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INDIAN FIRMS IN ELECTRONICS GLOBAL VALUE CHAINS: SECTORAL ANALYSIS

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This working paper is the result of the joint study undertaken by Indian Institute of Management Bangalore (IIMB) and Centre for WTO Studies (Indian Institute of Foreign Trade, New Delhi) to explore and understand the factors affecting participation of firms in India in the Electronics Global Value Chains (GVCs). It is the second part of the sectoral studies on two important sectors of the Indian economy – Automotive and Electronics – under the GVC lens.

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ABSTRACT

With the advent of liberalization and globalization, businesses are increasingly becoming multinational. Companies have started to reorganize and relocate their operations across the globe so as to gain from the comparative advantages offered by different geographies; thereby making ***Global Value Chains (GVCs)*** the latest paradigm in International Trade. Global Value Chains (GVCs) are still a nascent field of study both in academia and practice, more so in developing countries like India where participation in GVCs is essential and the impact is anticipated to be significant. This study was undertaken to explore and understand the factors that either encourage or hinder participation of firms in India in the sectoral GVCs for two chosen sectors – Automotives and Electronics.

This working paper presents the findings from the firms' perspective as to which factors aid or deter them from participating in Electronics Global Value Chains. The gamut of broad factors covered under this firm-level survey-based study includes institutional, regulatory, financial, trade-related, technological, sectoral and input-related elements; then further categorized into sub-factors. Apart from firm-level characteristics (like firm size and ownership type) having an effect on participation, other factors like sectoral traits (consolidation within sector, importance of brands, constant technology upgradation and diversification of product range) and trade-related factors (tariff and non-tariff measures) were found to significantly influence participation in electronics GVCs. On the other hand, financial factors (especially credit, taxes and foreign exchange rates), technology (R&D, ease of access and transfer restrictions) and market barriers (market entry costs, capital costs, gestation time of projects) posed major challenges to participation. The study also ascertains the impact of the existing relevant laws for the electronics sector with the manufacturing policy, Government tax and investment incentives and trade agreements having the most positive impact and with import policy of India and labour laws having the most negative impact. In short, a comprehensive picture of the factors influencing participation of firms in India in the electronics global value chains has been attempted through this study.

Keywords: *Global Value Chains, electronics sector, factors affecting participation, firm-level analysis, India*

INDIAN FIRMS IN ELECTRONICS GLOBAL VALUE CHAINS – SECTORAL ANALYSIS

Ankita Dash, Rupa Chanda

1. INTRODUCTION

Global Value Chains (GVCs) are the latest paradigm in International Trade. Although GVCs have existed in practice since the early times of trade, as a concept and a field of study, GVCs have gained importance only in recent times. World trade, production and investments are increasingly being organized and analysed in this light as globalization and liberalization have been encouraging companies to reorganize and relocate their operations so as to gain from the comparative advantages offered by different geographies. This implies that firms are preferring to either source from or locate to geographies that offer them the best value for their investment. International production networks have intricately intertwined global trade and investment as a result of firms investing in productive assets globally and creating cross-border value chains of varying complexity. Such value chains, intra-firm or inter-firm, regional or global in nature, account for around 80% of present global trade.

Value-added trade contributes about 30% to the GDP of developing countries, significantly more than it does in developed countries (18%). Furthermore the level of participation in GVCs is associated with stronger levels of GDP per capita growth. GVCs thus have a direct impact on the economy, employment and income and create opportunities for development. They can also be an important mechanism for developing countries to enhance productive capacity, by increasing the rate of adoption of technology and through workforce skill development, thus building the foundation for long-term industrial upgrading.

Value chains have assumed high importance as trade in intermediates is on the rise. For many economies today especially in Asia, imports are increasingly a key complement of local production and exports. The WTO report 2013[1] trade figures in East Asia portray the following picture: intermediate goods comprise of over 50 per cent of exports and over 60 per cent of imports in Asia, since the year 2000. A range of competitively priced foreign intermediate goods has become crucial to achieving higher productivity in both industrialized countries and recent developers such as India and China.

[1] Global value chains in a changing world Edited by Deborah K. Elms and Patrick Low, WTO Report, 2013

Increasingly governments are recognizing that participating in global value chains will bring value and opportunities to their workers and economies; they have thus sought to foster friendly policy frameworks. Policy makers are concerned with several other facets of value-addition in a country where GVCs affect macroeconomic variables, apart from employment generation and expansion of economic activity. Trade in value added can be a vital statistic to measure a nation's trade imbalances and effects on exchange rates. Trade balances are better measured with value-added (rather than gross) trade data because gross figures can exaggerate the importance of producing countries at the end of value chains, e.g., China. Changes in relative prices (including through exchange rate changes) would result in non-symmetric rebalancing effects between downstream and upstream countries.

For developing countries, the trade, investment, and knowledge flows that underpin GVCs can provide mechanisms for rapid learning, innovation and industrial upgrading (Lall, 2000[2]; Humphrey and Schmitz, 2002[3]). Participating in global value chains provides access to advanced technology and business processes of partner firms in the chains for local firms in developing countries. These local firms can also achieve greater success in their own markets by combining domestic and foreign intermediate inputs and creating economies of specialization that leverage cross-border complementarities. GVCs also tend to "compress" the development experience, making non-linear catch up possible, as has been the case in China.

There are also a few potential negative impacts on developing countries due to participation in GVCs. A developing country's share in the total value chain may be limited if the work done domestically is relatively low value adding. In addition, if there is no automatic process that guarantees diffusion of technology, skill-building and upgrading, developing countries face the risk of operating in permanently low value-added activities. Finally, there are potential negative impacts on the environmental and social conditions, including poor workplace conditions, occupational safety and health, and job security. The relative ease with which the governors (or lead firms) of Value Chain can relocate their production (often to lower cost countries) also creates additional risks.

Global Value Chains being a relatively recent phenomenon, this is still a nascent field of study both in academia and practice. Specific GVCs have been examined as case studies at

[2] Sanjaya Lall (2000) QEH Working Paper Series

[3] Humphrey, J., Schmitz, H. (2002), Journal of Regional Studies

the country level mostly to understand the layout of these value chains, productivity and competencies within the value chain and the extent of participation of that country in the value chain. Sectoral studies are gradually being undertaken with the intent of understanding sector-specific GVCs better in order to explore opportunities of higher participation in them. While the emphasis has been largely on increasing manufacturing abilities and efficiency, the GVC lens of scrutiny has been largely missing, especially in studies on sectors in the Indian economy.

1.1. CONTRIBUTION OF THE STUDY

This Study titled ***Indian Firms in Global Value Chains – Sectoral Analysis***, jointly undertaken by Indian Institute of Management Bangalore (IIMB) and Centre for WTO Studies (CWS, IIFT), aims to understand the factors of participation of firms in India in Global Value Chains (GVCs) for two vital sectors of the Indian Economy – **Automotives and Electronics**. This primary objective of the study was to explore and understand the factors that either encourage or hinder participation of firms in India in the sectoral GVCs for these two chosen sectors. Further detailed description of the study has been provided in Sections 4 and 5.

Though there have been sectoral studies on the Indian Automotive and Electronics Industries, the focus primarily has been to discover ways of motivating manufacturing in the country. But developing manufacturing intensity will require some time before it yields results because both these sectors have long gestation times for projects to be set up and to become operational.

In the meanwhile, partaking in global value chains with existing capabilities is a practical tactic to harness present abilities of firms in India. This field study has tried to comprehensively understand the major factors that are facilitative or inhibitive of such participation of firms in the sectoral GVCs and how further prospects can be developed/created to enhance this participation to make the extent of GVC present in the country more vibrant and robust. The factors included range from institutional to economic, legal to financial, thereby encompassing a wide range of potential explanatory variables that affect participation of firms in global value chains that probably have not been covered by any prior study. In addition, finer details of measures that affect participation like different cost heads and various laws/policies have also been gathered.

This study has also attempted to determine the extent of impact of these factors on participation by the use of principal component analysis and logistic regression. Although the final number of respondent firms was somewhat limited owing to time constraints, the sample size was still sufficient to undertake elementary analysis to determine the key broad factors of participation. Secondary sources have been explored extensively to make the data robust and the analysis accurate.

In the first of its kind, this study attempts to understand the perceptions of (primarily manufacturing) firms about the challenges they face and opportunities they desire for furthering their role in the electronics global value chain. This study has attempted to cover a representative set of firms across both the sectors (Automotives and Electronics) in terms of scale, location, ownership type, sub-segment and listed (vs non-listed); instead of covering a limited number of firms or lead firms only as has mostly been done by previous studies.

This study employs certain concepts related to GVCs and data analysis; hence these clarifications are necessary at the very beginning. A detailed outline of the various definitions used in this study has been provided later (Section 5.3). The focus here is on the "industry-level" value chain, and not "firm-level" value chain. The core difference lies in the fact that the former involves cross-border flows of goods, investment, services, knowledge and labour that are associated with GVC processes performed by a network of firms, unlike the latter that refers to the chain of activities that a "firm" operating in a specific industry performs to deliver goods or services. An "industry" value chain includes various activities that are involved in creating goods and services beginning with the design of a product, moving onto the procurement of raw materials, and ending with the final product.

Participation of any firm in GVCs involves a certain degree of direct or indirect trade. For instance, a firm that may not be a direct exporter but is a supplier to another firm that exports can be considered as a participant of the sectoral GVC. But this study defines GVC trade as a specific type of trade which excludes firms involved in only trade (no value addition) or involved in unidirectional trade (imports only or exports only). Trade combined with domestic value addition (in India) provides the foundation for classification of firms as GVC participants. So while trade in components and end-products may be present along the value chain, actual participation in GVCs is narrowly defined. Please refer to Section 5.3 for the comprehensive description.

Firms which are identified as non-participants in their sectoral GVCs have been included in this study as a control group for analysis. They provide the baseline for comparing the effect of factors that affect involvement in GVCs vis-à-vis the participants. This improves robustness in observational studies, especially cross-sectional studies which are susceptible and need to be corrected for selection bias. The survey aims at capturing a well-rounded view of what affects firms in India for partaking in their sectoral GVCs for which the responses of both participant and non-participant firms are essential. Including all perceptions enriches the analysis.

This paper presents the findings for the Electronics Sector only[4] and is organized into the following sections: establishing the context of this paper - Understanding Global Value Chains (Section 2) followed by Literature review (Section 3) and the background of the Indian Electronics Sector (Section 4). Details of the study that was implemented at the firm-level are outlined under Description of the Study (Section 5) and Survey Methodology (Section 6). The findings of the survey have been reported under the Data Section (Section 7), Data Analysis (Section 8) and Survey Findings (Section 9). Section 10 gives the summary and Section 11 concludes the paper along with outlining the limitations of this study and the scope for further research.

2. UNDERSTANDING GLOBAL VALUE CHAINS

2.1. VALUE CHAINS

Value Chains comprise of the assortment of activities that are required to bring a product from its conception to its delivery to the final consumer – transitional stages involving design, sourcing of raw materials, manufacturing of intermediate inputs, assembly of final product, marketing, distribution and support after delivery. When these series of activities are dispersed across different geographies, the value chains become global and are termed as Global Value Chains (GVCs). It has been observed that firms, of late, have increasingly started optimizing their production process by restructuring their operations internationally through outsourcing and off-shoring to different locations.

Value Chains are often confused with Supply Chains. Supply chains are rooted in Operations Management which focuses on the sourcing and organization of products, materials

[4] A separate paper presents the findings for factors affecting participation of firms in India in the global value chains of the Automotives Sector

and funds for the various stages of a product's development cycle. Value chains, on the other hand, have developed as a Business Management concept that concentrates on adding value to a product or service and the maximization of this value along each stage. The value-addition idea extends to aftermarkets and service support, well after the concern of Supply Chain ends. While Supply Chains are generally focussed on goods/materials management, Value Chains also have services concerns along with manufacturing-related concerns. Briefly put, the major difference between a Supply Chain and a Value Chain is centred in the idea that while the former emphasizes maximization of efficiency and coordination of various activities originating from suppliers till the end-product delivery downstream, the latter is value-addition centric wherein the value flows from the customer towards upstream.

Since Asia is fast becoming the manufacturing and services hub of the world, a majority of the Asian economies have very high levels of domestic value addition in their gross exports. The data (Table 1) from the OECD's TiVA database, though slightly dated, provides an interesting insight into the trends in value addition in economies world-wide. Although there is no concrete measure/index of the extent of a country's participation in GVCs5, the extent of Domestic Value Addition in a sector is a fairly decent proxy for a country's contribution to that sector's GVC.

India's level of domestic value addition in its gross exports (DVA) is quite high. It is important to note though that the share of DVA in gross exports has fallen over the years. This decline is more prominent in the manufacturing sector. There are two possible explanations for this phenomena – (a) Manufacturing sector in India has not advanced over time as expected, unlike those in counterpart nations and (b) with time, the value chains have become greatly fragmented; as a result DVA contribution by any particular nation is low unless a significant portion of the value chain operates within its boundaries (several value added activities are performed domestically).

[5] TiVA Database had an earlier index of participation in GVCs which measured the Forward and Backward participation of nations but has been discontinued due to lack of cohesive explanation and data.

DOMESTIC VALUE ADDED SHARE OF GROSS EXPORTS[6] (in %)							
	1995	2000	2005	2008	2009	2010	2011
AUS: Australia	87.89	84.09	87.82	86.25	86.92	87.02	85.9
FRA: France	82.71	77.17	76.56	75.23	78.41	76.26	74.87
DEU: Germany	85.14	79.78	78.66	75.23	78.13	76.66	74.46
ISR: Israel	77.41	79.05	73.96	73.05	78	76.37	74.73
JPN: Japan	94.37	92.6	88.88	84.23	88.8	87.27	85.32
KOR: Korea	77.67	70.23	66.98	58.24	62.47	60.76	58.3
MEX: Mexico	72.66	65.61	66.97	67.25	66.45	65.53	68.29
USA: United States	88.54	87.42	86.95	84.38	88.4	86.56	84.97
BRA: Brazil	92.17	88.54	88.29	87.46	90.01	89.66	89.23
CHN: China (People's Republic of)	66.62	62.72	62.57	68.23	69.18	68	67.84
HKG: "Hong Kong, China"	78.31	84.34	82.42	78.02	80.8	79.86	79.59
IND: India	**90.64**	**88.72**	**82.53**	**77.34**	**79.03**	**77.69**	**75.9**
IDN: Indonesia	87.43	82.63	83.44	85.38	88.92	88.92	88.03
MYS: Malaysia	69.5	52.27	54.05	58.77	59.96	58.27	59.38
RUS: Russia	86.74	81.69	87.22	86.11	87.3	86.9	86.28
SGP: Singapore	57.62	54.67	60.21	62.53	58.15	58.68	58.19
ZAF: South Africa	86.83	82.22	80.51	76.2	81.19	82.08	80.53
THA: Thailand	75.71	68.08	63.16	60.75	65.42	63.43	61.01
VNM: Viet Nam	78.69	73.06	69.25	64.58	67.15	65.29	63.74
APEC: Asia-Pacific Economic Cooperation	**84.97**	**81.79**	**79.84**	**77.79**	**79.83**	**78.34**	**77.49**
ASEAN: Association of South East Asian Nations	**72.15**	**63.6**	**63.94**	**66.12**	**67.47**	**66.9**	**67.11**
Eastern Asia	**83.95**	**78.73**	**71.98**	**70.47**	**72.42**	**71.06**	**69.86**

Table 1: Domestic Value Added in Gross Exports – Select Countries[7] (Source: TiVA Database)

For India, the Net DVA of certain sectors like primary activities (Agriculture and allied sectors, Mining and quarrying) and Services has always been high. In Manufacturing, certain sectors like Food processing, Textiles & allied sectors, Chemicals, Rubber & plastic products and Construction have a fairly high degree of domestic value addition. However certain other sectors like Transport Equipment, Machinery & equipment and Electronics, which though extremely significant to the domestic economy, do not feature as prominently in GVC participation for India (Table 2).

[6] The definition of Domestic value added share of gross exports (EXGR_DVASH) is domestic value added in gross exports (EXGR_DVA) by industry i divided by total gross exports of industry i, in %. It is a 'DVA intensity measure' and reflects how much value-added is generated by an industry per unit of its total gross exports.

[7] Trade in Value Added Database (TiVA) Data as extracted on August 31, 2016 (https://stats.oecd.org)

INDIA'S DOMESTIC VALUE ADDED SHARE OF GROSS EXPORTS (IN %)							
	1995	2000	2005	2008	2009	2010	2011
TOTAL	**90.64**	**88.72**	**82.53**	**77.34**	**79.03**	**77.69**	**75.9**
Agriculture, hunting, forestry and fishing	97.15	97.38	95.95	95.95	96.51	96.35	95.93
Mining and quarrying	96	95.28	93.68	91.65	92.46	92.9	92.13
Total Manufactures	**87.42**	**84.75**	**74.84**	**65.7**	**68.42**	**66.29**	**63.89**
Food products, beverages and tobacco	92.78	92.23	88.57	89.81	89.9	89.01	87.86
Textiles, textile products, leather and footwear	90.23	90.4	85.04	81.28	83.54	81.26	80.17
Coke, refined petroleum products and nuclear fuel	73.36	57.11	54.53	45.37	48.85	46.85	43.43
Chemicals and chemical products	85.86	86.47	78.3	70.58	75	73.51	71.44
Rubber and plastics products	84.59	88.05	78.64	73.06	75.61	74.36	72.87
Basic metals and fabricated metal products	82.26	75.33	68.98	61.33	64.35	61.88	59.78
Machinery and equipment, nec	83.69	81.42	73.24	68.41	70.49	69.44	67.36
Computer, Electronic and optical equipment	84.57	78.79	72.34	67.34	67.65	69.45	68.81
Electrical machinery and apparatus, nec	84.88	80.51	73.36	67.33	69.16	68.19	66.04
Motor vehicles, trailers and semi-trailers	87.2	82.05	77.65	66.87	70.52	69.66	67.52
Other transport equipment	83.93	78.64	74.77	60.09	67.51	69.34	68.51
Electricity, gas and water supply	90.61	84.38	83.11	76.32	80.95	80.37	76.95
Construction	88.34	83.46	79.66	78.05	79.7	78.42	75.95
Total Services including Construction activities	**94.25**	**92.56**	**88.84**	**88.04**	**89.16**	**88.89**	**87.73**

Table 2: India's Domestic Value Added Share of Gross Exports (in % - Select Sectors) (Source: TiVA Database[8])

2.2. GLOBAL VALUE CHAINS (GVC)

Global Value Chains refer to the phenomena where the activities in a value chain are dispersed across geographies. In other words, a value chain becomes global when intermediary products or services utilized for value addition in any phase originate from different locations. For instance, say in the electronics value chain, Country X produces intermediates (like chip-grade silica, plastic goods, connectors, printed circuit boards etc.) by utilizing inputs (raw materials like sand, rare earth metals, rubber, coke etc. and/or designing services) sourced from different nation(s) including domestically. These intermediates are then exported to Country Y

[8] Trade in Value Added (TiVA) is a joint initiative of OECD and WTO to measure the value added by each country in the production of goods and services that are consumed worldwide. The 2015 edition of the TiVA database includes 61 economies covering OECD, EU28, G20, most East and South-east Asian economies and a selection of South American countries. The industry list has been expanded to cover 34 unique industrial sectors, including 16 manufacturing and 14 services sectors. The years covered are 1995, 2000, 2005 and 2008 to 2011.

for further value addition (say assembly into display units like LED screens) and finally a portion of the product is sold in markets of Country Z. This involvement of multiple geographies (Countries X,Y,Z) adding value along the chain (both manufacturing and services) makes the chain global.

Firms have been able to globalize their businesses, majorly aided by advances in technology and an enabling policy environment. Operating from multiple operations has primal advantages of increased efficiency, lowered costs and faster production. Businesses today look to add value in production where it makes most sense to do so; indeed this has become a key element of corporate competitiveness. Bernard et al (2011)[9] showed that firms that trade tend to be larger, earn higher profits, spend more on R&D, and pay higher wages than firms that do not. Firms looking for increased market access and better performance stand to gain much from participating in global value chains.

Generic Value Chains

A generic Value Chain encompasses various stages – Manufacturing value chain comprising of raw materials and inputs to manufacturing of sub-components and components, subassemblies, final product assembly for a variety of end market segments, and the ultimate sale of final products. Services inputs to manufacturing include utilities, logistics and capital and labour services. Apart from the regular supply chain and manufacturing activities, other functions that also add value to the entire process include research, product and process development, designing, marketing and after-sales services. Although specific value-adding activities might change, the generic value chain is applicable to all industries in an overall sense.

The Value Chain in each industry is unique owing to the end-market, nature of the product and industrial/sectoral structure. The very concept of Value Chain was introduced and made popular by Michael Porter in 1985[10] (Fig 1). Porter's proposition was that within a single firm there are several activities

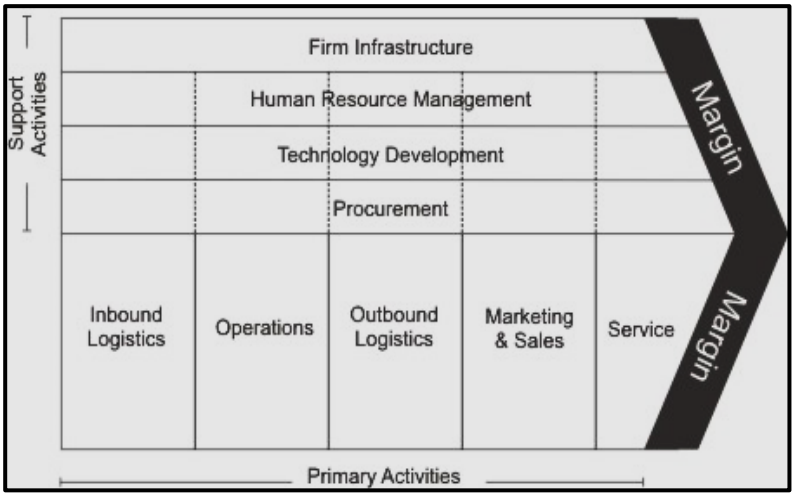

Figure 1: Michael Porter's Generic Value Chain

[9] Andrew B. Bernard, J. Bradford Jensen, Stephen J. Redding, and Peter K. Schott (2011), NBER Working Paper No. 17627

[10] Michael Porter (1985), "Competitive Advantage: Creating and Sustaining Superior Performance "

that add value and hence form a chain of value addition within the firm. This concept has been extended to the entire production and supply chain at the industry level at present to form Value Chains for an Industry. Any firm which manufactures any product or supplies a service uses some input and provides its output to another firm or the market; hence it automatically becomes a part of a value chain. But the nature of the value chain – domestic or global- is determined depending on the location of the supplier(s) and customer(s).

3. LITERATURE REVIEW

Global Value Chains is a recent field of study in trade, hence extant literature on this topic is still in the nascent stage. Most of the literature available in the academic space consists of case studies of sectors in specific countries. Theorization for global value chains as a whole is still an unexplored area.

Sturgeon (2001)[11] was amongst the earliest to introduce the "value chain approach" to better understand the increasing global economic integration. He suggested certain typologies based on three important dimensions of value chains - geographic scale, organisational scale, and actors in value-chain – that could be used for standardizing the understanding of value chains. Kraemer et.al (2009)[12] revolutionized the way supply chains were analysed by showing the importance of value in the supply chain. Their case study on Apple's ipod showcased by value was distributed across nations in the production chain for the iconic ipod. Shin et.al (2009)[13] examine empirically the relationship of R&D spending and location in the value chain (lead vs. non-lead firms) to firm performance in the global electronics industry. This was one of the earliest studies on identifying and testing for individual factors that affect participation in a sectoral GVC.

The UNCTAD Report (2010)[14] was amongst the earliest reports to focus on the integration of firms in Global Value Chains. This publication focuses on what governments should do to facilitate the entry of Small and Medium Enterprises into GVCs and to ensure that they benefit from such participation. It contains case studies by OECD and UNCTAD on various sectors – automotive, cinema, scientific and precision instruments,

[11] Sturgeon, Timothy J. (2001), IDS Bulletin

[12] Linden, G., Kraemer, K.L., Dedrick, J. (2009). Communications of the ACM, 52(3), 140-144

[13] Namchul Shin, Kenneth L. Kraemer, Jason Dedrick (2009), Journal of Innovation and Industry

[14] UNCTAD Report (2010), "Integrating Developing Countries' SMEs into Global Value Chains"

software and tourism sectors, in both developed and developing countries to try to understand the factors determining participation in GVCs.

The OECD-WTO-UNCTAD report (2013)[15] was the inception point for focusing on the implications of Global Value Chains for matters of trade, investment and development. This report explored in greater depth the place of value chains in the new global economy and evolving relationships between nations through GVCs. It took a closer look at the elements of national and international policy that affected the participation of firms and economies in GVCs, including international agreements and national policies in such diverse areas as trade, investment, services, education, and infrastructure. It extensively used data from the TiVA database for its analysis.

Kimura and Ando (2005)[16] came up with a conceptual framework for fragmentation of trade where the existing trends pointed to a rapid rise in the trade of intermediates. According to the authors, this fragmentation was on two dimensions – geographical distance and controllability of a firm. Cattaneo et.al (2013)[17] attempted to introduce a framework and analytical tools for measuring and improving a country's performance with respect to participation in global value chains. The focus of the paper is operational and seeks to offer stratagems to developing nations, in particular those willing to participate in GVCs on how to maximize the benefits and minimize the risks of such participation.

Kowalski, P. et al. (2015)[18] was amongst the earliest papers to take a look at the factors affecting participation of developing nations in GVCs. This paper has empirically analysed five developing sub-regions in Africa, the Middle East and Asia and showed that structural factors (such as geography, size of the market and level of development), trade and investment policy, logistics and customs, intellectual property protection, infrastructure and institutions are key determinants of GVC participation.

