machines, nes	126.9
853710	Boards, panels, includg numerical control panels, for a voltage <=1000 V	3.5	850110	Electric motors of an output not exceeding 37.5 W	114.8
903300	Parts & access nes for machines, appliances, instruments or apparatus of Chapter 90	2.1	852990	Parts suitable for use solely/ principally with the apparatus of headings 85.25 to 85.28	111.3
854390	Parts of electrical machines & apparatus having individual functions, nes	0.8	853720	Boards, panels, including numerical control panels, for a voltage > 1,000 V	94.1
901590	Parts and accessories for use with the apparatus of heading No 90.15	0.7	854390	Parts of electrical machines & apparatus having individual functions, nes	84.8
851890	Parts of microphones, loudspeakers, headphones, earphones & electric sound amplifier	0.3	901590	Parts and accessories for use with the apparatus of heading No 90.15	35.5

Final Products Imported by China from India			Final Products Exported by India to World		
902214	X-rays apparatus, medical/surgical/veterinary use nes	30.8	851712	Telephones for cellular networks mobile telephones or for other wireless	2849.6
902230	X-ray tubes	18.7	852380	Gramophone records and other media for the recording of sound or of other phenomena, whether or not recorded	351.6
852380	Gramophone records and other media for the recording of sound or of other phenomena, whether or not recorded	5.4	852340	Optical media for the recording of sound or of other phenomena excluding products of chapter 37	194.3
847170	Computer data storage units	5.0	852871	Reception apparatus for television, whether or not incorporating radio	164.0
901890	Instruments and appliances used in medical or veterinary sciences, nes	4.8	852352	Cards incorporating one or more electronic integrated circuits smart cards	162.9
851769	Apparatus for the transmission or reception of voice, images or other data	4.2	851769	Apparatus for the transmission or reception of voice, images or other data	160.1
901812	Ultrasonic scanning apparatus	3.3	901890	Instruments and appliances used in medical or veterinary sciences, nes	142.4
847141	Non-portable digital edp machines with processor & i/o	2.7	847150	Digital processing units not sold as complete systems	127.1
851711	Line telephone sets with cordless handsets	2.3	902214	X-rays apparatus, medical/surgical/veterinary use nes	107.9
851762	Machines for the reception, conversion and transmission or regeneration	2.0	851762	Machines for the reception, conversion and transmission or regeneration	95.9

Source: UNCOMTRADE, EXIM Bank Analysis

to the world are also the top three products imported by India from China (Table 27).

Among India's final electronics imports from China, majority of the products come within the ambit of computers & storage devices; phones, fax machines & routers; and television and monitors. This import basket mirrors the development of telecom and information technology in India. These

categories of final electronics imports also constitute a significant portion of China's final electronic goods exports to the world.

Since it is evident that there exist strong complementarities between the trade baskets of India and China in the electronics industry, there is scope for attracting horizontal FDI, as well as development of domestic capabilities in products which have high import demand in China, and thereby neutralizing the trade deficit.

Table 27: Top Ten Electronics Products Exported by China to the World and Imported by India from China (2012)

Final Products Exported by China to World			Final Products Imported by India from China		
HS code	**HS Description**	**Value (US$ mn)**	**HS Code**	**HS Description**	**Value (US$ mn)**
847130	Portable digital computers <10kg	113784.3	851712	Telephones for cellular networks mobile telephones or for other wireless	3181.6
851712	Telephones for cellular networks mobile telephones or for other wireless	81453.7	847130	Portable digital computers <10kg	1678.5
851762	Machines for the reception, conversion and transmission or regeneration	26543.6	851762	Machines for the reception, conversion and transmission or regeneration	486.1
847170	Computer data storage units	18638.9	852851	Monitors of a kind solely or principally used in an automatic data-processing system	391.2
852580	Television cameras, digital cameras and video camera recorders	12737.6	847170	Computer data storage units	359.1
852872	Reception apparatus for television, color, whether or not incorporating	12108.6	852580	Television cameras, digital cameras and video camera recorders	315.1
847150	Digital processing units not sold as complete systems	11471.3	851769	Apparatus for the transmission or reception of voice, images or other data	290.1
854370	Electrical machines and apparatus, having individual functions, nes	7596.1	852871	Reception apparatus for television, whether or not incorporating radio	268.2

852190	Video recording or reproducing apparatus nes	6362.7	847150	Digital processing units not sold as complete systems	246.0
847160	Computer input/outputs, with/without storage	5962.1	852380	Gramophone records and other media for the recording of sound or of other phenomena, whether or not recorded	180.7
Subassembly Products Exported by China to World			**Subassembly Products Imported by India from China**		
851770	Parts of telephone sets, telephones for cellular networks or for other data	39594.3	851770	Parts of telephone sets, telephones for cellular networks or for other data	1815.4
847330	Parts & accessories of automatic data processing machines & units thereof	29622.4	847330	Parts & accessories of automatic data processing machines & units thereof	764.8
852990	Parts suitable for use solely/principally with the apparatus of headings 85.25 to 85.28	10398.3	852990	Parts suitable for use solely/principally with the apparatus of headings 85.25 to 85.28	435.7
853710	Boards, panels, including numerical control panels, for a voltage <=1000 V	3853.1	854390	Parts of electrical machines & apparatus having individual functions, nes	109.1
852290	Parts and accessories of apparatus of heading nos 85.19 to 85.21, nes	2699.8	850680	Primary cells & primary batteries nes	91.3
850110	Electric motors of an output not exceeding 37.5 W	2657.8	850110	Electric motors of an output not exceeding 37.5 W	70.4
901390	Parts and accessories of optical appliances and instruments, nes	1949.5	852910	Aerials & aerial reflectors of all kinds; parts suitable for use therewith	55.3
852910	Aerials &aerial reflectors of all kinds; parts suitable for use therewith	1475.9	903300	Parts & access nes for machines, appliances, instruments or apparatus of Chapter 90	44.0
851890	Parts of microphones, loudspeakers, headphones, earphones & electric sound amplifiers	972.3	853710	Boards, panels, including numerical control panels, for a voltage <=1000 V	42.2
853720	Boards, panels, including numerical control panels, for a voltage > 1,000 V	843.4	852290	Parts and accessories of apparatus of heading Nos 85.19 to 85.21, nes	34.7

Component Products Exported by China to World			Component Products Imported by India from China		
854231	Electronic integrated circuits as processors and controllers, whether or not combined with memories	27056.5	854140	Photosensitive semiconductor device, photovoltaic cells & light emit diodes	341.7
854140	Photosensitive semiconductor device, photovoltaic cells & light emit diodes	17483.2	850440	Static converters, nes	281.1
850440	Static converters, nes	15550.6	853400	Printed circuits	228.3
854232	Electronic integrated circuits as memories	14374.6	854231	Electronic integrated circuits as processors and controllers, whether or not combined with memories	178.5
853400	Printed circuits	13739.3	854239	Electronic integrated circuits excluding such as processors, controllers,	120.0
854239	Electronic integrated circuits excluding such as processors, controllers,	7507.6	853890	Parts for use with the apparatus of headingno. 85.35,85.36 or 85.37,nes	99.6
854233	Electronic integrated circuits as amplifiers	4495.6	850490	Parts of electrical transformers, static converters and inductors	98.3
853890	Parts for use with the apparatus of heading no. 85.35,85.36 or 85.37,nes	2958.5	853229	Electrical capacitors, fixed, nes	74.5
854129	Transistors, other than photosensitive transistors, nes	2541.8	854110	Diodes, other than photosensitive or light emitting diodes	70.6
850450	Inductors, electric	2369.4	854129	Transistors, other than photosensitive transistors, nes	65.9

Source: UNCOMTRADE, EXIM Bank Analysis

5. IDENTIFICATION OF AREAS FOR COOPERATION

TRADE SPECIALIZATION INDEX FOR CHINA AND INDIA

Trade specialization index is used to measure the degree of net exportation by a country in a particular commodity. It basically compares the net flow of goods with the total flow of goods, thereby removing bias due to re-export activities, if any. It thus helps in identification of real producers of a commodity and not merely traders. The range of TSI is (+)1 to (-)1, where (+)1 indicates complete specialization and (-)1 indicates no specialization. Algebraically, it can be written as-

$$TSI = \frac{X-M}{X+M}$$

Where, X= exports of the commodity by the country and M=imports of the commodity by the country.

At the six digit HS code level, India and China will have complementary trade structure if one is a real producer of the good, while the other is not.

Trade specialization index of India for electronic goods indicate that India is a real producer in only 10.4 percent of total electronic products, which is fairly low. On the other hand, China is a real producer of 60.9 percent of total electronic products traded by the country. India has relatively higher specialization in subassembly category with 22.8 percent of total subassembly products having positive TSI. In the final goods category, India's performance is below average with TSI being positive for only 6.6 percent of the products. On the other hand, China has greatest specialization in the final goods category, with 68.1 percent of goods in the final category having positive TSI (Table 28).

Identification of Electronic Sub-Sectors for Attracting FDI from China to India

At the six digit HS code level, three major points have been considered while identifying the products where India can attract investment from China:

Table 28: Share of Specialized Products in Each Category

Category	India	China
Components	12.1%	41.9%
Subassembly Products	22.8%	55.7%
Final Goods	6.6%	68.1%
All Electronic Products	**10.4%**	**60.9%**

Source: UNCOMTRADE, EXIM Bank Analysis

- China's outward investment in electronics sector has been increasing. As per the data from FDI Markets, outward FDI (capital investment) from China in the electronics industry increased from US$ 575 mn in 2008 to US$ 2,563 mn in 2012 before moderating to US$ 1,928.8 mn in 2013. Outward investment from China in the electronics industry accounted for 13.8 percent and 8.5 percent of the total outward investments from the country in 2012 and 2013, respectively. Quite a few of these investments are horizontal and were envisaged with the objective of serving the local Chinese market (import platform investment)[48]. Hence, an analysis of Chinese electronic imports becomes important.

- However, when it comes to investments into India in the electronics goods sector by Chinese firms, they have cited market seeking as the major reason for investment. This implies that India's import demand becomes a key parameter for the identification process.

- From the above two, a case can be made for identifying products where trade structures of India and China are complementary. If India's exports are complementary to China's imports, import platform investment can be attracted. If China's exports are complementary to India's imports, market seeking investment can be attracted.

The intersection of the three sets – a) where India and China have complementary trade pattern (i.e. where TSI for the product is at variance for India and China – positive for one and negative for the other and vice versa); b) where India has significant

[48]Alon, Molodtsova & Zhang (2012). Macroeconomic Prospects for China's outward FDI

Exhibit 40: Criteria for Identification of Electronic Sub-Sectors for Attracting FDI from China to India

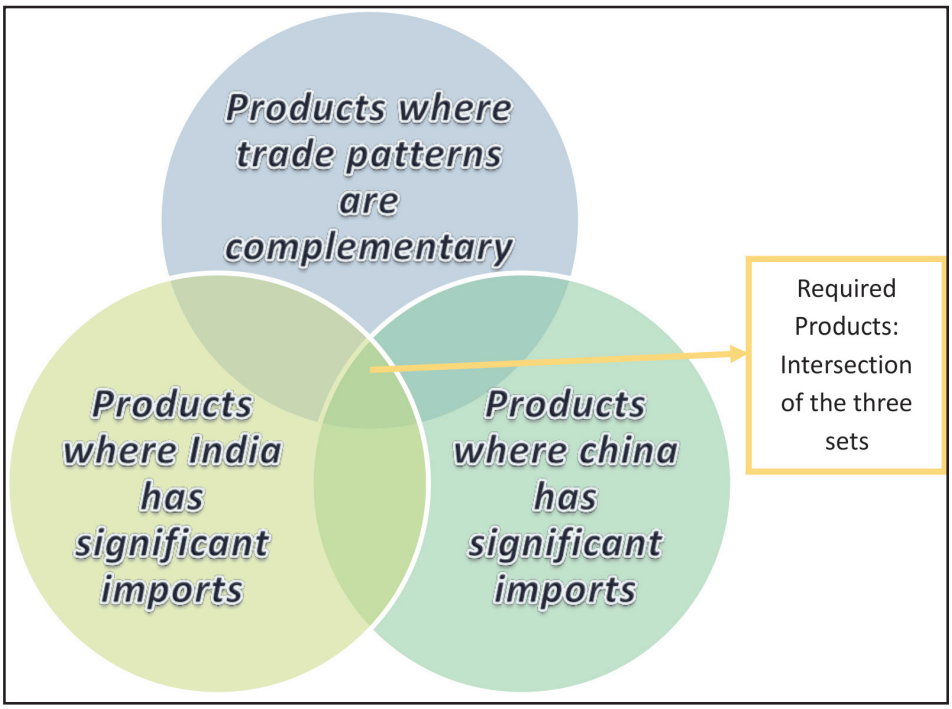
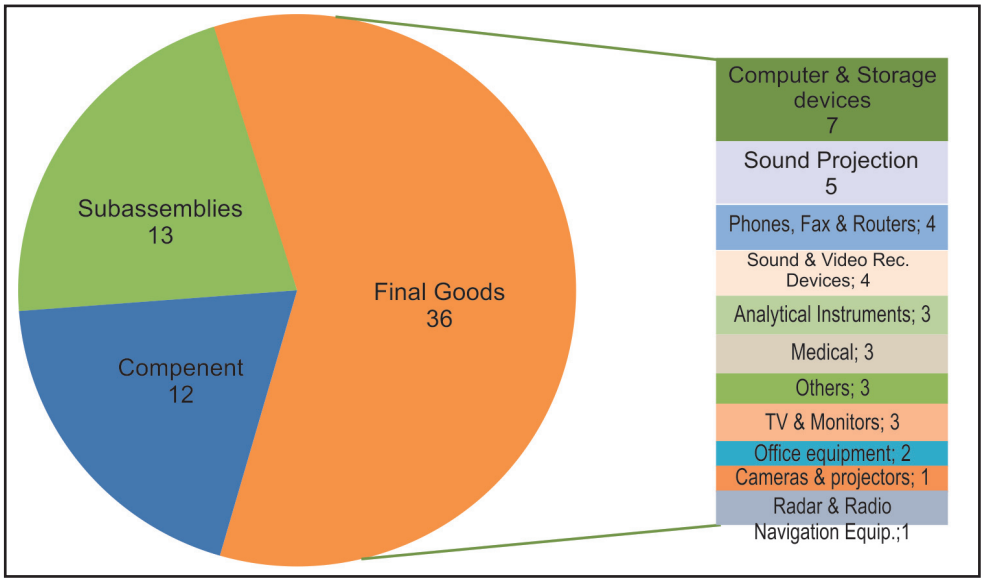


Exhibit 41: Electronic Segments Where Investment from China could be Attracted (Total: 61 Products)



Source: UNCOMTRADE, EXIM Bank Analysis

imports (minimum threshold level of US$ 10 million) and; c) where China's imports are above a threshold level (at least US$ 50 million) - is derived as the required set of electronic products where FDI could be attracted from China by India. Based on the above methodology, sixty one such products have been identified, accounting for 19.8 percent of China's total imports of electronic goods, and 69.7 percent of India's imports in total electronic goods in 2012 (Exhibit 41; Annexure 2). Most of these products are in the final electronic goods segment. Within the final goods segment, computer and storage devices is the most important sub-category where investment can be attracted.

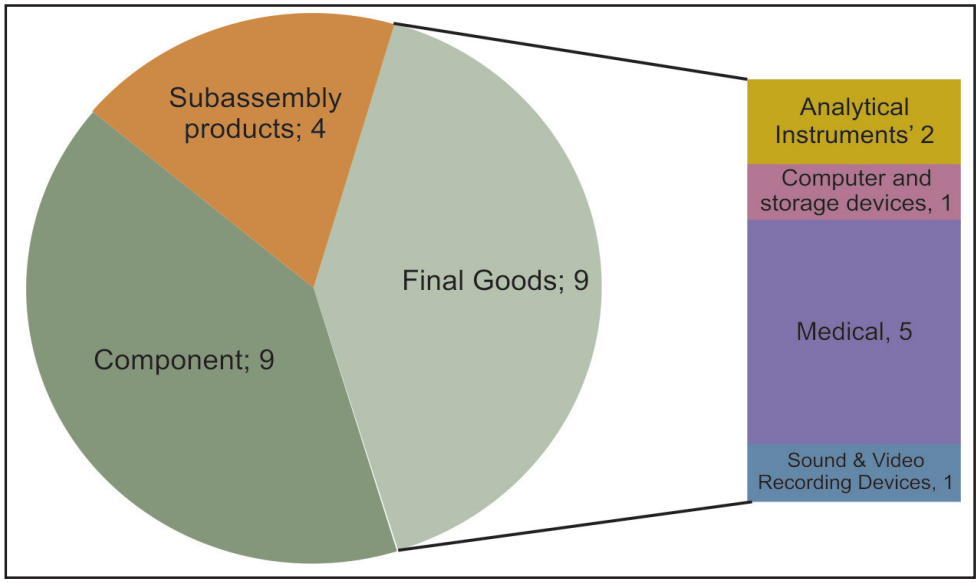
Identification of Electronic Product Categories for Enhancing Exports from India to China

India can also strive towards enhancing its export capabilities in identified electronic goods. These would include products where:

- China is not a real producer currently and has got significant import demand (>US$ 50 million). Whether China is a real producer can be verified through the TSI index. China will not be a real producer in all those goods where TSI is negative.

- India has got a certain minimum amount of exports (>US$ 10

Exhibit 42: Product Categories for Enhancing Exports from India to China



Source: UNCOMTRADE, EXIM Bank Research

million), indicative of some production capabilities available in the country.

Twenty two such products have been identified, largely from the segments of medical devices and components. These products together account for 50.4 percent of total imports by China. These products account for 15.9 percent of India's total electronics exports and 17.3 percent of India's total electronics imports (Exhibit 42, Annexure 3). Among these products, computer data storage units (HS: 847170), electronic integrated circuits as memories (HS: 854232) and electronic integrated circuits as processors and controllers (HS: 854231) are important categories of imports by China.