There are very few papers that analyse participation in GVCs at the firm level, even more so for the Asian countries although almost all production networks across the world source inputs from this region. Harvie et. al (2010)[19] used the ERIA Survey in ASEAN Countries that focussed on SME Participation in Production Networks to analyse the firm-level

[15] OECD-WTO-UNCTAD Report (2013), "Implications of Global Value Chains for Trade, Investment, Development and Job"

[16] Kimura F, Ando M (2005), International Review of Economics and Finance

[17] Cattaneo, Gereffi, Miroudot, Taglioni (2013), World Bank Report

[18] Kowalski, P. et al. (2015), OECD Trade Policy Papers

[19] Harvie C, Narjoko D, Oum S (2010), ERIA Discussion Paper Series 2010–11.

characteristics that determined SME participation in supply chains. They found that primarily firm size, ownership type and productivity in addition to managerial practices and innovation attitude were important for integration of SMEs in supply chains. Wignaraja (2015)[20] furthered this line of analysis by studying a larger dataset that includes both SMEs and large firms and by incorporating more variables like human capital (apart from the ones that Harvie et al. had included). He mapped the supply chains in Southeast Asian economies to find that firm size (reflecting economies of scale to overcome entry costs) mattered for joining supply chains, with large firms playing the dominant role. In addition, efficiency (building technological capabilities and skills) as well as access to commercial bank credit also influenced involvement in supply chains.

Many subsequent case studies on specific sectors of various nations ensued. A gamut of studies on the Automotive Sector and Electronics Sectors, worldwide and in India, is present, since these sectors are sunrise sectors for manufacturing. But the emphasis has been largely on increasing manufacturing abilities and productivity. The GVC lens of scrutiny has been largely missing but is gradually coming into focus. In the interest of space and relevance, only the major studies on these two sectors that were referenced for this paper have been cited.

Sturgeon & Lee (2001)[21] explored the outsourcing in the Electronics industry which led to the growth of highly proficient contract manufacturers based in the United States and Taiwan. Though this paper was not exactly from a global value chains perspective, the insights of the paper reveal how value chains work globally with the co-evolution of outsourcing and supplier networks. Oikawa (2008)[22] used value addition as a metric to find out which nations gained the most out of the East Asian production network in the Electronics and Automobile industries. Using input-output tables he showed that the gains from trade were unevenly distributed between trading partners and interestingly how ASEAN countries were witnessing a declining share of value addition.

Sturgeon & Kawakami (2010)[23] studied the Global Value Chains in the Electronics Industry in the NAFTA region in greater detail. They analysed how the rise of global value chains in the electronics industry led to revamping of the regional economic integration and resulted in the rise of China as a major supplier. Another paper by Sturgeon & Kawakami

20 Wignaraja (2015), Asia and The Pacific Policy Studies

[21] Sturgeon T.J, Lee Ji-Ren (2001), Global Taiwan: Building Competitive Strengths in a New International Economy, M.E. Sharpe

[22] Oikawa, Hiroshi (2008), IDE Discussion Paper No. 172

[23] Sturgeon T.J, Kawakami M. (2010), World Bank Policy Research Working Paper 5417

(2011)[24] explored another angle of electronics global value chains – the evolution of supplier capabilities and the challenges of upgrading along the value chain. They have outlined the various models used by developing nations to overcome their handicaps in upgrading. Shin et.al (2012)[25] have tested the "smiley curve" concept to find who captured the most value in electronics GVCs by using profit margins and return in assets and equity. They found that the lead firms enjoyed higher net margins as did the active component suppliers.

Interestingly, studies on the degree of global value chain participation in Indian sectors are still absent. FICCI – Grant Thornton Report (2013) on Integrating MSMEs into the Global Value Chain is one of the earliest studies in India that takes a look at the challenges faced by India's Micro, Small and Medium Enterprises in trying to enter global value chains. It suggests specific models and approaches that MSMEs could explore to discover new market opportunities like revamped government policies, innovative marketing tools, collaboration, etc. to make these companies globally competitive.

4. BACKGROUND - ELECTRONICS SECTOR IN INDIA

The Electronics Industry in India had a late initiation around 1965 when the focus of policy makers turned away from Heavy Industries towards Space and Defence technologies. This was followed by a focus on Consumer electronics, mainly transistor radios, Black & White TV, calculators and other audio products that were affordable and popular. In 1982, colour televisions were introduced in the country to broadcast the Asian Games in New Delhi. Computers were used commercially in the Telecommunications sector for the first time in 1985. The Electronics sector in the country witnessed rapid growth in the 1980s.

With liberalization in the early 1990s and the global software boom, India's concentration shifted to software, instead of hardware. Major Indian start-ups like Infosys, Wipro became global leaders in software. What seemingly dealt a death blow to Electronics manufacturing in India, according to industry experts, was the signing of the Information Technology Agreement (ITA-1) in 1997 where India committed itself to total elimination of all customs duties (import tariffs) on IT hardware by 2005. The ITA covers a large range of high technology products that account for nearly 10 per cent of global merchandise exports in today's times[26], including computers, telecommunication equipment, semiconductors, semiconductor manufacturing and testing equipment, software, scientific instruments, as well

24 Sturgeon T.J, Kawakami M. (2011), International Journal of Technological Learning Innovation and Development
25 Shin, N., Kraemer K.L., Dedrick, J. (2012), Industry and Innovation
26 WTO – ITA An Explanation (https://www.wto.org/english/tratop_e/inftec_e/itaintro_e.htm)

as most of the parts and accessories of these products. With effect from March 1, 2005 the customs duty on all the specified 217 items were eliminated by the Government of India.

The Electronics market of India is one of the largest in the world and is anticipated to reach US$ 400 billion in 2022 from US$ 69.6 billion in 2012. The market is projected to grow at a compound annual growth rate (CAGR) of 24.4 per cent during 2012-2020.[27] The total production of electronics hardware goods in India is estimated to reach US$ 104 billion by 2020. The communication and broadcasting equipment segment constituted 31 per cent, which is the highest share of total production of electronic goods in India in FY15, followed by consumer electronics at 23 per cent. The revenue-wise categorization of the Indian electronics market also exhibits a similar trend. Mobile devices segment was the highest revenue earner (27% of the total market revenue) followed by consumer electronics (18%) and industrial electronics (15%) (Fig 2)

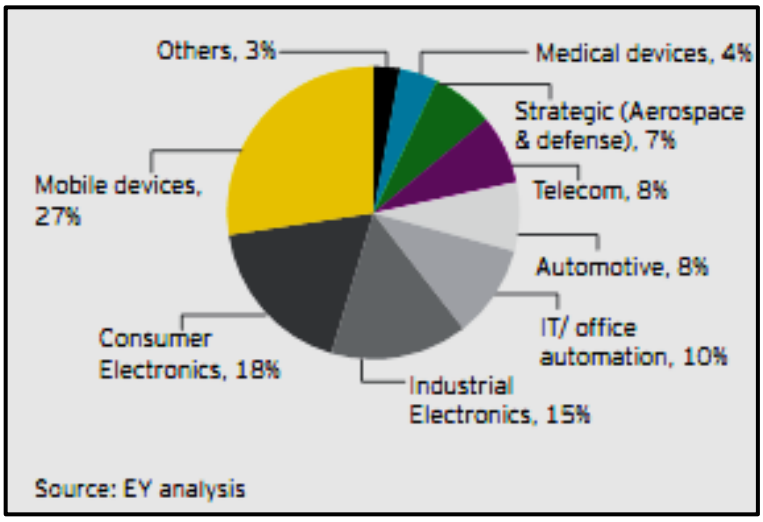

Figure 2: Indian Electronics Industry 2015 (Revenues by Segments; Total US$ 61.8 bn)

India's Electronics Exports have also seen a marked rise in the 2000s although a lot of ground still remains to be covered (Table 3). Electronic exports from India reached US$6.1 billion in FY15, at a CAGR 10.2% over FY07–15. At present around 50-60% of the demand for Electronics products is met through imports while nearly 70-80% of the need for Electronics components is met through imports. Although the Indian Electronics and Hardware industry is expected to grow at a CAGR of 13% – 16% during 2013– 18 to reach US$ 112– 130 billion by 2018, given the state of local manufacturing , the dependence on imports is likely to continue.

PARAMETER VALUE	(US $ BILLION)
Production (Revenues)	32.7
Exports	6.0
Imports	36.9

Table 3: Electronics Sector in India (2016)[28]

27 Estimates by India Brand Equity Foundation (IBEF)
28 NITI Aayog Report on Make in India Strategy for Electronic Products (2016)

The gap between imports and exports of various segments of the electronics industry in India is substantial as shown in Table 4 with imports outstripping exports by a huge margin. Industry estimates predict the demand for electronics products and systems to grow to about US$ 400 billion by 2020 in India.[29] At the present growth rate of domestic production, only about US$ 104 billion can be met internally by 2020. The rest would have to depend on imports. The Government has become very proactive in promoting manufacturing in this industry in its latest "Make in India" campaign, although India has a huge lag when compared with global trends. This gap showcases the extent of future prospects for domestic manufacturers to capture value in the domestic market, without the need for discovering new markets.

SEGMENT	EXPORTS		IMPORTS	
	$Million	Percent	$MIllion	Percent
Computer Hardware & Peripherals	364	6.1	7248.12	19.6
Consumer Electronics	793	13.2	4119.89	11.2
Electronics Components	1878	31.2	5409.39	14.7
Electronics Instruments	1903	31.7	5409.72	14.7
Telecom Instruments	1073	17.9	14716.23	39.9
Total	6011	100	36903.34	100

Table 4: Exports and Imports of Electronics and IT hardware in India (2015) (Source: NITI Aayog Report 2016)

Global markets also hold potentially attractive prospects for the electronics manufacturing industry in India. Electronics is considered to be the largest and fastest growing industry worldwide with annual global production touching nearly US $ 2 trillion in 2014-15 and is expected to reach USD 2.4 Trillion by 2020. India has less than 1% share in the global electronics markets.[30] This projected surge in global demand can offer the domestic electronics manufacturers a good opportunity to make a mark in the international markets. But given current capabilities, this will be feasible provided certain pre-conditions are met – (a) dramatic increase in production capacities (huge investments), (b) rapid technological improvements, (c) cost effective and globally competitive standards of products, (d) increased outlay for improving basic infrastructure like power, transport and (e) conducive environment for R&D and FDI.

The top three segments which witness the highest production are Computer Hardware and peripherals (26.6%) followed by Communication Equipment (21.7%) and Consumer Electronics (12.6%). and competitively cost effectiveness could prove to be main drivers for demand of Indian electronics products abroad.

29 According to India Brand Equity Foundation (IBEF) report
30 NITI Aayog Report on Make in India Strategy for Electronic Products (2016)

The top source markets and destination markets are given below in Table 5.

SECTOR	Top 5 EXPORTS DESTINATION (Value of Exports in USD Million)	Top 5 IMPORTS SOURCES (Value of Imports in USD Million)
Electronics and IT Hardware	1. U S A (1,156.87) 2. UAE (747.81) 3. U K (408.99) 4. GERMANY (390.34) 5. CHINA P RP (285.96)	1. CHINA P RP (19,758.19) 2. KOREA RP (2,807.58) 3. U S A (1,430.85) 4. GERMANY (1,270.27) 5. MALAYSIA (1,193.52)

Table 5: Imports and Exports in Electronics Sector for 2015-16 (Source: Ministry of Commerce and Industry)

The Electronics Industry has several verticals ranging from industrial electronics to medicine to consumer (Fig 3). For the purpose of this Study, the focus has been on four important segments, as described below.

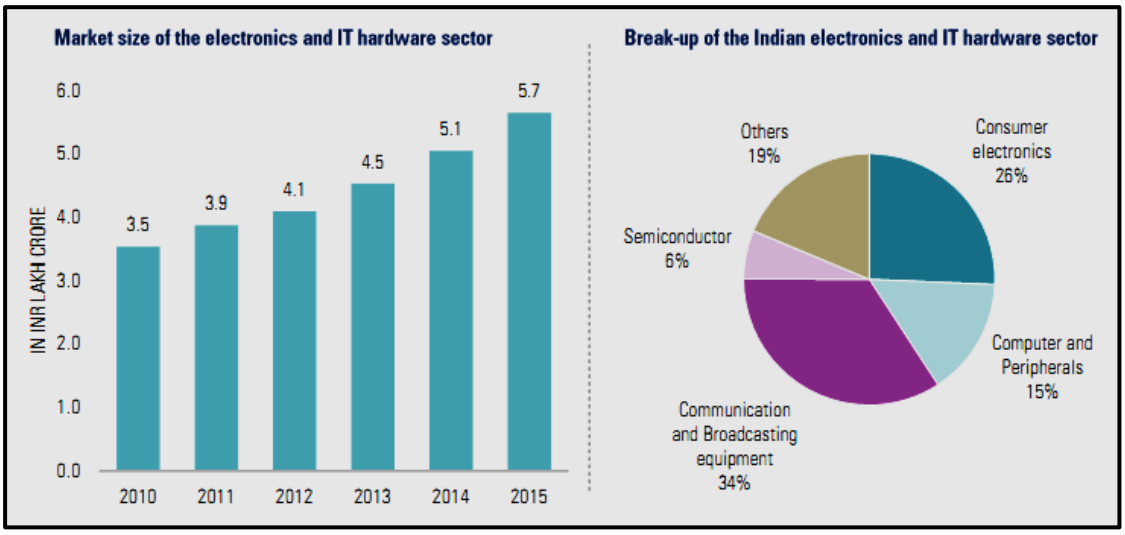

Figure 3: Market Size and Segments of Indian Electronics Sector (2015) (Source: NSDC Report 2013-17, 2017-22)

4.1. CONSUMER ELECTRONICS (INCLUDING APPLIANCES)

Consumer Electronics refers to devices of daily use for individuals or households that contain an electronic circuit board. It includes Televisions, Audio and Videos systems (like music systems, DVD players), appliances (like AC, Washing machines, refrigerators), personal use items like digital cameras and electronics accessories.

The Indian consumer electronics market has always been considered as a "high spend" sector and it is briskly growing. As per estimates of Consumer Electronics and Appliances Manufacturers Association (CEAMA), Consumer durables account for more than 40% of end consumer spending in India and continue to remain the backbone of the Indian electronic industry contributing more than a third of the total electronic hardware production. As per estimates of CEAMA, the consumer electronics witnessed a growth of 17.24% in 2014-15 (Rs 55,806 crore over 2013-14 (Rs 47,599 Crore). Buoyed by a growing middle-class with rising

disposable income, improved consumer financing and attractive discount offers from both online and offline retailers, this market is expected to grow at a brisk pace.

This segment of the electronics industry is in a state of constant flux due to rapid changes in technology worldwide. For instance, the growth in Consumer Electronics over the years has been accompanied by an increase in imports of certain items like LCD/ LED TVs that are not manufactured (rather assembled) widely in the country. Similarly, Direct to Home (DTH) satellite service has affected manufacturing of DVD players.

4.2. IT HARDWARE

IT hardware refers to computers and their peripheral parts, including various types of computers – desktops, laptops, notebooks, tablets. The physical parts of the computer and its accessories include display units (screen), memory units (hard disk drives, RAM), input-output units (keyboards, mouse) and associated components (like motherboard, graphic chip)

According to estimates by the Manufacturers Association for Information Technology (MAIT), the value of production in the Indian Computer Hardware Industry amounted to Rs 187 billion in 2014-15 (, as against Rs 174.84 billion in 2013-14); implying a growth of about 6.9%. There is a marked shift in the product composition in this sub-sector as well. The production of Notebooks registered growth of about 17% at Rs 105.42 Billion in 2014-15 (as compared to Rs 90.10 Billion in 2013-14). Production of Tablets also registered robust growth of 27% at 14.30 Billion in 2014-15 (as compared to Rs 11.26 Billion in 2013-14). In contrast to the foregoing, the production of Desktop PCs registered negative growth of 16% in 2014-15.

With the rise of the Indian middle class and the indispensability of internet in everyday lives, India offers exciting prospects as a largely untapped market for IT Hardware. Rising product innovations, increased variety and affordability are key drivers of growth for this sub-sector.

4.3. TELECOM (INCLUDING MOBILE PHONES)

The Telecommunications industry uses equipment for wireless and landline modes that include infrastructure equipment, networking devices (routers and switches) and handsets (landline handsets, cellular phones). The Telecom industry also incorporates telecom services (voice and data) and applications development

India is currently the second-largest telecommunications market in the world and has recorded strong growth in the past two decades. According to the Telecom Equipment Manufacturers Association of India (TEMA), the demand for telecom equipment in India was Rs 769.4 billion in 2013-14 and capital expenditure on expanding the domestic telecom network is estimated to grow to approximately Rs 5.3 billion by 2020. The Indian telecommunication services market is expected to cross Rs 2,220 Billion (US$ 37 billion) by 2017 and is likely grow by 10.3 per cent year-on-year to reach Rs 6,234 Billion (US$ 103.9 billion) by 2020[31].

Increased penetration of handheld devices and rising demand for data services, together with the gradual opening up of the rural market, will fuel this sector even further in the near future. According to the Telecom Regulatory Authority of India (TRAI), the total telecom subscriber base was 1.04 billion in December 2015 (1.01 billion mobile subscribers and 25.52 million landline subscribers), making India the second largest mobile subscriber base in the world. The smartphone user base is expected to quadruple to 810 million users and smartphone data consumption is expected to increase 15-fold to 4.5 Exabyte (EB) per month by 2021.[32] Additionally, interest in next generation and high bandwidth data services, new technologies, managed services, rollout of National Optical Fibre Network (NOFN) will boost demand for the telecom equipment industry. The requirement of 3G and 4G equipment is expected to be worth Rs 101.3 billion and Rs 126.6 billion respectively, in 2015–16, according to TEMA.

31 Estimates by India Brand Equity Foundation (IBEF)(http://www.ibef.org/industry/telecommunications.aspx)
32 Estimates by India Brand Equity Foundation (IBEF)(http://www.ibef.org/industry/telecommunications.aspx)

Electronics & IT Production (Financial Year)

(₹ Crore)

S. No.	Verticals / Item	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15 *
1	Consumer Electronics @	29000	32000	34300	40447	47599	55806
2	Industrial Electronics	15160	17000	18700	25800	33600	39374
3	Automotive Electronics				5629	7278	Data Not Available
4	Medical Electronics				Data Not Available		
5	Computer Hardware	14970	14970	16500	9376	17484	18691
6	Mobile Phones #	31000	35400	40500	46000	26650	18900
7	Strategic Electronics	6980	7700	8500	9000	13800	15700
8	Electronic Components	13610	21800	24800	26645	32102	39723
9	Solar Photovoltaic Cells				Data Not Available		
10	Light Emitting Diodes (LED)				1275	1941	2172
11	Electronic Design				Data Not Available		
	Sub-Total (Electronics Hardware)	110720	128870	143300	164172	180454	190366
12	Software for Exports	237000	268610	332769	412191	527292	612144
13	Domestic Software	67800	78700	91766	104700	114784	131040
	Sub-Total (Software)	304800	347310	424535	516891	642076	743184
	Total	415520	476180	567835	681063	822530	933550

Figure 4: Production figures for Electronics Sector in India (Source: DEITY Report 2015)

4.4. SOLAR ELECTRONICS

Solar Energy has gained prime importance in the past few years due to Government's focus on renewable sources of energy for sustainability. Solar energy technology consists of two approaches - solar thermal technology (which utilizes the sun's heat energy to indirectly generate electricity) and solar photovoltaic technology (which converts solar energy directly into electricity).

According to the 11th and 12th Five Year Plans of the Central Government, the target is to expand solar power generation capacity from current 4 GW to 100 GW by 2022. The National Solar Mission has been set up with the objective to reduce the cost of solar power generation in the country through promotion of FDI in the sector, rampant R&D, large scale deployments and revitalized domestic production of critical raw materials, components and products.

The contribution of solar energy under the total renewable energy sector is currently at 11% and is expected to grow in the near future. Nearly 7.5 GW of solar installations were done by mid-2016, which exceeded the cumulative solar installations in 2015. The rooftop solar capacity addition touched 525 Mega Watts (MW), 66% increase from last year. India is

expected to add nearly 10.86 GW of solar power in 2016, nearly five times the addition of 2,133 MW in 2015[33]. Prices for solar modules have declined by almost 80% since 2008.[34] India has been ranked 7th worldwide for solar photovoltaic (PV) cell production and secure 9th rank in solar thermal power generation.

With vigorous support from the government and increasing cognizance of the importance of renewable energy generally, the Indian solar market is expected to grow at a rapid pace over the next decade. The Indian Renewable Energy Development Agency has been established to promote, develop and extend financial assistance for renewable energy and energy efficiency/conservation projects.

The Electronics industry is quite optimistic about the Indian market owing to the rate at which demand is outstripping supply. The increased gap between the demand and supply, fuelled by the demographic dividend, rising middle class, emphasis on tele-connecting the entire country and massive Government attention, is being viewed as a golden opportunity to expand India's Electronics Manufacturing capabilities.

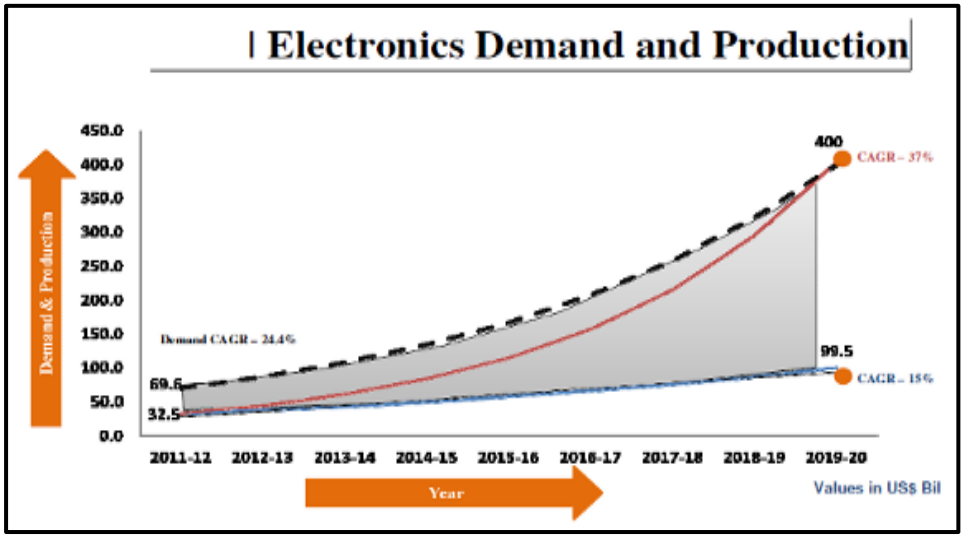

Figure 5: Indian domestic Electronics Market (Source: DEITY)

India's domestic demand for electronics products and systems is expected to cross Rs 24 trillion (US$ 400 billion) by 2020 (Fig 5). The Electronics industry has very high potential for increased domestic value addition and generating employment. Rising disposable incomes, increased consumer interest, low domestic penetration (including largely untapped rural

[33] Estimates by India Brand Equity Foundation (IBEF((http://www.ibef.org/industry/power-sector-india.aspx)
[34] Make in India – Renewable Energy (http://www.makeinindia.com/sector/renewable-energy)

markets) and emergent economy make India a very attractive market for the electronics sector in the near future.

4.5. LOCATION

The Electronics Industry also has a tendency for agglomeration, forming clusters like the automotive firms, usually to benefit from common externalities like skilled labour supply, infrastructure like power and water, common markets, and decreased costs of transport due to proximity of components. In India, electronics manufacturing and assembly is concentrated around the four major centres: Noida/Greater Noida (UP), Pune, Bangalore and Chennai, in terms of ***location*** forming three large clusters across the country. The distribution of ELCINA member firms in these three major regions has been given below (Table 6).

REGION	TOTAL	% DISTRIBUTION
North	364	35%
West	341	32%
South	310	30%
East	27	3%
TOTAL	**1042**	100%

Table 6: Region-wise distribution of Electronics firms (Source: ELCINA Directory)

For this Study, these three clusters, along with firms located in the surrounding regions have been the primary field of study along with a few firms located in the Eastern region:

(a) North – National Capital Region (NCR cluster), UP (Noida, Greater Noida cluster)
(b) West – Maharashtra (mostly Pune cluster and Mumbai), Gujarat
(c) South – Tamil Nadu (mostly Chennai cluster), Karnataka (mostly Bangalore cluster)
(d) East – West Bengal (mostly Kolkata)

4.6. ELECTRONICS VALUE CHAIN

This Study focussed on the participation in Global Value Chain of the Electronics Sector. For the purpose of the study, the Electronics Sector was sub-divided into the following value ***segments***:

(a) ***Original Equipment Manufacturers (OEMs)*** - which are essentially the assemblers of the final products and generally are the brand names like Samsung, Panasonic, Micromax, Intex Technologies, First Solar

(b) ***Components Manufacturers/Assemblers (CM/ODM)*** – Contract Manufacturers and Original Design manufacturers provide design and manufacturing services to brand-name manufacturers for components and sub-systems that involves manufacturing/assembling of sub-components

(c) ***Sub-Components Manufacturers/Assemblers*** – which include the components and sub-components manufacturers which produce active components like vacuum tubes, transistors, diodes and integrated circuits; passive electrical components like resistors, capacitors; and interconnection technologies

(d) ***Semiconductor Manufacturers/Suppliers*** – Also known as Fabs, these firms are semiconductor fabrication units for manufacturing integrated circuits and chips using complex processes for devices. These suppliers have their own value chain starting with sourcing raw materials like silica to manufacturing wafers to packaging chips

(e) ***Raw Materials Suppliers*** – which include suppliers of metals (like copper, nickel, aluminium, rare earth metals), high-grade plastics and other petroleum based products (Polycarbonates), silicon, ceramic, etc.

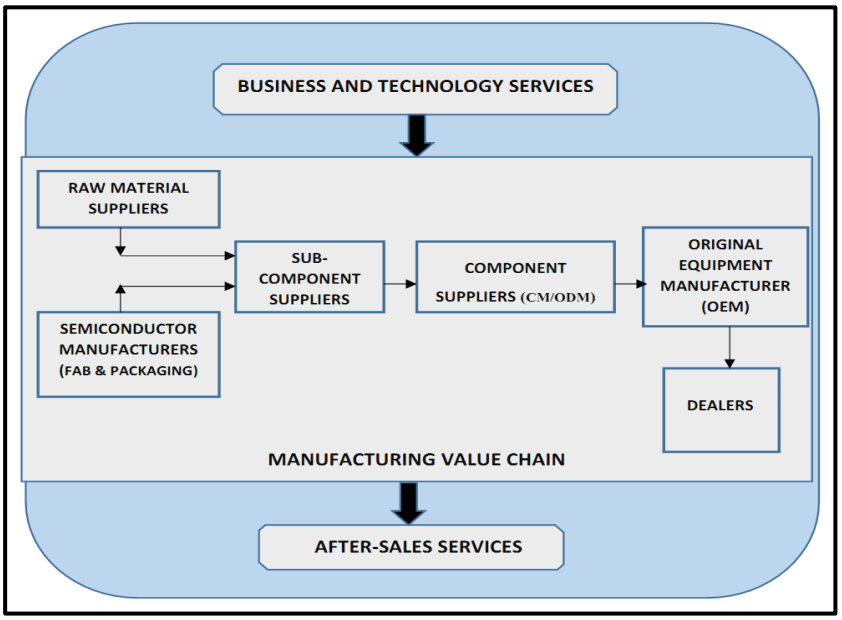

Figure 6: Electronics Value Chain (Source: Authors' Conceptualization)

(f) ***Engineering Manufacturing Services*** – these are firms that provide testing, manufacturing, distributing, and return/repair services for electronic components and assemblies for OEMs. Some firms in the solar sub-sector also provide expertise in setting up manufacturing plants and solar power production plants.

Since much of the domestic value addition is still limited to final assembly in the country (after importing ready-to-assemble kits or components) and to packing & testing (estimated at roughly 5-10%)[35], the majority of manufacturing and other value addition activities like design, architecture development, and associated services are up for grabs. This gives the extra inspiration for the Industry to hasten its growth and investment rate.

A Task Force Report released by the major associations of Electronics in India in partnership with E&Y (2009) laid out a roadmap to stimulate electronics manufacturing in India. The Indian Electronics and Semiconductor Association (IESA) – E&Y Report (2014) [36] conducted a methodical analysis of Indian Electronics industry in an attempt to identify the challenges faced by the Indian electronic system design and manufacturing companies. This report provides a comprehensive overview of the challenges and windows of opportunities for the firms in this sector.

The National Skill Development Corporation (2015) brought out a skill-gap report on India's auto sector highlighting the requirement for labour in the industry and the gaps in the skill generation that exist in the country. A similar report on the Electronics and IT Hardware Sector[37] in India was released by NSDC in 2015. ASSOCHAM in association with Ernst & Young (2016) has released reports on how to convert India into a global manufacturing hub for Automotives and Electronics. These reports focus on the overall challenges faced by the Auto and Electronics sector in India and possible suggestions to overcome these.

5. DESCRIPTION OF THE STUDY

5.1. THE OBJECTIVE

This report is part of a study which aims to determine the factors influencing participation of Automotives and Electronics firms operating in India in the sectoral global value chains. This report focuses on the electronics sector[38]. As described earlier, India has a significant presence in the Services Value Chains (Table 2) based on the degree of domestic value addition, but it is yet to make a mark in the manufacturing value chains vis-à-vis its counterparts in BRICS and ASEAN. In order to achieve the goal of becoming a global

[35] According to DEITY estimates
[36] IESA-E&Y Report (2014), "Indian Electronic System Design and Manufacturing (ESDM) Disability Identification Study"
37 NSDC-KPMG Report (2015), Human Resources and Skill requirements in the Electronicss & IT Hardware Sector (2013-17, 2017-22)
[38] The Automotives Sector is covered in another report

manufacturing hub, India's domestic value addition in manufacturing needs to go up profoundly.

5.2. CHOICE OF ELECTRONICS SECTOR FOR THE GVC STUDY

The rationale behind choosing Electronics sector for the GVC Study is as discussed below:

(a) *Significance*- Significance of Electronics in Manufacturing in the Indian Economy (in terms of contribution to GDP and output) as well as their potential for employment and growth.

SECTOR	CONTRIBUTION TO GDP	EMPLOYMENT
Electronics and IT Hardware	2%	3.68 million

Table 7: Importance of Electronics Sector in Indian Economy (All figures for FY 2015-16) Source: India Brand Equity Foundation (IBEF), Nasscom, DEiTY)

(b) *Participation in GVCs* - The span of Value Chains for Electronics is quite wide and intense globally but India's presence is not substantial yet. Using the degree of DVA as an indicator for GVC participation, higher amount of value-added activities to the chain domestically reflects the country's contribution to the sector's GVC.

VALUE ADDITION INDICATOR	COMPUTER, ELECTRONIC AND OPTICAL EQUIPMENT
Value added as a percent of production	28.5%
Domestic value added share of gross exports (EXGR_DVASH)[39]	68.81%
Industry domestic value added contribution to gross exports (EXGR_TDVAIND) [40]	1.32%

Table 8: Value Addition Statistics for Electronics sector in India – 2011 (Source: TiVA Database)

(c) *Pivotal industry in terms of linkages within sectors* - The Grubel–Lloyd index[41] , which measures the level of intra-industry trade of a particular item (arises if a country simultaneously imports and exports similar types of goods or services), for Electronics is fairly high.

[39] Domestic value added share of gross exports (EXGR_DVASH) is defined as domestic value added in gross exports (EXGR_DVA) by industry i **divided by total gross exports of industry i,** in %. It is a 'DVA intensity measure' and reflects how much value-added is generated by an industry per unit of its total gross exports.

[40] Industry domestic value added contribution to gross exports (EXGR_TDVAIND), in %, is calculated as Domestic Value Added Content of Gross Exports of industry i **divided by total Gross Exports of all industries**. Sum of EXGR_TDVAIND across industries equals Domestic Value Added Content of all industries (EXGR DVASH). While EXGR DVASH measures the intensity of DVA in an industry's exports**, EXGR_TDVAIND captures the magnitude compared to other industries**.

[41] Introduced by Herb Grubel and Peter Lloyd in 1971 to measure the degree of Intra-Industry Trade. The formula for the index of a product "i" is $GL_i = 1 + {|Xi - Mi|}/{(Xi + Mi)}$ where Xi = Exports and Mi = Imports. GLi = 1 indicates only intra-industry trade while GLi = 0 indicates only inter-industry trade.

SECTOR	GRUBEL-LLOYD INDEX
Agriculture, Hunting, Forestry and Fishing	0.222547
Mining and Quarrying	0.313648
Food, Beverages and Tobacco	0.812232
Textiles and Textile Products	0.184938
Leather, Leather and Footwear	0.185807
Wood and Products of Wood and Cork	0.656832
Pulp, Paper, Paper , Printing and Publishing	0.619258
Coke, Refined Petroleum and Nuclear Fuel	0.498961
Chemicals and Chemical Products	0.951918
Rubber and Plastics	0.683457
Other Non-Metallic Mineral	0.556309
Basic Metals and Fabricated Metal	0.689843
Machinery, Nec	0.95135
Electrical, Electronics and Optical Equipment	0.712225
Transport Equipment	0.393494
Sale, Maintenance and Repair of Motor Vehicles and Motorcycles; Retail Sale of Fuel	0.642215
Manufacturing, Nec; Recycling	0.907903
Electricity, Gas and Water Supply	0.052474
Construction	0.000151
Financial Intermediation	0.999249
Real Estate Activities	-0.00035
Public Admin and Defence; Compulsory Social Security	-4.9E-05
Education	-4.5E-05

Table 9: Grubel-Lloyd Index for Sectors in Indian Economy, FY 2015 (Authors' Calculation)

(d) *Tariff Structure* - Most importantly, from the trade perspective, these sectors – Automotives and Electronics- have very diverse sectoral tariff structures which makes them interesting to analyse in terms of the impact of policy on their GVC participation. While Automotives is somewhat protected owing to high rates of import duty (ranging from 10% for Components to 125% for Fully Assembled (New or Used) Cars), the Electronics Sector has an inverted duty structure where it is cheaper to import final products than import components and manufacture domestically.[42] The peak rate of Basic Customs Duty (BCD) on final products is 10% while the BCD on 217 tariff lines covered under the Information Technology Agreement (ITA- 1) of WTO is 0%. All components/products required in the

42 Rates of Customs and Excise Duties in the Appendix

manufacture of ITA- 1 items also have been exempted from basic customs duty subject to actual user condition. These have been the state of affairs for quite a while now. But after the introduction of the "Make in India" campaign by the Central Government, several significant announcements regarding the modification of the taxes and tariff structure in the Electronics Sector have been made in the Annual Budgets in order to deal with the problems resulting from this inverted duty structure.[43]

5.3. DEFINITIONS

This Study defines Global Value Chains in a more concise and precise manner. Harvie et. al (2010)[44] in their study on East Asian production networks have defined SME participation in supply chain trade as a firm which is either a supplier to Multinational Corporation(s), an importer of intermediate goods or an exporter of some of its products. Since the definition of GVCs generally still lacks clarity in academic literature and that is probably the reason why a Value Chain is often mistaken for a Supply Chain, this Study has used the following definitions to analyse the trends in the factors that are affecting the participation of firms in India in the global value chains of Automotives and Electronics:

(a) Value Chain (VC): While each sector can be deemed to have a Value Chain, this Study has considered value chains for each final product. For instance, the Value Chain for a Television is different from the Value Chain for a Solar Project. Thus each sector has multiple value chains based on the final product as sold in the market (under a specific category and a brand name). The "value chains" studied here are refer to the "industry" or "sectoral" value chain (often performed by networks of firms involved in producing goods and services) and not "firm" value chain (chain of activities that a "firm" operating in a specific industry performs to deliver goods or services).

(b) Global Value Chains (GVC): Value Chains involving at least three geographies, with India being one. This study focusses only on the small fraction of the sectoral GVCs which have their presence in India. In other words, if any value added activity (either manufacturing or services) in the sectoral value chain that is performed in India directly utilizes a product/service sourced from another country and the output (part of or entirely) of a value added activity in India is shipped to another country, the value chain is deemed to be a GVC.

43 Latest Announcements in the Budget in the Appendix
44 Harvie C (2010), International Journal of Business and Development Studies

In simpler terms, “Global” refers to the spread of the industry value chain activities across (atleast) three geographies including India, “Value” refers to value addition done by the firm in India either through manufacturing or by providing services and “Chain” refers to the series of activities involved in bringing a product from its conception to delivery in the end market.

In today’s world of high intermediates trade, there are hardly any value chains that are not global. The only exception -when a value chain is not global- is when all the value added activities, right from inception of the product to the final sale is within the country. Since this might probably be non-existent in practice, the participation of firms was defined somewhat narrowly to determine whether firms in India are a part of any sectoral GVC or not.

(c) Participation of a firm in GVC: A firm has been deemed to be a part of its sectoral GVC if it is directly engaged in imports and exports of intermediates/final products (i.e. if its supplier and customer is located in another country). The various possible categories where firms engage in trade are:

- Firms sourcing inputs domestically and manufacturing products in India for foreign markets (Exports Only),
- Firms importing inputs for manufacturing and selling domestically in India (Imports Only),
- Firms importing inputs for manufacturing and selling domestically in India as well as in foreign markets (Imports and Exports)

The firms that are categorized under Imports and Exports have been deemed as participants in the Electronics GVC. To further streamline this definition, the degree of imports and/or exports is considered only if it is above 5% of the total input sourcing or output supply for a firm, as was decided in consultation with the industry experts.

(d) Firm - A company that may be a standalone entity or a fully owned subsidiary or a part of a consortium. For the firm level characteristics, the information has been sought as a Stand Alone Entity only, even when it is a subsidiary or part of a consortium. For all other purposes, the legal identity has been taken into consideration. For instance, if the question is pertaining to factors for greater participation of the Firms in GVCs, then the answer expected is from the point of view of the Company (in case of Stand Alone entity) or from the view of the Parent Company (in case of a subsidiary or consortium).

6. SURVEY METHODOLOGY AND SCOPE

The methodology consisted of seeking information regarding participation of firms in India in sectoral GVCs through a combination of in-depth discussions and a firm-level survey. The in-depth discussions were held with relevant industry associations i.e. Society of Automobile Manufacturers (SIAM) and Automotive Component Manufacturers' Association of India (ACMA) for the Automotive Sector. For the Electronics Sector, industry associations like Electronics Industry Association of India (ELCINA), Indian Electronics and Semiconductor Association (IESA) and Manufacturers' Association for Information Technology (MAIT) provided comprehensive information via personal interviews. A snapshot of the total number of interviews achieved and the number of final respondents for both sectors has been given in Table 10.

MODE	AUTOMOTIVES			ELECTRONICS		
	INDUSTRY EXPERTS	OEMs	COMPONENTS	INDUSTRY EXPERTS	OEMs	COMPONENTS
IN-DEPTH DISCUSSIONS	3	6	10	3	10	13
FIELD SURVEY	-	4	90	1	34	74
SUB TOTAL	**3**	**110**		**4**	**131**	
TOTAL FIRMS IN DIRECTORIES	730			1042		
TOTAL FIRMS APPROACHED	400			600		
RESPONSE RATE	15.1%			12.6%		

Table 10: Distribution of Respondents for the GVC Survey for Automotive and Electronics Sector

Apart from Sectoral bodies, in-depth discussions with several Industry experts belonging to Lead Firms in respective segments were conducted. Some of these experts occupied comparable important positions in the Industry Associations as well, which resulted in an all-round perspective of the sector as well as insights into the factors affecting the GVC participation of individual firms in the sector. These in-depth discussions were supplemented with a firm-level survey to gather more ground-level information.

6.1. TARGET LIST OF FIRMS

The source of the list of firms is the industry directory of ELCINA (Directory 2015) – and CMIE Prowess Database. Electronics Industry Association of India (ELCINA) is the principal association of Electronics and IT Hardware manufacturers of the country and works

closely with the Government on policy-related matters. This directory contained the particulars of nearly 1040 member electronics firms – Company Names, Location details, Management details, Contact information, Products Manufactured, Customers etc.

In order to make the sample of firms representative, conscious effort was made in choosing the firms across the different attributes, i.e. in terms of segment, primary business, size, region, type of location, ownership structure and manner of participation. Since the final responses could not be controlled for, representativeness of firms was targeted in the sample list of firms (target list) to whom the survey was sent. Attempts were made to cover all segments of the two sectors – Automotives and Electronics – with players in all key parts of the GVCs. Care was also taken to ensure that the target list was a rough reflection of the distribution of firms in the master list (as per the Association directories). The distribution of the final respondent firms across these attributes has been outlined later in the Data section (Section 7)

6.2. RESPONDENTS

The point of contact in the firms for the field survey was also selected carefully after extensive consultations with the industry experts. Since Global Value Chains is yet to be a term or concept in common parlance of an industrial employee, the survey sought out persons in such positions that have exposure to Corporate Strategy, Sourcing Business and Operations Management. The typical respondent of the survey was at the level of either Vice President (VP)/Director (Corporate Affairs or Business Strategy or Operations) or General Manager (Manufacturing) or Plant Heads. The target has been to interact with decision makers who are aware of the firm's present operations, position in the GVC and future outlook towards participation of their firm in GVCs of respective sectors. Multiple respondents within each firm were approached to minimize response bias.

This survey was implemented by the student researcher via telephonic interviews, online questionnaire and industrial visits. A mix of various modes was employed in order to maximize the response rate. Telephonic interviews, while detailed and complete, were usually difficult to set up because of appointment related issues. Hence an online questionnaire was also floated which firms filled at their convenience. But in terms of response rates, telephonic and face-to-face interviews typically had a very high response rate as compared to the online survey.

Two survey agencies were engaged to conduct the survey more extensively, on behalf of IIM Bangalore, through online mode and face-to-face interviews with the relevant

respondents. These agencies were – (a) Feedback Consulting, conducting the survey in the Western and Southern Region primarily; and (b) Spectrum Research, conducting the survey in the Eastern and Northern Region primarily. IIM Bangalore provided these survey agencies with the target list of companies along with contact details and a letter of introduction to be produced, if needed, on behalf of IIM Bangalore.

6.3. QUESTIONNAIRE

Survey of relevant literature – academic papers, industry reports and news articles- was the first step towards identifying and mapping out broad factors of participation of firms in global value chains. The ensuing in-depth discussions with industry experts provided deeper insights into the structure, functioning, challenges and anecdotal nitty-gritties of each sector which helped narrow down and polish the individual factors. A separate survey questionnaire for Electronics was designed after extensive consultations with the Project Guide and industry experts to extract relevant evidence on the factors of participation in GVCs from the firms' perspective.

The questionnaire consisted of both closed questions (rating and ranking questions where firms were asked to rate /rank factors) as well as open-ended questions (where firms were asked to describe their perceptions related to broad factors and relevant trends). A pilot survey was floated where industry experts and a few firms were asked to fill the questionnaire. Feedback was taken on several facets like length of the questions, time required to fill the questionnaire, comprehensiveness of the questionnaire, missing factors/questions etc. The suggestions for change were discussed and incorporated in the final questionnaire (attached in the appendix) which was then sent to the field.

7. SURVEY DATA - DISTRIBUTION OF FIRMS

Since the final responses could not be controlled for, representativeness of firms was targeted in the sample list of firms to whom the survey was sent (target list). In the attempt to make the sample of firms a representative set, conscious effort has been made in choosing the firms across the segments for the Electronics sector with players in all key parts of the GVCs in this industry and also ensure that the target list was a rough reflection of the distribution of firms in the master list (as per the Association directories). Care was taken to ensure diversity in the

target list of firms in terms of the following attributes. Descriptive statistics for the responses under these attributes has been given below:

7.1. SECTORAL SEGMENTS

Four important sub-segments of the Electronics industry in India were chosen for the study - Consumer, IT Hardware, Telecom and Solar. The aim was to cover at least 30 firms per segment including both Original Equipment Manufacturers and Components manufacturers/assemblers for each sub-segment. There were firms that had presence in multiple sub-segments, so were requested to respond to the survey questionnaire in a holistic manner as to what affected them as firms in the electronics industry and for participation in the electronics global value chains. In addition, they were asked to mention specifics, if any that were unique to an individual sub-segment. For instance, firms that manufactured both consumer electronics and IT hardware products answered the questionnaire as an Electronics firm and separately mentioned any particular factor affecting their participation in the Electronics global value chain that was specific to either the consumer electronics segment or the IT hardware segment.

SECTOR	INITIAL TARGET	NO. OF FIRMS COMPLETED (TOTAL SAMPLE SIZE)
ELECTRONICS SECTOR	**Total = 120**	**Total = 131****
1. Consumer Electronics	30	**65**
2. IT Hardware Electronics	30	**31**
3. Telecom (including Mobile Phones)	30	**34**
4. Solar Electronics	30	**37**

*Table 11: Distribution of Respondent Firms across Sectors and Segments in Electronics (** - The total does not add up because there are firms which operate in multiple segments)*

7.2. PRIMARY BUSINESS

The *Primary business* of the firms referred to the activity that yielded more than half of their revenue and were broadly categorized as Manufacturing, Trading and Both Manufacturing and Trading. Apart from manufacturers,

PRIMARY BUSINESS	ELECTRONICS
Manufacturing	109
Trading	19
Both Manufacturing and Trading	-
Others[45]	3
TOTAL	**131**

Table 12: Primary Business-wise distribution of Respondent Electronics Firms

[45] The category "Others" includes testing, software development activities as primary business

trader-only firms were also included in the target firms' list, that simply imported (or exported) products and supplied them to firms here (or abroad) without involving any value addition through manufacturing. This was done since the Electronics sector in India is highly reliant on imports and some firms simply act as facilitators of inputs to other firms engaged in manufacturing. The Primary Business essentially gives the context in which firms have responded, as in whether the factors faced in participation in GVCs are from a manufacturing perspective or trading or simply others.

7.3. SIZE (SCALE)

The definition of size (scale) is as per the Micro, Small and Medium Enterprises Development (MSMED) Act, 2006 wherein the Manufacturing enterprises are categorized according to Investment in Plant and Machinery. This definition is often used in empirical work as value added or output as a measure of size are likely to be more liable to variations in macroeconomic conditions. Besides, firms in Electronics association directories are also categorized using this definition.

SCALE	ELECTRONICS	% of FIRMS IN SAMPLE
(a) Small	41	31.3
(b) Medium	51	38.9
(c) Large	39	29.8
TOTAL	**131**	**100%**

Table 13: Size-wise distribution of respondent Electronics Firms

7.4. REGION

The Electronics industry has a tendency to agglomerate in one location, creating a cluster. The survey covered the three primary Electronics regions in India in the North, West and South with a few firms in the Eastern region as well. For instance, the Northern region comprises of NCR along with the states of Haryana, Punjab, Uttar Pradesh and Rajasthan.

SECTOR	NORTH	EAST	WEST	SOUTH	TOTAL
TOTAL NUMBER OF FIRMS	65	18	17	31	**131**
% Distribution	49%	14%	13%	24%	**100%**
1. Consumer Electronics	32	10	11	12	65
2. IT Hardware Electronics	16	1	5	9	31
3. Telecom (including Mobile Phones)	15	2	7	10	34
4. Solar Electronics	17	9	4	7	37

Table 14: Region- wise distribution of respondent Electronics firms

7.5. LOCATION

The survey covered the three primary Electronics clusters in India. In addition to clusters, firms in nearby locations have also been covered to account for any intangible effects of locating in a cluster. The additional categories included Industry Centre (an industrial area where often an OEM first establishes itself and develops its supplier base around it), Special Economic Zones (SEZs), Export Oriented Units (EOUs)/ Export Processing Zones (EPZs) (as demarcated by the Government of India) and Semi-Commercial Areas.

TYPE OF LOCATION	ELECTRONICS	% of FIRMS IN SAMPLE
Industry Centre	57	43.5
Cluster	56	42.7
Special Economic Zone (SEZ)	7	5.3
Export Processing Zone (EPZ)/Export Oriented Unit (EOU)	4	3
Semi Commercial Area	7	5.3
TOTAL	**131**	**100%**

Table 15: Location-wise distribution of Respondent Electronics Firms

7.6. OWNERSHIP STRUCTURE

Ownership structure might be one of the reasons influencing participation in GVCs. (Wignarajan, 2015)[46]. For instance, fully owned Indian subsidiaries of foreign firms have much easier entry into the global value chain due to their parent company as compared to fully Indian firms. To make the target list of firms representative, firms under various categories of ownership type were considered - No foreign ownership (Fully Indian firm), Foreign Partner(s) having less than 50% share and Foreign Partner(s) having more than 50% share (Foreign firms, fully owned subsidiaries)

OWNERSHIP STRUCTURE	ELECTRONICS
No foreign ownership	104
Foreign partner(s) having less than or equal to 50% ownership	9
Foreign partner(s) having more than 50% ownership	18
Total	**131**

Table 16: Ownership Structure - wise distribution of Respondent Electronics Firms

Although the collected data suggests that the majority of the respondent firms are Indian, the survey attempted to cover firms with different types of ownership. This study is about firms in

46 Wignaraja, Ganeshan (2015), Asia and the Pacific Policy Studies.

India and their participation in sectoral GVCs and not about Indian firms alone. It is vital to understand the factors that encourage or dissuade foreign entities from setting up their business in India as well, if one has to ultimately design policies to encourage more foreign firms into the economy. But since the responses were not in the researchers' control, the distribution of firms based on their ownership type is as shown in Table 16.

7.7. MANNER OF PARTICIPATION IN GVCs

A firm has been deemed to be a part of its sectoral GVC if it is directly engaged in imports and exports of intermediates/final products (i.e., if its supplier or customer is located in another country). The various categories with respect to degree of trade are:

- Exports Only - Firms sourcing inputs domestically and manufacturing products in India for foreign markets (Exports > 5% of Total Output; No (or <5%) Imports),
- Imports Only - Firms importing inputs for manufacturing and selling domestically in India (Imports > 5% of Total Inputs; No (or <5%) Exports),
- Both Imports and Exports - Firms importing inputs for manufacturing and selling domestically in India as well as in foreign markets (Imports > 5% of Total Inputs; Exports > 5% of Total Output)
- Neither Imports nor Exports - Firms sourcing inputs domestically for manufacturing and selling domestically in India (No (or < 5%) Imports of Total Inputs; No (or < 5%) Exports of Total Output)

TRADE	ELECTRONICS
Import Only	54
Export Only	13
Both Import and Export	29
Neither Import nor Export	24
Did not Reveal/Missing	11
TOTAL	**131**

Table 17: Trade - wise distribution of Respondent Electronics firms

Any firm that is part of the manufacturing or services process in the Electronics Industry functions to cater to other firms in the sector or to the end-customer. As a result, that firm becomes part of a value chain. To be part of a Global Value Chain, the firm is either located in or engages with entities present in other geographical locations. A firm in India (Indian or Multi-National) can be part of the Electronics GVC by engaging in imports of products (components or assembly kits) and exports of products (components and/or finished goods) thereby usually serving both the domestic and foreign markets.

MANNER OF PARTICIPATION	ELECTRONICS
(a) Indian Firm sourcing domestically and manufacturing/assembling components in India for foreign markets (Exports Only)	10
(b) Indian Firm Importing inputs for manufacturing/assembling and selling domestically in India (Import Only)	26
(c) Indian Firm Importing inputs for manufacturing/assembling in India for domestic market and exports (Both Import and Export)	55
(d) MNC sourcing domestically and manufacturing/assembling components in India for foreign markets (Exports Only)	-
(e) MNC importing inputs and manufacturing/assembling for the domestic Indian market (Import Only)	7
(f) MNC Importing inputs for manufacturing/assembling in India for domestic market and exports (Both Import and Export)	9
(g) None of the above	24
TOTAL	**131**

Table 18: Manner of Participation – wise distribution of Respondent Firms

8. DATA ANALYSIS

8.1. PRELIMINARY ANALYSIS - FIRM SPECIFIC FACTORS

Firm level information related to scale (size) of the firm, ownership structure, location, primary business and segment of operation were collected as part of the firm description. This information was then cross-verified against data available from secondary sources like company websites, PROWESS Database and suppliers' aggregator websites like TradeIndia and MoneyControl. The descriptive statistics of these characteristics are already provided above (Tables 11-18)

Since these variables are mostly categorical (nominal) variables, cross-tabs and case-wise correlations for categorical variables (Pearson Chi-squared[47]; Phi and Cramer's V tests[48]) provide interesting insights into how these firm-specific characteristics are related with the manner of participation of firms in the sectoral GVCs.

[47] Pearson Chi-Squared Test is a statistical test for evaluating the significance of a relationship between categorical variables. The null hypothesis for the test is that the two categorical variables are independent; hence rejection of H0 proves that the categorical variables are related.
48 Phi's test and Cramer's V Test are tests of the strength of association between two categorical variables. The significance of the test determines if the variables have a strong or weak association.

8.1.1 Size (Scale) of the Firm

The distribution of various sized respondent firms in the four electronics segments of study has been given in Fig 7. All four segments (Consumer, Telecom, IT hardware and Solar) have almost an equal proportion of the various sizes thereby demonstrating the representativeness of the sample with respect to size (scale) of the firms.