Identification of Sectors for Establishing India-China Joint Ventures in the Electronic Sector of India

Many objectives have been identified by researchers for setting up of joint ventures. The prominent ones are: reducing risks, achieving economies of scale, support technologies/ patents, block competitors, jump trade barriers, expand internationally and integrate vertically with a partner.

While looking for a potential JV partner, companies look into various aspects like financial security, resource and management capabilities, production performance, reputation, etc. Hence, JVs can be attracted successfully only in those sectors where Indian companies already have a critical mass and experience. For the purpose of identifying such potential sectors, performance analysis of Indian companies has been undertaken with net profit as an indicative parameter measuring their operating success.

List of companies engaged in electronic production was obtained from the Prowess database, and taking 2011-12 as the reference period, those companies were selected whose profit after tax was positive[49]. Table 29 gives the list of products which these companies produce/trade. These segments could offer potential opportunities for India-China joint ventures.

[49]The companies for which 2012-13 data was available were few. Hence, 2011-12 data has been considered for the present analysis.

Table 29: Main Product Groups Where JVs can be Formed

Medical equipment	Line printers
Analytical instruments	Control valves
Printed circuit boards	LED lamps
Uninterrupted power supplies	Other diodes & transistors
Control instrumentation & industrial electronics	Diodes & transistors
Therapy equipments	Level controllers
Microwave passive components	Industrial fans, blowers, etc.
Weighing system, load cell	Other automation electronics equipment
Filters	Crystals
Electro cardio graphics	Electronic lighters
Defence communication equipments	Computer systems
Strategic electronics equipments	Solar modules
Connectors	Instrument cooling fans
Surgical equipments	Industrial ultrasonic equipments
Piezo electric elements	Semiconductor devices
Other testing & measuring instruments	Integrated circuits
Thermal analysis equipments	Computer peripherals
Soft ferrites	Electronic components
VHF radio systems	Reed switches
Solar appliances	Switch mode power supply systems
Transmission equipments	Process controllers
Electronics	Integrated circuits, nec
Process control equipments	Ph analysis equipment and ph meters
Electronic buzzers	Television receivers, colour
Electrolytic capacitors	Telephone components
Temperature controllers	Computer terminals
Antennae for radios & TVs	Communication & broadcasting equipments
Rotary switches	Television receivers
Control panels	

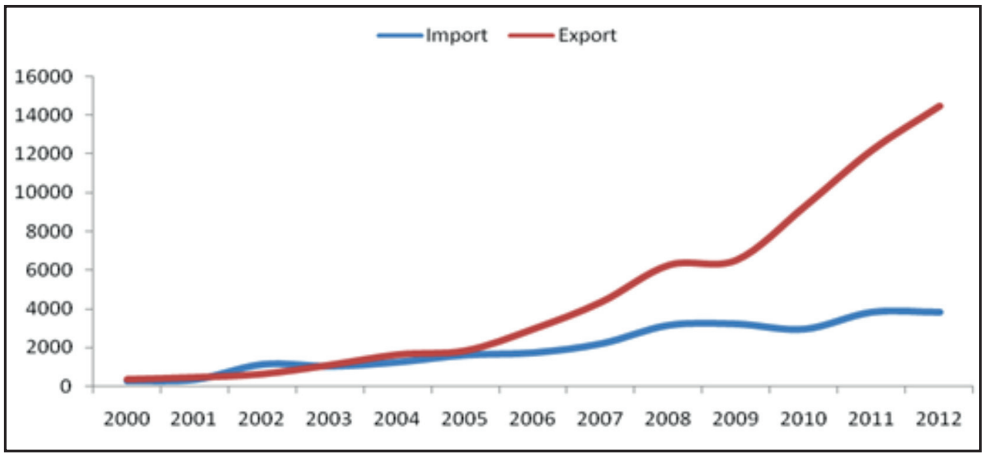
Source: CMIE Prowess, EXIM Bank Analysis

Identification of Segments for Development in Software Industry to Meet the Requirements of Chinese Market.

While China excels in production of electronic hardware, India has substantial exports in the arena of computer and information services. India was the largest exporter of Computer and Information Services in 2012, accounting for 19.9 percent of total exports under this category (Table 30). China also has developed its computer and information services segment over the years. Value of export and import of computer and information services was in close range for China till 2005. However, exports have witnessed phenomenal increase thereafter, gradually increasing the difference between the exports and the imports (Exhibit 43). The country remains as one of the top five countries in terms of computer software and services spending as a share of GDP[50]. Therefore, India can identify areas for cooperation where China's demand is robust and aim towards catering to the market.

China's software industry is an important area for the Chinese government, with incentives for both domestic growth and foreign investment. The software market in the country is diverse and fragmented, and according to an estimate, have over 16,000 local-certified software companies, approximately 40,000

Exhibit 43: China's Trade in Computer and Information Services (Value in US$ mn)



Source: United Nations Service Trade Statistics Database, EXIM Bank Analysis

[50]UNCTAD Information Economy Report 2012.

Table 30: Top Exporting Countries for Computer & Information Services

Exporting Country	Value of Export in 2012 (US$ bn)	Share %
India	49.3	19.9%
Ireland	45.9	18.5%
Germany	20.3	8.2%
USA	17.3	7.0%
United Kingdom	14.9	6.0%
China	14.5	5.8%
Sweden	8.0	3.2%
Spain	6.5	2.6%
The Netherlands	6.5	2.6%
France	6.3	2.5%
World	**248.1**	**100.0%**

Source: TradeMap, EXIM Bank Analysis

Table 31: China Enterprise Application Market (Value in US$ mn)

Enterprise applications Segments	2010	Share %	2014	Share %	2010-14 CAGR %
Enterprise resources planning (ERP)	604	31%	1085	32%	16
Supply chain management (SCM)	133	7%	246	7%	17
Digital content creation (DCC)	88	4%	158	5%	16
Enterprise content management (ECM)	67	3%	148	4%	22
Customer relationship management (CRM)	63	3%	136	4%	21
Office suites	349	18%	604	18%	15
E-mail and calendaring	60	3%	114	3%	17
Others	599	31%	849	25%	9
Total	**1963**	**100%**	**3341**	**100%**	**14**

Source: Credit Suisse Equity Research, 2011, EXIM Bank Analysis

registered software products, and more than one million software-industry professionals. However, China's software industry still lacks core technologies, high-end software development aptitude, and consistent high quality software products. Moreover, foreign brands relish a sizably voluminous market share in the high-end segment of the software market, with local software products comprising less than 30 percent of the market.

Indian companies can venture into the Chinese market for high-end software solutions, which require a certain level of customization. Some of the prominent areas where China has considerable demand as identified by the Department of Commerce, USA are:

- Application software and specialty software: Solutions pertaining to enterprise resource planning, customer relationship management, service-oriented architecture, middleware and open-source software have bright prospects in the Chinese market.

- High-end enterprise management systems software: Solutions that address database management systems, systems management software products, networking security software products remain some of the fastest growing areas for foreign firms selling into the China marketplace.

- Specialty software: Customized software targeted for a specific industry or market sector is a market segment in which foreign firms have an estimated 70 percent of the market.

Total enterprise application market is estimated to have recorded a CAGR of 14 percent during 2010-2014 in China. Of this, enterprise resource planning, office suites and supply chain management are important segments, with respective shares of 32 percent, 18 percent and 7 percent in the total enterprise application market. The ERP segment is estimated to further grow by 20-25 percent annually during 2011-2015. In China, although the number of clients for ERP is more in small and medium enterprises, spending from large enterprises is much larger[51].

Enterprise Resource Planning: Enterprise Resource Planning has been defined by Gartner as a technology strategy that integrates a

[51]Credit Suisse Equity Research 2011.

set of business functions through tight linkages- from operational business transactions to financial records. As wage costs become dearer in China, more and more firms are expected to opt for ERP for making processes cost-effective. China's market for ERP services is highly fragmented and many global providers are also present. According to Gartner's September 2010 report 'Magic Quadrant for ERP Service Providers, China', there were no Indian players in the market, although they have been able to succeed in many other advanced countries. Reasons cited for this has mainly been obstacles such as culture, language and business confidence. Some important requirements (characteristics of demand) for Chinese ERP buyers are given below, which can be useful for Indian players looking to enter the Chinese market:

- Customization: Chinese enterprises regard customized solution as against packaged solutions. Many manufacturing companies have their own customized local systems and look for customized option to fit their requirements. About 60 percent of ERP implementations in the country are customized.
- Cultural affinity: To tap into the Chinese market, players must familiarize with the business culture and language of the customers. Around 90 percent of ERP implementations were delivered on-site in China, and about 10 percent of them were delivered offshore.
- On-site delivery: On-site delivery consultants are an important consideration, especially for buyers who have multiple rollouts across the country.
- Software-as-a-Service (SaaS) ERP Offerings: Whole suite SaaS ERP implementations are rare in China. Some companies have adopted specific modules of SaaS ERP, such as for the purpose of accounting and expense management.

Supply Chain Management (SCM): ERP system consists of many modules which can be largely divided into: a) management related, and b) business process-related functions. Focus of customers is increasing in business process related functions, SCM being one of them. Globalization has made it necessary to dispense

purchase and supply functions more efficiently. This along with the rising cost of labour has been important factors in propelling the demand for SCM.

This demand in China largely comes from multinationals, and hence foreign software companies can play a greater role here. Moreover, companies having greater experience in global operations can perform better in these areas as compared to domestic players in China who have limited experience and proficiency. China is already a major player in the global supply chain trade. As more and more Chinese companies are engaged in the global supply chains, the demand for such software is expected to increase.

Identification of Areas for Investment Where China Faces Temporary Trade Barriers

India can attract investment in those areas where China faces temporary trade barriers from other countries and hence would like to circumvent these trade barriers. These product categories can also be identified on a country-wise basis.

The scope of barriers is fairly large and includes wide array of non-tariff

Table 32: Trade Barriers Affecting China's Trade in Electronics

Country/ Region Name	Trade Barrier	Commodity	Relevant HS codes	Import of the commodity, 2012 (US$ mn)
Argentina	**Anti-Dumping**	**Microwave Ovens**	**851650**	**1.61**
Argentina	Anti-Dumping	Car Stereos	852721	85.69
Argentina	Anti-Dumping	Colour TVs	8528	106.60
Argentina	**Anti-Dumping**	**Lighters used in Kitchens**	**961380**	**1.92**
Brazil	Anti-Dumping	Other Permanent Magnets and Magnetized Articles	850519	19.23
Brazil	Anti-Dumping	Loudspeakers	851821	50.94
European Union	Anti-Dumping	Microwave Ovens	851650	649.79
European Union	Anti-Dumping & Countervailing Duties	Wireless Wide Area Networking Modems	851762	15335.34
European Union	Anti-Dumping	Laser Optical Reading Systems	852721	710.67

European Union	Anti-Dumping	Colour Television Receivers	8528	10765.91
European Union	**Anti-Dumping**	**Certain Cathode-Ray Colour Television Picture Tubes**	**854011**	**2.03**
European Union	Anti-Dumping	Certain Cargo Scanning Systems	902219	224.94
European Union	Anti-Dumping & Countervailing Duties	Certain Magnetic Disks (3.5 Micro disks)	852329	356.06
European Union	Anti-Dumping & Countervailing Duties	Compact Disks - Recordable (CD-Rs)	852340	1025.38
Mexico	Anti-Dumping	Electrical Equipment and Machinery and Parts Thereof	850110	376.37
Mexico	Anti-Dumping	Sound Equipment	MI*	
Turkey	Anti-Dumping	Colour TV Receivers with Integral Picture Tube	8528	1149.01
Turkey	**Anti-Dumping**	**Wall Clocks (Battery Accumulator or Main Powered)**	**910521**	**3.76**
Turkey	**Safeguard****	**Certain Voltmeters and Ammeters**	**903039**	**7.12**
USA	Anti-Dumping & Countervailing Duties	Raw Flexible Magnets	850519	28.95
USA	Anti-Dumping	Colour Television Receivers	8528	1732.61

*A cell entry for missing data (i.e., data which definitely exists, but which is difficult to be found) is filled in with MI.

**India is exempt from this safeguard, while China is not.

Commodities in bold are where the scope for attracting investment is relatively lesser on account of low level of imports of the product from the country imposing duty. An arbitrary threshold of US$ 10 million has been taken as significant for attracting investments.

Source: Bown, Chad P. (2012) “Global Antidumping Database,” available at http://econ.worldbank.org/ttbd/gad/,

Bown, Chad P. (2012) “Global Countervailing Duties Database,” available at http://econ.worldbank.org/ttbd/gcvd/,

Bown, Chad P. (2012) “Global Safeguard Database,” available at http://econ.worldbank.org/ttbd/gsgd/, UNCOMTRADE, EXIM Bank Analysis

barriers as well. For the purpose of this analysis, three significant trade barriers have been considered, viz., Anti-Dumping duties, Countervailing duties, and Safeguards. Data for these three has been accessed from Temporary Trade Barriers Database[52]. Twenty seven commodities in six different countries/regions (including European Union) have been identified where China faces these trade barriers. However, import by some of the countries placing import-restrictions on electronic products is low, thereby limiting the prospects of investment in those products.

On the whole, China loses approximately US$ 32.63 billion of potential electronic exports to the world on account of these trade barriers. While most barriers are in the final electronic goods category, some are also in the component and subassembly category. Of all the countries imposing such restrictions on China, European Union has the maximum number of goods under these trade barriers.

Products featuring under monitors and projectors, not incorporating television reception apparatus; reception apparatus for television, whether or not incorporating radio-broadcast receivers or sound or video recording or reproducing apparatus (HS code: 8528, Category: Television & Monitors) has witnessed significant import-restricting actions from across the globe. Under this category, imports from China have been banned by Argentina, EU, Turkey and USA. All these countries are also significant importers of the product, with total imports from these four countries under this HS code amounting to US$ 13,754.13 million in 2012 (Table 32). Hence, investments in this area can be attracted.

Within the sound and video recording devices segment, magnetic media for the recording of sound/of other phenomena, but excluding products of Ch. 37., other than cards incorporating a magnetic stripe (HS code: 852329) and optical media for the recording of sound/of other phenomena, but excluding products of Ch. 37 (HS code: 852340) are important categories where China faces anti-dumping and countervailing duties from European Union. Total imports under these two HS codes by European Union were US$ 1,381.44 million in 2012. China also faces barriers from Argentina and European Union in the category of microwave ovens (HS code: 851650).

[52]The database covers 95% of the global use of these particular import-restricting trade remedy instruments.

Table 33: List of Electronic Products in which India has Preferential Access in MERCOSUR

HS code	Product description	Margins of preference offered
84717011	Automatic Data Process Machines; Magnetic Reader Etc-For Floppy disks	20
84717029	Automatic data process machines; magnetic reader etc-other	10
84717032	Automatic Data Process Machines; Magnetic Reader Etc-For Cartridges	20
84719011	Automatic Data Process Machines; Magnetic Reader Etc-Of magnetic cards	10
84719012	Automatic Data Process Machines; Magnetic Reader Etc-Bar code readers	10
84719014	Scanners	10
84733019	Parts etc for typewriters & other office machines-other	10
84733031	HDA Head Disk Assembly of rigid disk units, mounted	10
85011011	Less than 1.8 degrees	100
85011019	Electric motors and generators (no sets)-other	10
85042100	Electric Transformers, Static Converters & Inductors -Having a power handling capacity not exceeding 650	20
85044030	DC converters	10
85173041*	Electric Apparatus For Line Telephony Etc, Parts-With a trunk speed exceeding 72 kbits/second and s	10
85173061*	Electric Apparatus For Line Telephony Etc, Parts-Of the crossconnect type	10
85173062*	Electric Apparatus For Line Telephony Etc, Parts-With a serial interface speed of at least 4 mbits/	10
85173069*	Electric apparatus for line telephony etc, parts-other	10
85179099*	Electric apparatus for line telephony etc, parts-other	10
85181000	Microphones and stands therefor	10
85232010*	Magnetic Discs - Of a kind used in hard disc drives	100
85252019*	Trans apparatus for radio-telephony etc; tv camera & receivers-other	10
85252021*	Trans Apparatus For Radio-telephony Etc; Tv Camera & receivers-For base stations	10
85252023*	Fixed terminals, without an incorporated energy so	10
85299090	Parts for television, radio and radar apparatus-other	10
85389020	Electronic assemblies, mounted	10
85409190	Other	10
90139000	liquid crystal devices nes; lasers; optical appliances; pt-parts and accessories	10
90189031	Lithotripters operating by shock waves	100
90189093	Computerized microwave apparatus for intra-urethra	100
90189094	Endoscopes	100
90189095	Clamps and clips, applicators and extractors there	100
*HS codes for these products have changed in subsequent revisions. Comparable six digit codes used in the current study are: 851762 for 851730; 851770 for 851790; 852329 for 852320 and 852520.		

Source: Ministry of Commerce, Government of India; EXIM Bank Analysis

Within the components segment, China faces maximum trade barrier on account of these measures in the category of other permanent magnets and articles intended to become permanent magnets after magnetisation (HS code: 850519). Both Brazil and USA have placed import-restricting duties on China in this category. Total import for this product from both the countries amounted to US$ 48.18 million in 2012.

Identification of Areas for Investment Where India has Access to Preferential Duties

Although both China and India have greater access through trade agreements in many regions, India has concluded agreements with some countries/regions where China has not been able to gain preferential access. It is the latter category of agreements which are crucial from the point of view of attracting market-seeking investments from China. Even in countries where both India and China have FTA, some product categories can be identified for investment by Chinese companies in India where FTA partners of China have put several items under sensitive list for imports from China, but not from India.

India MERCOSUR PTA

A Preferential Trade Agreement was signed between India and MERCOSUR in 2005 wherein the latter provided concession in 452 products. Of these 452 products, 30 are electronic products. Maximum preference is allowed by MERCOSUR in the medical electronics products category wherein four product categories benefit from 100 percent margin of preference[53]. These are lithotripters operating by shock waves (HS code: 90189031), computerized microwave apparatus for intra-urethra (HS code: 90189093), endoscopes (HS code: 90189094), and clamps and clips, applicators and extractors there (HS code: 90189095) (Table 33).

India ASEAN Agreement

Both India and China have entered into trade agreement with ASEAN. However, some of the products which

[53]Margin of preference is the percentage difference between MFN tariff and the preferential tariff for a product. Numerically,

$$\text{Margin of Preference} = \frac{\text{MFN tariff} - \text{Preferential tariff}}{\text{MFN tariff}} \times 100$$

Table 34: List of Electronic Products which are in Sensitive List of ASEAN for China but not for India

HS code	Description	Country	Access to India
847141	Non-portable digital edp machines with processor & i/o	Cambodia	NT-2
847150	Digital processing units not sold as complete systems	Cambodia	NT-2
847190	Automatic data processing equipment nes	Cambodia	NT-2
850132	DC motors, DC generators, of an output exceeding 750 with but not exceeding 75KW	Cambodia	NT-2
850490	Parts of electrical transformers, static converters and inductors	Cambodia	NT-2
850680	Primary cells & primary batteries nes	Cambodia	NT-1
851810	Microphones and stands therefor	Cambodia	NT-2
851821	Single loudspeakers, mounted in the same enclosure	Cambodia	NT-2
851829	Loudspeakers, nes	Cambodia	NT-2
852190	Video recording or reproducing apparatus nes	Cambodia	NT-1
852712	Pocket-size radio-cassette-players	Cambodia	NT-1
852713	Radio apparatus nes with sound recording/reproducing	Cambodia	NT-1
852990	Parts suitable for use solely/principally with the apparatus of headings 85.25 to 85.28	Cambodia	NT-1
853720	Boards, panels, including numerical control panels, for a voltage > 1,000 V	Cambodia	NT-2
850110	Electric motors of an output not exceeding 37.5 W	Thailand	NT-1
850132	DC motors, DC generators, of an output exceeding 750 with but not exceeding 75KW	Thailand	NT-1
850421	Liquid dielectric transformers having a power handling capacity </= 650 KVA	Thailand	NT-1
850422	Liquid dielectric transformer having a power handling cap >650 KVA but </= 10,000KVA	Thailand	NT-2
850680	Primary cells & primary batteries nes	Thailand	NT-2
851650	Microwave ovens	Thailand	NT-1
852721	Radio receivers not capable of operation without external source of power for motor vehicle, combined with sound recording or reproducing apparatus	Thailand	NT-1
852910	Aerials & aerial reflectors of all kinds; parts suitable for use therewith	Thailand	NT-1
852990	Parts suitable for use solely/principally with the apparatus of headings 85.25 to 85.28	Thailand	NT-1

Source: Ministry of Commerce, Government of India; China FTA Network; EXIM Bank Analysis

Table 35: Electronic Products where China has Preferential Access in Pakistan

HS code	Description	Margin of Preference
852210	Pick-up cartridges	10
853180	Electric sound or visual signalling apparatus, nes	5
853190	Parts of electric sound or visual signalling apparatus	7
853223	Electrical capacitors, fixed, ceramic dielectric, single layer, nes	5
854020	Television camera tubes, image converter and other photo-cathode tubes	35
854040	Data/graphic display tubes, colour	20
854050	Data/graphic display tubes, monochrome	20
854060	Cathode-ray tubes, nes	20
854071	Magnetron tubes	50
854072	Klystron tubes	50
854081	Receiver or amplifier valves and tubes	10
901812	Ultrasonic scanning apparatus	15
902212	Computed tomography apparatus	10
902290	Parts & accessories for apparatus based on the use of X-rays or other radiations	10
902519	Thermometers, not combined with other instruments, nes	15
903039	Instruments and Apparatus, for measuring or checking voltage, current, etc without a record dev	15
903089	Instruments & apparatus for measuring or checking electrical quantities nes	15
903281	Hydraulic or pneumatic automatic regulating or controlling instruments & app	15
903300	Parts & access nes for machines, appliances, instruments or apparatus of Chapter 90	20
961210	Typewriter or similar ribbons, prepared for giving impressions	10
961380	Lighters, nes	10

Source: China FTA Network, EXIM Bank Analysis

are in the sensitive list of ASEAN countries for China are under the Normal Track-1 and Normal Track-2 list for India. Twenty three such products have been identified at the six digit level. For Normal Track-1 and Normal Track - 2 products, applied MFN tariff rates were to be reduced and subsequently eliminated over a period of time (Table 34). These products largely fall under the category of final electronic products and electronic subassemblies.

Agreement on South Asia Free Trade Area (SAFTA)

SAFTA is a free trade agreement among the countries of Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka. Out of these countries, China has FTA only with Pakistan. However, even in Pakistan, China has margin of preference in only 21 commodities at HS 6-digit level (Table 35).

Investment in India will give Chinese companies access to the markets of SAARC countries. Although the market size of individual countries within SAARC might be small, collectively it is an attractive export destination.

India Japan CEPA

India has a trade agreement with Japan, while China doesn't have any such agreement. Japan has given concessions to India on all electronic product categories.

India Korea CEPA

India also has a trade agreement with Korea, while China doesn't have any such agreement. Except for the product category of other parts of automatic control panels, which has been put under the sensitive list, Korea has allowed concessions on all electronic products from India.

6. REVIEW OF SECURITY RELATED ISSUES: POLICIES IN CHINA AND INDIA

RELEVANT OVERSEAS DIRECT INVESTMENT REGULATIONS IN CHINA

The State Council published "Government-approved investment project directory (2013)" on 2nd December 2013 which significantly eased the process of approval and filing requirements for outbound investment projects from China. There are three key regulatory bodies for overseas investment in China. Of the following, NDRC is the most important entity for investment approvals:

- National Development and Reform Commission (NDRC)
- Ministry of Commerce (MOFCOM)
- State Administration of Foreign Exchange (SAFE)

Approval in the non-sensitive category of investment requires NDRC approval only if the size of overseas investment is greater than US$ 1 billion. For all other investment in the non sensitive category, no approval is required, but filing is compulsory. In case of investment in sensitive countries or sensitive industries, both NDRC and MOFCOM approval is mandatory. Filing requirements also differ for Central State Owned Enterprises (SOEs) and entities other than Central SOEs.

The definition of sensitive countries and industries is not explicitly stated in the document. NDRC defines 'sensitive countries' as countries which have no diplomatic relations with China, or are under international sanctions, or are under situations of war and riot. Sensitive industries include segments like basic telecom operations, cross-border water resource development and utilization, large-scale land development, transmission lines, power grids, and news media.

From the point of view of electronics industry in India, approval requirements for overseas investment by Chinese firm in power grids and basic telecom operations are a hurdle.

Table 36: NDRC and MOFCOM Approval and Filing Requirements

Investor Type	Sensitivity	Project Size	NDRC Requirement	MOFCOM Requirement
Entities other than Central SOEs	Non-Sensitive	<= US$ 300 million	Local DRC Filing	Local MOFCOM Filing
		> US$ 300 million; <= US$ 1 billion	NDRC Filing	Local MOFCOM Filing
		> US$ 1 billion	NDRC Approval	Local MOFCOM Filing
	Sensitive Countries/ Regions or sensitive industries	All	NDRC Approval	MOFCOM Approval
Central SOEs	Non-Sensitive	<= US$ 1 billion	NDRC Filing	MOFCOM Filing
		> US$ 1 billion	NDRC Approval	MOFCOM Filing
	Sensitive Countries/ Regions or sensitive industries	All	NDRC Approval	MOFCOM Approval

Source: Covington & Burling LLP

Use of power electronics in electricity network is crucial for fuller utilization of current assets, as well as for regulation of power. In the 12th Plan period, smart grid has been considered a key focus area. According to the Report of the Working Group on Power for the Twelfth Five Year Plan, smart grids having advanced metering infrastructure with two-way communications, along with customer interface, integration of renewable and electrical vehicles with the grid, intelligent sub-stations with self-healing, are emerging technologies worldwide. Smart grids are expected to benefit many stakeholders, viz utilities, customers, the Government, and the regulators. The Ministry of Power, Government of India had also released a roadmap for development of the smart grid model.

Mandatory approvals from both NDRC and MOFCOM make the process of overseas investment from China into the power grid segment cumbersome. China has a relatively more developed electronics segment and could have immensely contributed

towards greater deployment of power electronics in the power transmission and distribution segment, and also help towards the development of smart grid industry in India.

RELEVANT FOREIGN DIRECT INVESTMENT REGULATIONS IN INDIA

Foreign companies can make investments into India by incorporating a company as a joint venture or a wholly owned subsidiary under the Companies Act, 1956. They can also set up a liaison office, project office or a branch office which can undertake activities permitted under the Foreign Exchange Management (Establishment in India of Branch Office or Other Place of Business) Regulations, 2000. Country-specific restrictions exist for investments from China which are:

- Without prior permission of the Reserve Bank, no person being a citizen of Pakistan, Bangladesh, Sri Lanka, Afghanistan, Iran or China can establish in India, a Branch or a Liaison Office or a Project Office or any other place of business.

- Branch/Project Offices of a foreign entity, excluding a Liaison Office are permitted to acquire property for their own use and to carry out permitted/incidental activities but not for leasing or renting out the property. However, entities from Pakistan, Bangladesh, Sri Lanka, Afghanistan, Iran, Bhutan or China are not allowed to acquire immovable property in India even for a Branch Office. These entities are allowed to lease such property for a period not exceeding five years.

- In those sectors where 100% FDI is permitted, RBI has provided the general permission for opening a branch office in SEZs for investors from all countries other than Pakistan, Afghanistan, Bangladesh, Sri Lanka, Iran and China.

In the electronic system design and manufacturing segment, 100% FDI is allowed under the automatic route. However, restrictions on investments exist in the segment of defence electronics. There restrictions emerge out of security concerns. Till recently, there were restrictions on brownfield investment in medical devices category, on account of lack of demarcation in policy for pharmaceuticals and medical devices. FDI up to 100% was permitted only

through the approval route in medical devices as well

Defence Electronics

In the Union Budget 2014-15, foreign investment in defence manufacturing sector has been raised from 26% to 49% with full Indian management and control under the Government approval route. Defence electronic items are largely covered in the M11 section of the munitions list[54]. Investment in defence electronics requires an industrial license and must comply with certain requirements as set by the Reserve Bank of India in Foreign Exchange Management (Transfer of Issue of Security by a Person Resident outside India) Regulations, 2013[55].

License for defence electronics is given only in close consultation with the Ministry of Defence, Government of India. Applicant of such a license should also be an Indian company/ partnership firm. There is also no purchase guarantee for the products manufactured. There is a three year lock-in period for transfer of equity from one non-resident investor to another non-resident investor and such transfer is subject to prior approval of the Government. Arms and ammunitions produced by these manufacturers can't be sold within the country to any other person or entity other than the Government entities. Moreover, export of these goods are also subject to policy as applicable to ordnance factories and defence PSUs. However, non-lethal items can be sold to persons or entities with prior approval from the Ministry of Defence, Government of India.

According to DIPP, defence industry attracted extremely low FDI during the period April 2000 to January 2014. Total FDI inflow into the sector during this period was a miniscule US$ 4.94 million.

[54]The full list of defence related items can be accessed from- http://dipp.nic.in/English/Investor/Investers_Gudlines/defenceProducts_LicencingRequired_26April2013.pdf

[55]Full list of requirements can be accessed from- http://rbidocs.rbi.org.in/rdocs/notification/PDFs/285NTI130913S.pdf

6. STRATEGY AND ROAD MAP

To neutralize India's trade deficit in electronics goods, strategies may be undertaken as suggested under the following three broad heads: a) developing domestic electronic production capabilities, b) attracting investments from China in the electronics segment, and development of software industry to meet the needs of the Chinese market, and c) adopting good practices in the broader policy space. While the first two are specific to the electronics industry, the last one refers to a more general framework. It is imperative to improve India's position on this general framework as the current day electronics production is characterized by global value chains. For India to become a significant part of such a value chain, it needs to adopt practices which other competing nations have adopted, and which can be viably adopted in the Indian case. Such a strategy would ease the process of doing business in the country, and as a result provide an opportunity for the country to be enmeshed in the global value chain.

Electronics industry consists of many segments and not all of them have the same kind of needs. Hence, it will be useful to look at the strategies not only from the overall perspective, but also at the segmental level.

DEVELOPING DOMESTIC CAPABILITIES

• **Developing the Electronic Components category:** Electronic components are the building blocks of a successful electronics industry. As has been observed in previous sections, its growth has been frail in India. Like India, Brazil also has seen a surge in the electronic components import. An influential effort has been taken by the Brazilian government in the form of Integrated Circuits Brazil (CI Brasil) program, from which cue can be taken by India. Established in 2007, this program has established training centers in ICT clusters and many semiconductor designers have graduated under this program. The program is taught in two training centres and the students receive a

support scholarship from the Brazilian National Council for Scientific and Technological Development. Under the program, the students are divided into three knowledge areas, where the designers get the following profiles:

- Digital Systems Design - Focus on the design of digital systems for medium and large companies, emphasizing the steps involved in the digital design flow for modern fabrication technologies;

- Mixed-Signals Systems Design- Focus on the design of basic analog electronic systems and interface, such as: operational amplifiers and comparators, analog to digital and digital to analog converters, phase - lock - loops and voltage controlled ascillators (VCOs);

- Radio Frequency Systems Design - Focus on blocks design used in integrated Radio Frequency communication systems, such as: low noise amplifiers, Mixers, VCO, Frequency Synthesizers, Filters.

Such training help develop domestic technical pool. It is not that India is aloof from such kind of initiatives. KarMic Training Centre, in India, is a rural VLSI training institute which offers specialized semiconductor design training to graduate engineers to prepare them for absorption into the design sector. Interestingly, it was a private initiative which absorbed these students upon graduation.

• **Tax Related Incentives for Semiconductor Industry:** Tax related incentives also go a long way in developing the electronics industry. Brazil started the Program for the Development of the Semiconductor and Display Industry (PADIS) which provides incentives for manufacture of semiconductor electronic devices, crystal and plasma displays and on-board chip systems. PADIS allows for several incentives, including zero percent corporate income tax for development and design, testing and packaging and diffusion (physical/ chemical) processes. Countries like Japan, China and Taiwan also provide tax subsidy for manufacturing in the electronics and semiconductor manufacturing category, which is not provided in the Indian case. Japan provided subsidies and taxes under two laws- Machinery Industry Law (1956) and Electronics Industry Law (1957). Subsidies for R&D and loans, along with tax incentives were provided under these laws for firms

that developed or used advanced production technologies. In this direction, India recently provided for reimbursement of central taxes and duties in select high-tech units like fabs under the M-SIPS scheme. More such incentives along with simplification of tax structure are required.

• **Venture Capital (VC) Investment:** Investment is crucial in the electronics industry and the Indian government has attempted to put emphasis on the VC funding route in the recent past. International experiences of VC in technology intensive industries have been quite positive. Chinese and Taiwanese semiconductor industries have expanded significantly as a result of VC investments. Israel also has a developed VC sector. The country had provided tax incentives to capital gains which had attracted foreign VC funds into the country.

In India, VC investment has more than doubled from US$ 600 million to US$ 1.4 billion between 2006 and 2012, principally driven by regulatory changes, including the elimination of tax on capital gains and the relaxation of rules preventing foreign investment. However, bulk of the VC investment has been in the consumer services sector[56].

Although VC firms might seem skeptical about their involvements in the electronics sector and might see these investments as high risk, low yield and unstable return, the government backing can help build trust in the sector. In Europe, the government supports VC in several ways. In Germany, the High-Tech Gründerfonds invests directly in emerging businesses which fund technology start-ups. The European Investment Fund, which is funded by member states of the European Union, also plays a key role through investment in VC growth funds.

• **Setting Up of Clusters for Mobile Telecom:** State of cluster development is considered as strength in the Indian case, among all other ways to promote innovation linkages[57]. It is essential to promote the concept of cluster development for mobile telecom in India, as the country has substantial prowess in the model of cluster development. Marshall (1919) was one of the pioneers in explaining the benefits from industrial clustering. Clusters of firms, predominantly in the same sector, could benefit by sharing

[56]Global venture capital insights and trends 2014, Ernst and Young

[57]Global Innovation Report 2013

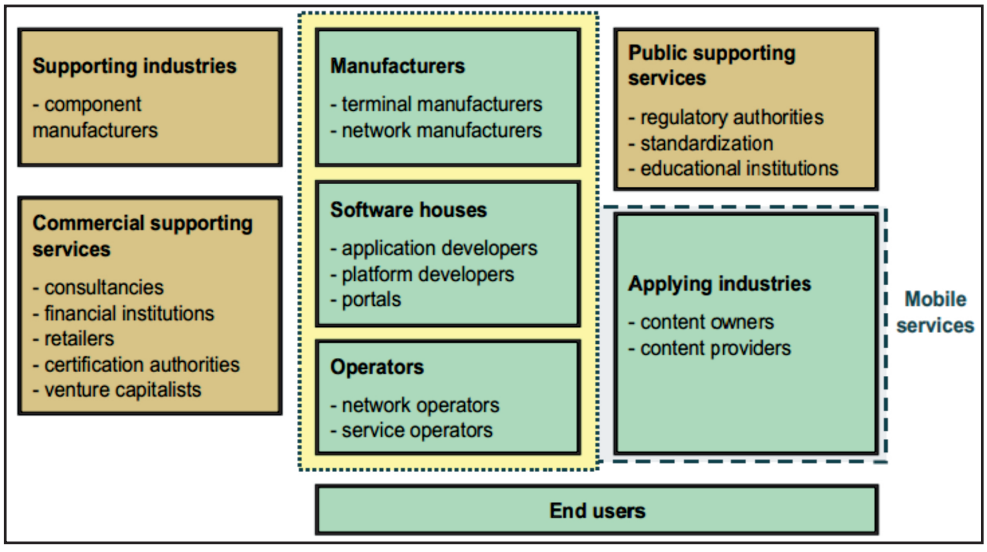
of sector-specific resources, skilled labor and also knowledge. These would minimize cost and promote efficiency seeking investment in this industry.