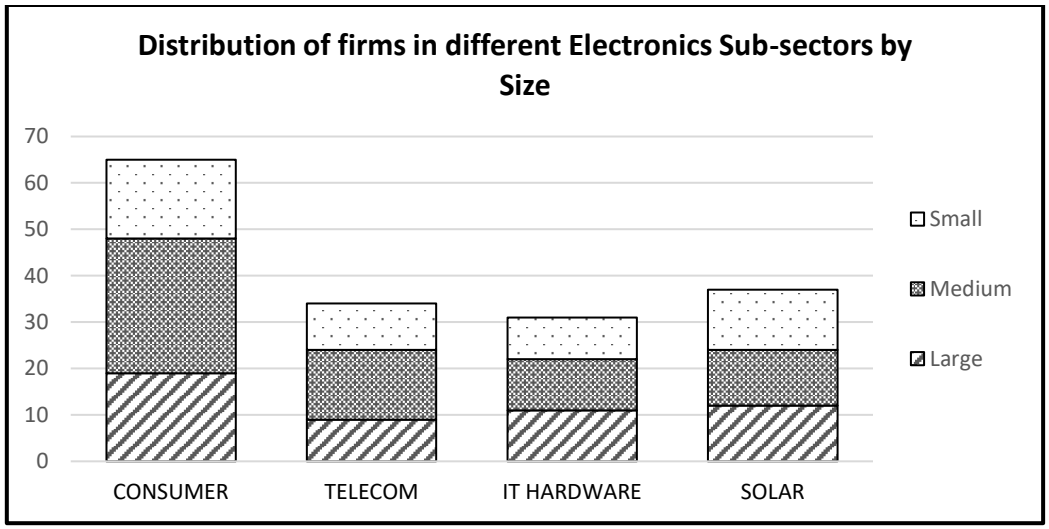

Figure 7: Size-wise distribution of respondent firms in various Electronics segments (Source: Based on Survey Findings)

Most of the respondent firms in the electronics survey were involved in some form of trade (either imports, or exports or both) (Table 18). About one-fifth of the electronics sample (18.5%) was not a part of any Electronics GVC, i.e., these firms source their inputs domestically and supply to domestic customers only (neither imports nor exports). A majority of such firms are of Medium or Small scale. Most of the large respondent firms (both Indian firms and MNCs) are direct participants in the Electronics GVC by being involved in both imports and exports. On the other hand, more small firms are absent as opposed to being present in GVCs, which indicates that size probably has an effect on participation in GVCs.

With regard to position in the Electronics GVC (Fig 8), most of the large respondent electronics firms are Original Equipment Manufacturers (OEMs) though this segment has presence of small and medium firms as well. Medium firms have a notable presence in all the segments while small firms are conspicuous by their absence in the Electronics GVCs with the highest number of small firms present in the "Not Applicable" segment. In the sub-components manufacturing, mostly medium and small firms are present while the Electronics Manufacturing Services and Components manufacturing segments have firms of all sizes. Semi-Conductor Manufacturing is almost absent in the sample, which is reflective of the

general state of affairs in the country where semiconductor wafer fabrication manufacturing facilities (also known as "fabs") are noted for their absence.

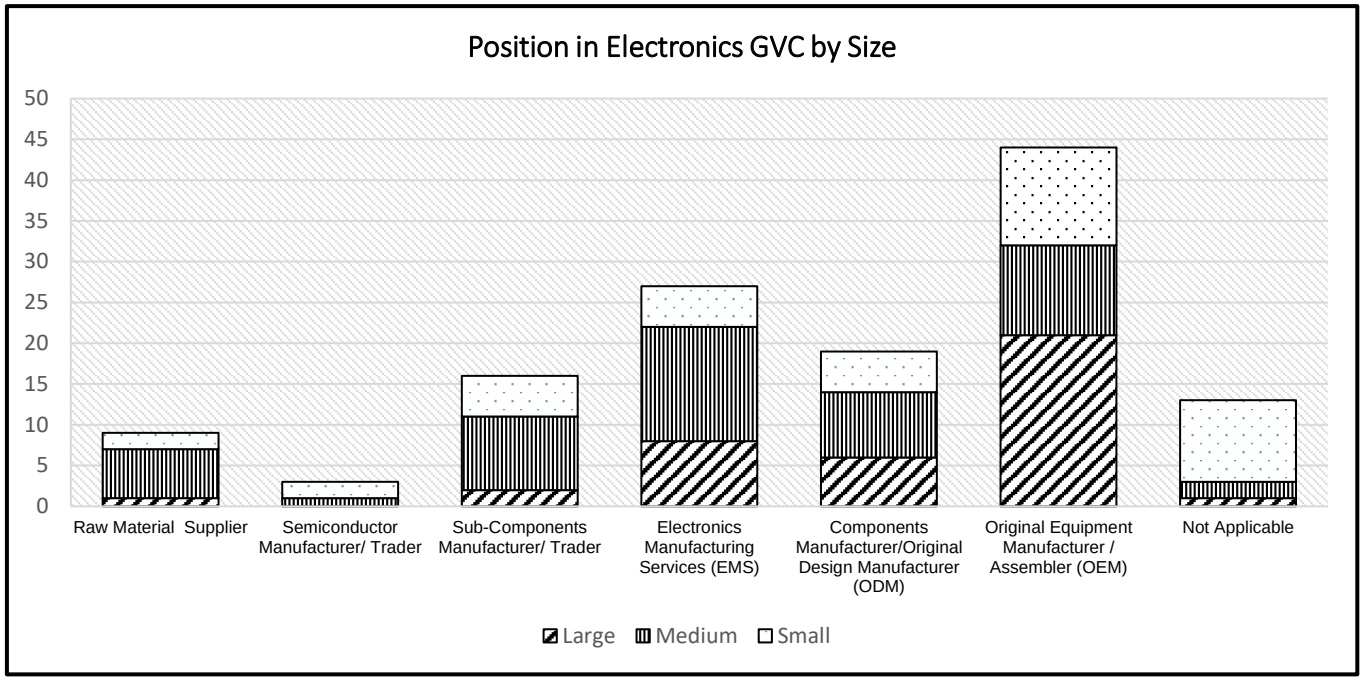

Figure 8: Position in Electronics GVC by Size (Source: Based on Survey Findings)

The results of the tests for independence (Pearson's Chi-squared) (Table 19) and effect size (Phi and Cramer's V Tests) (Table 20) reveal that size (scale) of a firm has a strong connection with manner of participation and the position of firms in Electronics GVCs.

	MANNER OF PARTICIPATION			POSITION IN ELECTRONICS GVCs		
Pearson Chi-Square Tests	Value	df	Asymptotic Significance (2-sided)	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	26.773[a]	10	.003	38.874[a]	16	.001
Likelihood Ratio	26.954	10	.003	38.932	16	.001
N of Valid Cases	131			131		

Table 19: Pearson Chi-squared test for independence between Size of firm and Manner of Participation & Position in Electronics GVCs

The magnitude of the strength of association between size (scale) of a firm and manner of participation in the Electronics GVC is fairly high at 0.452 while that for size (scale) and position in GVC of a firm is 0.545

		MANNER OF PARTICIPATION		POSITION IN ELECTRONICS GVCs	
Strength of Association		Value	Approximate Significance	Value	Approximate Significance
Nominal by Nominal	Phi	.452	.003	.545	.001
	Cramer's V	.320	.003	.385	.001
N of Valid Cases		131		131	

Table 20: Test for Effect Size of Relationship between Scale of Firm and Manner of Participation & Position in Electronics GVCs (Source: Based on Survey Findings)

Firm size, as defined by the Micro, Small and Medium Enterprises Definition Act (MSMED), 2006 wherein the manufacturing enterprises are categorized according to investment in plant and machinery, is possibly reflective of the potential to achieve economies of scale by the firm. Hence the domino effect on lowered costs of production (lower average and marginal costs (Zhao & Li, 1997)) and lower costs of delivery make the firm a reliable supplier. Additionally, larger firms are expected to have access to more resources at their disposal to meet the entry costs into value chains such as technology and accreditation expenses (Srinivasan & Archana, 2011)[49]. Wignarajan (2015) has showed that firm size has a positive effect on the probability of joining supply chain trade in a nonlinear form.

The survey responses indicate that the size of the firm does have a role to play in enabling it to be a reliable supplier. Size also has secondary effects in terms of building capacity for future, signalling to competitors its future strategy, firm's access to resources like finance and ability to undertake risks in case of need. SMEs can possibly overcome the handicap of size by forming clusters or targeting niche markets. Usually on achieving a certain volume of production, costs of production (especially fixed costs) become less significant over time as compared to early stages of participation.

8.1.2. Type of Ownership

Ownership type is another firm-specific characteristic that has an effect on participation of firms in value chains (Wignarajan, 2015). Ownership type in this study was categorized into three groups – No foreign ownership, foreign partner(s) owning less than 50% and foreign

[49] T. N. Srinivasan and Archana V. (2011), Economic and Political Weekly

partner(s) owning more than 50%. Although roughly a fifth of the respondent firms (20.6%) have foreign partners, still their side of the story is also a part of this narrative (Table 16).

Most fully Indian firms (no foreign ownership) in the sample are involved in both imports and exports. This means that these firms engaged have managed to meet the requirements of being an international supplier and/or supply to multiple OEMs both within the country and abroad; hence are active on the international supply scene. About one-fifth of the fully Indian firms (21.1%) are absent in Electronics GVCs meaning these firms either are (a) domestic dedicated suppliers to certain OEMs only and hence are absent as international suppliers; or (b) were unsuccessful in meeting international standards of demand, hence could not be the part of the supply chain of any foreign buyer firm. For instance, domestic OEMs and subsidiaries of international OEMs often source locally whenever and wherever possible. An interesting point to be noted here is that more than two-thirds (70.2%) of the respondent firms that are fully Indian are engaged in imports which reflects the country's heavy dependence on imports for this sector.

A similar scene is witnessed for respondent firms with foreign partners. Half of the firms with foreign partners (50%) are involved in both imports and exports. This is most likely because transnational companies tend to maintain ties with their home countries, especially foreign OEMs, who often have the suppliers in their home countries follow them to new destinations (follow-sourcing) or source material from their home countries. Here also majority of the respondent foreign firms (88.89%) are engaged in imports corroborating the fact that electronics sector in India is still highly dependent on imports.

With regard to position in the GVCs (Fig 9), most respondent fully Indian firms are present in the Original Equipment Manufacturer (OEM) segment followed by the Electronics Manufacturing Services segment of the Electronics GVCs. The OEM segment in the survey included the assemblers along with manufacturers, so across the four sub-sectors Indian firms seem to have a considerable presence. Firms with foreign partners (partially owned firms or MNCs) are present uniformly in all segments of the Electronics GVCs except for the Components Manufacturer segment. Foreign firms have a sizeable presence in the Original Equipment Manufacturer (OEM). This sample distribution of the firms in the various segments of the Electronics GVCs might not be an exact representation of the population distribution of the firms in the country but gives a decent indication of the relative distribution of firms by ownership type and also provides the context of the responses. What is to be noted is that there is a dearth of firms in the sub-components and components manufacturing segments.

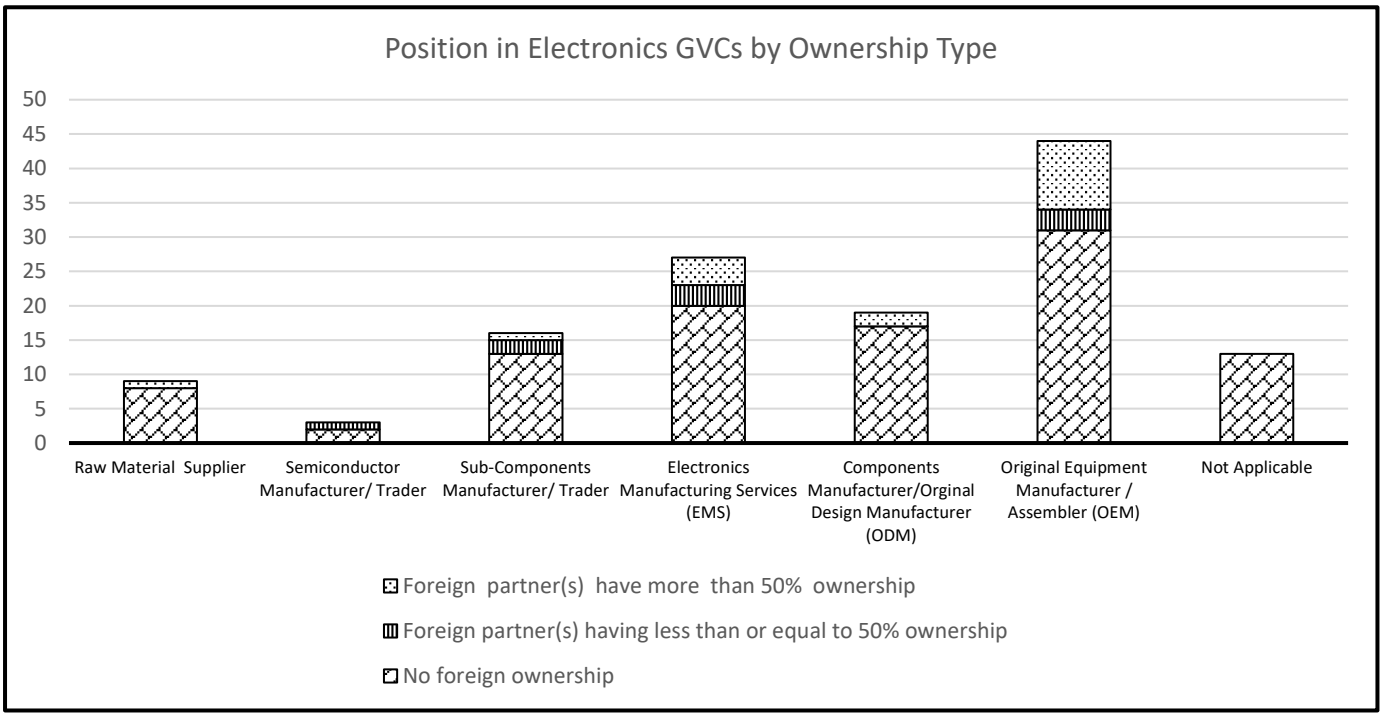

Figure 9: Position in Electronics GVC by Ownership Type (Source: Based on Survey Findings)

The results of the tests for independence (Pearson's Chi-squared) (Table 21) and effect size (Phi and Cramer's V Tests) (Table 22) reveal that ownership type of a firm has a strong connection with the manner of participation but has no significant association with the position of firms in Electronics GVCs.

	MANNER OF PARTICIPATION			POSITION IN ELECTRONICS GVCs		
Pearson Chi-Square Tests	Value	df	Asymptotic Significance (2-sided)	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	118.256	10	.000	15.269	16	.505
Likelihood Ratio	95.289	10	.000	18.682	16	.286
N of Valid Cases	131			131		

Table 21: Pearson Chi-squared test for independence between Ownership type of firm and Manner of Participation & Position in Electronics GVCs

The magnitude of the strength of association between ownership type of a firm and manner of participation in the Electronics GVC is very high at 0.95 while that for ownership type and position in GVC of a firm is insignificant.

		MANNER OF PARTICIPATION		POSITION IN ELECTRONICS GVCs	
Strength of Association		Value	Approximate Significance	Value	Approximate Significance
Nominal by Nominal	Phi	.950	.000	0.341	.505
	Cramer's V	.672	.000	0.241	.505
N of Valid Cases		131		131	

Table 22: Test for Effect Size of Relationship between Ownership type of Firm and Manner of Participation & Position in Electronics GVCs (Source: Based on Survey Findings)

Firms with foreign ownership (partially or fully owned subsidiaries) have the advantage of relatively easier entry to foreign markets owing to the presence of a foreign partner or parent. As compared to their local counterparts, they also have relatively easier access to sophisticated and more advanced technology, latest technical know-how, better management proficiency and overall capabilities. The immediate environment of operation and competition influences the capability of firms as strategies evolve in response to challenges faced. With foreign partners or parent, this competition becomes global and firms have to adhere to international standards in order to remain competitive in the international markets.

8.1.3. Type of Location

The type of location has the potential to affect a firm's ability to participate. For this study, the various types of location where the respondent firms are present are clusters, industry centres (specially demarcated industrial zones), Special Economic Zones (SEZ), Export Processing Zones (EPZ)/Export Oriented Units (EOUs) and Semi-Commercial Areas (Table 23).

Most of the respondent electronics firms are located in either in clusters or industry centres (regions specially demarcated as industrial estates and may or may not belong to a specific OEM). This might be explained in two ways. Firstly this might reflect the general tendency of the sector for agglomeration. Or alternatively, response rates to the survey may have been high in certain clusters or industry centres. Interestingly, a high percentage of the firms not involved in GVCs are located in industry centres, implying they are dedicated suppliers to OEMs located in those industrial areas.

MANNER OF PARTICIPATION IN ELECTRONICS GVC	SCALE (SIZE)			OWNERSHIP TYPE			TYPE OF LOCATION					Total
	Large	Medium	Small	No foreign ownership	Foreign partner(s) have less than or equal to 50% ownership	Foreign partner(s) have more than 50% ownership	Cluster	Industry Centre	Export Processing Zone (EPZ)	Semi Commercial Area	Special Economic Zone (SEZ)	
Indian Firm Importing inputs for manufacturing and selling domestically in India (Imports Only)	8	10	8	23	3	0	13	10	1	2	0	26
Indian Firm manufacturing components in India for foreign markets (Exports Only)	2	6	2	9	1	0	1	8	0	1	0	10
Indian Firm Importing inputs and Manufacturing for Domestic Market AND Exports (Both Imports and Exports)	15	25	15	50	5	0	27	18	2	3	5	55
MNC importing inputs and manufacturing/assembling for the domestic Indian market (Imports Only)	5	1	1	0	0	7	3	2	0	1	1	7
MNC importing inputs and manufacturing for domestic AND exports market (Both Imports and Exports)	6	3	0	0	0	9	3	5	0	0	1	9
None of the above	3	6	15	22	0	2	9	14	0	0	1	24
Total	**39**	**51**	**41**	**104**	**9**	**18**	56	57	2	7	6	**131**

Table 23: Manner of Participation of firms in Electronics GVC by Size (Scale), Type of Ownership and Type of Location (Source: Based on Survey Findings)

A high portion of firms located in industry centres (18%) and clusters (23%) are active participants in GVCs engaged in both imports and exports. Almost all respondent firms present in the SEZs and EPZs are active participants in the Electronics GVC. This indicates that these areas which are specially delineated for encouraging trade (imports and exports) also contribute to participation in GVCs. The response rate from these regions, however, is not adequate as a few SEZs and EPZs required special permission for entry into the zone.

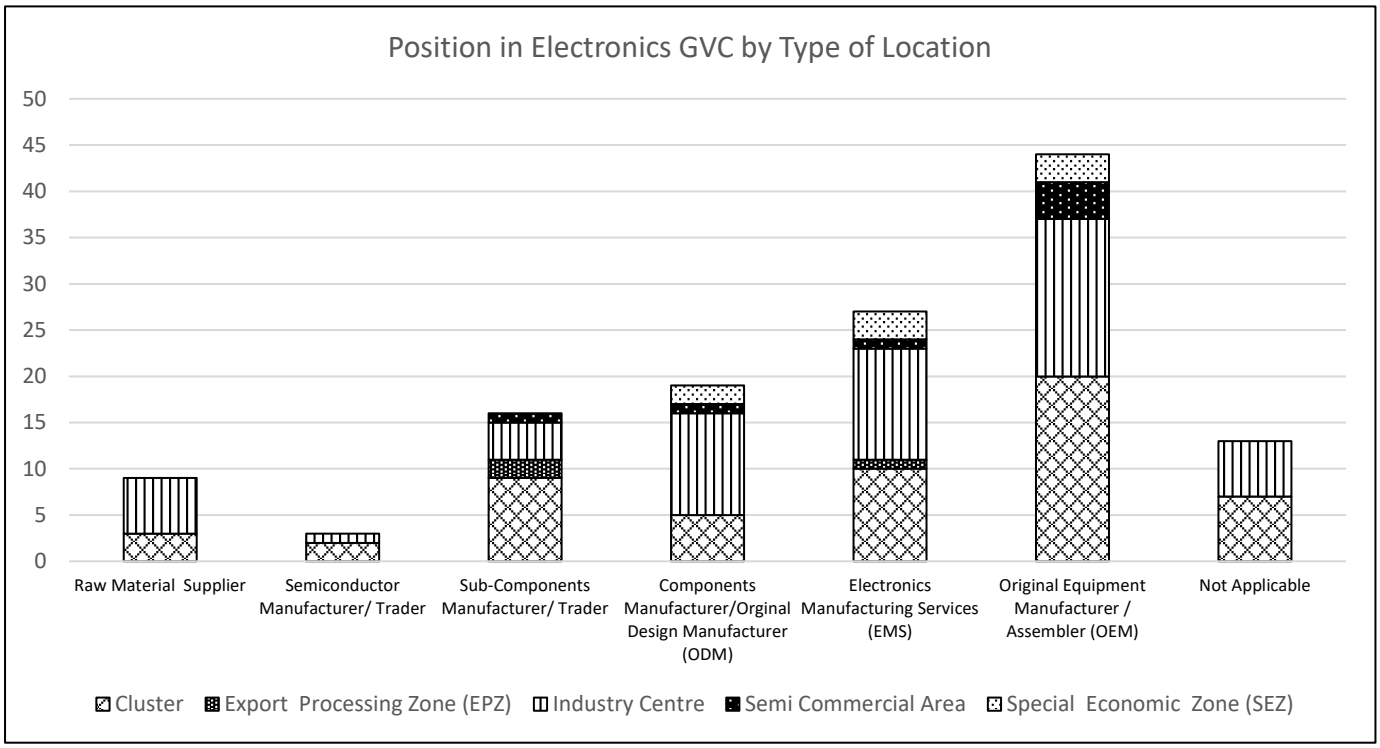

Figure 10: Position in Electronics GVC by Location (Based on Survey Findings)

The results of the tests for independence (Pearson's Chi-squared) (Table 24) and effect size (Phi and Cramer's V Tests) (Table 25) reveal that the connection between location of a firm with the manner of participation and the position of firms in Electronics GVCs is a weak one.

	MANNER OF PARTICIPATION			POSITION IN ELECTRONICS GVCs		
Pearson Chi-Square Tests	Value	df	Asymptotic Significance (2-sided)	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	23.610	35	.270	37.825	56	0.138
Likelihood Ratio	27.909	35	.268	38.075	56	0.128
N of Valid Cases	131			131		

Table 24: Pearson Chi-squared test for independence between Location of firm and Manner of Participation & Position in Electronics GVCs

The magnitude of the strength of association between location of a firm and manner of participation in the Electronics GVC at 0.425 and that for location and position in GVC of a firm at 0.537 is high but insignificant.

		MANNER OF PARTICIPATION		POSITION IN ELECTRONICS GVCs	
Strength of Association		Value	Approximate Significance	Value	Approximate Significance
Nominal by Nominal	Phi	.425	.270	.537	0.138
	Cramer's V	.190	.270	.203	0.138
N of Valid Cases		131		131	

Table 25: Test for Effect Size of Relationship between Location of Firm and Manner of Participation & Position in Electronics GVCs (Source: Based on Survey Findings)

With regard to the various sub-sectors of the Electronics industry, Consumer Electronics and IT hardware firms were mostly located in Industry centres while the Telecom and Solar firms were largely found in clusters (Fig 11). This represents the importance of lead firms in the Consumer and IT hardware sectors which drive the demand along the entire value chain. The telecom and solar sectors can function in a fairly distributed manner (without the need to be located in the vicinity of the OEM) as presented by the survey responses.

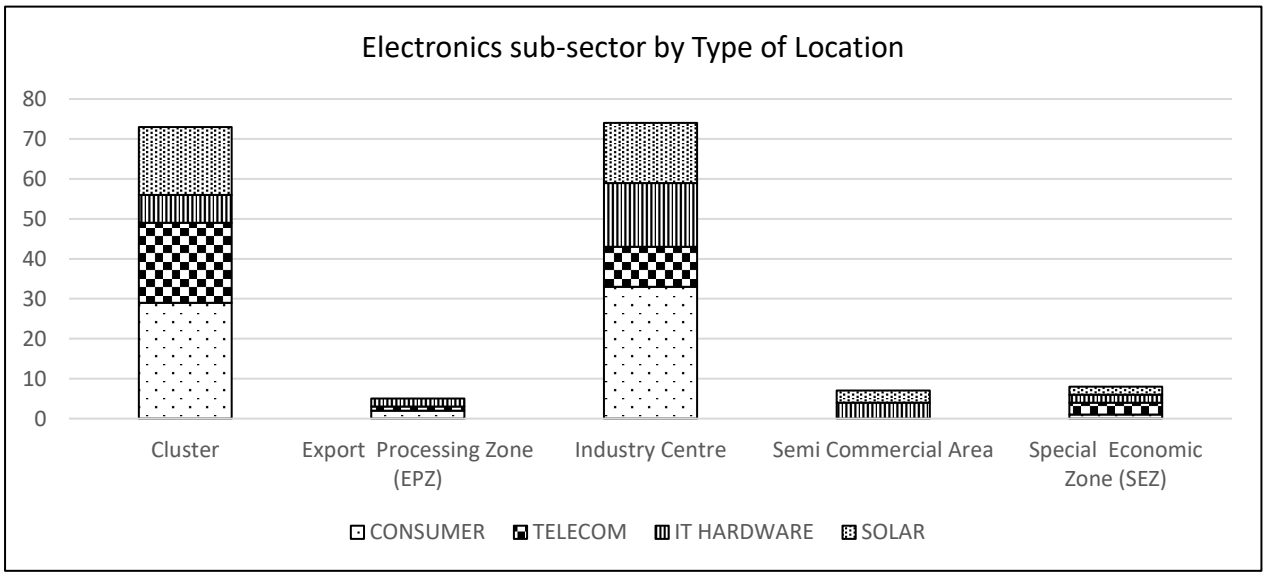

Figure 11: Electronics sub-sectors by type of location (Source: Based on Survey Findings)

It was interesting to note the results of the tests for independence (Pearson's Chi-squared) (Table 26) and effect size (Phi and Cramer's V Tests) (Table 27) for location of a firm and the sub-sector of the Electronics industry. The type of location affects Consumer and IT

hardware sub-sectors very strongly while it is not that significant for the Telecom sector and is insignificant for solar sector.

	CONSUMER			TELECOM			IT HARDWARE			SOLAR		
Pearson Chi-Square Tests	Value	df	Sig	Value	df	Sig	Value	df	Sig	Value	df	Sig
Pearson Chi-Square	19.486	7	.007	10.786	7	.148	13.744	7	.050	5.477	7	.602
Likelihood Ratio	26.444	7	.000	12.986	7	.072	13.519	7	.060	6.532	7	.479
N of Valid Cases	131			131			131			131		

Table 26: Pearson Chi-squared test for independence between Location of firm and Sub-sector of Electronics Industry

The magnitude of the strength of association between location of a firm and Consumer sector & IT hardware sectors is fair at 0.386 and 0.324, respectively.

		CONSUMER		TELECOM		IT HARDWARE		SOLAR	
Strength of Association		Value	Sig	Value	Sig	Value	Sig	Value	Sig
Nominal by Nominal	Phi	.386	.007	.287	.148	.324	.056	.204	.602
	Cramer's V	.386	.007	.287	.148	.324	.056	.204	.602
N of Valid Cases		131		131		131		131	

Table 27: Test for Effect Size of Relationship between Location of Firm and Sub-sector of Electronics Industry

Location determines the type of facilities available due to the prevailing policies (like tax breaks, free land), externalities due to presence of other firms (like clusters have a common resource pool) and infrastructure (like electricity and water). For instance, firms located in specially demarcated zones like the Export Processing Zones (EPZs) or Export Oriented Units (EOUs) are offered special incentives to promote exports. Similarly, firms in Industry centres, pivoted around lead firms, may have better prospects for GVC participation due to opportunities created by the lead firms, as opposed to firms in clusters that have been unsuccessful in positioning themselves in the import/export market through collective bargaining.

Clusters are usually of firms producing similar kinds of products (firms in the same segment of GVC) that make use of the common resource pool like skilled labour and infrastructure. Generally these firms are SMEs present in the components manufacturing space that can overcome shortcomings like size and finance through agglomeration. Industry centres, on the other hand, generally evolve gradually around a lead firm (generally an OEM) to generate comparative advantages like low transportation cost, low lead time and easier communication as well as ensure quality systems and standards of the supplier base. Usually

for the more complex and technologically advanced components, like display units or microprocessor control units, OEMs prefer to work very closely with components suppliers (ODMs); hence encourage their preferred suppliers to set shop nearby (follow sourcing). However, the demand for these highly sophisticated products is still being met by imports.

8.2. METHODOLOGY

The Electronics survey had 131 final respondents (after eliminating case-wise missing values) and 56 sub-factors (which include all the laws/policies governing the Electronics sector grouped together under one factor) of participation in Electronics GVCs. Though these sub-factors were categorized into broad heads in the survey questionnaire, based on the researcher's deliberations with the project guide and industry experts, further analysis was carried out to discover if any underlying structure could be discovered from this primary data that could contribute to theory building in this topic of study.

With such a huge number of variables, the dispersion matrix is too large for proper study and interpretation. There will probably be too many pairwise correlations between the variables to consider that cannot be deciphered using graphical displays or cross tabs alone. In addition, multicollinearity between factors is hard to avoid with such a large number of variables. For a better and more meaningful understanding of the data, it is essential to simplify the data set by reducing the number of variables to a few, interpretable linear combinations of the data. Krishnakumar and Nagar (2008)[50] have outlined various dimension reduction methods and their statistical properties.

The main variable of study (the dependent variable) is "***Participation***" which is a binary variable taking the value of 0 for firms which are absent and 1 for firms that are present in the electronics global value chain. Logistic regression is the most commonly used method for modelling a binary response variable. But regression methods require adequate sample size[51] for robust results. Additionally, logistic regression imposes the requirement for independence amongst the explanatory variables for stability (absence of multicollinearity). Aguilera et al. (2006)[52] have outlined a method to deal with the dimension problem of explanatory variables and to improve the estimation of the logistic model parameters under multicollinearity through

[50] Krishnakumar J., Nagar A.L. (2008), Social Indicators Research, (2008) 86:481-496

51 Gregory T. Knofczynski, Daniel Mundfrom (2008), Educational and Psychological Measurement Vol. 68

[52] Aguilera, Anna., Escabias, Manuel., Valderrama, Mariano. (2006), Computational Statistics & Data Analysis

the use of a reduced set of optimum principal components of the original predictors as covariates of the logistic model.

8.2.1. PRINCIPAL COMPONENT ANALYSIS

The dimension reduction technique of **Principal Component Analysis (PCA)**[53] was employed to reduce the number of sub-factors into more manageable numbers. PCA is a standard statistical tool for reducing a large dataset of observations of assumingly correlated variables into a set of linearly uncorrelated variables called *principal components*. Under this method, the first principal component obtained explains the highest amount of variation in the data and subsequent components attempt to explain the remainder variances under the condition of orthogonality.

PCA was used instead of another popular statistical method for dimension reduction - Factor Analysis (FA). FA is usually used in scenarios where researchers have a decent guesstimate about the underlying latent variables (that cannot be directly measured but is measured indirectly through observed variables known as manifest variables) and employ Exploratory Factor Analysis (EFA) for identifying the number and type of those factors. Confirmatory Factor Analysis is then used to confirm their proposed theoretical model. PCA is an ideal tool for scenarios where no assumptions about the underlying causal model have been made.

Principal Component Analysis (PCA) reduces the number of variables by computing the linear combination of directly measured variables that accounts for the largest variation in the sample. These variables that are directly measured are also known as indicators or manifest variables. Say the directly measured variables (indicators) are X_1, X_2 …. X_P. PCA calculates the principal components, Z_1, Z_2 ….. Z_n as shown below:

$$Z_1 = a_{11}X_1 + a_{12}X_2 + \ldots + a_{1p}X_p$$

$$Z_2 = a_{21}X_1 + a_{22}X_2 + \ldots + a_{2p}X_p \quad \ldots\ldots\ldots$$

$$Z_n = a_{n1}X_1 + a_{n2}X_2 + \ldots + a_{np}X_p$$

The first principal component, Z_1 explains the maximum variation in the sample data. Each subsequent principal component explains the highest amount of variation in the remainder data. The principal components so obtained are also known as *latent variables*, because they cannot be measured directly. PCA gives weights (coefficients a_{ij}) to various manifest variables for

53 Dunteman, George. (1989), Sage Publications Inc.

computing the weighted linear combination, based on the covariance matrix if analysed variables are comparable.

8.2.1(a) Suitability of PCA

Whether PCA can be applied or not is determined by the Bartlett test of Sphericity and the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy. The Bartlett test, which compares the correlation matrix with an identity matrix (matrix with only 1's along the diagonal and the remaining elements are all zero) tests if the observed values have zero correlations between them. For PCA to be recommended suitable (rule of thumb), the Bartlett's Test of Sphericity must be less than 0.05.

Value	Importance of KMO Statistic
0.00 to 0.49	unacceptable.
0.50 to 0.59	miserable.
0.60 to 0.69	mediocre.
0.70 to 0.79	middling.
0.80 to 0.89	meritorious.
0.90 to 1.00	marvelous.

Table 28: Interpretation of KMO Statistic for PCA

The KMO test measures the proportion of variance between variables that can be attributed to a common underlying variance. KMO test provides the sampling adequacy for each variable in the model and the complete model. KMO has values between 0 and 1. As reference, Kaiser[54] put the following thresholds given in Table 28.

The results of the KMO test and Bartlett's Test have been given in Table 29. Both the results indicate that sampling was adequate (KMO > 0.8) and that the sample had adequate correlations to justify a valid PCA (Bartlett's test p-value = 0.00).

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.831
Bartlett's Test of Sphericity	Approx. Chi-Square	5955.64
	df	1378
	Sig.	.000

Table 29: Test of adequacy for Principal Component Analysis

8.2.1(b) Principal Components

From all the factors in the survey, individual laws governing the Electronics sector were not included in the PCA analysis because attempting to combine laws with other factors did not make any theoretical sense.

From the remaining 55 factors, 3 factors were excluded because (a) a single variable (Standards of Trading partners) loaded onto its principal component only; (b) the factor loading of the variable (Import Quotas) was less than the desired threshold (0.3) and (c) the variable

[54] Kaiser, H. (1974) "An index of factor simplicity" Psychometrika 39: 31–36.

(Tax Rates) was a complex variable that loaded onto multiple components. So, they were removed from the PCA analysis and considered as independent variables in subsequent investigation.

The remaining 52 factors were used for Principal Component Analysis with Varimax and Promax rotations. Varimax is an orthogonal rotation method that assumes that the factors (principal components) are independent of each other (hence orthogonal). In case even if the factors are not, it forces them to be orthogonal. Promax, on the other hand, is an oblique rotation method that allows the factors to be correlated. Tabachnick and Fiddell (2007)[55] have provided the basis for determining the type of rotation to be used based on factor correlations in the correlation matrix. If correlations exceed 0.32 then oblique rotation should be used.

Total Variance Explained			
Component	Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %
1	13.626	25.709	25.709
2	8.737	16.485	42.195
3	2.778	5.242	47.436
4	2.654	5.007	52.444
5	2.289	4.319	56.763
6	1.993	3.760	60.523
7	1.653	3.119	63.642
8	1.516	2.859	66.502
9	1.344	2.536	69.038

Table 30: Total variance explained by principal components

A total of 9 principal components were found for the factors of participation in Electronics GVC that had eigenvalues greater than 1 and explained the maximum amount of variation in the sample. The total cumulative variance explained by these first 9 components was nearly 70% in the data. The initial run of PCA produced 10 principal components that explained 71% of the variation but the last principal component only had a single factor loading significantly onto it; hence had to be dropped. Subsequent components added only nominal variance explained to the total variance (less than 2%), hence 9 principal components were decided to be considered for further analysis. Promax rotation delivered the best defined factor structure although the difference between the structures generated by the two rotations was almost minimal (all variables loaded onto the same factors, only the factor loadings were slightly different).

[55] Tabachnick, B. G., Fidell, L. S. (2007). Pearson Allyn & Bacon.

8.2.1(c) Factor (Principal Components) Loadings and Reliability

According to Kline (2002)[56], with a sample size of around 100 respondents, loadings of 0.30 or higher can be considered important. This is the rule of thumb usually followed for PCA loadings.

Cronbach's alpha score[57] is reported as a measure of internal consistency. For high internal consistency, high value of Cronbach's alpha is desirable (preferably above 0.6). Coefficients below 0.5 are unacceptable. The various factor loadings along with the Cronbach's alpha (in the third row) have been reported below (Table 31). Factor loadings < 0.3 have been suppressed.

	PRINCIPAL COMPONENTS								
	1	2	3	4	5	6	7	8	9
Cronbach Alpha (Reliability)	0.95	0.87	0.91	0.94	0.77	0.98	0.78	0.69	0.75
Skilled Labour - Availability	0.861								
Skilled Labour – Cost	0.881								
Skilled Labour - Quality	0.875								
Technology - Availability	0.487								
Technology - Cost	0.800								
Technology - Quality	0.649								
Basic Infrastructure - Availability	0.805								
Basic Infrastructure - Cost	0.883								
Basic Infrastructure - Quality	0.890								
Degree of Global Presence		0.585							
Ownership Structure		0.687							
Ease of Access to Finance		0.664							
R&D		0.792							
Access to latest Technology		0.889							
Technology Transfer Restrictions		0.776							
Supply Chain Barriers		0.623							
Long Design to Revenue Cycles		0.635							

[56] Kline, P. (2002). An easy guide to factor analysis. London: Routledge.

[57] Cronbach's alpha is a measure of reliability that is calculated by correlating the score for each scale item with the total score for each variable and then comparing that to the variance for all individual item scores. It ranges between 0 (items are fully independent) and 1 (items have highly co-variances). Higher Cronbach's alpha coefficient imply greater shared co-variance of the items; hence implying these items most likely measure the same underlying concept.

	PRINCIPAL COMPONENTS								
	1	2	3	4	5	6	7	8	9
Cronbach Alpha (Reliability)	0.95	0.87	0.91	0.94	0.77	0.98	0.78	0.69	0.75
Domestic Laws			0.837						
Public Institutions - Transparency			0.837						
Bureaucratic Red-tape			0.803						
Dispute Resolution Mechanism			0.828						
Competition in Value Chains			0.663						
Risks from Value Chains			0.667						
Investment Environment			0.669						
Cost of Doing Business			0.620						
Certification & Standards			0.601						
Timely Delivery of Products			0.514						
Structure of Value Chains			0.501						
Ownership Restrictions			0.426						
Raw Materials - Availability				0.804					
Raw Materials - Cost				0.830					
Raw Materials - Quality				0.770					
Intermediates - Availability				0.624					
Intermediates - Cost				0.559					
Intermediates - Quality				0.663					
Consolidation in Sector					0.727				
Constant Technology Upgradation					0.674				
Brand Driven Sector					0.787				
Ease of Diversification of Products					0.734				
Advance Planning Strategy					0.436				
Inventory Management - Availability						0.949			
Inventory Management - Cost						0.950			
Inventory Management - Quality						0.937			
International Transport Costs							0.476		
Non-trade Barriers							0.870		
Burdensome Customs Documentation							0.783		
Trade Agreements							0.824		
Import Licenses								0.843	
Export Licenses								0.759	
Import Tariffs of Trading Partners								0.656	
High Market Entry Costs									0.757
High Capital Costs									0.618
Long Gestation Time									0.610

Table 31: Principal Component Analysis for Electronics Sector (with Promax rotation)

Almost all factors in this PCA albeit two (Ownership restriction and Advance Planning strategy) had primary loadings of more than 0.45. A majority of items (variables) had clean significant loadings onto one factor only. Although a few variables had cross-loadings (i.e. loading onto more than one factor), but in each case, the primary loadings were stronger and greater than 0.3, so the cross-loadings were eliminated.

The Cronbach's alpha for all 9 components is more than the desired threshold ($\alpha > 0.6$). Components 5 and 9 just meet the minimum criteria of $\alpha > 0.6$ probably because the number of items under each of these scales is less (3 and 2 respectively).

The component correlation matrix provided below (Table 32) indicates that the components were largely independent of each other with almost all correlations below 0.3. These 9 components explain the maximum variance of the observed 53 factors and are used as independent variables for further analysis using logistic regression.

Component Correlation Matrix									
Component	1	2	3	4	5	6	7	8	9
1	1.000								
2	-.283	1.000							
3	-.182	.537	1.000						
4	.541	-.112	-.039	1.000					
5	.122	.244	.252	.129	1.000				
6	.464	-.145	-.154	.341	.052	1.000			
7	.393	-.202	-.099	.286	.198	.304	1.000		
8	-.112	.321	.248	-.083	.097	-.015	.052	1.000	
9	-.266	.413	.298	-.187	.126	-.180	-.261	.116	1.000
Extraction Method: Principal Component Analysis. Rotation Method: Promax with Kaiser Normalization.									

Table 32: Correlations between principal components for Electronics sector PCA

Based on the items that loaded onto each of these components, they have been renamed as shown in Table 33. Components 1, 4 and 6 were under the broad factor heading of "Inputs-related" formulated at the inception of the study. For Component 5, almost all sub-factors in the initial categorization under these broad heads loaded onto similar components.

COMPONENT	LABELS
1	Other Inputs
2	Operational
3	Institutional
4	Direct Inputs
5	Sectoral Structure
6	Inventory
7	Non-tariff Measures
8	Trade-related
9	Market Barriers

Table 33: Labels of Principal Components

Component 2 had factors related to technology (R&D, access to technology etc) and firm level

characteristics (ownership structure, degree of global presence) loading onto it, hence was renamed as Operational Characteristics. Component 3 had institutional (public institutions, bureaucratic red-tape, dispute resolution), value chain-related (structure, competition and risks in value chains) and product-related factors (standards compliance, timely delivery) under it, so was broadly classified as "Institutional". The trade related measures were classified under two broad factors – non-Tariff Measures and Trade-related measures (Components 7 & 8). Variables in the broad head Marker Barriers remained the same under both initial categorization and PCA (Component 9).

To summarize, a total of 9 principal components were obtained from PCA that subsumed 52 factors affecting participation that were included in the electronics survey. These principal components represented the broad determining factors encompassing the socio-economic, institutional and policy-related structural elements of the overall environment of operations of the industry and hence were vital for determining the ease (/difficulty) of participation of firms in the Electronics GVC. Whether these broad factors encouraged or impeded participation in GVCs has been determined by logistic regression analysis in the following section. Use of the broad factors provided the overall sense of what affected engagement in electronics GVCs at the macro level and has valuable policy implications. In addition, it also simplified analysis given the relatively small sample size and large number of explanatory factors.

8.2.2. PRINCIPAL COMPONENT LOGISTIC REGRESSION (PCLR) WITH PROPENSITY SCORE ANALYSIS

Principal Component Analysis (PCA) provided the broad factors affecting participation of firms in electronics GVCs in lieu of numerous number of sub-factors. To determine whether these broad factors had a positive or negative impact on participation, further analysis needed to be done. Hence logistic regression was employed only for the principal components to determine the importance of each of these components.

Before logistic regression, propensity score analysis (PSA) was carried out to address the concerns associated with observational studies. Observational studies, as opposed to experiments, are often criticised for non-randomized comparisons. The foundation for such criticism stems from the fact that baseline features (basic characteristics) of the subjects in the treated group often differ from those of untreated subjects. For instance, there might be greater number of large firms in the GVC participant group (as they have more resources at their disposal) as opposed to higher number of small firms (that face resource crunch) in the non-

participant group. To compare broad factors affecting these two cohorts (that differ in sizes) might not be illustrative unless they are made similar.

Observational studies also suffer from selection bias, which is again a case of non-randomization. How subjects are selected into groups is often scrutinized to determine whether the sample is representative of the population that it intends to analyse. A subject may have an inherent predisposition to self-select itself into a group (either treatment or control). For instance, older firms that have been in business for a longer period of time have a greater likelihood of being GVC participants versus a relatively newer firm which might find it difficult to position itself in GVCs due to lack of history of operations that prove its capabilities.

PSA (as proposed by Rosenbaum and Rubin, 1983)[58] accounts for these systematic differences between treated and untreated subjects by implementing a balancing score. Using propensity score weighting, covariates or control variables (that are essentially independent explanatory variables) are balanced across treatment and comparison groups in the sample to create a weighted sample. This ensures that comparison takes place between groups with analogous covariate characteristics (and not a situation where apples are compared with oranges). PSA also overcomes the shortcoming of selection bias by balancing the distribution of observed baseline covariates (or control variables) conditional on the propensity score between the groups of subject. This ensures that that the difference in outcome is attributable to the treatment alone and not due to inherent variances between the studied groups, in further analysis.

For this study, the treatment group comprised of the firms that were GVC participants and the control group consisted of non-participant firms. The covariates that were addressed through PSA were the firm-level characteristics – *age*, *size* (large, medium, small), *type of location* (cluster, industry centre, others) and *ownership type* (Indian, foreign). These baseline characteristics were attempted to be addressed in the initial stage of the survey by trying to build a representative list of firms to be approached. But since the responses could not be controlled for, PSA was used to address sample selection and non-randomization issues.

PSA involves first checking for the balance of covariates for the firms in both the groups (GVC participants and non-participants). If the coefficient of the covariate is significant, then there exists substantial differences between the firms in the two groups. Balance needs to be

[58] Rosenbaum, Paul R.; Rubin, Donald B. (1983). "The Central Role of the Propensity Score in Observational Studies for Causal Effects". Biometrika. 70 (1): 41–55

enforced by calculating the propensity score (predicted probability of being included in the treatment group) and then using these as weights for further multivariate analysis (logistic regression in this case). Table 34 below shows the balanced weighted sample.

	BEFORE PSA	AFTER PSA
COVARIATE	**p-value**	**p-value**
Age	0.313	0.893
Cluster	0.351	0.957
Industry Centre	0.089	0.983
Large	0.457	0.993
Medium	0.270	0.951
Ownership	0.727	0.934

Table 34: Propensity Score Analysis for firm characteristics as covariates

Logistic regression is a commonly used method for modelling a binary response variable – in this case "*Participation*" (which has the value 0 (or 1) when the firm is not present (or present) in the electronics global value chain respectively). The Principal Component Logistic Regression (PCLR) model as proposed by Aguilera et al. (2006) is an extension of the Principal Component Regression (PCR) that uses the principal components obtained from PCA as predictor variables for the logistic regression. They also suggest that the optimum number of components to be used in the logit model should be chosen based on conditional likelihood ratio tests from introducing principal components in a stepwise manner and then deciding their ability to explain the dependent variable ("*Participation*") based on the likelihood ratio. This technique has been used for predictions in operations management research literature (Mendes & Miller 2013[59], Saeed & Mahdi 2013[60] etc)

The rule of thumb for the minimum sample size for logistic regression is 10 cases per independent variable[61]. With a sample size of 131, the maximum number of predictor variables that could be included in the logit model for robust results was 13 (including the constant). Since 9 principal components explained the maximum variance in the data and all 9 components when included gave the best fit in the conditional likelihood tests, these were included as the predictor variables. The focus was on understanding the effect of these principal components on participation of firms in electronics global value chains. Interpreting the Odd's ratio for these principal components was tricky since these were the amalgamation of several sub-factors. But the Odd's ratio still indicated the general direction of impact and the relative

[59] Glauco Henrique de Sousa Mendes, Gilberto Miller Devós Ganga (2013), Regression Journal of Technology Management & Innovation

[60] Mehrjoo, Saeed., Bashiri Mahdi. (2013), Journal of Industrial Engineering International

61 Pampel, Fred. (2000), Sage Publications

magnitude of the impact of these broad factors on participation of firms in the electronics global value chains. Better odds indicated better chances of participation in GVCs. The results of the logit regression are given in Table 35.

				Number of obs = 129 LR chi2(9) = 13.04 Prob > chi2 = 0.0001 Log likelihood = 162.075 Pseudo R^2 = 0.105
Participate	**Coeff (B)**	**Robust Std. Err.**	**Sig.**	**Odds Ratio (exp (B))**
Other Inputs (PC1)	-0.373	0.256	0.145	0.688
Operational (PC2)	-0.015	0.239	0.950	0.985
Institutional (PC3)	0.107	0.233	0.656	1.113
Direct Inputs (PC4)	-0.076	0.209	0.717	0.467
Sectoral Structure (PC5)	0.498	0.217	0.022	1.645
Inventory (PC6)	0.254	0.198	0.201	1.289
Non-tariff Measures (PC7)	0.118	0.229	0.606	1.125
Trade-related (PC8)	0.401	0.240	0.095	1.493
Market Barriers (PC9)	-0.372	0.211	0.079	0.689
Constant	-0.042	0.192	0.827	0.958

Table 35: Principal Components Logistic Regression results for Electronics Sector

The pseudo-R^2 of a logistic regression does not measure the goodness of fit of the model. However, it is useful in indicating the degree to which the explanatory variables are useful in predicting the response variable and is usually referred to as a measure of effect size. Since only the principal components have been included in this regression, the pseudo-R^2 value of 0.105 indicates that the model is fair in predicting participation in electronics global value chains.

For assessing the goodness of fit of a model, the Hosmer–Lemeshow test is usually used. Similar to a χ^2 test for goodness of fit, it tests the hypothesis if the participation in the sample is not significantly different from the predicted participation by the model. For this model, the Hosmer-Lemeshow test (df = 8, P=0.956) shows that the null hypothesis cannot be rejected; hence the model is a good fit for the data.

Since the total number of responses (sample size) in our survey for the Electronics sector was not sufficient for regression analysis with all the indicators, and the logit regression performed here contained only the 9 principal components derived from the 52 major factors , the logit power analysis was performed to determine the achieved power of the multiple logistic regression model given the α (=0.1), sample size (= 131) and effect size (Odd's ratio) using GPower 3.1 software. The achieved power for the various variables at $\alpha = 0.1$ is given in Table

36. All the significant independent variables have achieved power above the decent level of 0.8. Although post hoc power procedures have been questioned based on the argument that most investigations will have the maximum posteriori power of 0.5 (Zumbo (1998)[62], Hoenig and Heisey (2001)[63]), the observed power is still cited as evidence of the adequacy of the study.

DEPENDENT VARIABLE	SOURCE	PARAMETER ESTIMATE	ODD's RATIO	p-value	POWER
Participation	Other Inputs	-0.373	0.688	0.145	0.91
	Operational	-0.015	0.985	0.950	0.11
	Institutional	0.107	1.113	0.656	0.51
	Direct Inputs	-0.076	0.467	0.717	0.81
	Sectoral Structure	0.498	1.645	0.022	0.94
	Inventory	0.254	1.289	0.201	0.62
	Non-tariff Measures	0.118	1.125	0.606	0.51
	Trade-related	0.401	1.493	0.095	0.83
	Market Barriers	-0.372	0.689	0.079	0.81

Table 36: Achieved power in PCLR for Electronics Sector

The regression results (Table 35) show that Sectoral Structure, Trade-related factors and Market Barriers were the most significant factors that affected participation of firms in electronics GVCs. While the effect of the sectoral and trade-related factors has been positive, marker barriers have been deterrent to the likelihood of participation in Electronics GVCs.

The **Sectoral Structure** component is positively significant. The odds of participation in global value chains increase by 64.5% with improvement in sectoral structure. This component represents sectoral traits like consolidation in the sector and the importance of brand in the industry as well as the expectations of the sector like the need for constant technology upgradation, advance planning strategy and ease of diversification of products. Higher consolidation is usually beneficial to the existing players since it increases the supplier power over buyers (when there are fewer suppliers). But consolidation also helps build scale and capabilities (through mergers and acquisitions) that increase competitiveness and profitability; hence firms are able to upgrade along the value chain. Smaller firms that get acquired might find this an indirect way of participating in the global value chains. The most common precedent is acquisition of firms that have high technical and innovation capabilities in order to deliver next-generation technology.

On the other hand, improving a firm's brand name ensures participation as brands espouse faith amongst buyer firms and influence their purchasing decisions in a positive

[62] Zumbo, B.D., Hubley, A.M. (1998), The Statistician
63 Hoenig, J.M., Heisey, D.M. (2001), The American Statistician

manner. Similarly, meeting the demands of clients through enhanced abilities by use of up-to-date technology through constant upgradation and processes put in place to diversify product lines on short notices (ease of diversification of products) helps improve the supplier firm's credibility and hence increases participation in global value chains. The Electronics industry is highly technology-intensive and electronics product design, functionality, and component sizes evolve rapidly. Supplier firms need not only to be able to meet current demand and anticipate future expectations of clients and the industry but also prepare for any exigencies. This is achievable only through foresight and robust advance planning. Hence any improvement in these capabilities augments the chances of participation and upgradation in the electronics GVCs.