Finland's "wireless valley" is an example of mobile telecom cluster which was a major component of "Mona" – a Finnish mobile services development program. The cluster comprised several related players, with terminal manufacturers (producing mobile phones) and network manufacturers (producing equipment needed for mobile networks) being a part of the core industries (Exhibit 44). A cluster for mobile telecom on similar lines can be set up in India.

• **Development of Industrial Clusters for Medical Devices:** Similarly, development of industrial clusters specifically for the medical devices industry would provide an impetus to the sector. In this regard, Gujarat Government has taken some initiatives, such as developing a specialized pharmaceutical machinery cluster in the State. More Central and State Government initiatives towards cluster development in this sector would help improve Indian capabilities in the segment.

• **Guidance for Product Development in Medical Devices:** US-FDA and European Medicines Agency give guidance to their national industry about product development. In a case study by

Exhibit 44: Map of the Finnish Mobile Cluster



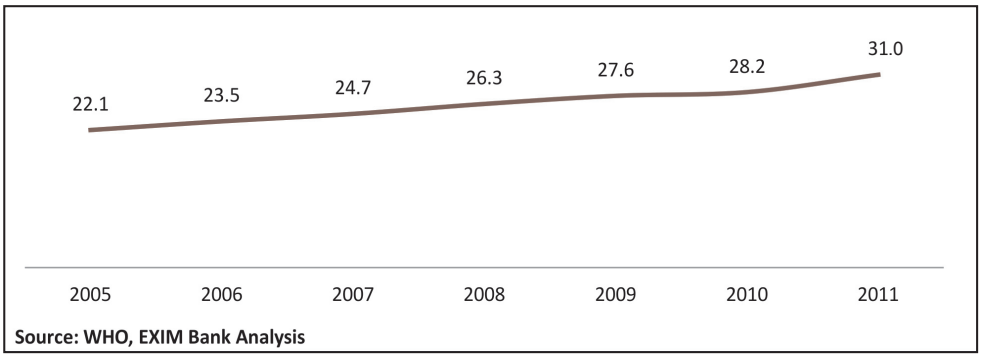
Source: Helsinki (2002)

Szymon Jarosławski and Gayatri Saberwal (2013), lack of guidance and dialogue regarding product specifications has emerged as a major challenge for product innovations. The firms found it essential to engage with foreign regulatory agencies for their guidance, distinguishing their innovative products from other substandard ones and also to access global markets[58]. Such guidance needs to be provided by national regulatory agencies in India.

• **Greater and More Transparent Procurement of Innovative Medical Devices:** Share of general government expenditure on health as percentage of total expenditure on health in India has risen steadily over the years and is expected to continue to rise. Given this trend, promotion of innovative technologies through government procurement is likely to gain significance (Exhibit 45).

Szymon Jarosławski and Gayatri Saberwal (2013) suggested greater government procurement of 'innovative devices' in the Indian case to encourage product innovations. The process of such procurement should also be made more transparent through use of evidence-based decision making[59]. Evidence-based practice is the use of the best available evidence together with a clinician's expertise and a patient's values and preferences in making health care decisions. Agencies in many European and Asian countries (like, Japan, Singapore and Malaysia)

Exhibit 45: General Government Expenditure on Health as Percentage of Total Expenditure on Health in India (%)



Source: WHO, EXIM Bank Analysis

[58]Szymon Jarosławski and Gayatri Saberwal (2013), Case studies of innovative medical device companies from India: barriers and enablers to development

[59]Ibid.

appraise technologies and advise on their financing from public sources.

• **Separate Regulatory Environment for Medical Devices:** Under the Drugs and Cosmetics Act, many medical devices have been currently notified as drugs. The difference between drugs and devices is stark. While drugs are based on chemistry and pharmacology, devices are based on engineering. While drug is regulated by licensing system, device is regulated by notified bodies in most countries. While in the case of a drug, the issue may be that of dosage, in the case of device, it may be of the size, especially in implantable devices. Moreover, the latter would be more risky than a drug, especially in later-phase trials. Industry and regulatory authorities have for long felt that provisions related to drugs can't be applicable entirely for medical devices.

Not all medical devices have been classified as drugs. Those which are not considered "drugs" only require import or manufacturing license and no quality check system exists for them. Hence, Drugs and Cosmetics (Amendment) Bill, 2013 is an attempt towards specifying provisions specific to medical devices. For example, conditions have been specified under which medical devices shall be deemed to be misbranded, adulterated, and spurious. The Bill needs speedy implementation.

• **Stronger Linkages between Academia and Industry:** Existing students and researchers engaged in biomedical engineering courses need to be motivated towards research suited to the development of medical devices in India through proper incentives. Through incentivizing research, India can enlarge the technical pool suited for a vibrant medical devices industry.

In promoting partnerships between industry and academia, India can take inspiration from the Innovation Law and Good Law of Brazil. These laws allowed automatic use of fiscal benefits for investment in R&D, without any need for a formal request.

Innovation Law has been enacted to strengthen the university-industry research relationship, promoting the shared use of science and technology infrastructure by research institutions and firms, allowing direct government grants for innovation in firms and stimulating the mobility of researchers within the S&T system. Public resources could be transferred as non-refundable funds for enterprises, sharing the costs and risks of innovative activities. The law permitted the creation of the Economic Subsidy Program, created in 2006

and coordinated by FINEP, which provides resources for research and development activities undertaken by industrial firms. Under this umbrella programme, four sub-programmes provide grants viz.: a) nationally competitive grants to firms of any size to develop new products and processes; b) grants to firms to hire researchers holding masters or PhD degrees; c) state-level competitive grants for innovation to small firms, to be implemented through partnerships of business federation, micro and small enterprises agency, etc.; and d) locally competitive milestone-based small grants to start-ups.

Good Law has been enacted in Brazil for authorizing the automatic use of fiscal benefits for companies that invest in R&D. The significant incentives under this Law include: deductions from income tax and social contributions on net profits from expenses on R&D (between 60% and 100%); reductions in the tax on industrial products for purchasing machines and equipment for R&D (50%); economic subsidies for scholarships of researchers in companies; and exemption from the Contribution for Intervention in the Economic Domain carried to payments of patent deposits. The Law also included provisions for funding firms which hire employees with Masters Degrees and PhDs.

• **Creation of Fund for Promotion of Innovation in Analytical Instrument Category:** A Fund can be created to support the premier science and technology related educational and research institutes in the country for the development of scientific instruments. Since, the amount of funding requirement can be quite large in case of some scientific instruments, programs of joint funding can be established with like-minded countries.

Joint funding in such analytical instruments can strengthen the scientific and technological capabilities of countries, leading to discovery and development of new knowledge, product, process or services, or improvement in existing knowledge, products, processes or services. India already has in place several cooperation agreements in the field of science and technology. However, there is need for more such agreements with focus on development of scientific instruments, in particular.

Motivation can be taken from the PRODEX program, which was a joint funding of European Union countries. It began in 1986 with the objective of providing funds “for the industrial development of scientific instruments or experiments, proposed by Institutes or Universities in the Participating

States that have been selected by European Space Agency for one of its programs in the various fields of space research (science, microgravity, earth observation, etc)."

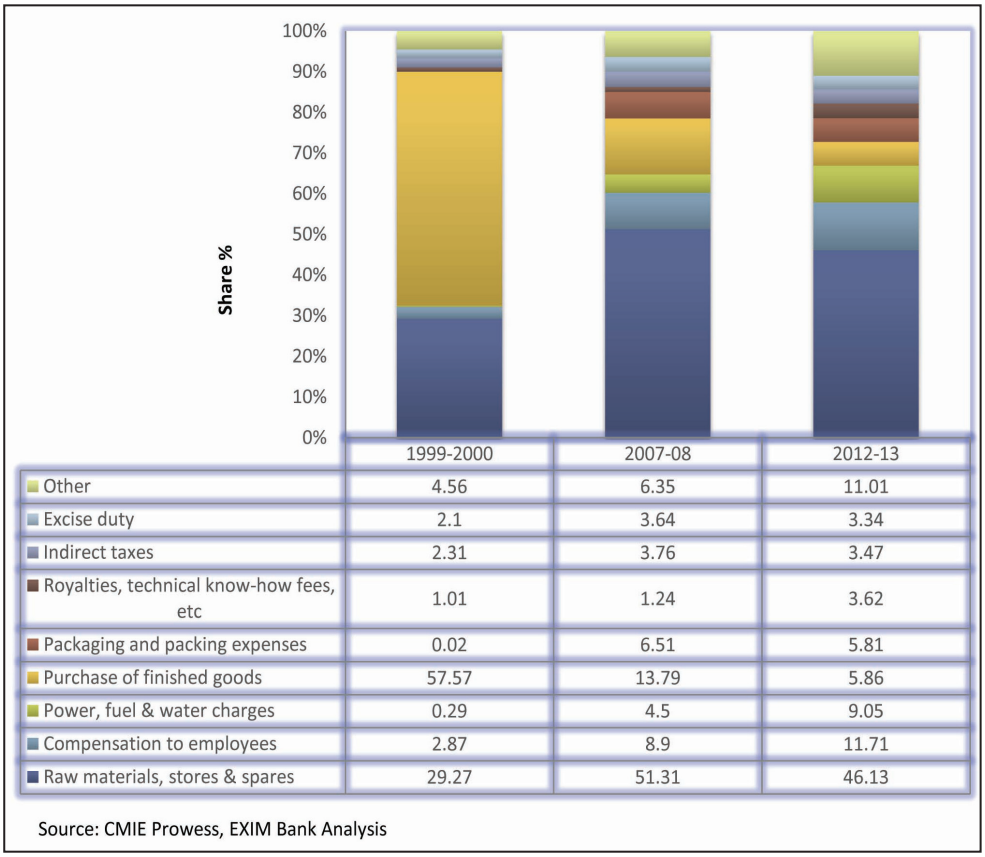
• **Creation of a Fund for Computer Hardware Component Production:** In 2012-13, imported raw materials accounted for 78.7% of the total raw materials consumed by the computer hardware industry, as per the sample of companies taken from CMIE Prowess Database. The ratio was higher in comparison to the ratio in other sub-categories of communication equipment and other electronics. Around 46.1% of operating expenses incurred by this industry category has been on account of raw materials, stores and spares, which is indicative of immense potential which exists for electronic component producers (Exhibit 46).

According to Prathap (2013), value added in the electronics industry of India is merely 5-10%, with electronic giants like Samsung, Dell and Hewlett Packard importing nearly 90% of their electronic components. There is a need to increase the value added production of electronics in India. Boosting production of electronic components and subassemblies gains greater significance in this context as substantial value addition happens at the components and subassembly stage of an electronics manufacturing process, contrary to other manufacturing activities. Many of the processes at these initial stages are capital and skill intensive (Pratap, 2013)[60]. Hence, for lowering the import intensity in this category and increasing the domestic value added production, promotion of production of computer hardware components is crucial.

Inspiration can be taken from the Electronics Industry Development Fund (EIDF) which was set up in China in 1986. It was first set up to support R&D and production of four key electronic products: integrated circuits, computers, software and program-controlled switching devices. Producers that were eligible to apply for support from the Fund had to meet the criteria of state-owned status and high local content of their products. The Fund later enlarged its support to include all major electronic products, components, and to include non-state owned firms[61]. A project catalogue was issued every year for identification of priority fields and grants were allocated through a combination of bidding and application by companies. The grants took the form of direct

[60]Surendra Pratap (2013), Workers in the Supply Chain of Electronics Industry in India: The Case of Samsung.
[61]Zhongxiu Zhao et al. / 33 - 51, Vol. 15, N0. 3, 2007

Exhibit 46: Components of Operating Expenses of Computers, Peripherals and Storage Devices Industry



	1999-2000	2007-08	2012-13
Other	4.56	6.35	11.01
Excise duty	2.1	3.64	3.34
Indirect taxes	2.31	3.76	3.47
Royalties, technical know-how fees, etc	1.01	1.24	3.62
Packaging and packing expenses	0.02	6.51	5.81
Purchase of finished goods	57.57	13.79	5.86
Power, fuel & water charges	0.29	4.5	9.05
Compensation to employees	2.87	8.9	11.71
Raw materials, stores & spares	29.27	51.31	46.13

Source: CMIE Prowess, EXIM Bank Analysis

grants, loan interest subsidies, and capital investment.

ATTRACTING INVESTMENT FROM CHINA

- **Development of Infrastructural Facilities:** Infrastructure is an important element for attracting investments. This is especially important in the case of electronics industry because of large presence of global value chains which require swift movement of goods across the nations. However, the current state of infrastructure and logistic services in India is inadequate. According to the World Bank's Logistics Performance Index 2014, India is ranked 54th out of 160 countries which reflects of the relatively poor state of infrastructure and logistics. The index which lies in between values 1 and 5, takes into account "efficiency of customs clearance process, quality of trade and transport related infrastructure,

ease of arranging competitively priced shipments, quality of logistic services, ability to track and trace consignments, and frequency with which shipments reach the consignee within the scheduled time". Germany was the best performing nation with an index of 4.12 in 2014, followed by the Netherlands (4.05), Belgium (4.04), United Kingdom (4.01) and Singapore (4.00) (Table 37). Holding other factors constant, Kumar (2001) had shown that infrastructure availability contributes to the FDI attractiveness of a country and also that export orientation of production of investing firms is significantly related to the infrastructure of the country[62]. Countries like Singapore and Hong Kong which rank high on the logistics performance index have attracted large investments in their electronics industries and established an important presence in the global value chain for electronics. Hence, infrastructure development will have a crucial role to play in attracting FDI in the industry.

- **Human Resource Development:** India has not been able to use its human resources to the fullest. China has been able to utilize its labor effectively, as a result of which its GDP per person employed (constant 1990 PPP $) in 2011 stood at US$ 14,196, witnessing growth rates in the range of 8-9% during the last five years. For India, on the other hand, GDP per person employed was US$ 8,939 in 2011 after witnessing a moderation in y-o-y growth rate. Electronics companies require workforce with diverse knowledge and skills, and as the industry moves on a path with greater technological innovations,

Table 37: Top Performing Nations in Logistics Performance Index

Country Name	2014	2012	2010	2007
Germany	4.12	4.03	4.11	4.10
The Netherlands	4.05	4.02	4.07	4.18
Belgium	4.04	3.98	3.94	3.89
United Kingdom	4.01	3.90	3.95	3.99
Singapore	4.00	4.13	4.09	4.19
India	**3.08**	**3.08**	**3.12**	**3.07**

Source: World Bank

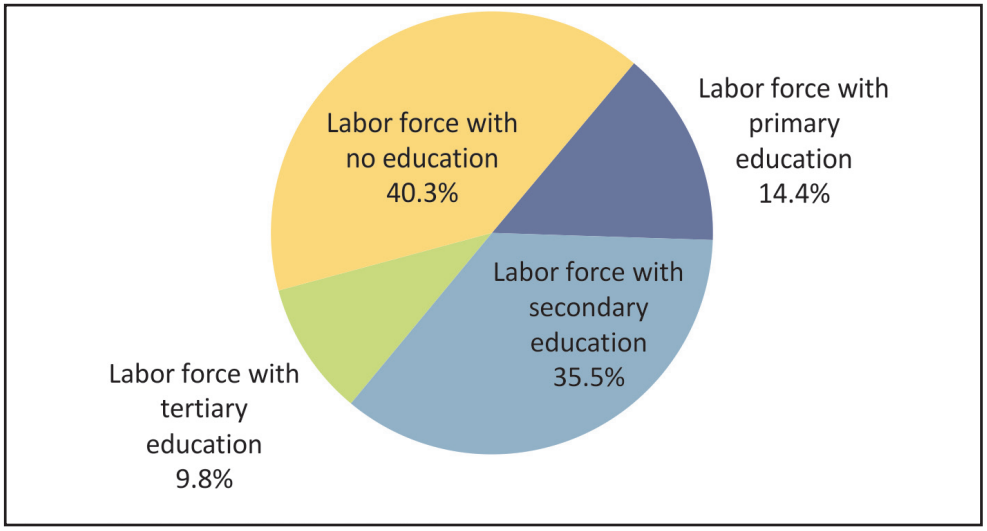
[62]Nagesh Kumar (2001), Infrastructure Availability, Foreign Direct Investment Inflows and Their Export-orientation: A Cross-Country Exploration.

the worker profile needs greater education and training. Without such a knowledge base, the conversion of sand to integrated circuits is an impossible task. In light of this, education standards in India needs to be synchronized with the industry requirements; it may be mentioned that only 9.8% of the labor force in India have had tertiary education in 2010 (Exhibit 47).

As per a Report by NSDC on Human Resource and Skill Requirements in the Electronics and IT Hardware Industry, the incremental requirement in India for level-2 and level-3 (which require technical knowledge and long drawn preparations) in the industry will be the highest at 25-27% and 49-50%, respectively, in 2022. In order to attract investment into this industry, workforce needs to be trained as per the industry requirements.