The Odds ratio for **Trade-related factor(s)** indicated that this component had a substantial positive impact on the odds of participation ("yes" category). The trade-related component included factors like licenses and tariffs. This was expected as participation in global value chains (in general as well as according to the definition employed in this study) involves a high degree of trade (imports as well as exports). Without facilitative trade factors, participation would not be smooth. As per India's Foreign Trade Policy, almost all Electronics and IT products are freely importable (exception being some defence related items) and freely exportable (exception being a small negative list that includes items like high end super computer, high power microwave tubes, data processing security equipment, second hand computers etc.). Similarly, lowering of tariffs by trading partners in general or under trade agreements will help boost trade further. Hence any positive change in these factors (which will lead to a positive change in the Trade-related component) will increase the odds of participation in electronics GVCs by nearly 50%.

Market Barriers component, on the other hand, had a substantial negative impact on the odds of participation. The Market Barriers component included high capital costs, high market entry costs and long gestation time of projects. With intensification of Market Barriers (i.e., with an increase in market barriers), the odds of participating in electronics GVCs decline by nearly 31%. This is intuitive as market barriers such as huge capital requirements, access to resources, antagonistic moves by incumbent competitors etc. act as deterrents to new enterprises in entering the market, especially in becoming a part of the electronics global value chain. The probability of participation in the electronics GVCs can be improved by lowering these market barriers, for instance through easier access to finance and technology which will lower the entry costs significantly.

Although not statistically significant even at $\alpha = 0.1$, the impact of the rest of the principal components – Other Inputs, Direct Inputs, Inventory, Operational. Institutional and Non-tariff measures – is worth discussing.

The Inputs-related factors which subsumed the availability, cost and quality of inputs for manufacturing/ assembly were grouped under three components – **Direct Inputs** (comprising of Raw materials and Intermediates), **Other Inputs** (comprising of Labour, Technology and Basic Infrastructure) and **Inventory**. Interestingly, Direct Inputs and Other Inputs had a negative effect on the odds of participation. Inputs determine the nature of output and thereby the overall profitability of a firm, and hence assume high significance in supply chain management. Pal et al. (2013)[64] provide a comprehensive literature review on supplier selection criteria employed by firms. Most firms focus on reducing purchasing risks and maximising value of input, hence focus on availability, cost and quality of inputs. Meeting these criteria helps develop close and long term relationships between buyers and suppliers. Easy availability of inputs (like raw materials, technology, etc.) ensures a sustained production process (no shutdowns due to stock outs), low cost ensures competitiveness and high quality ensures high output product quality and overall profitability. Production delays resulting from shortage of inputs and faulty products recall result not only in massive losses to firms in the form of warranty costs and recalls charges but also affect the reputation of firms (suppliers and buyers) that hampers future prospect of participation in GVCs. Rare materials, volatile supply markets, poor quality inputs, restricted infrastructure, etc. are deemed as deterrents to participation in global value chains.

Raw materials and Intermediates are extremely vital inputs for the entire production process in the electronics value chain and this fact is corroborated by the rise in trade in intermediates. These direct inputs range from simple (for instance metals like copper & tin, plastic, passive elements like resistors) to highly sophisticated (chip-grade silica, rare earth metals, printed circuit boards).The negative bearing of the *Direct Inputs* component (except for inventory management) on the odds of participation of firms in the electronics GVC indicated the country's dependence on imports for even basic inputs like raw materials and intermediates (which demand very high quality and ready availability), rather than building domestic competence (Baldwin (2011))[65]. An improvement in this component in terms of availability, cost and quality of raw material and intermediates through imports reduced the odds of

[64] Pal O., Gupta A.K., Garg R.K. (2013), International Journal of Social, Behavioural, Educational, Economic, Business and Industrial Engineering

[65] Baldwin R. (2011), NBER Working Paper Series, Paper No. 17716

participating by around 53%. This prominence of imports of raw materials and intermediates over exports is probably responsible for the negative effect of intermediates on participation. But the negative impact of *Other Inputs* (Labour, Technology, and Infrastructure) on the odds of participation in electronics sector GVC was rather surprising. According to the Odds ratio of this component, an improvement in Other Inputs in terms of availability, cost and quality reduced the odds of participating by 31%. One possible explanation could be that any improvement in this factor will definitely spur manufacturing in the country, thereby reducing the dependence on imports. But without the commensurate increase in the degree of exports the rate of participation in electronics GVCs will remain low. The other explanation could be that it is simply an inconsistent result.

Improvement in **Inventory Management** in terms of quality, cost and availability increases the odds of participation by 29%. Inventory optimization has been a very vital focus area in supply chain management, especially leading to management systems like just-In-Time (JIT). These new systems emphasize correct sizing of inventory to minimize costs, meet buyer demands within short lead times and improve overall operational efficiency. Electronics components being relatively small in size and very delicate need proper handling and storage; so are usually preferred to be manufactured and shipped on demand. Hence any enhancement in inventory management increases a supplier firm's abilities to meet customer demand for inputs; thereby improving the chances of the firm for greater participation.

The **Operational** component comprising of technological factors (like R&D, Access to and restrictions of transfer of Technology) and firm level characteristics (like ownership structure, degree of global presence) had a negative impact on the odds of participation. With improvement in this component, the odds of participation of firms in electronics GVCs decline by 1.5%. The effect was somewhat ambivalent because of the mix of factors like technological barriers (technology transfer restriction, supply chain barriers, long design to revenue cycles) and technology enhancers (access to latest technology, research and development). But since the Odds ratio is almost equal to 1, there is nearly a probability of 0.5 that this component will have an equivalent reciprocating effect on the odds of participation.

The **Institutional** component had a positive impact on the odds of participation of firms in electronics GVCs, with the odds improving by 11.3% with improvement of this component. This component had factors related to general institutional setup for business in the economy, features of the value chain and expectations regarding a product, with influencers on

participation like transparency of public institutions, domestic laws, dispute resolution mechanisms, investment environment, structure of value chains, bureaucratic red-tape, risks from integrating in global value chains, competition in value chains and cost of doing business. Similarly, the product-related factors like standards compliance and timely delivery of products are impediments faced by firms, especially smaller ones that do not have ready access to resources like technology. Supplier qualifications include stringent demands on supplier quality (certification like ISO), ability to meet buyer specifications and ability to diversify products based on consumer demand (Beil 2009)[66]. So any firm that desires integration into a value chain has to meet certain benchmarks. All these factors have a potential for affecting a firm's performance, and hence participation in GVCs, by affecting the conduciveness of its business environment. Hence eliminating the negative influences like removing red-tape, ensuring transparent and reliable public institutions, introducing efficient dispute resolution, providing a promising investment environment, having facilitative domestic laws, and reducing the risks from integration in GVCs will promote participation.

Finally, the non-trade factors and procedural requirements of trade that were subsumed under the **Non-tariff Measures** component have a positive impact on the odds of participation which increased by around 12.5% with an improvement in this component. The easing of these factors are essential for improving the simplicity of trade. For instance, faster and less cumbersome customs documentation procedures at the borders (or ports of entry) will help immensely in quicker turnaround times for the manufacturers/assemblers and is extremely vital for an industry like Electronics where lead-times are expected to be short.

The use of PCA has several advantages like addressing the measurement problems, complexity of data and multicollinearity in data. But PCA suffers from certain shortcomings as well. For instance, generalization of variables under principal components leads to loss of information (impact of individual factor on the dependent variable of study- *participation*). Similarly, factors under a single principal component might not make theoretical sense, since the components are determined by maximum variation of factors. But given the relatively small sample size and large number of potential predictor variables, PCA was the best method to be employed to ensure reduced dimensionality and independence of explanatory variables. Additionally, use of only principal components for the logistic regression might seem somewhat restrictive. But given the sample size and the fact that majority of factors were

[66] Beil, D. R. (2010), Wiley Encyclopaedia of Operations Research & Management Science.

accounted by the principal components, use of PCs for regression seemed justified. The potential predictor variables entered the regression through the principal components and still exhibited their impact on participation of firms in electronics global value chains.

Analysing participation in Electronics GVCs with varied characteristics of the sub-segments (Consumer, IT Hardware, Telecom and Solar) also poses certain challenges. For instance, the nature of the market for Consumer electronics is very different from that of Solar Electronics. While the former is largely customer driven (products and processes are designed to meet customers' expectations), the latter mostly generates its demand from the Government (Government schemes and regulations). Similarly, the presence (length) of GVCs for each sub-segment in India is very different. Consumer electronics and Telecom have a much higher and evolved presence while IT Hardware and Solar Electronics are still in their nascent stages. Although the small number of firms in each sub-segment (roughly 30 in each) did not allow us to undertake quantitative analysis for individual sub-segment, a comprehensive approach that includes factors affecting all these sub-segments has been attempted. This approach might have abstracted away typical sub segment-specific factors, but the broad trends in the Electronics GVCs participation have been captured and presented in this paper.

9. SURVEY FINDINGS – FIRMS' PERCEPTION

This study also aimed to present the opinion of the firms regarding the facilitation, challenges and opportunities that the firms faced for participation in Electronics GVCs. In the preceding section (Section 8), PCLR provided insights into how broad factors (determined by PCA) affected participation, giving a sense of the direction (positively or negatively) and the relative impact on the odds of participation. Since the use of PCA abstracted away information regarding individual factors affecting participation in Electronics GVCs that were contained within the survey questionnaire, this section has been included to provide insights into how firms responded to these individual factors that were ascertained as significant in the logistic regression.

A brief snapshot of the majority responses to individual factors has been provided in the table below (Table 37). This reveals the overall picture vis-à-vis the general perception of these firms. The complete responses along with detailed discussions have been provided in Annexure 1.

BROAD FACTORS	FACTORS OF PARTICIPATION	DEGREE OF IMPORTANCE[67]
Institutional Factors	Risks from Value Chain	Moderately Important
	Competition in Value Chains	Important
	Structure of Value Chains	Not Important (OEMs) Important (Components Manufacturers)
	Investment Environment	Important
	Bureaucratic Red-tape	Not Important (Large Firms) Important (Small & Medium Firms)
	Public Institutions - Transparency	Moderately Important
	Dispute Resolution Mechanism	Important
	Domestic Laws	Important
Input-related Factors	Raw Materials - Availability	Extremely Important
	Raw Materials - Quality	Extremely Important
	Raw Materials - Cost	Important
	Intermediates - Availability	Extremely Important
	Intermediates - Quality	Extremely Important
	Intermediates - Cost	Important
	Basic Infrastructure – Availability	Important
	Basic Infrastructure - Quality	Important
	Basic Infrastructure - Cost	Important
	Skilled Labour - Availability	Important
	Skilled Labour - Quality	Important
	Skilled Labour - Cost	Important
	Technology - Availability	Extremely Important
	Technology - Quality	Extremely Important
	Technology - Cost	Important
	Inventory Management - Availability	Extremely Important
	Inventory Management - Quality	Extremely Important
	Inventory Management - Cost	Important
Trade and Non-Trade Related Factors	Non-trade Measures	Important
	Trade Agreements	Highly Important
	Import Tariffs of Trading Partners	Not Important
	Standards of Trading Partners	Important (Exporter Firms)
	Burdensome Customs Documentation	Not Important
	Import Quotas	Not Important
	Import Licenses	Not Important
	Export Licenses	Not Important
Technological Factors	Access to latest Technology	Highly Important (OEMs, ODMs) Not Important (Mid-value segment)
	Research & Development	Highly Important (OEMs, ODMs) Not Important (Mid-value segment)
	Technology transfer restriction	Not Important
	Supply Chain Barriers	Moderately Important

[67] As reported by the majority of firms in the survey questionnaire. Reveals the firms' perception.

BROAD FACTORS	FACTORS OF PARTICIPATION	DEGREE OF IMPORTANCE[68]
Market Barriers	High Capital Costs	Extremely Important
	High Market Entry costs	Important
	Long gestation time	Important
Financial Factors	Cost of doing business	Highly Important
	Tax rates	Moderately Important
	Access to credit	Highly Important
	Cost of credit (Interest rates)	Highly Negatively Important
Sectoral Characteristics	Consolidation in Sector	Not Applicable
	Brand-driven Sector	Important (Large firms) Not Important (Small & Medium Firms)
	Standards Compliance	Extremely Important
	Constant Technology upgradation	Important
	Timely delivery of products	Extremely Important
	Ease of diversification of products	Important
	Advance Planning Strategy	Important
	Long design to revenue cycles	Moderately Important
Regulatory Factors	Import Policy of India	Negatively & Highly Important
	Export Policy of India	No Impact
	Import Policies of Trading Partners	Positively & Highly Important
	Foreign Direct Investment (FDI) policy	No Impact
	Intellectual Property Rights (IPR) regime	Moderately important
	Government Subsidies	Positively & Important
	Manufacturing Policy	Positively & Highly Important
	Investment and Tax incentives of Governments	Positively & Highly Important
	State Laws	Negatively & Highly Important
	Environmental Laws	No Impact
	Competition Policy	Moderately Important
	Labour laws	Negatively & Highly Important
Image and Culture-related Factors	Image of Indian firms	Extremely Important
	Cultural Factors	No Impact

Table 37: Factors affecting participation of firms in India in the Electronics GVCs and their importance (Source: Based on survey findings)

In addition to the detailed responses of Electronics firms (Annexure 1), a separate analysis of the reactions of firms that are direct participants of Electronics GVCs has also been undertaken in order to gain greater clarity about the major factors that aid or hinder participation. This complete analysis along with a brief discussion has been provided in Annexure 2.

[68] As reported by the majority of firms in the survey questionnaire. Reveals the firms' perception.

10. SUMMARY OF KEY FINDINGS

As supported by prior literature, firm size was found to influence not only participation in value chains but also the position of the firm in the global value chain. Size (large, medium, small based on investment in plant and machinery) reflects a firm's potential to achieve economies of scale, access to resources and ability to undertake risks; hence large firms have a comparative advantage over medium and small firms with a higher probability of being in a global value chain. Ownership structure was found to influence the manner of participation only (whether firms engaged in one-way trade through imports or exports or participated in GVCs by engaging in both imports and exports). Firms with foreign ownership (partially or fully owned subsidiaries) have the advantage of relatively easier entry to foreign markets owing to the presence of a foreign partner or parent. As compared to their local counterparts, they also have relatively easier access to sophisticated and more advanced technology, latest technical know-how, better management proficiency and overall capabilities.

Interestingly, the type of location of the firm did not affect participation in Electronics GVCs. When examined segment-wise, the type of location seemed to affect the Consumer and IT Hardware firms significantly, rather than Telecom and Solar firms. Clusters of firms producing similar kinds of products (firms in the same segment of GVC) make use of the common resource pool like skilled labour and infrastructure and potentially overcome shortcomings like size and finance through agglomeration (specially SMEs). Industry centres, on the other hand, that evolve around a lead firm have easier access to global value chains owing to the opportunities created by the lead firm. These features are more prominent in the Consumer and IT hardware firms.

To summarize the above discussion on the wide spectrum of factors affecting participation in Electronics GVCs, a brief snapshot of the broad factors along with the constituent factors and their importance as reported by the majority of the respondent electronics firms has been provided above (Table 37). In the discussion above, the broad factors revealed the comprehensive trends with regards to how participation is affected by them (Section 8) and the ensuing discussion revealed the importance of individual factors as reported by the respondent electronics firms (Annexure 1).

The results of the micro-econometric analysis, performed on the broad factors of participation (as determined by the principal component analysis) revealed that Sectoral Structure, Trade-related factors, and Market Barriers had the strongest influence on participation albeit in different directions. The **sectoral structure** comprised of sectoral factors like consolidation and importance of brands in the sector and were found to be positively significant in both modes (econometric analysis as well as firms' perception). Product related factors such as constant technology upgradation and ease of diversification of products, which were a part of the sectoral characteristics were considered as important by the respondent firms as well as econometrically found to have a positive significant impact on participation. This set of factors represents the high standards and expectations of the industry in terms of technology, abilities and reliability and therefore probably is considered vital to participation; though these can pose as major challenges for firms, especially SMEs.

Trade-related factors that subsumed the licences and quotas has been positive and highly significant in increasing the odds of participation of firms in Electronics GVCs. This was a clear reflection of India's Foreign Trade Policy measures under which almost all Electronics and IT products are freely importable (exception being some defence related items) and freely exportable (exception being a small negative list that includes items like high end super computer, high power microwave tubes, data processing security equipment, second hand computers etc.). Easing of the licences and quota system facilitates trade as much as lowering of tariffs by trading partner nations does.

Market Barriers, on the other hand, had a negative impact on participation as a broad factor. As expected, market barriers constituted by high market entry costs, high capital costs, and long gestation time of projects affect participation of firms in Electronics GVCs negatively. Additionally most of these individual factors have been rated as important or extremely important by a majority of firms. This gamut of factors relates to costs associated with setting up a business venture in the Electronics sector and is usually significantly high, hence has been declared as a deterrent by the respondent firms. Firms unable to meet the challenges posed by the constant flux in the sector find it hard to enter and/or survive in global value chains.

Inputs (raw materials, intermediates, labour, technology, infrastructure and inventory) have been considered important (to highly important) by the firms for participation in Electronics GVCs, though they were not found to be significant in the econometric analysis (at $\alpha = 0.1$). Only inventory was found to have a positive effect on participation amongst all inputs. The negative impact of the rest of the inputs was probably owing to the greater

dependence on imports and rather low exports volumes of intermediates. Inputs, in terms of quality, cost and availability, determine the operations and output of firms, hence are vital for determining participation.

The **Operational** component comprising of technological factors (like R&D, Access to and restrictions of transfer of Technology) and firm level characteristics (like ownership structure, degree of global presence) had a negative impact on the odds of participation. Research and Development (R&D) and technology transfers have probably not been at the desired level, as these have been considered as moderately important especially by the small and medium firms. Apart from needing a huge investment, R&D also requires trained manpower and innovation skills. R&D spending is still mostly restricted to OEMs and a few large ODMs. Firms in the lower segments of the GVC hardly invest in R&D and are reliant on these lead firms for technical support including design aspects, production efficiency, quality improvement, development cycle of products etc. The Government has already started providing subsidy for investment in R&D, technology and machinery to encourage more research. Another possible solution to this problem could be a creation of joint R&D facilities for the entire industry. Firms and the Government could pool resources to jointly develop processes and innovations for standardized products and provide technical support to the needy within the industry. Becoming shareholders in the development process could improve individual firm's efficiency and raise overall industry productivity. Additionally, the Government could also promote investor outreach programmes with several countries to bring global practices to India.

A positive impact of the **Institutional** component was observed, which comprised of factors related to general institutional setup for business in the economy, features of the value chain and expectations regarding a product. Several sub-factors like domestic laws, dispute resolution mechanisms, investment environment and competition & structure of value chains have been deemed as important by majority of firms while the rest of the sub-factors like bureaucratic red-tape, transparency of public institutions and risks from integrating in global value chains have been reckoned as moderately important. This set of factors determine the conduciveness of the business environment in an economy and hence have huge potential for affecting a firm's performance, growth and thereby participation in global value chains.

Domestic laws have been perceived to play a major role in aiding or deterring participation of firms in electronics GVCs. Policies like the manufacturing policy, investment and tax incentives of Governments, trade agreements and import policies of trading partner

nations have had positive impact. Incentives by the Government to encourage manufacturing within the country (with the recent "Make in India" campaign) coupled with tax/duty breaks, investments spurs, guidelines to meet international standards and sustainable industry practices have encouraged participation in electronics global value chains.

State Governments have also played a vital role in encouraging this industry in the global markets by providing incentives like relaxation or exemption of stamp duty on sale or lease of land, concessional rate of interest on loans for capital expenditure, tariff incentives for infrastructure, concessional tax rate periods, backward area subsidies, special incentive packages for mega projects, etc. But greater stimuli for attracting foreign investors, especially to prior untapped regions, are desired by a lot of firms. For instance, the Eastern region has a very small supplier base due to absence of any major OEM in the vicinity, as opposed to the three other major clusters. Special packages by state governments could potentially help attract other major OEMs and enlarge this supplier base resulting in the virtuous circle of more industrialization, employment and growth.

Labour laws, on the other hand, have had the most negative impact on participation in Electronics GVCs. Archaic and restrictive labour laws governing hiring, layoffs, wages and minimum operational environment have made the workforce composition skewed towards contractual labour which has actually started to turn counter-productive. In addition, skilled labour is also becoming a scarce commodity as technological advancements in the industry have fast outpaced skilling and training. The Government could step in to fill this void by creating more sector-specific training institutes and/or operate in a PPP mode for creation of skill development resources.

Apart from domestic laws, other **public institutions** are also vital for healthy participation of firms in electronics GVCs. Transparency, efficiency, effectiveness and no corruption enhances the dependability of these institutions and espouses confidence in the general business climate of the economy. Procedural simplicity and efficient dispute resolution mechanism are important steps for institutional assurance. For instance, single window clearances on environment and other compliances, quick building approvals and certificates issuance services by local authorities, reliable land acquisition, etc. are measures that inspire confidence in investors.

Financial factors have been considered to be highly important and deterrents to participation by majority of firms. These red flags are important for policy makers to deal with

as ease of access to credit and investment are extremely vital for the electronics industry for operations and growth, as is cost of credit. SMEs specially desire preferential treatment from formal sources of credit in the form of lower interest rates and fewer procedural expectations (like collaterals) and from the Government in the form of special financial packages. Dissemination of subsidies and incentives related information at the industry level would be a great first step towards firms availing the existing inducements.

Finally, N**on-trade measures** and procedural requirements for trade were determined to have a positive impact on improving participation rates in electronics GVCs. Customs procedures (which were considered as not important) and other trade-related factors like trade agreements were deemed to have a positive impact. Firms desire proper and timely information regarding change in import and export policies, if any. Quicker turnaround time at ports of clearance would aid firms in timely delivery of products and avoid losses due to production stoppages. Standardization of clearance rates at the ports (instead of having different rates for different shipping lines) would also lessen the clearance cost burden. Similarly, trade agreements which were facilitative of trade in terms of access to inputs (like intermediates and technology) and markets were considered as highly important by a majority of firms. Apart from these, positive trade-related factors set an encouraging trend as greater participation in global value chains itself means enhanced trade and facilitative trade factors are a step in the right direction.

11. CONCLUSION

This paper attempted to understand the major factors of participation of firms in Electronics Global Value Chains (GVCs) from a firm-level perspective. It conducted econometric analysis of broad factors influencing value chain participation (thereby determining the degree and direction of impact) and analysed the perceptions of enterprises regarding the influence of extended factors concerning the business environment. These insights will be useful in planning for the future with the goal of encouraging greater participation in global value chains and increased domestic value addition.

The key takeaways from this study are –

(a) Though India might have missed the bus in terms of promoting manufacturing in the Electronics sector early on, the reality remains that the country cannot indefinitely rely on imports to meet its need for raw materials and components if it wants to increase its participation in electronics global value chains. The extent of domestic value addition (in terms

of both quantity and quality) cannot be augmented unless there is a strong manufacturing base at home, especially for components. India needs to focus on improving its share of participation in GVCs, especially in the higher value added segments. A major step is to address the inverted duty structure existing in the sector, i.e., equalizing the import duties for components and final products and creating a strong ecosystem for native manufacturing. Government remains a major facilitator of the process, for instance, as showcased by the solar electronics sub-sector.

(b) The focus on Research and Development (R&D) has to increase radically. Advancement in technology offers a major comparative advantage in terms of value addition. India has a huge potential market for electronics products, hence technology adapted to indigenous needs can also offer huge benefit for value addition as proven by the smart phones market. Dedicated centres for R&D with stakeholders from the Government, private sector and academia should be promoted to develop technology for the industry. Massive investments and incentives are also needed.

The fact that major global Electronics players have set up their R&D Centres in India already signals that the country has a critical mass of skilled and highly skilled workforce to carry out such high-end value added services. But since the benefit of such efforts accrues to the individual MNCs (in-house R&D), domestic manufacturers do not stand to gain (unless they invest in their own R&D facilities, which might not be financially feasible). To counter this situation, the Government could proactively provide an ecosystem for creating independent R&D hubs that are delinked from the ownership of OEMs (or lead firms) and cater to the innovation and research needs of the sector as a whole.

(c) Skilling of labour and easing of Labour-related regulations should be yet another primary focus area for increasing participation in Electronics GVCs. Since manufacturing in this sector is still at a nascent stage in the country, desired levels of manufacturing cannot be achieved without adequate skilled manpower at all levels. Since skilling has a certain incubation time, the sooner the country embarks on this effort, the better.

(d) Small and Medium Enterprises desire preferential treatment in order to be able to increase participation in and upgrade along the electronics global value chain. SME-centric policies should be an area of focus for the Government. For instance, promoting agglomeration of SMEs in clusters could potentially overcome the deficiencies they face due to their small size and enhance their access to resources like finance and labour. SMEs should be aided to improve in terms of productivity, efficiency and flexibility as demonstrated by Chinese manufacturers.

(e) "*Brand India*" needs to be marketed internationally for ease of access to foreign markets, potential clients and investments. Platforms for highlighting products by firms in India at an international level should be encouraged. Frequent manufacturing suppliers-buyers meets should be organized globally through transnational visits, Electronics Expos in different countries, government exchange programmes, etc. that will lead exchange of information and technology and building of a potential foreign client base.

(f) Finally, Government remains a significant facilitator of participation of firms in India in the electronics global value chains. Apart from addressing macro-level issues (domestic laws, trade agreements, public institutions, etc.), government intervention is required even at the micro level. Assistance as desired by the firms is in form of financial incentives (including credit and taxes), access to technical support, basic infrastructure development and improving ease of doing business.

Limitations of the Study

There are certain limitations in the methodology used in this study. Firstly, the analysis done in this paper is only on cross-section data collected first-hand from surveying electronics firms. Changes over time can only be highlighted by collecting data over time to create a panel. Panel data analysis would be invaluable. Secondly, the data used for analysis is responses as reported by the firms. While robustness of the data was ensured to the best possible extent through use of secondary sources and industry experts, there are still data points (like costs, ratings of factors) that were accepted as reported by the firms. Thirdly, the econometric procedure used only the 9 broad factors obtained from the principal component analysis that comprised of 52 factors included in the study. The rest of the factors included in the study (most importantly the domestic polices and laws) were analysed for their importance based on the firms' perceptions and in-depth discussions. These factors can be included in the econometric exercise if the sample size increases with responses from more firms. Fourthly and finally, there might be other factors affecting participation that this study could not incorporate although given that 55 factors affecting participation of firms in electronics global value chains were included, there has been a serious attempt to cover as many factors as possible (though this increased the length of the questionnaire substantially). These shortfalls can be addressed in further research.

Extensions of the Study

There are several areas where further research can be carried out. Firstly, the impact of sectoral laws/policies can be explored in greater depth as policy decisions can then be adjusted accordingly to encourage greater participation in electronics GVCs. With the launch of several new programs like "Make in India" and "Skill India" and roll out of GST, the Government has been undertaking proactive steps to facilitate greater manufacturing and value addition in the country. But unless a detailed analysis of these measures is undertaken, their effectiveness cannot be determined. Yet another dimension of analysis can be to closely examine state level policies. The state-level analysis can be done by selecting one state at a time and analysing the impact of policies on firms operating there vis-à-vis sister-firms in other states. Firms with manufacturing plants at multiple locations will be the best candidates for this kind of study.

The role of infrastructure and logistics in promoting GVC integration in the Electronics sector also needs to be examined closely. The importance of basic infrastructure was repeatedly highlighted in the in-depth discussions with firms and industry experts. Since electronics manufacturing is highly dependent on facilities like uninterrupted power and water supply; smooth, careful and quick transport of components and finished products, a closer look at these factors, in terms of their current state and future prospects in the country, will help in determining how to make India a more attractive destination for international manufacturers and a better hub for domestic manufacturers.

In addition to reviewing the impact of domestic laws and basic infrastructure, the role of trade agreements and foreign investment policies in facilitating participation in global value chains can also be explored. Trade agreements play a significant role in determining the international access and transfer of resources (including technology, investment, personnel, knowledge etc.) and entry to newer markets which are essential for improving capabilities of firms in India and are also desired by the firms. Trade and investment agreements with current trading partners and prospective partners have the potential of impacting participation of firms in India in electronics global value chains and should be studied closely.

Next, this study can be extended to cover other regions and other sectors. The focus of this study has been mostly on the clusters present in two chosen sectors. But there are firms that also operate in other states and at other types of locations like Special Economic Zones (SEZ), Industry centres promoted by State Governments, Export Processing Zones (EPZ), etc.

Attempts can be made to cover more firms at these locations and analyse whether the type of location (clusters vs others) have any impact on participation. Cluster Theory is a well-studied branch in Economics. This study can empirically corroborate propositions in cluster theory.

Additionally, a cross-country comparative study can also be proposed to understand if the factors that were discovered as vital for participation in GVCs in India also hold true in other similar developing nations, other BRICS nations for instance (Brazil, Russia, China, and South Africa). Automotives and Electronics Sectors at a global level are also agglomerated. But the general axis of power (aka higher value addition positions) in Global Value Chains is gradually shifting from the developed world to the emerging economies. What has caused this shift of power and to what extent have government policies and emerging economies' ecosystem aided this shift is an interesting topic that should be explored further.

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ANNEXURE – 1: SURVEY FINDINGS – ELECTRONICS FIRMS' PERCEPTION

This section presents the opinion of firms regarding the facilitation, challenges and opportunities that the firms faced for participation in Electronics GVCs. In the preceding section (Section 8), PCLR provided insights into how broad factors (determined by PCA) affected participation, giving a sense of the direction (positively or negatively) and the relative impact on the odds of participation. Since the use of PCA abstracted away information regarding individual factors affecting participation in electronics GVCs that were contained within the survey questionnaire, this section has been included to provide insights into how firms responded to these individual factors. In other words, this section provides insights into the firms' perceptions of their side of the story.

Views of the firms were collected through the survey using multiple modes - online survey, telephonic interviews and face-to-face interviews. A combination of these modes was adopted since the response rates varied across them – high, medium and low in case of face-to-face interviews, telephonic interviews and online survey, respectively. The overall response rate (as measured against the total number of firms in the association directories) was 12.6% for the Electronics survey.

The questions in the survey questionnaire were largely divided into broad factors of participation and relevant sub-factors were finalized after extensive discussions. These broad factors and the subsequent sub-factors under each category have been outlined below, along with the descriptive statistics of responses obtained. Factors which more than 50% of the firms deem important (or extremely important) have been perceived as significant.

A1.1. IMPRESSION AND CULTURE RELATED FACTORS

A1.1.1. Image of Indian firms

Image or impression plays a vital role in the choice of sourcing and supplier firms. Very often, sellers' and/or buyers' perception about a firm is based on the past performance of the firm derived from either a history of direct experience or word-of-mouth in the business. The general impression about Indian firms (in terms of trustworthiness and affordability), the image of Indian products (in terms of quality, cost and reliability) and generally the brand image of India as a major manufacturing hub on the world scene could affect the firms' prospects of participating in GVCs. This question was intended to gauge if Indian firms faced image-related issues in participation in GVCs.

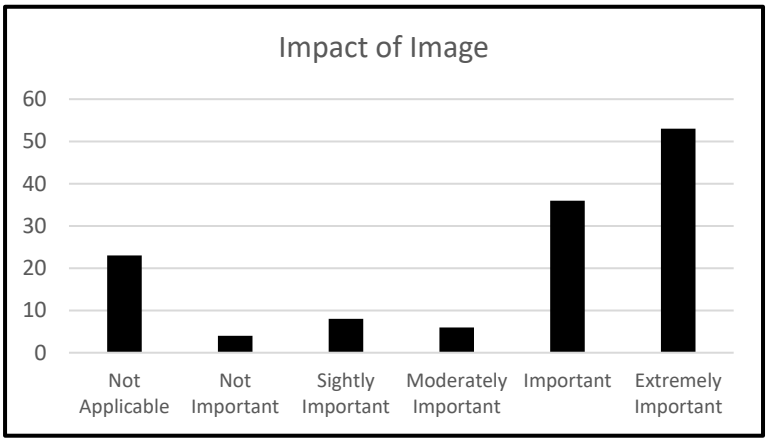


Figure 12: Effect of Image of Indian Firms on Participation in Electronics GVCs (Source: Based on Survey Findings)

According to the responses (Fig 12), most firms feel that the buyers' perception about Indian firms is extremely important for participation. This implies that Indian firms need to cultivate a good image as suppliers with high reliability and worthy standards and need to keep updating their capabilities like standards certification, technology, production capacity, employee strengths, and adaptability based on current and anticipated customer requirements.

A1.1.2. Cultural Factors

Very often cultural factors affect the way firms execute business. These factors are a reflection of their nation's culture, organizational culture or general philosophy of operations. Cultural factors impact business decisions regarding who the firm's clients and suppliers should be, how and where business should be conducted and strategy regarding future goals. For instance, certain OEMs wish to make their entire value chain domestic by sourcing from their local suppliers and catering to the domestic market alone. Some MNCs in India prefer to source from their home countries only as a result of their organizational tradition. This question was asked to gauge if cultural factors influence the sourcing/supplying patterns of electronics firms. Carter et.al. (2010)[69] have showed that culture influences the decision of procurement managers in choosing suppliers from different geographies.

[69] Carter, Joseph., Maltz Arnold, Maltz Eliot, Goh Mark, Tingting Yan (2010), " Impact of culture on supplier selection decision maker", International Journal of Logistics Management, Vol.21, No.3, pp 353-374

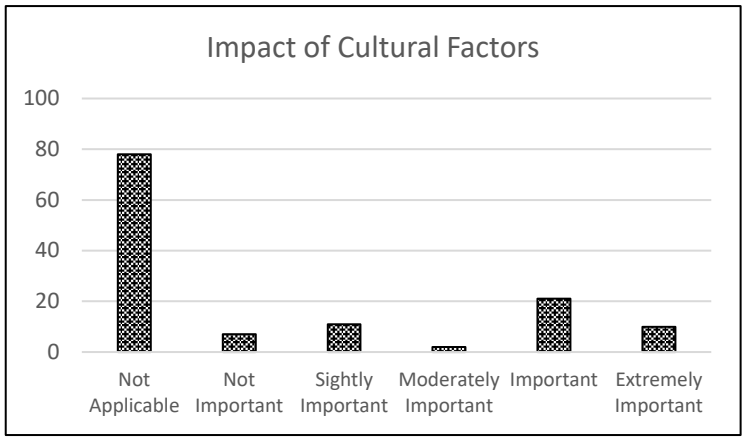


Figure 13: Impact of Cultural factors on Participation in Electronics GVCs (Source: Based on Survey Findings)

Based on the responses (Fig 13), cultural factors seem to be of no major consequence to most firms in participating in the Electronics GVC, though a small proportion of firms do deem these as important. A closer look at the type of firms attaching importance to cultural factors revealed that most of these firms were large. Most medium and nearly all small firms felt cultural factors were not important determinants of participation in GVCs. Larger firms, which have more resources at their disposal, have the luxury of upholding their organizational and national philosophy as part of their business strategy. But Electronics industry, in general, is one of the most fragmented industries with sourcing and supplying operations spread across the globe; thus making the electronics value chains global in the truest sense.

A1.2. INSTITUTIONAL FACTORS

Institutional Factors determine the general climate of doing business in an economy through the prevailing political, economic, social and legal institutions. Though it is difficult to determine precisely which institutions affect the participation of firms in global value chains, a range of sub-factors relating to the impact of existing institutional setup and practices were covered in the survey.

A1.2.1. Domestic Laws and Policy-related

Laws and policies are generally considered to be important for participation in GVCs by the electronics firms because they not only affect the current operations but also future strategies. A law/policy has the capability to create opportunities or challenges for businesses. Questions on the level and type of impact (positive or negative) of specific laws/policies (comprising of both State Government and Central Government policies) governing the Electronics sector and

the overall level of difficulty of domestic laws were posed to the firms to understand the degree of impact of these policies on their integration in value chains.

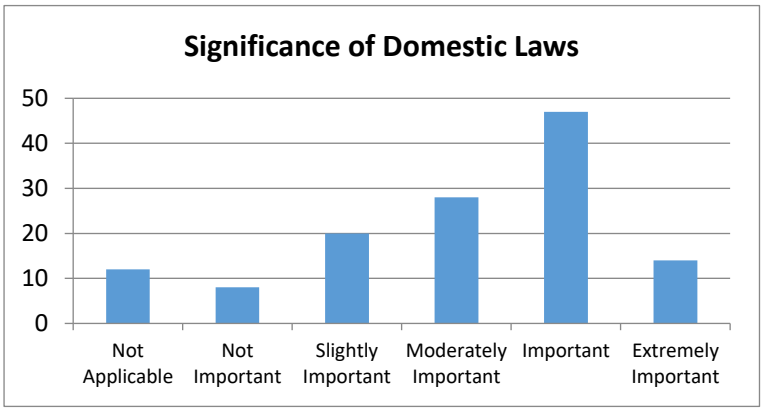


Figure 14: Significance of Domestic Laws in Participation in Electronics GVCs (Source: Based on Survey Findings)

Nearly half of the respondent firms (47%) considered the domestic laws as important or extremely important for participation (Fig 14). For a deeper understanding of the impact, the most important laws specific to the Electronics Sector that could have a bearing were shortlisted after extensive discussions and the pilot survey. The reaction of the respondent firms to individual laws/policies has been shown below (Fig 15). There are three broad categories of impact – (a) No Impact; (b) Positive Impact (High and Moderate); and (c) Negative Impact

(a) ***No Impact***: The laws/policies which the respondent firms felt had no major impact on participation in the Electronics GVC were the Export policy of India, Foreign Direct Investment (FDI) policy and Environmental laws (Fig 15).

Interestingly, the **Export Policy** in India for Electronics seems to have no major impact on participation in Electronics GVCs. Under the foreign trade policy, exports have been promoted through several incentives like duty drawback, duty remission schemes etc. At present, there are no particular prohibitions on exports in the electronics sector, including no license requirements or quotas, except for a small negative list. Exports have been encouraged through the Merchandise Export from India Scheme (MEIS) to improve export competitiveness in select international markets, reduce exports transactions cost and increase market penetration. This scheme has notified certain products (including final products and components) and markets for exports which when exported to specified markets are offered 2% export subsidy. Here transferable duty scrips issued on realized FOB value of exports can also be freely used for payment of customs duties for imports of inputs/products, excise duties on domestic procurement and service tax. There is also provision for higher subsidy under this scheme for export items with high domestic content and value addition. To encourage

manufacturing and exports, Special Economic Zones (SEZs) are being set. Sales from Domestic Tariff Area (DTA) to SEZs are treated as physical export which entitles the domestic suppliers (deemed as exporters) to drawback benefits, Central Sales Tax exemption and Service Tax exemption.

In addition, several tax-based interventions are in place for promoting manufacturing for exports. For instance, the Exports Promotion Capital Goods Scheme (EPCG) allows import of capital goods for pre-production, production and post-production (including Semi/Completely Knocked Down condition and computer software systems) at 0% customs duty, subject to an export obligation equivalent to 6 times of duty saved on capital goods imported under the EPCG scheme. The list of capital goods comprises of spares (including refurbished/reconditioned), tools, fixtures, dies and moulds as well as second hand capital goods (without any restriction on age). As per the Ministry of Commerce, the export obligation can also be fulfilled by the supply of ITA-1 items to the domestic tariff area, provided the realization is in free foreign exchange. Similarly, several duty exemption schemes like Advance Authorization Scheme (AAS) and Duty Free Import Authorization scheme (DFIAS) enable duty free imports of inputs required for export production, though these might not be applicable to the items that are already duty free under ITA-1. [70] Recommendations for exempting exporters from service tax have been forwarded by the Ministry of Commerce as well.

Despite favourable steps in form of tax relief and investments to incentivise exports, India's electronics exports continues to remain low. Part of the reason is the relatively small domestic manufacturing base and low value addition. The other reason could be implementation-based issues of these provisions where enforcement of these provisions on ground is being realised an effective manner. Although the trade policy for exports has been generally favourable for the sector, but there is ground yet to be covered as imports still exceed exports by a huge margin.

In the electronics manufacturing and components sector, automatic approval of 100% FDI is allowed (except for electronics items for defence), so FDI policy for the sector is quite open and encouraging; hence it does not seem to be a constraint for participation in GVCs. However, as per Department of Industrial Policy and Promotion (DIPP) data, the sector

[70] Department of Commerce, Ministry of Commerce & Industry of India, India's Foreign Trade Policy and Procedures, Chapter 4 & 5, (http://commerce.nic.in)

received a total FDI of $142.9 million in 2014-15 that amounted to a mere 0.42% of the total FDI inflow. Between April 2000 and June, 2015, the electronics sector in India received only $1.68 billion or 0.66% of the total FDI inflow of $258 billion FDI inflow. Although telecommunications is one of the largest recipients of foreign investment, it is mostly directed at services. Additional even when the FDI route is quite open and investments are being encouraged by the "Make in India" campaign, the flow of investments is a mere trickle and needs to gather pace especially in key areas like semiconductor wafer fabrication (FAB) and components manufacturing.

Environmental laws also have been deemed to have no major impact on participation by the firms. State Governments have also become highly expedient in granting environmental clearances to projects within fixed time windows in order to promote industrialization. In fact, states now demarcate special areas for industries like agricultural wastelands that have low adverse environmental impact, hence do not require clearances or special estates that have been earmarked for industries; hence are granted automatic clearances. These incentives for increased manufacturing also reflect highly and positively in participation in global value chains.

(b) ***Highly Positive Impact***: The policies that have the most positive impact are the manufacturing policy, Investment and Tax incentives of Governments, Trade agreements and Import policies of trading partner nations. (Fig 15)

The **manufacturing policy** and incentives by Government as established by the National Policy on Electronics (NPE), exempt manufacturing from licensing and approvals, except for manufacturing in defence and aerospace equipment. The former tradition of reservation for public sector enterprises in this sector has also been done away with. Foreign equity investment up to 100% has been approved under the automatic route, with no prior commitment criteria for minimum investment. To encourage domestic manufacturing on a large scale, a Modified Special Incentive Package Scheme (M-SIPS) has been announced which provides subsidy on capital expenditure (capex subsidy of 25% in non-SEZ and 20 % within SEZ) and reimbursement of taxes (CVD/excise for capital equipment for non-SEZ units; central taxes and duties for 10 years in select high- tech units like fabs). This capital expenditure includes expenditure incurred on plant, machinery and equipment, tools, etc. as well as expenditure incurred on Research & Development (including cost of IPRs, copyrights) and costs of infrastructure (like buildings). Specially demarcated regions like Electronics

Manufacturing Clusters (EMCs) are also being promoted by the Government where assistance of upto 50% of the project cost for Greenfield projects and upto 75% of the project cost for brownfield projects subject to a ceiling of Rs. 50 crores for every 100 acres of land is provided. To further encourage manufacturing in the country, preferential market access (which gives preference to domestic products in government procurement) has been announced.

The National Policy on Electronics (NPE) has set firm goals to achieve a turnover of $400 billion involving an investment of about $100 billion, including $55 billion in chip design and embedded software industry and $80 billion of exports in the sector as well as achieving employment to around 28 million in the sector by 2020. [71] NPE aims to encourage manufacturing within the country, increasing technology modernization, improving skilling within the industry and generally establishing India as the world's favoured destination for design and manufacture of electronics components.

In addition to this, state governments have their individual additional incentives like relaxation or exemption of stamp duty on sale or lease of land, concessional rate of interest on loans for capital expenditure, tariff incentives for infrastructure, investment subsidies/tax incentives like tax breaks or concessional tax rate periods, backward areas subsidies, special incentive packages for mega projects. The impact of Investment & Tax incentives as well as subsidies by the Government is also positive according to most respondent firms. Tax holidays in the form of exemptions for a defined period (of various taxes like Income Tax, Excise Duty, Stamp Duty) and/or reduced tax rates for a subsequent limited period is often a most favoured tool of governments to attract investment at particular locations.

Trade agreements and Import Policies of Trading partner nations have been deemed as highly positive for participation by majority of firms. These do not include the ITA-1 agreement of WTO, under which imports of 217 tariff lines have been exempted from import duty. India has a number of trade agreements, including Free Trade Agreements (FTAs), Regional Trade Agreements (RTAs), Preferential Trade Agreements (PTAs) and Comprehensive Economic Cooperation Agreements (CECA/CEPA)) mostly with its Asian counterparts. India has bilateral FTAs with its SAARC neighbours (Sri Lanka (1998), Afghanistan (2003), Bhutan (2006) and Nepal (2009)), East Asian trading partners (Korea

[71] Ministry of Electronics & Information Technology (MEITY)

(2009), and Japan (2011)) and South East Asian partners (Thailand (2004), Singapore (2005), Malaysia (2011)).

In addition, there are regional trade agreements - the South Asian Free Trade Agreement (SAFTA, 2004), the India-Association of Southeast Asian Nations Agreement (ASEAN, 2010), the SAARC PTA, BIMSTEC FTA. India also has FTAs with South America (MERCOSUR) and African nations. The Economic Survey 2015-16[72] has reported that the effect of FTAs has been significant and positive for trade by India. The volume of trade has increased with FTA countries more than would have happened otherwise, with the increase seen more in imports than exports. This is mostly because India had greater tariff reductions than its FTA partners since it had relatively higher prior tariffs. But the impact of individual FTAs on the electronics sector is yet to be studied in detail. A closer look is needed to reveal the extent of impact of these FTAs on electronics GVC participation.

Trade agreements should also aim to cover subjects where India is lacking like technology and investment. For instance, special collaborations with technologically advanced nations like Japan. USA and Israel have been initiated for investment, skills & standards development and R&D. Such agreements will help enhance India's domestic manufacturing capabilities and augment competitiveness of Indian products in the global markets. In addition, trade agreements that provide preferential treatment to Indian exports are desired by industry.

(c) ***Moderate Impact***: Competition Policy and Intellectual Property Rights (IPR) regime seem to have equivocal effect on participation in Electronics GVCs according to the respondent firms. Almost an equal number of firms were divided in their opinion between the positive and negative impact of such policies. (Fig 15).

Competition Policy in India has helped develop a deregulated and competitive business environment in India. But its ability to keep up with the changing demands of the evolving business landscape has been under question for a while now. Morris and Basant (2000)[73] have outlined the strengths and shortfalls of this policy in dealing with current demands – the competition policy in India is a strange juxtaposition of simplicity and complexity. High levels of skill, perseverance and commitment are required to enforce it on the ground.

[72] Economic Survey 2015-16, Chapter 8 "Preferential Trade Agreements" Pg 118-129
[73] Basant, Rakesh, Morris Sebastian (2000), Economic and Political Weekly

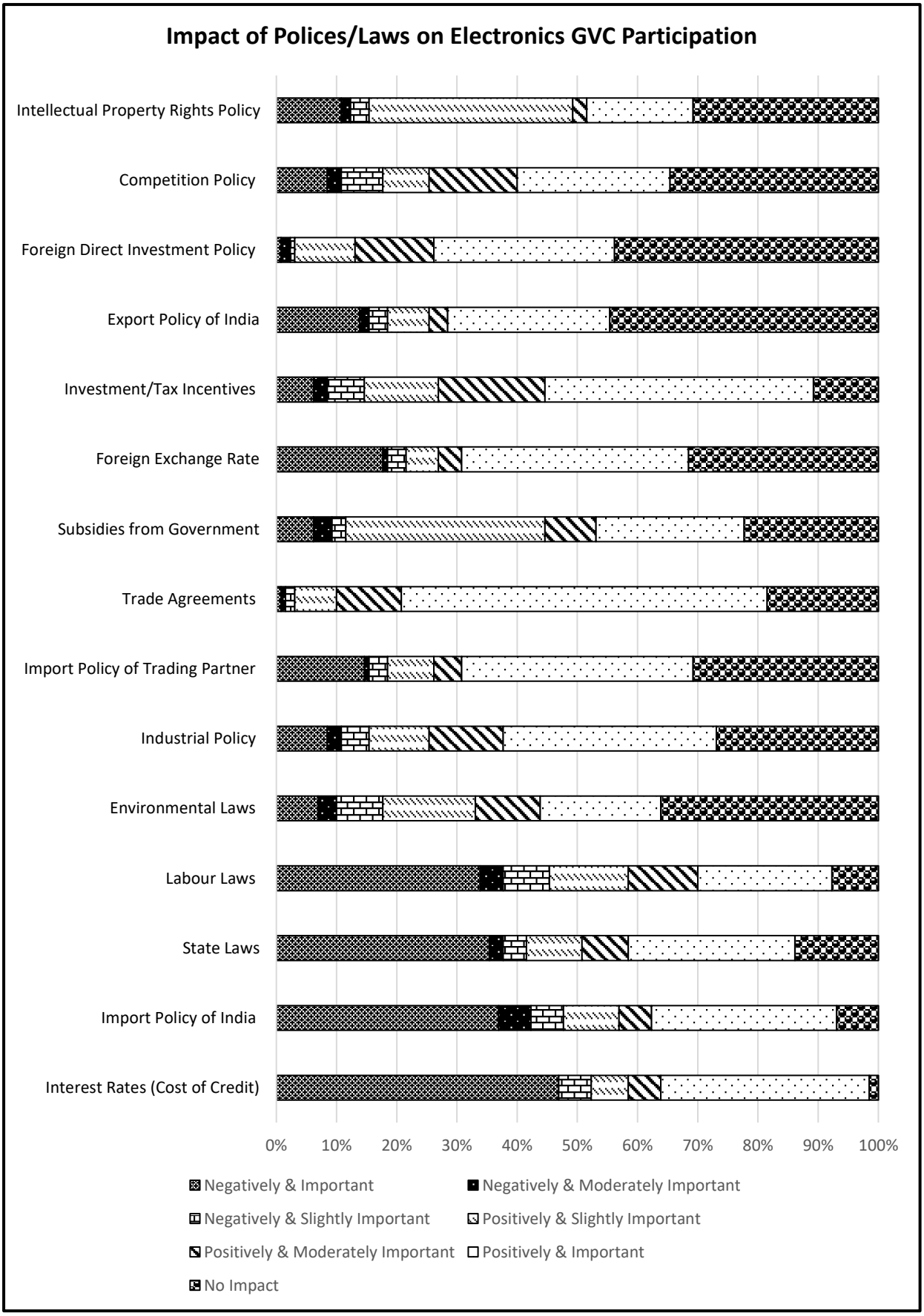


Figure 15: Impact of Policies on participation in Electronics GVCs (Source: Based on Survey Findings)

While most respondent firms feel that the Competition Policy in India has had a positive impact, the concerns of those firms which feel it has a negative impact needs to be closely examined. The most important factor that seems to be affecting electronics firms (those who have responded as negative) is the undue advantage that Multinational Firms enjoy in terms of access to investments, technology and resources owing to their international reach. Many SMEs in fact desire some sort of protection from the Government for furthering their cause, such as the permission to form alliances for collective bargaining. Additionally, due to non-harmonization of competition policies across countries, Indian firms face tougher competition world-wide from firms that have enormous governmental patronage, for instance Chinese firms (especially SMEs) that enjoy huge incentives, thereby making their products cheaper. While in-depth studies have been undertaken to understand the impact of Competition policy on the telecommunications sector (the services aspect), there is a dearth of such studies for other sub-sectors as well as the electronics sector as a whole. For instance, price wars are common in the lower-end electronics products (consumer electronics like small domestic appliances; telecom hardware like low-end smart phones), which the competition policy seems to be unable to curb. Hence a greater scrutiny of the effectiveness of this policy needs to be undertaken.

The IPR regime in the country has evoked mixed responses in terms of importance for participation in Electronics GVCs, with most firms responding positively to this factor. Specific IP laws govern specific sectors. For instance, under the Semi-conductors and Integrated Layout design Act, 2000, a Semiconductor Integrated Circuits Layout-Design Registry (SICLDR) has been created where layout designs of integrated circuit chips can be registered and verified for originality, following which patent protection is granted for 10 years.

India has been a faithful adherer of the WTO Agreement on Trade Related Aspects of Intellectual Property (TRIPs) as well as other international treaties and conventions implemented by World Intellectual Property Organization (WIPO). Over the past decade, the process of filing for intellectual property rights have become streamlined and simplified. The Electronics Development Fund (EDF) has been established by the Government to increase investment in R&D in Electronics sector in form of venture funds. Additionally, incubators in well-established centres of excellence (like the IITs) have been set up to support start-ups in the Electronics System Design and Manufacturing (ESDM) sector. In addition, special incentives to SMEs, start-ups and foreign applicants to secure intellectual property rights have

been provided. Reimbursement for expenses incurred for patent application (filing and processing) has been approved.