The Right to Education Act has been successful in extending the reach of primary education in the country, with India inching towards achieving universal enrollments[63]. However, the scenario is not positive in higher education. In 2010, India's Gross Enrolment Ratio (GER) was only 16% as compared to the world average of 27%. It also fared poorly in terms of other emerging economies like China and Brazil which had 26% and 36% GER, respectively[64]. One major

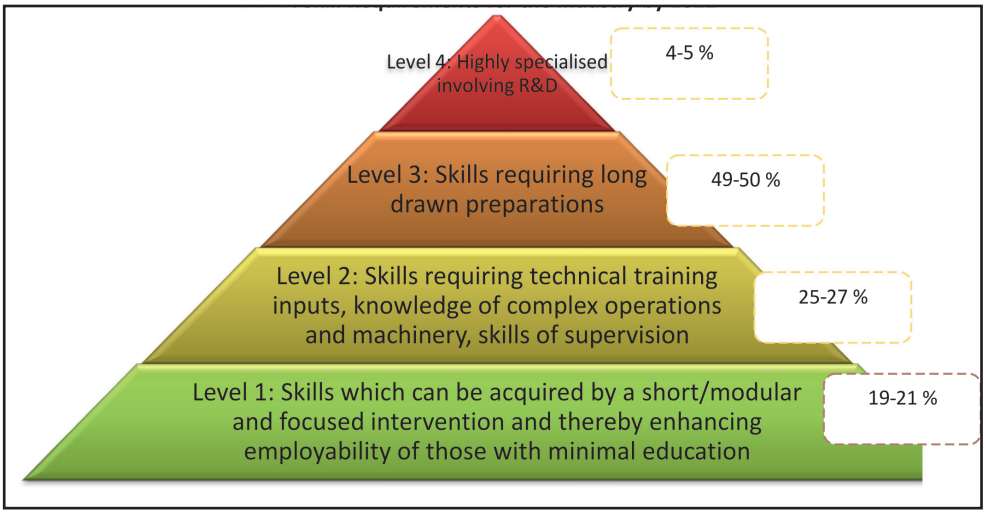
Exhibit 47: Distribution of Labour Force based on Educational Attainment (2010)



Source: World Bank, EXIM Bank Analysis

[63]ASER Survey
[64]Higher Education in India: Twelfth Five Year Plan(2012–2017) and beyond

Exhibit 48: Skill Requirements for the Industry by 2022



Source: NSDC

problem which has emerged out of the studies concerning the education sector has been the presence of significant regulatory roadblocks like limitations on entry by foreign universities, and collaboration with foreign players. These regulatory hurdles need to be addressed, especially since the role of private players in higher education has been growing at a rapid pace.

- **Enlarging the Technical Pool Required for Medical Devices:** The number of colleges offering biomedical engineering/ bio-engineering courses in India is not much. Biomedical engineering is an interdisciplinary subject in which engineering and technology is applied to medicine, surgery and healthcare of humans and other higher forms of life. It mainly involves bio-instrumentation, biomaterials, imaging, and biomedical devices. Such programs need to be promoted in more number of institutions, so that the skill set required for manufacture of medical electronics is enhanced.

- **Creating Greater Market for Analytical Instruments through R&D Promotion:** India ranks fairly low in gross expenditure on R&D (ranked 44th) and only 33.9% of it is financed by business enterprises. China on the other hand has 71.7% of its R&D by business enterprises (Table 38). R&D promotion will serve the dual purpose

of creating robust innovation base in India and also create a greater market for electronic goods in India.

Israel, which ranks topmost in GERD (Gross Expenditure on R&D) had come up with novel ways to encourage R&D in the economy. It has got plethora of domestic R&D programs which can be categorized into-competitive R&D, pre-seed and seed programs, and pre-competitive and long-term R&D programs, along with crucial international cooperation R&D. India has already taken many steps to promote R&D in the country, but needs to focus more on incentivizing the business enterprises and promoting collaborations among institutions.

In Israel, Life Sciences Fund has been created to bring about growth in the biotechnology industry. The Government of Israel had selected a private healthcare investment firm, Orbimed Partners, Israel, in an open tender to become the Fund's general partner and its manager. The Fund is structured as a standard venture capital fund and capital commitments in a limited way has been made by the Israeli Government as a minority partner. Another initiative by the Israeli Government was setting up of Tnufa which is a national pre-seed

Table 38: Ranking of Countries Based on Gross Expenditure on R&D

Rank	Country	GERD as % of GDP	% financed by business enterprises
1	Israel	4.4	39.0
2	Finland	3.8	67.0
3	South Korea	3.7	71.8
4	Sweden	3.4	58.2
5	Japan	3.3	75.9
6	Denmark	3.1	60.2
7	Switzerland	2.9	68.2
8	Germany	2.8	65.6
9	Austria	2.8	44.6
10	United States	2.8	60.0
21	China	1.8	71.7
43	**India**	**0.8**	**33.9**

Source: Global Innovation Report 2013

fund. It assists individual inventors and nascent start-up companies during the earliest stages of their projects. This includes evaluation of the technological and commercial potential of a project, filing for a patent, building a prototype, drafting a business plan and initial business development.

Apart from these, Bi-national Industrial R&D (BIRD) Foundation for joint R&D between American and Israeli companies has also been set up. Under this, one Israeli and one American company can jointly apply for BIRD support as long as they have combined capability and infrastructure to define, develop, manufacture, market, sell and support an innovative product based on industrial R&D. The BIRD Foundation offers conditional grants for joint development projects on a risk-sharing basis. The Foundation funds up to 50% of each company's R&D expenses associated with the joint project. Repayments are due only if commercial revenues are generated as a direct result of the project. Israel has also set up other bi-national funds like SIIRD (Singapore), CIIRDF (Canada), KORIL-RDF (Korea) and US-Israel Science & Technology commission and Foundation.

• **Favorable Duty Structure for Final Electronics Exports:** The duty structure should be such that it should favour the production of final electronics goods over the components and subassemblies, and also support the domestic production over imports. China had established an export processing policy wherein raw materials such as parts and components and other intermediate imported goods did not have any duty imposed, as long as they were used to produce export goods. However in the Indian case, there exists no such enabling environment.

While there is no import duty on finished products, the Government has put tariff barriers on electronic components required to manufacture telecom hardware (Chattopadhyay, 2013)[65]. For example, while most of the six final electronics products in the category of phones, fax machines, and routers do not face basic custom duty (average effective rate of duty-18.1%), electronic integrated circuits: Other (Hs code: 85423900) faces basic customs duty of 7.5% (effective rate of duty- 21.6%). Simplifying the taxes in favour of domestic manufacturing is essential. Preferential laws for usage of domestic products can also help incentivize investments.

[65]Utpal Chattopadhyay (2013), Making India a Telecom Manufacturing Hub: Emerging Issues and Challenges.

ADOPTION OF GOOD PRACTICES FOR DOING BUSINESS

Both India and China have put policies in place for development of the electronics industry. These policies in the spheres of taxation, manufacturing, science and technology, and trade, provide opportunities for businesses to expand. Some of the policies have a parallel in both the countries. Annexure 4 provides a detailed account of these policies.

India ranks fairly low in terms of starting a business. India does not have one-stop shop for business registration which is considered a good practice under this methodology, and this practice is being currently adopted by 96 economies across the world. Many economies adopting this practice have reported increased firm registrations. According to the Doing Business Report, this practice led to 17% increase in new firm registrations in Portugal.

Moreover, the minimum capital requirement which is basically intended to protect investors is also being reduced or eliminated across many countries, in order to boost the activity of small entrepreneurs. It has also been noted that the recovery rates in the case of bankruptcy is no higher in economies which have adopted such a practice from those who have not.

With regard to paying of taxes, India has adopted most good practices except one tax per tax base. One tax per tax base basically implies simplification of the tax structure. Multiple taxations makes doing business difficult as it increases the compliance time, complicates tax administration and also increases the cost of revenue administration. This can significantly hurt investor confidence. Implementation of GST can significantly help simplify the tax structure in India.

As far as trading across borders is concerned, India has adopted only one of the three good practices. It neither uses risk based inspection, nor has a single window that integrates some of the relevant government agencies. Countries have reported benefits from the implementation of single window systems. According to the Doing Business Report, Korea Customs Service estimated US$ 18 million of benefits in 2010 from the single-window system and a total of US$ 3.47 billion from all its trade facilitation efforts. India also does not have a system of risk based inspection which limits the physical opening of containers through the use of risk profiles. India should adopt such

trade facilitating measures, especially keeping in mind the ensuing WTO Agreement on Trade Facilitation.

India has not adopted any of the good practices in enforcing contracts. This will require setting up of specialized courts for handling commercial disputes and allowing for electronic filing of complaints.

DEVELOPMENT OF SOFTWARE INDUSTRY

As discussed earlier, ERP and SCM are important segments in China's enterprise application market. In the ERP segment, Indian software companies need to provide more customized products and should also try to provide on-site delivery which is an important consideration for the Chinese customers. Indian players will also have to familiarize with the Chinese business culture and language as it is another important factor for Chinese ERP demand. Moreover, the business process-related functions of ERP system (like SCM) are more in demand in the Chinese market. So, there should be more emphasis on this particular segment.

Table 39: Good Practices in Areas Where India Performed Relatively Poor in Doing Business Index

Topic	Good Practices
Starting a Business	Can procedures be completed online? Is there a one-stop shop? Is there no paid-in minimum capital requirement?
Paying Taxes	Is electronic filing and payment available and used by majority of firms? Is self-assessment allowed? Is there one tax per tax base?
Trading Across Borders	Are risk-based inspections used? Is electronic submission and processing allowed? Is there a single window that links some of the relevant government agencies?
Enforcing Contracts	Is electronic filing of complaints allowed? Is there a specialized commercial court, division or judge?

Source: Doing Business, World Bank, EXIM Bank Analysis

SUM UP

Several steps have been taken towards the improvement of electronics industry in recent times by the Government of India, including the seminal National Electronics Policy 2012 (NEP), which envisages achieving a turnover of about US$ 400 billion by 2020. The policies enshrined in the NEP need to move in tandem with exploring opportunities presented by the electronics market in China, and attracting Chinese investors.

Going forward, rapid urbanization, rising personal disposable income, adoption of high-end technology devices, high rate of technology obsole-scence and product innovation, competitive pricing of products, easy financing schemes, expansion of organized retail and distribution networks, and several government initiatives are going to be the major drivers for the electronics industry in India. On the back of these, there exists huge opportunity for the domestic manufacturers.

Select strategies for development of domestic capabilities and encouragement of FDI like establishment of training centres for electronic components production; promoting venture capital investment; development of dedicated clusters on the lines of Finnish mobile telecom cluster; guidance for product development, and strengthening of regulatory environment in the category of medical devices; development of stronger linkages between academia and industry; incentivizing innovative products through Government procurement as in the case of several countries like Japan, Singapore, European countries and Malaysia; engagement in international co-operation on R&D and electronics production; and streamlining tax structure, can help create an enabling environment for the domestic manufacturing.

ANNEXURE I: CATEGORIZATION OF HS CODES IN THE ELECTRONICS SECTOR

HS Code	Commodity Name	Category	Final Sub-Category
850421	Liquid dielectric transformers having a power handling capacity </= 650 KVA	Component	-
850422	Liquid dielectric transformers having a power handling capacity >650 KVA but </= 10,000KVA	Component	-
850440	Static converters, nes	Component	-
850490	Parts of electrical transformers, static converters and inductors	Component	-
850511	Permanent magnets & articles intended to become permanent magnets, of metal	Component	-
850519	Permanent magnets & articles intended to become permanent magnets, nes	Component	-
853400	Printed circuits	Component	-
853649	Electrical relays for a voltage exceeding 60 V but not exceeding 1,000 volts	Component	-
853810	Boards, panels, etc for goods of heading no. 85.37,not equipped with their apparatus	Component	-
853890	Parts for use with the apparatus of heading no. 85.35,85.36 or 85.37,nes	Component	-
854011	Cathode-ray television picture tubes, including video monitor tubes, colour	Component	-
854140	Photosensitive semiconductor device, photovoltaic cells & light emit diodes	Component	-
850450	Inductors, electric	Component	-
853210	Fixed capacitors designed for use in 50/60 Hz circuits (power capacitors)	Component	-
853222	Electrical capacitors, fixed, aluminium electrolytic, nes	Component	-
853229	Electrical capacitors, fixed, nes	Component	-
853230	Electrical capacitors, variable or adjustable (pre-set)	Component	-

853340	Variable resistors, including rheostats and potentiometers, nes	Component	-
853641	Electrical relays for a voltage not exceeding 60 volts	Component	-
854232	Electronic integrated circuits as memories	Component	-
961210	Typewriter or similar ribbons, prepared for giving impressions	Component	-
853290	Parts of electrical capacitors	Component	-
854129	Transistors, other than photosensitive transistors, nes	Component	-
854231	Electronic integrated circuits as processors and controllers, whether or not combined with memories	Component	-
854290	Parts of electronic integrated circuits and micro assemblies	Component	-
853331	Wirewound variable resistors, including rheostat & potentiometers </=20 W	Component	-
854130	Thyristors, diacs and triacs, other than photosensitive devices	Component	-
854190	Parts of mounted piezo-electric crystals and semiconductor devices	Component	-
854239	Electronic integrated circuits excluding such as processors, controllers	Component	-
854079	Microwave tubes, nes	Component	-
854089	Valve and tubes, nes	Component	-
853321	Electrical resistors fixed for a power handling capacity not exceeding 20 W	Component	-
854150	Semiconductor devices, nes	Component	-
854160	Mounted piezo-electric crystals	Component	-
853339	Wirewound variable resistors, including rheostat and potentiometers, nes	Component	-
854110	Diodes, other than photosensitive or light emitting diodes	Component	-
853225	Electrical capacitors, fixed, dielectric of paper or plastics, nes	Component	-
853310	Electrical resistors, fixed carbon, composition or film type	Component	-
853329	Electrical resistors, fixed, other than heating resistors, nes	Component	-
853390	Parts of electrical resistors, rheostats and potentiometers	Component	-

854121	Transistors, other than photosensitive, with a dissipation rate < 1 W	Component	-
854233	Electronic integrated circuits as amplifiers	Component	-
854099	Parts of valve and tubes, nes	Component	-
853224	Electrical capacitors, fixed, ceramic dielectric, multilayer, nes	Component	-
854081	Receiver or amplifier valves and tubes	Component	-
853221	Electrical capacitors, fixed, tantalum, nes	Component	-
853223	Electrical capacitors, fixed, ceramic dielectric, single layer, nes	Component	-
854020	Television camera tubes, image converter and other photocathode tubes	Component	-
854040	Data/graphic display tubes, colour	Component	-
854060	Cathode-ray tubes, nes	Component	-
854050	Data/graphic display tubes, monochrome	Component	-
854072	Klystron tubes	Component	-
854071	Magnetron tubes	Component	-
854091	Parts of cathode-ray tubes	Component	-
854012	Cathode-ray TV picture tube including video monitor tube, B&W/other monochrome	Component	-
847330	Parts & accessories of automatic data processing machines & units thereof	Subassemblies	-
847340	Parts and accessories of other office machines, nes	Subassemblies	-
847350	Parts and accessories for more than one office machine	Subassemblies	-
850110	Electric motors of an output not exceeding 37.5 W	Subassemblies	-
850132	DC motors, DC generators, of an output exceeding 750 with but not exceeding 75KW	Subassemblies	-
850133	DC motors, DC generators, of an output exceeding 75 KW but not > 375KW	Subassemblies	-
851770	Parts of telephone sets, telephones for cellular networks or for other data	Subassemblies	-
852910	Aerials & aerial reflectors of all kinds; parts suitable for use therewith	Subassemblies	-
853190	Parts of electric sound or visual signalling apparatus	Subassemblies	-
853710	Boards, panels, including numerical control panels ,for a voltage <=1000 V	Subassemblies	-

853720	Boards, panels, including numerical control panels, for a voltage > 1,000 V	Subassemblies	-
901590	Parts and accessories for use with the apparatus of heading No 90.15	Subassemblies	-
903090	Parts & access for instruments & apparatus for measuring or checking electrical quantities	Subassemblies	-
903300	Parts & access nes for machines, appliances, instruments or apparatus of Chapter 90	Subassemblies	-
851120	Ignition magnetos, magneto-generators and magnetic flywheels	Subassemblies	-
852990	Parts suitable for use solely/principally with the apparatus of headings 85.25 to 85.28	Subassemblies	-
847329	Parts and accessories of calculating & accounting machines, nes	Subassemblies	-
850680	Primary cells & primary batteries nes	Subassemblies	-
851890	Parts of microphones, loudspeakers, headphones, earphones & electrical sound amplifiers	Subassemblies	-
852290	Parts and accessories of apparatus of heading Nos 85.19 to 85.21, nes	Subassemblies	-
854390	Parts of electrical machines & apparatus having individual functions, nes	Subassemblies	-
901320	Lasers, other than laser diodes	Subassemblies	-
901290	Parts and accessories for microscopes other than optical microscopes	Subassemblies	-
847310	Parts & accessories of typewriters & word-processing machines, o/t cases	Subassemblies	-
847321	Parts & accessories of electronic calculating machines of heading No 84.70 nes	Subassemblies	-
852210	Pick-up cartridges	Subassemblies	-
910911	Clock movements, complete & assembled, battery powered, for alarm clocks	Subassemblies	-
910919	Clock movements, complete and assembled, battery powered, nes	Subassemblies	-
910811	Watch movements, assembled, battery powered with mechanical display	Subassemblies	-
910812	Watch movements, assembled, battery powered, with opto-electronic display	Subassemblies	-
901390	Parts and accessories of optical appliances and instruments, nes	Subassemblies	-

854320	Signal generators	Final	Analytical Instruments
854370	Electrical machines and apparatus, having individual functions, nes	Final	Analytical Instruments
901210	Microscopes other than optical microscopes and diffraction apparatus	Final	Analytical Instruments
901580	Surveying, hydrographic, oceanographic, meteorologic/geophysical instruments nes	Final	Analytical Instruments
903010	Instruments & apparatus for measuring or detecting ionising radiations	Final	Analytical Instruments
903033	Instruments and apparatus for measuring or checking voltage, current	Final	Analytical Instruments
903210	Thermostats	Final	Analytical Instruments
854310	Electrical particle accelerators for electrons, protons, etc	Final	Analytical Instruments
854330	Machines & apparatus for electroplating, electrolysis or electrophoresis	Final	Analytical Instruments
901600	Balances of a sensitivity of 5 cg or better with or without weights	Final	Analytical Instruments
902519	Thermometers, not combined with other instruments, nes	Final	Analytical Instruments
903084	Instruments and appliances for measuring or checking electrical quantities	Final	Analytical Instruments
903089	Instruments & apparatus for measuring or checking electrical quantities nes	Final	Analytical Instruments
903289	Automatic regulating or controlling instruments and apparatus, nes	Final	Analytical Instruments
901720	Drawing, marking-out or mathematical calculating instruments, nes	Final	Analytical Instruments
903031	Multimeters	Final	Analytical Instruments
903020	Cathode-ray oscilloscopes and cathoderay oscillographs	Final	Analytical Instruments
903039	Instruments and Apparatus, for measuring or checking voltage, current, etc without a record dev	Final	Analytical Instruments
903281	Hydraulic or pneumatic automatic regulating or controlling instruments & app	Final	Analytical Instruments
903220	Manostats	Final	Analytical Instruments
903040	Instruments & apparatus, specially designed for telecommunications nes	Final	Analytical Instruments

903032	Multimeters with recording device	Final	Analytical Instruments
903082	Instruments for checking semiconductor wafers	Final	Analytical Instruments
901420	Instruments & appliances for aeronautical/space navigation (other than compasses)	Final	Analytical Instruments
901480	Navigational instruments and appliances nes	Final	Analytical Instruments
852580	Television cameras, digital cameras and video camera recorders	Final	Cameras and projectors
852869	Projectors, not incorporating television reception apparatus	Final	Cameras and projectors
852861	Projectors of a kind solely or principally used in an automatic data-processing system	Final	Cameras and projectors
910521	Wall clocks, battery, accumulator or mains powered	Final	Clocks & Watches
910191	Pocket-watches & other watches battery powered & with case of precious metal	Final	Clocks & Watches
910610	Time-registers; time-recorders	Final	Clocks & Watches
910511	Alarm clocks, battery, accumulator or mains powered	Final	Clocks & Watches
910591	Clocks, nes, battery, accumulator or mains powered	Final	Clocks & Watches
910291	Pocket-watches and other watches battery or accumulator powered, nes	Final	Clocks & Watches
910310	Clocks with watch movements, battery/accumulator powered, excluding clocks of 9104	Final	Clocks & Watches
910212	Wrist-watches, battery/accumulator powered with opto-electronic display only, nes	Final	Clocks & Watches
847141	Non-portable digital edp machines with processor & i/o	Final	Computer and storage devices
847190	Automatic data processing equipment nes	Final	Computer and storage devices
847130	Portable digital computers <10kg	Final	Computer and storage devices
847150	Digital processing units not sold as complete systems	Final	Computer and storage devices
847160	Computer input/outputs, with/without storage	Final	Computer and storage devices
847170	Computer data storage units	Final	Computer and storage devices

847149	Digital data processing systems, nes	Final	Computer and storage devices
847180	Units of automatic data processing equipment nes	Final	Computer and storage devices
901812	Ultrasonic scanning apparatus	Final	Medical
901819	Electro-diagnostic apparatus, nes	Final	Medical
902214	X-rays apparatus, medical/surgical/veterinary use nes	Final	Medical
902219	Apparatus based on the use of X-rays for other uses	Final	Medical
902230	X-ray tubes	Final	Medical
902290	Parts & accessories for apparatus based on the use of X-rays or other radiations	Final	Medical
901811	Electro-cardiographs	Final	Medical
901813	Magnetic resonance imaging apparatus	Final	Medical
901890	Instruments and appliances used in medical or veterinary sciences, nes	Final	Medical
901814	Scintigraphic apparatus	Final	Medical
902140	Hearing aids, excluding parts and accessories	Final	Medical
902221	Apparatus based on the use of alpha beta/gamma radiations, for medical use	Final	Medical
901820	Ultra-violet or infra-red ray apparatus	Final	Medical
902229	Apparatus based on the use of alpha beta/gamma radiations, for other uses	Final	Medical
902212	Computed tomography apparatus	Final	Medical
902213	X-rays apparatus, dental use, nes	Final	Medical
902150	Pacemakers for stimulating heart muscles, excluding parts & accessories	Final	Medical
847029	Electronic calculating machines, nes	Final	Office equipment
847010	Electronic calculators capable of operation without an external source of power	Final	Office equipment
847030	Calculating machines, nes	Final	Office equipment
847050	Cash registers	Final	Office equipment
847021	Electronic calculating machines, incorporating a printing device, nes	Final	Office equipment
853110	Burglar or fire alarms and similar apparatus	Final	Others
851650	Microwave ovens	Final	Others

853180	Electric sound or visual signalling apparatus, nes	Final	Others
961380	Lighters, nes	Final	Others
853120	Indicator panels incorporating liquid crystal device/ light emitting diode	Final	Others
910690	Time of day recording apparatus, nes	Final	Others
950410	Video games of a kind used with a television receiver	Final	Others
851711	Line telephone sets with cordless handsets	Final	Phones, Fax Machines, & Routers
851712	Telephones for cellular networks mobile telephones or for other wireless	Final	Phones, Fax Machines, & Routers
851718	Telephone sets excluding line telephone sets with cordless handsets	Final	Phones, Fax Machines, and Routers
851762	Machines for the reception, conversion and transmission or regeneration	Final	Phones, Fax Machines, and Routers
851769	Apparatus for the transmission or reception of voice, images or other data	Final	Phones, Fax Machines, and Routers
851761	Base stations of apparatus for the transmission or reception of voice	Final	Phones, Fax Machines, and Routers
852610	Radar apparatus	Final	Radar and Radio Navigation Equipment
852691	Radio navigational aid apparatus	Final	Radar and Radio Navigation Equipment
852692	Radio remote control apparatus	Final	Radar and Radio Navigation Equipment
852550	Transmission apparatus for radio-broadcasting or television, not incorporating reception apparatus	Final	Radio and TV Transmission
852560	Transmission apparatus for radio-broadcasting or television, incorporating reception apparatus	Final	Radio and TV Transmission
852712	Pocket-size radio-cassette-players	Final	Radios and Alarm Clocks

852713	Radio apparatus nes with sound recording/reproducing	Final	Radios and Alarm Clocks
852799	Radio-broadcast receivers, for mains operation only, not combined with sound recording or reproducing apparatus and not combined with a clock	Final	Radios and Alarm Clocks
852729	Radio receivers not capable of operation without external source of power for motor vehicles, nes	Final	Radios and Alarm Clocks
852719	Radio broad receivers capable of operation without an external source of power, nes	Final	Radios and Alarm Clocks
852721	Radio receivers not capable of operation without external source of power for motor vehicle, combined with sound recording or reproducing apparatus	Final	Radios and Alarm Clocks
852791	Radio-broadcast receivers, for mains operation only, combined with source	Final	Radios and Alarm Clocks
852792	Radio-broadcast receivers, for mains operation only, not combined with sound recording/reproducing apparatus but combined with a clock	Final	Radios and Alarm Clocks
851989	Sound recording or sound reproducing apparatus excluding using magnetic, optical or semiconductor media	Final	Sound and Video Recording Devices
852340	Optical media for the recording of sound or of other phenomena excluding products of chapter 37	Final	Sound and Video Recording Devices
852352	Cards incorporating one or more electronic integrated circuits smart cards	Final	Sound and Video Recording Devices
852380	Gramophone records and other media for the recording of sound or of other phenomena, whether or not recorded	Final	Sound and Video Recording Devices
852110	Video recording or reproducing apparatus magnetic tape-type	Final	Sound and Video Recording Devices
852190	Video recording or reproducing apparatus nes	Final	Sound and Video Recording Devices

852351	Solid-state, non-volatile data storage devices for recording data from an external source	Final	Sound and Video Recording Devices
852329	Magnetic media for the recording of sound or of other phenomena excluding cards incorporating a magnetic stripe and goods of chapter 37	Final	Sound and Video Recording Devices
851930	Turntables record-decks	Final	Sound and Video Recording Devices
852321	Cards incorporating a magnetic stripe for the recording of sound or of other phenomena	Final	Sound and Video Recording Devices
851950	Telephone answering machines	Final	Sound and Video Recording Devices
852359	Semiconductor media, unrecorded, for the recording of sound or of other phenomena	Final	Sound and Video Recording Devices
851981	Sound recording or sound reproducing apparatus, using magnetic, optical or semiconductor media	Final	Sound and Video Recording Devices
851920	Sound recording or sound reproducing apparatus, operated by coins, banknotes, bank cards, tokens or by other means of payment	Final	Sound and Video Recording Devices
851810	Microphones and stands therefor	Final	Sound projection
851829	Loudspeakers, nes	Final	Sound projection
851830	Headphones, earphones and combined microphone/speaker sets	Final	Sound projection
851840	Audio-frequency electric amplifiers	Final	Sound projection
851850	Electric sound amplifier sets	Final	Sound projection
851821	Single loudspeakers, mounted in the same enclosure	Final	Sound projection

851822	Multiple loudspeakers, mounted in the same enclosure	Final	Sound projection
852849	Cathode-ray tube monitors, not incorporating television reception apparatus	Final	Television and Monitors
852859	Monitors, not incorporating television reception apparatus	Final	Television and Monitors
852871	Reception apparatus for television, whether or not incorporating radio	Final	Television and Monitors
852872	Reception apparatus for television, colour, whether or not incorporating radio	Final	Television and Monitors
852873	Reception apparatus for television, black and white or other monochrome	Final	Television and Monitors
852851	Monitors of a kind solely or principally used in an automatic data-processing system	Final	Television and Monitors
852841	Cathode-ray tube monitors of a kind solely or principally used in an automatic data-processing machine of heading 8471	Final	Television and Monitors

Source: Stracery

ANNEXURE 2: PRODUCTS IN WHICH INVESTMENT FROM CHINA COULD BE ATTRACTED

HS Code	Category	Product Description	China's Imports, 2012 (US$ mn)	India's Imports, 2012 (US$ mn)
854140	Component	Photosensitive semiconductor device, photovoltaic cells and light emitting diodes	4422.12	871.94
850440	Component	Static converters, nes	4616.61	715.32
850490	Component	Parts of electrical transformers, static converters and inductors	1188.62	311.33
854011	Component	Cathode-ray television picture tubes, including video monitor tubes, colour	224.47	175.67
853649	Component	Electrical relays for a voltage exceeding 60 V but not exceeding 1,000 volts	212.55	147.63
850511	Component	Permanent magnets and art intended to become permanent magnets of metal	438.49	76.48
854130	Component	Transistors, diodes and triodes, other than photosensitive devices	217.13	50.50
853641	Component	Electrical relays for a voltage not exceeding 60 volts	388.86	41.42
961210	Component	Typewriter or similar ribbons, prepared for giving impressions	68.20	30.49
850519	Component	Permanent magnets and articles intended to become permanent magnets	199.75	28.95
854091	Component	Parts of cathode-ray tubes	122.29	16.75
853210	Component	Fixed capacitors designed for use in 50/60 Hz circuits (power capacitors)	61.59	13.41
854370	Final goods (Analytical Instruments)	Electrical machines and apparatus, having individual functions, nes	1399.50	403.61
903210	Final goods (Analytical Instruments)	Thermostats	191.26	20.10
902519	Final goods (Analytical Instruments)	Thermometers, not combined with other instruments, nes	59.53	13.94

852580	Final goods (Cameras and projec-tors)	Television cameras, digital cameras and video camera recorders	3187.85	584.54
847130	Final goods (Computer and storage devices)	Portable digital computers <10kg	396.52	2022.98
847150	Final goods (Computer and storage devices)	Digital processing units not sold as complete systems	1110.69	688.34
847160	Final goods (Computer and storage devices)	Computer input/outputs, with/without storage	768.06	267.73
847180	Final goods (Computer and storage devices)	Units of automatic data processing equipment and nes	1210.63	99.40
847149	Final goods (Computer and storage devices)	Digital data processing systems, nes	1296.64	58.47
847141	Final goods (Computer and storage devices)	Non-portable digital edp machines with processor and i/o	417.27	58.32
847190	Final goods (Computer and storage devices)	Automatic data processing equipment nes	299.15	53.16
901819	Final goods (Medical)	Electro-diagnostic apparatus, nes	147.01	121.22
902214	Final goods (Medical)	X-rays apparatus, medical/surgical/ veterinary use, nes	373.10	90.72
902140	Final goods (Medical)	Hearing aids, excluding parts and ac-cessories	69.80	46.83
847010	Final goods (Office equipment)	Electronic calculators capable of operation without an external source of power	78.44	23.08
847050	Final goods (Office equipment)	Cash registers	95.81	11.85
853120	Final goods (Others)	Indicator panels incorporating liquid crystal device/light emitting diode	321.20	27.17

853180	Final goods (Others)	Electric sound or visual signalling apparatus, nes	99.07	27.00
853110	Final goods (Others)	Burglar or fire alarms and similar apparatus	99.46	21.39
851712	Final goods (Phones, Fax Machines, and Routers)	Telephones for cellular networks mobile telephones or for other wireless	1858.36	4591.36
851762	Final goods (Phones, Fax Machines, and Routers)	Machines for the reception, conversion and transmission or regeneration	3099.81	1052.22
851769	Final goods (Phones, Fax Machines, and Routers)	Apparatus for the transmission or reception of voice, images or other data	229.51	966.23
851761	Final goods (Phones, Fax Machines, and Routers)	Base stations of apparatus for the transmission or reception of voice	77.13	39.27
852691	Final goods (Radar and Radio Navigation Equipment)	Radio navigational aid apparatus	386.06	19.41
852352	Final goods (Sound and Video Recording Devices)	Cards incorporating one or more electronic integrated circuits smart cards	187.78	273.87
852351	Final goods (Sound and Video Recording Devices)	Solid-state, non-volatile data storage devices for recording data from an external source	2492.76	193.04
852190	Final goods (Sound and Video Recording Devices)	Video recording or reproducing apparatus nes	123.73	100.93
852329	Final goods (Sound and Video Recording Devices)	Magnetic media for the recording of sound or of other phenomena excluding cards incorporating a magnetic stripe and goods of chapter 37	1246.53	32.85

851830	Final goods (Sound projection)	Headphones, earphones and combined microphone/ speaker sets	458.07	225.78
851829	Final goods (Sound projection)	Loudspeakers, nes	623.91	206.37
851822	Final goods (Sound projection)	Multiple loudspeakers, mounted in the same enclosure	98.78	33.18
851840	Final goods (Sound projection)	Audio-frequency electric amplifiers	88.37	18.98
851810	Final goods (Sound projection)	Microphones and stands therefor	546.84	16.52
852872	Final goods (Television and Monitors)	Reception apparatus for television, colour, whether or not incorporated	84.69	630.04
852851	Final goods (Television and Monitors)	Monitors of a kind solely or principally used in an automatic data-processing system	1258.66	469.76
852859	Final goods (Television and Monitors)	Monitors, not incorporating television reception apparatus excluding with	168.60	48.17
851770	Subassembly products	Parts of telephone sets, telephones for cellular networks or for other data	13574.51	2829.27
847330	Subassembly products	Parts and accessories of automatic data processing machines and units thereof	14978.15	1598.93
852990	Subassembly products	Parts suitable for use solely/principally with the application of headings 85.25 to 85.28	8148.74	981.78
903300	Subassembly products	Parts and accessories for machines, appliances, instruments or apparatus of Chapter 90	575.56	331.21
853710	Subassembly products	Boards, panels, including numerical control panels, for a voltage <=1000 V	2882.04	312.12
850110	Subassembly products	Electric motors of an output not exceeding 37.5 W	1446.82	197.56
852910	Subassembly products	Aerials and aerial reflectors of all kinds; parts suitable for use therewith	236.31	116.65
853190	Subassembly products	Parts of electric sound or visual signalling apparatus	132.73	88.56

847340	Subassembly products	Parts and accessories of other office machines, nes	327.92	73.47
852290	Subassembly products	Parts and accessories of apparatus of heading Nos 85.19 to 85.21, nes	2691.09	55.33
901590	Subassembly products	Parts and accessories for use with the apparatus of heading No 90.15	186.82	35.48
851890	Subassembly products	Parts of microphones, loudspeakers, headphones, earphones and electric sound amplifier	395.11	31.51
847350	Subassembly products	Parts and accessories for more than one office machine	126.21	25.77

Source: UNCOMTRADE, EXIM Bank Analysis

ANNEXURE 3: PRODUCT CATEGORIES FOR ENHANCING EXPORTS FROM INDIA TO CHINA

HS Code	Category	Product description	Import by China, 2012 (US$ mn)
853890	Component	Parts for use with the apparatus of heading no. 85.35,85.36 or 85.37,nes	3992.54
901890	Final goods (Medical)	Instruments and appliances used in medical or veterinary sciences, nes	1507.77
853400	Component	Printed circuits	14481.73
847340	Subassembly products	Parts and accessories of other office machines	609.43
902214	Final goods (Medical)	X-rays apparatus, medical/surgical/veterinary use	966.35
854390	Subassembly products	Parts of electrical machines and apparatus having individual functions	804.16
847170	Final goods (Computer and storage devices)	Computer data storage units	25590.04
903289	Final goods (Analytical Instruments)	Automatic regulating or controlling instruments and apparatus	3767.80
852329	Final goods (Sound and Video Recording Devices)	Magnetic media for the recording of sound or of other phenomena excluding cards incorporating a magnetic stripe and goods of chapter 37	1454.40
902290	Final goods (Medical)	Parts and accessories for apparatus based on the use of X-rays or other radiations	554.85
901590	Subassembly products	Parts and accessories for use with the apparatus of heading No 90.15	233.38
902230	Final goods (Medical)	X-ray tubes	236.83
901580	Final goods (Analytical Instruments)	Survey, hydrographic, oceanographic, meteorological/ geophysical instruments	596.85
853210	Component	Fixed capacitors designed for use in 50/60 Hz circuits (power capacitors)	61.63
901812	Final goods (Medical)	Ultrasonic scanning apparatus	906.82

854231	Component	Electronic integrated circuits as processors and controllers, whether or not combined with memories	108353.5
850450	Component	Inductors, electric	3109.17
854160	Component	Mounted piezo-electric crystals	2690.80
854232	Component	Electronic integrated circuits as memories	38009.04
903090	Subassembly products	Parts and accessories for instruments and application for measuring or checking electrical quantities	761.46
854290	Component	Parts of electronic integrated circuits and micro-assemblies	816.09
853229	Component	Electrical capacitors, fixed	232.34

Source: UNCOMTRADE, EXIM Bank Analysis

ANNEXURE 4: POLICY DEVELOPMENTS IN INDIA AND CHINA RELEVENT ELECTRONICS INDUSTRY

TAX POLICY COMPARISON

China

The general corporate income tax rate for China is 25 percent but there are incentives for firms in the electronics industry. Major tax incentives relevant for the electronics industry are:

- Firms in the 'High and New Technology Enterprises (HNTE)' category face reduced tax rate of 15 percent. HNTE status needs to be applied for and is renewed every three years. Activities qualifying for HNTE incentive can happen outside of China but the share of such activity must be less than 40 percent.
- Expenditure for research and development is provided with additional deduction of 50 percent of the R&D expenditures, if it is not capitalized as intangible asset. If capitalized as intangible assets, they are amortized at 150 percent of its cost.
- Upon transfer of eligible technology, business tax exemption is provided. Enterprise income tax exemption is also provided for some technology transfers.
- Exemption on import duty is provided for eligible domestic and foreign invested R&D. On purchase of domestic equipment for R&D, a refund on VAT is also provided.
- For technology / software companies, first 5 million Yuan of income earned from technological transfer in a tax year is tax exempt from Enterprise Income Tax (EIT) and above 5 million Yuan is taxed at 50 percent reduced rate.
- Tax losses attributable to R&D super deduction claims can be carried forward up to 5 years.
- Integrated circuit manufacturing is exempt for the first two years from EIT and in the following three years, starting the first

profit-making year, manufacturers receive 50 percent reduction in EIT.

- Large investment in circuit manufacturing of amounts exceeding 8 billion RMB, or manufacturers who produce IC products with a line width of less than 0.25 millimetres face 15 percent EIT, or in case the operational period of the investment is more than 15 years, exempt from EIT in the first five years followed by a 50 percent reduction in the next five years, starting with the first profit-making year.

India

In India, the current corporate tax rate stands at 30 percent for domestic firms and 40 percent for foreign firms. Starting from 2015-16, corporate tax rate would be cut from 30 to 25 percent over a period of four years. Major tax incentives relevant to the electronics industry are:

- 100 percent deduction for R&D expenses that satisfy some criteria. 200 percent super deduction is provided for in-house R&D expenditures. 150-200 percent super deduction is also provided for payment to prescribed research institutions.
- Unused benefits can be carried for eight years in case the taxpayer is in a loss.
- Tax benefits are also provided for companies operating in SEZs of which prominent one from export perspective is 100 percent income tax exemption on export profits for five years, 50 percent for the following five years, and 50 percent of ploughed back export profit for the following five years. Other prominent tax incentives are:
    - o Duty free import/domestic procurement of goods for development, operation and maintenance of units.
    - o Exemption from minimum alternate tax.
    - o External Commercial Borrowings by units up to US$ 500 million in a year without any maturity restriction through recognized banking channels.
    - o Exemption from Central Sales Tax and Service Tax.
    - o Single window clearance for Central and State level approvals.

- Electronic Hardware Technology Parks also provide tax incentives for firms. Especially with regard to export profits, 100 percent of it is tax-exempted.

- Modified Special Incentive Package Scheme provides subsidy for investments in capital expenditure - 20 percent for investments in SEZs and 25 percent in non-SEZs- to units all across the electronics value chain and covering 29 verticals of electronics products. It also provides for reimbursement of countervailing duty / excise duty for capital equipment for the non-SEZ units. For high technology and high capital investment units, like fabs, reimbursement of central taxes and duties is also provided.

MANUFACTURING RELATED POLICY COMPARISON

China

- China has pronounced high-end equipment manufacturing, biotechnology, next generation IT as strategic emerging industries, along with other four industry segments. Together, these industries are expected to account for up to 15 percent of China's GDP by 2020. Development of medical devices and integrated circuits have received focus under this. These industries receive preferential policies.

- In 1988, the State Council approved and started the Torch Program (Huoju Jihua) in China - an initiative which explicitly highlighted the building of hi-tech industrial development zones as a main focus. By 2012, 105 new and high-tech industry development zones were established in the country, realizing annual industrial value of 5.22 trillion Yuan.

- Targeted government procurement programs have generated significant demand for electronic products in China. The country has emerged as one of the largest market for Radio-frequency identifications (RFIDs), driven by government procurements and increasing use by public entities of RFID tags for transportation logistics and contactless reusable tickets. Moreover, China's Indigenous Innovation Policies introduced during and after 2006 are designed to develop an indigenous capacity to create innovation and advanced technology. As part of these policies, China has implemented rules related to government procurement, giving preferential treatment in the procurement process to

indigenous innovation products. Currently, the annual government procurement budget is estimated to be around US$ 1 trillion.

- Innovation Fund for Small and Medium Technology-based Firms (Innofund) is one of the largest Chinese government programs that support corporate R&D activities on corporate innovation outputs. Innofund mainly provides three forms of financing, namely, appropriation, bank loan interest subsidies, and equity investment. Appropriation is mainly the start-up capital provided to small firms founded by research personnel with their own scientific achievements. Partial subsidies are also provided to small and medium technology-based enterprises for new product development and pilot production. The appropriation amount to each project should not exceed 1 million RMB, with a maximum of two million for key projects.

  Loan interest subsidies are mainly provided to small and medium technology-based enterprises that require loans from commercial banks to expand the production scale of innovation projects. The total amount of subsidy of an individual project is generally within 1 million RMB and 2 million RMB for key projects. Equity investment is generally reserved for projects with high levels of technology, high innovation capacity, and market potential in emerging industries.

- Special incentives are provided for SMEs in China. Some prominent ones are:

  - The VAT and sales tax threshold has been raised and EIT has been reduced for small and micro enterprises by the State Council until 2015.

  - In 2012, the Central Government decided to establish a development fund in which 15 billion Yuan was to be injected in 5 years.

  - Preferential policies also exist in government procurement for SMEs. Thirty percent of total budget by authorities should be earmarked for SMEs, with 60 percent of the amount specifically for the small and micro sized enterprises. While submitting tender for procurement, small and micro sized enterprises also get an additional price preference of 6-10 percent.

- It has also been mandated that banks' credit support for small firms should not grow at a lower rate than the average growth of loans from banks. Small FIs meeting the loan growth target were also to be subjected to lower required reserve requirement which currently stands at 21 percent for major banks. Commercial banks were also barred from charging of fees like fund management fees and financial consulting fees for their services to small firms.

- The government has also set up a special fund for encouraging innovation in technology-intensive SMEs.

- According to ILO, Export Processing Zones are defined as industrial zones that offer generous and social incentives to attract foreign investors and in which imported materials are processed before being re-exported. According to ILO's 2012 report, China has ten different kinds of EPZs: Special Economic Zone, Comprehensive Reform Testing District, Economic and Technology Development Zone, High-tech Industrial Development Zone, Bonded Zone, Export Processing Zone, Bonded Port Areas, Bonded Logistics Zone, Comprehensive Free Trade Zone and Border Economic Cooperation Zone.

- China also has financial institutions like Export-Import Bank of India and China Export & Credit Insurance Corporation (SINOSURE) which provide impetus to the exports from the manufacturing segment through financing and insurance services.

India

- Large number of industries have been identified as strategic by the Government, including IT and electronic hardware industry, etc. Each of the strategic industries has received specific government policy intervention.

- Electronic Manufacturing Cluster (EMC) Scheme supports creation of world-class infrastructure for attracting investments in the Electronics Systems Design and Manufacturing Sector. The scheme supports grant assistance for setting up of both greenfield and brownfield EMCs. The financial assistance under the scheme is in the form of grant-in-aid only. For greenfield EMCs the assistance is 50 percent of the

project cost subject to a ceiling of Rs. 50 crore for every 100 acres of land, and for brownfield EMCs the assistance is upto 75 percent of the project cost subject to a ceiling of Rs. 50 crores.

- The Preference for Domestically Manufactured Electronics Goods Policy is applicable to all Ministries/ Departments (except Ministry of Defence). This is also applicable for procurement of electronic products made under all Centrally Sponsored Schemes and grants made by Central Government. The products notified for providing preference to domestic manufacturers are: desktop PCs, dot matrix printers, tablet PCs, laptop PCs, contact smart cards, contactless smart cards, LED products, biometric access control/authentication devices, biometric finger print sensors, and biometric iris sensors.

- An Electronic Development Fund (EDF) is proposed to be set up as a "Fund of Funds" to participate in "Daughter Funds" which in turn will provide risk capital to companies developing new technologies in the area of electronics, nano-electronics and Information Technology. Assuming that the average participation of EDF in Daughter Fund is 25 percent, the policy will help leverage four times Government funding in the area of R&D and innovation. It will help create a battery of Daughter funds and Fund Managers who will be seeking good start-ups (potential winners) and selecting them based on professional considerations.

- Some of the key incentives provided for MSMEs in India are:

  - MSMEs in India receive wide array of technological support. Some of the important organizations engaged in providing such support are Small Industries Development Organization and National Small Industries Corporation Limited. Apart from these, the National Manufacturing Competitiveness Programme has also implemented crucial measures to enhance the competitiveness of Indian MSMEs through technological support.

  - Programmes have also been launched to help in marketing of MSME products. Examples of such initiatives are Vendor Development Programme wherein opportunity is provided to the small businesses to interact with

large public sector units and SSI-MDA Scheme wherein opportunity is provided to MSMEs for getting international exposure and becoming aware about existing export opportunities.

- Ministry of MSME, Government of India also has a 'Scheme for Assistance to Training Institutions' which provides assistance for setting up and strengthening Entrepreneurship Development Institutes (EDIs). These EDIs work towards entrepreneurship development and skill building programmes.

- Small Industries Development Bank of India works towards providing financial assistance to the MSMEs. It has a range of product and services for the small scale sector and has also set up various other institutional infrastructures for the SME sector. Apart from SIDBI, the National Small Industries Corporation and State Finance Corporations also provide financial assistance to the MSMEs. An SME fund has also been created which provides assistance to SMEs at the rate of 200 basis points below the Bank's prime lending rate. Apart from these, loans up to Rs. 100 lakh can be provided to micro and small enterprises without collateral/third party guarantees under the Govt. of India's Credit Guarantee Fund Scheme for Micro and Small Enterprises.

- India currently has 173 operational SEZs with seven of them established by central government, namely Kandla, SEEPZ, Noida, MEPZ, Cochin, Falta and Vishakhapatnam. Number of incentives and facilities are offered to the units in the SEZs like exemption from central sales tax, exemption from services tax, single window clearance for approvals, etc. Moreover, the National Manufacturing Policy which aims to increase the share of manufacturing to 25 percent of GDP by 2022 proposed to launch National Investment and Manufacturing Zones (NIMZs). While the SEZs have been developed with a focus on exports, NIMZs are developed more on the lines of industrial towns having manufacturing and related facilities as well as other residential and social infrastructure.

- For encouraging exports of electronic hardware items, EHTP have been developed. Export profits under these are 100 percent tax exempt and CST is refundable. DTA sales are permissible upto 50 percent of FOB value of exports, subject to fulfilment of positive net foreign exchange on payment of concessional duties.

- India also has financial institutions like Export-Import Bank of India and Export Credit Guarantee Corporation of India which have a pivotal role in promoting foreign trade of India.

SCIENCE & TECHNOLOGY POLICY COMPARISON

China

- Total number of patent applications for inventions in China in 2013 was 795,517, of which 207,688 were granted patents. Applications received for layout designs of integrated circuits were as high as 1,561 in 2013, taking the total during the period October 2001-December 2013 to 9,279[66].

- Although obstacles remain in effective protection of IPR in China, the end of 11th Five Year Plan in China saw the strengthening of IP regime in the country. Third revision of the Patent Law which came into force on Feb 1, 2011 prescribed stricter conditions to patent granting, improved examination system for patents for design and compulsory license system, added system of preservation of evidence in proceedings, supplemented measures to protect public interests, and strengthen patent protection[67]. Many other crucial regulations were amended. The Supreme People's Court also attempted to standardize the trial of intellectual property cases.

- China has in place the National Computer Network Emergency Response Technical Team (CNCERT) which is engaged in network security technical coordination. It maintains the safety of China public Internet and ensures the safe operation of the information network infrastructures and the vital information systems[68]. The organization releases weekly reports containing data for

[66]State Intellectual Property Office of the P.R.C
[67]Ibid.
[68]Official website of National Computer Network Emergency Response Technical Team/Coordination Center of China.

incidents of malware activities, website security, vulnerabilities and also incident handling undertaken by CNCERT. Furthermore, State Council had, in 2012, released a set of guidelines for guarding against such risk. This included requiring all energy and finance sectors, nuclear facilities, space programs and large infrastructure projects to be put under information security and supervision measures.

- Although some guidelines do exist as far as personal data protection is concerned, there are no specific laws in this regard in China.

- To improve the level of scientific research in the country, Ministry of Education had two core programs- Project 211 and Project 985. Both these projects were aimed at improving the research capacity of Chinese universities. In 2011, both these projects were closed to new universities. According to the Global Innovation Index 2013 report, China ranked 9th in terms of quality of its scientific research institutions. Although the international significance of Chinese universities has been growing, they have attracted little scholarship (Zhang et. al., 2013).[69]

- The Ministry of Science and Technology also has several science and technology programmes like 863 program, National Key Technologies R&D program, 973 program, National Science and Technology Infrastructure Program, Environment Building for S&T industries, and Mega Projects for the 10th Science Research for the 10th Five Year Plan, which provide a boost to scientific research in the country.

India

- India has witnessed a y-o-y growth in patents filed and examined during 2012-13. However there has been a fall in patent granted from 2011-12 onwards. During the five year period 2008-09 to 2012-13, while both patents filed and patents examined have grown (CAGR) by 4.4 percent and 4.5 percent to reach the level of 43,674 and 12,268 respectively, patents granted have witnessed a negative CAGR of -28.8 percent. Of the total number of patent applications filed in 2012-13, 4,424

[69]Zhang et. al. (2013), Building Global-Class Universities: Assessing the Impact of the 985 Project.

were in the category of computer/ electronics (10.1 percent)[70].

- As per the report of the United State Trade Representative, India's legal framework and enforcement system for IPR is weak. Challenges are growing in many of the areas which can hamper innovation climate. With respect to electronics industry in particular, the USTR has raised concerns over India's Preferential Market Access policy for electronic products which appear to condition certain preferential treatment on the indigenous development of IPR.

- A scheme to support 3000 PhD (1500 in ESDM and 1500 in IT/ ITES) has been approved in February, 2014 at an estimated cost of Rs.401 crore. Out of 1500 additional PhDs in ESDM, 500 would be full time and 1000 would be part time. In addition, 100 PhDs (full-time) are to be supported by industry/State Government as a part of this Scheme.

- Scheme on Skill Development in ESDM for Digital India has been approved on 09.12.2014 to cover all the States/UTs of the country in order to facilitate creation of an eco-system for development of ESDM sector in the entire country, for facilitating skill development for 3,28,000 persons in ESDM sector at an outlay of Rs. 411 crore (approx.) in a period of 4 years.

- Under the Scheme of Financial Assistance for setting up of Electronics and ICT Academies, seven Electronics and ICT Academies are to be set up as a unit in IITs, IIITs, NITs, etc., for faculty/ mentor development/up gradation to improve the employability of the graduates/diploma holders in various streams, through active collaboration of States/UTs with financial assistance from the Central Government. Electronics and ICT Academy would aim to provide specialized training to the faculties of the Engineering, Arts, Commerce & Science colleges, Polytechnics etc, by developing state-of-the-art facilities.

- Project on 'Capacity building in the areas of Electronic Product Design and Production Technology' has been approved on 01.5.2012 at a total estimated cost of Rs. 49.69 Crore. The project has been initiated for development of human resource at various levels including Certificate, Diploma, Post Graduate and Research

[70]Annual Report 2012-13, Controller General of Patents, Designs, and Trade Marks.

Professionals with adequate competence levels with a target of training 11,515 candidates in five years.

- As far as cyber security is concerned, India recently came out with the National Cyber Security Policy, 2013, which aims at "building a secure and resilient cyberspace for citizens, businesses and Government". The Policy document contains strategies for building a robust cyber security system in India. Legal framework for cyber security already existed in the form of IT act of 2000 and IT (Amendment) Act of 2008.

- Although there is no specific legislation on data protection in India, some provisions intended to protect electronic data exists in the IT Act, 2000. Moreover, the Department of Information Technology, Government of India, adopted the Information Technology (Reasonable Security Practices and Procedures and Sensitive Data or Information) Rules, 2011, which requires corporate bodies collecting, receiving, possessing, storing, dealing or handling personal information to comply with certain procedures.

- Quality of scientific research institutions was considered as a major strength for India in the Global Innovation Index, 2013. The Department of Science and Technology, Government of India works towards strengthening institutional capacities in research and development. Major initiatives by the department include Fund for Infrastructure, Strengthening of S&T (FIST) and Promotion of University Research and Scientific Excellence (PURSE). Ministry of Human Resource Development in India has also played a seminal role in developing the science and technology environment. In recent times, it has proposed several legislations for restructuring higher education in India. Of this, prominent ones with focus on research orientation of Indian educational universities are 'The Universities for Research and Innovation Bill, 2011' and 'The Foreign Education Institutions (Regulation of Entry and Operations) Bill 2010'. While the former aims at providing a framework for establishment of universities for research and innovation, the latter aims at maintaining the standards of higher education in the country.

- The Department of Science and Technology, Government of India has several programs for technology development like Drugs and Pharmaceutical Research Programme, Instrumentation Development Programme, National Program on Carbon Sequestration Research, Solar Energy Research Initiative, etc.

EASE OF DOING BUSINESS COMPARISON

China

- China ranked 96 in the World Bank's Doing Business report. As compared to India, it fares well on the parameter of registering property, wherein it takes only 29 days in China and costs 3.6 percent of property value, as against 44 days in India and costing 7.0 percent of the property value.

- China's tax structure is also relatively simplified as compared to India. While a total of 33 payments are required in the Indian case, mere 7 payments are required in China's case. Simplifying the tax procedure in India by moving to GST will help improve the doing business ranking considerably. More number of taxes requires greater interaction between businesses and tax collecting agencies, and complicates the process.

- China also fares well in the criteria of trading across borders, with the cost to export and import almost half of that in the Indian case. The number of documents required for exporting/importing into the country is also lesser in China's case. Inland transportation and handling, and ports and terminal handling are major components of export cost in India, accounting for 53.4 percent of the total cost. On the other hand, it accounts for only 37.9 percent of China's cost of exports. In absolute value terms, while the total logistic related costs amount to US$ 625 per container in India's case, it is mere US$ 235 per container in China's case. India needs to improve infrastructure facilities and give impetus to its logistic services industry in order to improve manufacturing and trading conditions as a whole. Good practices under this include providing a single window which is practiced across 73 economies of the world, including China which should be implemented in India. A common practice which

has been applied in as many as 134 countries across the globe is that of risk-based inspections. Administrations in these countries have developed systems for instituted risk profiles which allow them to use physical inspection in proportion to the potential risk of consignments. Such a system is not present in India, while it is present in China.

- Enforcing contracts is a strong point for China as it ranks 19th in terms of ease of contracts, measured in terms of the time, cost and procedural complexity of resolving a commercial lawsuit between two domestic businesses. It takes only 406 days in China to enforce a contract, requiring 37 procedures and costing 11.1 percent of claims. On the other hand, in India it requires 1,420 days, costing a huge 39.6 percent of total claims and requiring 46 procedures in total. Good practices for enforcing contracts across the world include maintenance of specialized commercial court, division or judge, which exists in 90 economies across the world, including China, but is not present in India. Electronic filing of complaints is also not practised much in India which is practiced across 17 economies of the world.

- Resolving insolvency is essential for encouraging entrepreneurs to take risks and opt for innovation. While China ranks 78th in terms of resolving insolvency, India ranks 121st. It takes lesser time in China to resolve insolvency (1.7 years) as compared to India (4.3 years) and the recovery rate is also higher at 36.0 cents per dollar in China, against 25.6 cents per dollar in India. Promoting specialized courts to solve insolvency cases can make the system more efficient as the time factor is a major disability.

India

- Among all criteria, India fares the best in getting credit. It ranked 28th among all economies in this parameter. China on the other hand ranked 73rd. On a scale of 0 to 10, the strength of legal rights in India received a score of 8, while the depth of credit information received a score of 5 on a scale of 0 to 6.

- India also ranks fairly well in terms of protecting investors. It ranked 34th in this parameter. There is further scope for

improvement by strengthening the ability to sue directors for damages as represented by the 'extent of director liability index'. Thirty economies across the globe have defined lucid rules on liability of company directors in the event of abusive related-party transactions. However, in the past year India strengthened minority investor protections by requiring greater disclosure of conflicts of interest by board members, increasing the remedies available in case of prejudicial related-party transactions and introducing additional safeguards for shareholders of privately held companies.

TRADE POLICY COMPARISONS

China

- *Pre-shipment Inspection*: China's pre-shipment inspection (PSI) requirements are intended to protect public health, improve phytosanitary situation, protect environment and also to prevent entry of counterfeit goods into the country. Some foreign institutions have been designated to conduct such inspections and issue certificates. PSI for waste raw materials and of used material and electronic products is carried out largely by inspection bodies abroad, but for large scale sets of equipment where technical support is considered necessary, the Chinese Government may send inspection and quarantine personnel abroad, upon the request of foreign inspection bodies, to provide technical guidance and consultancy. PSI is also essential in the case of import of commodities related to national security, with high value or complicated technology, and also for equipments exceeding certain dimensional attributes.

- *Information Technology Agreement:* China is a party to ITA and eliminated tariffs on all ITA products on 1 January 2005.

- *Import Prohibitions:* On the grounds of public interest, environmental protection or in accordance with international commitments, China has import prohibitions which are generally listed in 'Catalogues of Commodities subject to Import Prohibitions'. In 2011, import prohibitions included second hand/used items or scraps in the machinery and electronic equipment category (Table 40).

- *Licensing*: China has an import licensing regime which applies

Table 40: List of Electronic Products for which Import is Banned under Used Category

HS Code	Description
852190	Video recording or reproducing apparatus nes
901811	Electro-cardiographs
901812	Ultrasonic scanning apparatus
901813	Magnetic resonance imaging apparatus
901814	Scintigraphic apparatus
901819	Electro-diagnostic apparatus, nes
901820	Ultra-violet or infra-red ray apparatus
901890	Instruments and appliances used in medical or veterinary sciences, nes
902212	Computed tomography apparatus
902213	X-rays apparatus, dental use, nes
902214	X-rays apparatus, medical/surgical/veterinary use nes
902219	Apparatus based on the use of X-rays for other uses
902221	Apparatus based on the use of alpha beta/gamma radiations, for medical use
902229	Apparatus based on the use of alpha beta/gamma radiations, for other uses
902230	X-ray tubes
902290	Parts & accessories for apparatus based on the use of X-rays or other radiations
950410	Video games of a kind used with a television receiver
847110	Analogue or hybrid automatic data processing machines
847160	Computer input/outputs, with/without storage
851650	Microwave ovens
851711	Line telephone sets with cordless handsets
851721	Facsimiles machines
852110	Video recording or reproducing apparatus magnetic tape-type
852520	Transmission apparatus, for radiotelephony incorporating reception apparatus
852530	Television cameras
852812	Colour television receivers
853400	Printed circuits
854011	Cathode-ray television picture tubes, inc video monitor tubes, colour
854210	Cards incorporating an electronic integrated circuit “smart cards”

Source: MOFCOM, People’s Republic of China

Table 41: Category-wise Electronic Products Requiring CCC Mark

HS Code	Description
Component	
850440	Static converters, nes
853641	Electrical relays for a voltage not exceeding 60 volts
853649	Electrical relays for a voltage exceeding 60 V but not exceeding 1,000 volts
854011	Cathode-ray television picture tubes, inc video monitor tubes, colour
854012	Cathode-ray TV picture tube including video monitor tube, B&W/other monochrome
854040	Data/graphic display tubes, colour
854050	Data/graphic display tubes, monochrome
854060	Cathode-ray tubes, nes
Subassemblies	
850110	Electric motors of an output not exceeding 37.5 W
850132	DC motors, DC generators, of an output exceeding 750 with but not exceeding 75KW
853710	Boards, panels, including numerical control panels, for a voltage <=1000 V
853720	Boards, panels, including numerical control panels, for a voltage > 1,000 V
Final	
847050	Cash registers
847130	Portable digital computers <10kg
847141	Non-portable digital edp machines with processor & i/o
847160	Computer input/outputs, with/without storage
851650	Microwave ovens
851711	Line telephone sets with cordless handsets
851719	Telephone sets, nes
851721	Facsimiles machines
851730	Telephonic or telegraphic switching apparatus
851821	Single loudspeakers, mounted in the same enclosure
851822	Multiple loudspeakers, mounted in the same enclosure
851840	Audio-frequency electric amplifiers
851921	Record-players without loudspeaker, nes
851929	Record-players, nes
851992	Pocket-size cassette-players
851993	Cassette type sound reproduction equipment

851999	Sound reproducing apparatus, not incorporating a sound recorder, nes
852110	Video recording or reproducing apparatus magnetic tape-type
852190	Video recording or reproducing apparatus nes
852520	Transmission apparatus, for radiotelephony incorporating reception apparatus
852731	Radiobroadcast receivers combined with sound recording or reproducing apparatus nes
852732	Radiobroadcast receivers not combined with sound recording but combined with a clock, nes
852739	Radio-broadcast receivers nes
852790	Radio reception apparatus nes
852812	Colour television receivers
852813	Black and white television receivers
852821	Colour video monitors
852830	Video projectors
853110	Burglar or fire alarms and similar apparatus

Source: Office of Technology and Electronic Commerce (OTEC) division of the International Trade Administration, U.S. Department of Commerce

to all WTO members and non-members. These licenses are not transferrable and the issuances of these do not require any fees, charges, deposits or advance payments. In 2010, 87 tariff lines (at HS 8 digit level) were subject to non-automatic import licensing which included specific old mechanical and electronic products. Applicants for an import license need to apply before for an import permit which is issued by the Ministry of Environment Protection or MOFCOM, depending on the product. Upon obtaining the permit, a license is granted automatically to the importer which is valid for one calendar year and can be extended.

- *Export Finance, Insurance and Guarantees:* China provides credit financing largely through the Export-Import Bank of China. Export credit insurance is provided by China Export & Credit Insurance Corporation (SINOSURE). There is no local content requirement to obtain export finance. One of the mandates of EXIM Bank of China is to facilitate export and import of Chinese mechanical and electronic products.

- *CCC Safety License Requirement:* China Compulsory

Certification (CCC) mark is required to be obtained by the manufacturers before exporting to or selling products in China. Many electronic products require CCC mark (Table 41). However, under certain conditions as mentioned in CNCA announcement no.3 2005, these product categories can be exempt from certification.

- *China RoHS:* "Measures for Administration of the Pollution Control of Electronic Information Products (EIP)", commonly known as RoHS is intended to restrict the use of hazardous materials in electronic equipments. All products manufactured on or after March 1st 2007 for sale in China must adhere to stage 1 requirements. Products imported into the country for the purpose of re-export or for manufacturing of other export products are excluded. The following requirements need to be adhered to:

a) The hazardous substances which come under the ambit of this measure are Lead (Pb), Hexavalent Chromium (Cr6+), Mercury (Hg), Cadmium (Cd), Polybrominated Biphenyls (PBBs) and Polybrominated Diphenyl ethers (PBDEs). If an EIP doesn't contain any of these, then the following symbol needs to be used:

b) If any of the above mentioned hazardous substance is present above the maximum concentration value, then the following symbol needs to be used, with the number inside it representing the Environmental Friendly Use Period (EFUP):

c) The user manual of the EIP should contain table of names and contents of toxic and hazardous materials if the product contains them in quantities above the maximum concentration values. China's maximum concentration values are 0.1 percent for all hazardous substances other than cadmium for which the level is set at 0.01 percent.

d) Packaging of EIPs should be in accordance with the GB18455-2001 standard.

India

- Generally, all electronic items are freely importable in India, with the exception of some defence related items. All electronic items, in general, are also freely exportable, with the exception of a small negative list which

includes items such as high power microwave tubes, high end super computer and data processing security equipment.

- Second hand capital goods are freely importable into India.

- Export Promotion Capital Goods scheme (EPCG): This allows manufacturer-exporters, including electronic exporters in India to import capital goods at zero percent customs duty for pre-production, production and post-production, subject to an export obligation equivalent to 6 times of duty saved on capital goods imported under EPCG scheme, to be fulfilled in 6 years reckoned from authorization issue-date. The concessional 3 percent duty EPCG scheme allows import, subject to an export obligation of 8 times of duty saved on the imported capital goods under the EPCG scheme, to be fulfilled in 8 years. The export obligation under EPCG Scheme can also be fulfilled by the supply of Information Technology Agreement (ITA-1) items to the domestic tariff area provided the realization is in free foreign exchange.

- Special Economic Zones (SEZs) are being set up for enabling hassle free manufacturing and trading for export purposes. Sales from Domestic Tariff Area to SEZs are currently treated as physical export. This entitles domestic suppliers to a plethora of benefits like Drawback benefits, CST exemption and Service Tax exemption.

- Supplies of Information Technology Agreement items and notified zero duty telecom/electronic items in the Domestic Tariff Area by EOU/EHTP/STP/SEZ units are counted for the purpose of fulfilment of positive Net Foreign Exchange Earnings.

- Deemed Exports: "Deemed Exports" refer to those transactions in which the goods supplied do not leave the country, and the payment for such supplies is received either in Indian rupees or in free foreign exchange. Supply of goods to Export Oriented Units (EOUs) / Software Technology Park (STP) units / Electronic Hardware Technology Park (EHTP) units / Bio Technology Park (BTP) units in India are treated as deemed

exports. Moreover, supply of goods to EPCG Authorization holders also come under this category. Deemed exports are eligible for any/all of the following benefits in respect of manufacture and supply of goods qualifying as deemed exports.

- Advance Authorization for annual requirement/duty free import authorization.

- Deemed Export Drawback

- Exemption from terminal excise duty where supplies are made against international competitive bidding. In other cases, refund of terminal excise duty is given

- The import of second hand computers including personal computers / laptops and refurbished/reconditioned spares are restricted. However, second hand computers, laptops and computer peripherals including printer, plotter, scanner, monitor, keyboard and storage units can be imported freely as donations by certain category of donees, subject to the condition that the goods shall not be used for any commercial purpose and are non-transferable.

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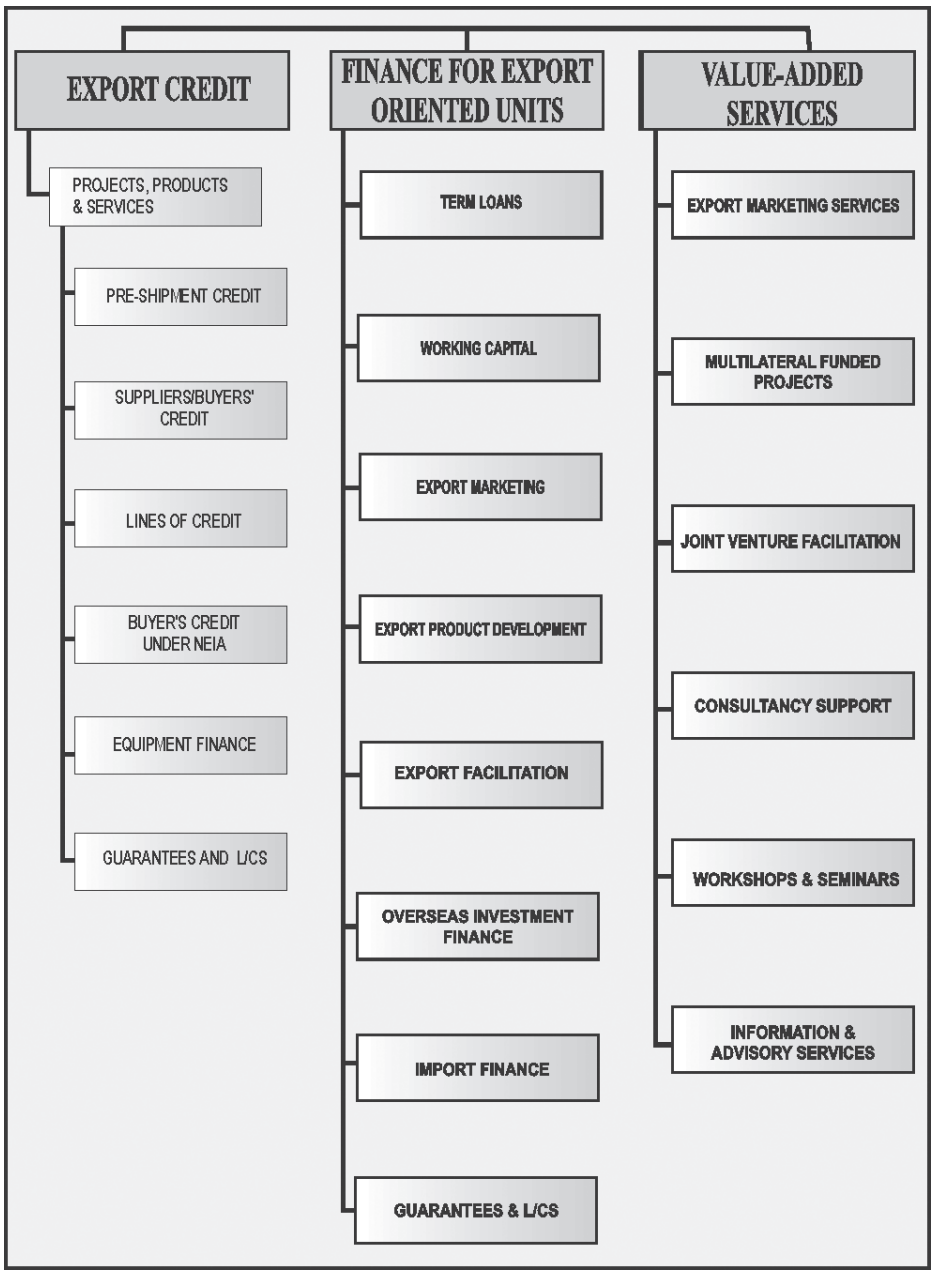

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