While access to investment for R&D and administrative processes have been made easier, innovation in the sector is yet to be observed on a large scale. It could either be because of the cost factor (which is still prohibitive for most firms, especially MSMEs), nature of research demanded by the sector (fast, accurate, sustained and cutting-edge) or skills (lack of skilled man power to undertake R&D at different levels). The ambivalent response of the firms (between no impact and positive) to the importance of this factor could be due to several reasons - (a) they are not affected by it as they do not engage in any R&D resulting in innovation; (b) firms engaging in R&D do not file for patents here in India (as most R&D is done by MNCs which might prefer to register the innovation in their home countries), hence are not affected by the IPR regime; or (c) the firms have a smooth overall experience with the IPR regime (as reported by a few firms). Among firms that did feel the IPR regime is important for participation, majority felt that the IPR regime in the country has had a positive impact. Firms without access to sufficient resources (financial, skilled manpower, technology) for R&D felt the IPR regime was disadvantageous to them as it restricted their access to latest innovations which were critical to stay competitive in a global market; hence reported a negative impact. A few firms also cited cost of filing patents as a prohibitive factor.

(d) ***Negative Impact*** - The most negative impact on participation in Electronics GVCs is that of the Cost of credit (Interest rates), Import Policy of India, State Government policies and Labour laws.

The **Import policy of India** has been cited as one of the most important factors affecting participation in electronics GVCs negatively. What seemingly dealt a death blow to Electronics manufacturing in India, according to industry experts, was the signing of the Information Technology Agreement (ITA-1) in 1997 where India committed itself to total elimination of all customs duties (import tariffs) on IT hardware by 2005. The ITA covers a large range of high technology products that account for nearly 10 per cent of global merchandise exports in today's times[74], including computers, telecommunication equipment, semiconductors, semiconductor manufacturing and testing equipment, software, scientific instruments, as well as most of the parts and accessories of these products. With effect from

[74] WTO – ITA An Explanation (https://www.wto.org/english/tratop_e/inftec_e/itaintro_e.htm)

March 1, 2005 the customs duty on all the specified 217 items has been eliminated by the Government of India. This has been used to a great advantage by the multinational companies that rely heavily on importing ready-to-assemble kits and engage in assembly instead of value addition through manufacturing in India. Home-grown firms have also started taking advantage of the inverted duty structure where it is cheaper to import finished (or near-finished) products rather than import components and manufacture the final product domestically. As a result, the domestic manufacturing base especially for components has not been able to develop and most electronics firms in India are trapped in low value-addition segments like final assembly, testing and packaging and are unable to turn into major exporters globally.

The Government has started to proactively take steps to counter these effects of the import policy. For instance, in the latest budget (Union Budget 2016-17), the Government has announced several changes to the duty structure for electronics components. To promote domestic value addition in several end-products like mobile handsets, inputs, parts and sub-parts for the manufacture of these goods have been exempted from BCD (Basic Customs Duty), CVD/Excise duty and Special Additional Duty (SAD) while additional duty has been imposed on imports of final products. Likewise, excise duty for local manufacturing of mobile chargers, batteries and headsets has been set at 2% while imports will face 29.44 % duty. Lower import duty for sub-components has also been announced. [75]

Similarly, to encourage manufacturing of solar cells, customs duty on import and central excise duty on purchase of raw materials and other inputs like copper wire and tin alloy have been waived off. CVD on the parts of Solar tempered glass, used in manufacture of solar cells/panels/modules, has been reduced from 12.5% to 6%. The main aim is to motivate domestic manufacturing in these sub-sectors. According to industry experts and several firms, these measures are "too little, too late". However most of them feel that since a start has been made, full efforts should be made to gather momentum for building the domestic electronics manufacturing base, especially in components and no steps should be taken that could potentially hamper this progress, like for instance signing the ITA-2.

The **cost of credit (interest rates)** is has also been considered as another major deterrent for participation by a large number of firms. The Electronics sector is a capital-

[75] The Government had to reverse the duty on components (to 0%) under pressure from handset manufacturers in May 2016. According to some industry experts, this rollback might be temporary and such a move by the Govt. was to give time to the industry to prepare itself for higher import duties in future. (http://www.elcina.com/policy.asp)

intensive sector which requires huge amounts of investment for setup and operations. The interest rates of formal sector lending institutions are typically considered high and have a double impact on electronics firms, similar to auto firms. The firms have a direct impact in terms of borrowing costs which tends to increase the cost of business (as interest expenses go up). The price sensitivity of an average electronics consumer is very high. High interest rates on consumer loans affect consumer spending by depreciating the value of money (purchasing power). As a result, consumer demand declines and affects the sales of electronics; thereby affecting the electronics firms as well. Lower interest rates as well as ease of access to credit are ideal for encouraging production activity and thereby participation in GVCs.

Electronics design and manufacturing sector has a high potential for generating employment and growth, **State Governments** are therefore keen on attracting and facilitating firms in Electronics manufacturing firms. Some of the notable states that have well defined ESDM policy are Andhra Pradesh, Telangana, Gujarat, Maharashtra, Karnataka, Uttar Pradesh, Odisha and Chhattisgarh. Despite the impetus by these state governments, the electronics sector has not developed to desired levels in these states (with the slight exception of consumer electronics in UP, IT hardware in Karnataka, Telecom in UP & Maharashtra). One of the major reasons is the lack of basic infrastructure. Electronics industry requires very high quality of infrastructure like access to 24x7 water and power and excellent transport system for fast and undamaged delivery of components. The standard of infrastructure in the country leaves a lot to be desired. The Electronics Manufacturing Clusters (EMCs) promise to provide world class infrastructure and facilities but are yet to be operationalized. Land acquisition, which a state government responsibility, is yet another factor affecting business setup. State governments have to improve implementation of their target policies to encourage the Electronics sector in their respective states because only tax and investment related incentives will not prove sufficient to stimulate production and participation in electronics value chains. Labour laws in India have been considered as yet another deterrent to participation in Electronics GVCs. These laws aim to protect and safeguard the interest of the workforce. Labour is a concurrent subject under the Indian Constitution; hence there are both Central and State Government legislations on important facets of labour. A brief compilation of relevant laws has been provided below (Table 36):

BROAD CATEGORY	LAWS/POLICIES
Industrial Relations	• Trade Unions Act, 1926 • Industrial Employment Standing Order Act, 1946 • Industrial Disputes Act, 1947
Wages	• Payment of Wages Act, 1936 • Minimum Wages Act, 1948 • Payment of Bonus Act, 1965
Working Hours, Conditions of Service and Employment	• Factories Act, 1948, • Motor Transport Workers Act, 1961 • Contract Labour (Regulation & Abolition) Act, 1970. • Industrial Employment (Standing Orders) Act, 1946
Equality and Empowerment of Women	• Maternity Benefit Act, 1961 • Equal Remuneration Act, 1976.
Deprived and Disadvantaged Sections of the Society	• Bonded Labour System (Abolition) Act, 1976 • Child Labour (Prohibition & Regulation) Act, 1986 • Children (Pledging of Labour) Act, 1933
Social Security	• Workmen's Compensation Act, 1923. • Employees' State Insurance Act, 1948. • Employees' Provident Fund & Miscellaneous Provisions Act, 1952. • Payment of Gratuity Act, 1972. • Employers' Liability Act, 1938 • Personal Injuries (Compensation Insurance) Act, 1963 • Personal Injuries (Emergency Provisions) Act, 1962 • Unorganized Workers' Social Security Act, 2008

Table 38: Labour Laws in India (Source: National Crime Investigation Bureau and Ministry of Law and Employment)

Most of these labour laws are archaic and restrictive laws governing hiring, layoffs, wages and minimum operational environment. This absence of up-to-date and transparent labour market reforms have made the workforce composition skewed towards contractual labour, as it is easier to manage temporary employees as opposed to permanent ones. As is the case with the auto sector, the number of contractual workers in most electronics firms is much higher than permanent workers. More contract labour also means (a) less worker unions; hence a lower probability of strikes, mass leaves or incited violence; (b) lower wages than permanent employees and (c) circumvention of legally directed benefits like health and accident insurance. These contract workers are also not allowed to advance to permanent positions.

State governments have proved ineffective in monitoring or updating the existing laws. For India which considers itself labour-intensive and labour as a rich resource, labour laws need to be improved in terms of flexibility to employers, better deal for employees and effective

governance. For a sector that employs nearly 4 million workers and is expected to generate employment in large numbers, workplace standards and labour practices need to be flexible and friendly to both businesses and workers.

A1.2.2. Public Institutions

Firms have to deal with executive, legislative and judiciary institutions like the bureaucracy and courts in the course of their business. Efficacy and effectiveness of public institutions in an economy signals the type of business climate in the nation. To gauge the importance of these public authorities in firms' participation, general questions on the bureaucratic system (existence of red tape), dispute resolution, and transparency of public institutions were posed to the respondents.

Transparency of a public institution refers to the openness, clarity and dependability with which public authorities function. Since businesses operate within regulatory frameworks where the role of the public authorities can at times assume very high significance, most firms (36%) felt that transparency of public institutions was a moderately important factor for participation (Fig 16). Public institutions need to be organized, predictable, open and accountable in dealings; only then can they incite confidence in them.

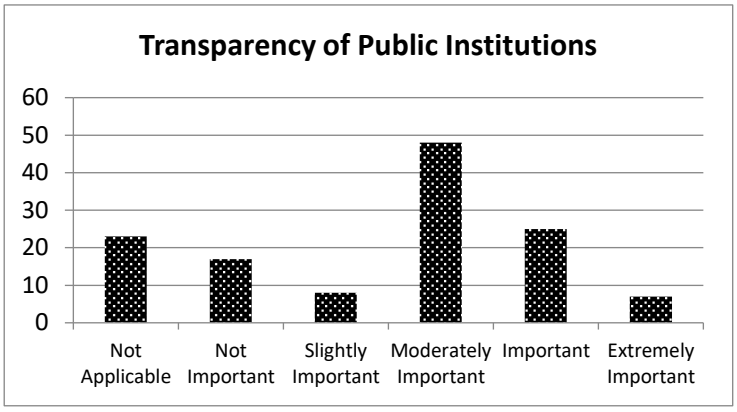


Figure 16: Importance of Transparency of Public Institutions (Source: Based on Survey Findings)

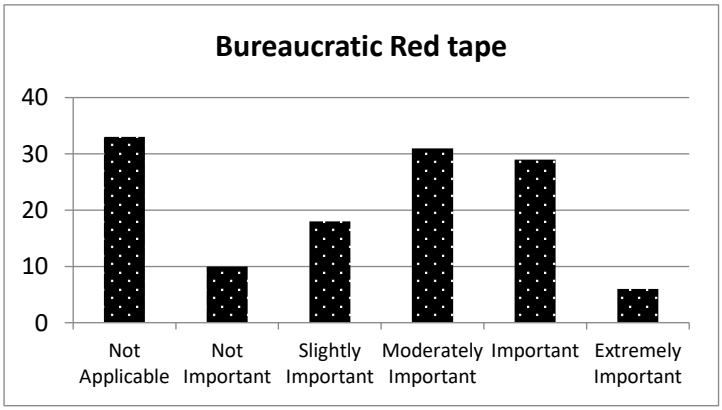


Figure 17: Importance of Bureaucracy for Participation in Electronics GVC (Source: Based on survey Findings)

Bureaucratic procedures are vital for establishing and functioning businesses in India. Furthermore, trade with foreign countries requires several bureaucratic diktats to be followed. As a result, this factor potentially could be a determinant of participation in GVCs. According to the responses (Fig 17), it seems that feeling amongst the respondent

electronics firms was uniformly distributed where 33% felt that bureaucratic red-tapism was either not applicable or not important, 24% felt it was moderately important and 27% felt it was important. Most large firms felt that the government (especially the state governments) had proactively taken measures for speedy execution of approvals and clearances in order to encourage industrialization while the small and medium firms categorized this factor as important for participation. For instance, electronics and IT industry can be located anyplace in the country subject to clearance from the state authorities responsible for monitoring of local zoning and land use regulations as well as environmental pollution. State governments have been proactive in setting in place several procedures like online services (e-filing, e-approvals) and dedicated cells for handling specific requests to facilitate businesses.

But the difference in opinion based on the scale of the firm is most likely due to the difference in established procedures. Large Industries (where investment in plant and machinery is more than Rs.10 crores) are exempted from licensing and are only required to file information in the prescribed format (Industrial Entrepreneurs' Memorandum (IEM) with the Secretariat for Industrial Assistance (SIA). Once an acknowledgement is obtained, commercial production can start. Thereafter no further approval is required and only a second form of IEM needs to be submitted. On the other hand, Small (where investment in plant and machinery is more than Rs.25 lakh but less than Rs.5 crores) and Medium (where investment in plant and machinery is more than Rs. 5 crores but less than Rs. 10 crores) scale industries are required to register with the District Industries Centre (DIC).

Dispute resolution is also very important for electronics businesses. In the Electronics industry, a lot of business collaborations in the form of joint ventures, contracts, crossholdings etc. take place. Additionally, a lot of innovation is demanded by the sector that gives rise to intellectual property rights. Sometimes there are also tax-related issues (domestic and trade related) between firms and the governments. At the international level too, disputes between nations in WTO also arises. Often countries employ legitimate actions against dumping (anti-dumping), subsidization (countervailing duties), and surges in imports (safeguard measures)

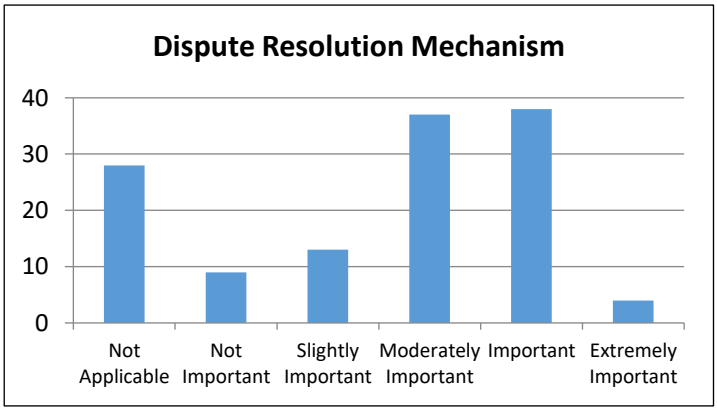


Figure 18: Importance of Dispute Resolution for Participation in Electronics GVC (Source: Based on Survey Findings)

which are contested by other nations. In short, there is a lot of scope for disputes in the sector. Hence, dispute resolution mechanisms become very vital. Most respondent firms (nearly 61%) have marked this as moderately to extremely important for participation (Fig 18). Firms typically are averse to the conventional dispute resolution route which is courts, as that could result in inordinately long, expensive and eventually ineffective drawn out battles and controversies. Alternative dispute resolution mechanisms like arbitration, mutual agreement procedures, advance pricing agreements, etc. are being explored for settling disputes confidentially.

A1.2.3. Value Chains

The Global Value Chain environ is also crucial for firms' participation in them. Each value chain has its own environment (for instance, the environment of a value chain of an MNC OEM will be very different from the value chain of a domestic OEM because of cultural and organizational sensitivities). But there are certain characteristics which are common to all value chains at a very broad level. Questions on the impact of general structure and governance of GVCs, competition intensity within GVCs and potential risks from integrating into GVCs were posed to the respondents to gauge the effect of these sub-factors on participation in GVCs.

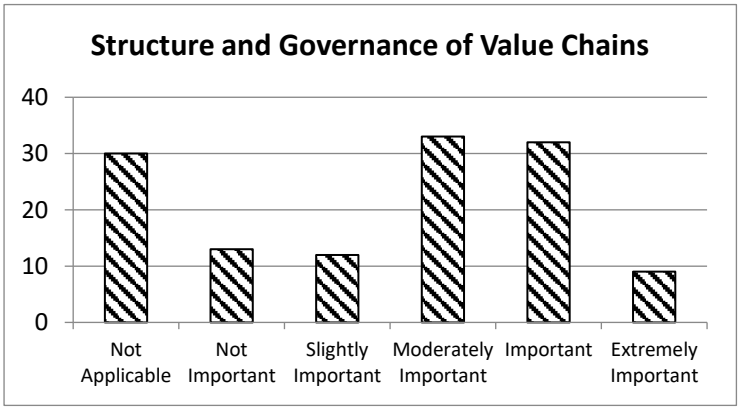


Figure 19: Importance of Structure of Value Chains for Participation (Source: Based on Survey Findings)

Structure and Governance of value chains refers to the relationships between various actors in the value chain and how power (or control) is exercised within the chain. Decisions regarding what, how and how much to produce are often taken by the most influential player in the value chain and that determines the structure of the chain. Gereffi et.al (2005)[76] described various governance forms of global value chains:

(a) *Market Governance*: This involves transactions of relatively simple nature with open information dissemination on product specifications; producers can make products with minimal input from buyers.

[76] Gereffi, G., Humphrey, J., & Sturgeon, T. (2005) **Review of International Political Economy**

(b) *Modular Governance*: This occurs when a product requires the firms in the chain to undertake complex transactions that are relatively easy to codify; higher level of information transfer takes place between the supplier and the buyer.

(c) *Relational Governance*: Based on network-style governance, interactions between buyers and sellers based on shared trust regulated through reputation, social ties, etc.

(d) *Captive Governance*: Here small suppliers are dependent on a few buyers who in turn wield a great deal of power and control. Usually the lead firm exerts a great deal of supervision and control.

(e) *Hierarchical Governance:* Marked by development and manufacturing of products in-house and branded by vertical integration and managerial control within the lead firms. This usually happens when products are highly complex, specifications cannot be collated, or proficient suppliers are absent.

Almost a third of respondent firms (32.9%) felt the structure of the global value chain was important as it determined the premise within which they had to operate (Fig 19). Usually OEMs being the lead firms exert a lot of influence in determining the nature of their value chain; hence felt this was important. For smaller firms in lower tiers (26%) which were eager to join or perform in global value chains, the structure was at best moderately important. Those who responded this factor was not applicable were not in any global value chain.

Competition to join and within electronics global value chains is fierce. Less value-addition segments operate on very thin margins and therefore have to stay competitive in order to survive within the chain. Firms face competition in upgrading along the chain as well, not only from aspiring co-upgraders but also from existing members in that segment. Often, high competition intensity is a deterrent for participation as firms may not be well equipped to handle competition; which is felt by most of the respondent firms (56.4%) (Fig 20). In global value chains, the competition is not only from domestic firms but also from global counterparts. Hence a firm needs to be prepared to handle international standards that are less lenient.

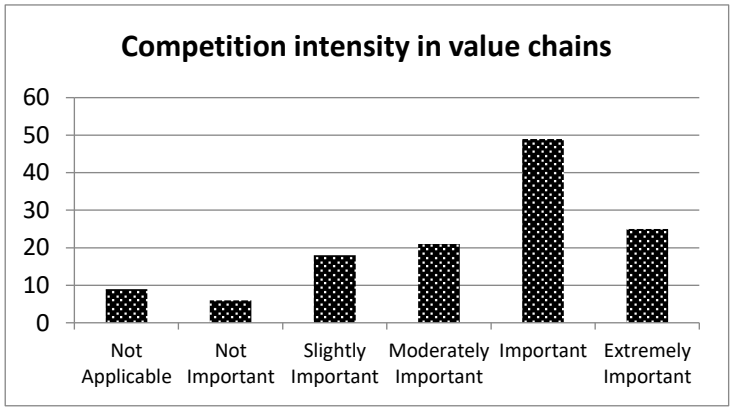


Figure 20: Importance of Competition Intensity of GVC (Source: Based on Survey Findings)

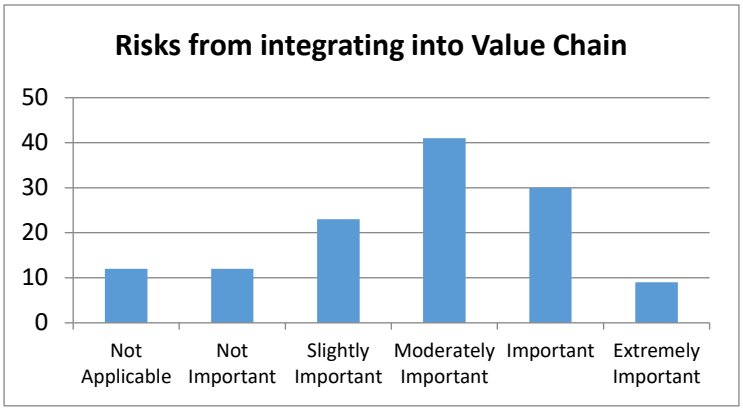


Figure 21: Importance of risks in GVCs for participation (Source Based on Survey Findings);

Integration into global value chains means effectively participating on the international markets. Participating in global value chains makes firms more vulnerable to vagaries of global markets. Apart from meeting global standards in terms of quality, reliability, price and delivery schedules, firms are also exposed to international economic shocks. Most electronics firms (49.2%), however, feel that these risks are slight-moderately important while about a fifth (23%) firms feel this is important (Fig 21). This could be because of – (a) firms higher up the value chain (OEMs and ODMs) have higher risks (owing to higher degree of exposure in terms of value) while most firms in the lower value added tiers are not as exposed; (b) all value chains are global in the broadest sense (there will always be at least one segment/player in a different geography), so participation in any value chain is risky for a firm.

A1.3. SECTORAL FACTORS

Sectoral Factors are innate to the sectors and are usually determined by the nature of the product, end markets and target customers. The Electronics sector has quite a few distinctive features-- highly technology-and cost-intensive, the product life has become shorter with customers expecting newer and advanced products every 1-2 years, high capital investments are necessary for setup and sustenance. The sub-factors which were identified for both sectors after extensive discussions included:

A1.3.1. Market Barriers

The Electronics sector has high barriers to market entry (challenges faced by new entrants to penetrate the market). The biggest hindrance is in terms of scale of investments due to the very high capital costs

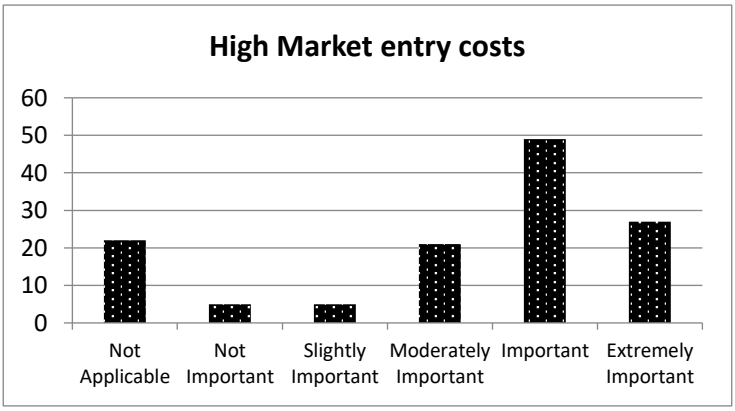


Figure 22: Importance of High Market Entry Costs for participation (Source: Based on Survey Findings)

for setup and subsequent significant operational costs (including skilling of labour and R&D). Market entry costs refer to the fixed costs of entry into supply chains that precedes the setup stage. These include information collection regarding target markets, marketing, technology expenses, distribution channels and regulatory clearances. More than half of the firms (58%) felt that this was very important for participation (Fig 22). Generally the OEMs face this cost more than other firms, especially while penetrating newer markets and establishing their value chains.

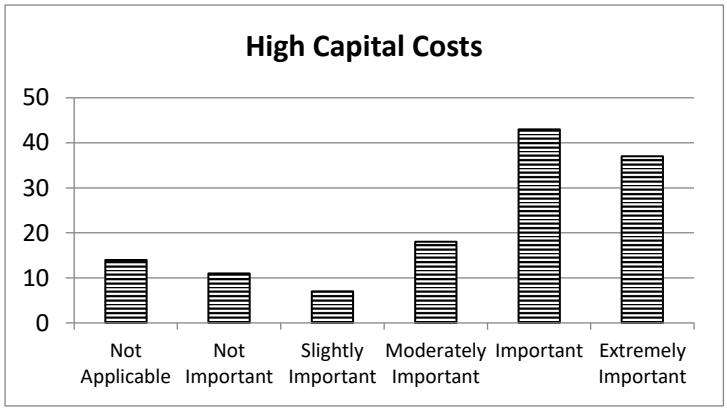


Figure 23: Importance of High Capital Cost for participation (Source: Based on Survey Findings)

Capital costs are the initial costs for setup that includes land, manufacturing plant, equipment, etc. and are very high for this sector. A majority of firms (61%) felt high capital costs is a very important determining factor for participation and was a deterrent to participation.

Owing to the nature of the sectors, projects also tend to have certain unique characteristics that can potentially affect participation. Projects in the Electronics sector typically have long gestation time for setup and skilling for projects, the time between initiation of the project and commencement of production being high. Majority of respondent firms (56.5%) feel that the long gestation time for projects was very important (Fig 24). The Electronics industry typically demands quick turnaround times. With rapid increase in innovative products, frequent product makeovers and high competition intensity, long gestation times for projects tend to affect the profitability of firms adversely. Once the production process is in place and functional, there is an inherent flexibility built-in which ensures that the firm has some degree of tractability in meeting minor changes in customer demand. For instance, the same manufacturing line can handle production of several standardized products. But

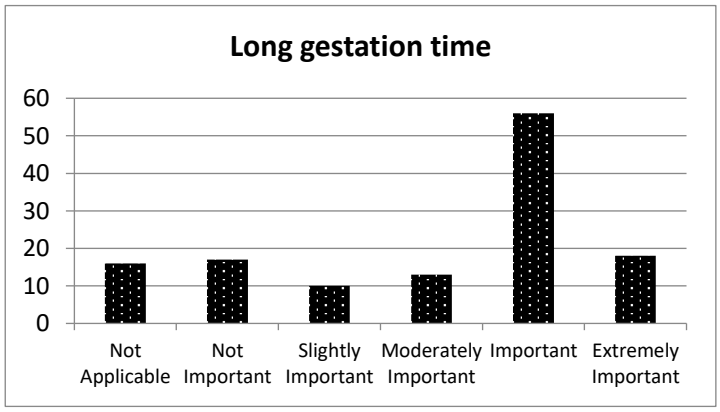


Figure 24: Importance of Gestation Time (Source: Based on Survey Findings)

longer times in setting up manufacturing lines for diverse products can affect participation rates of firms.

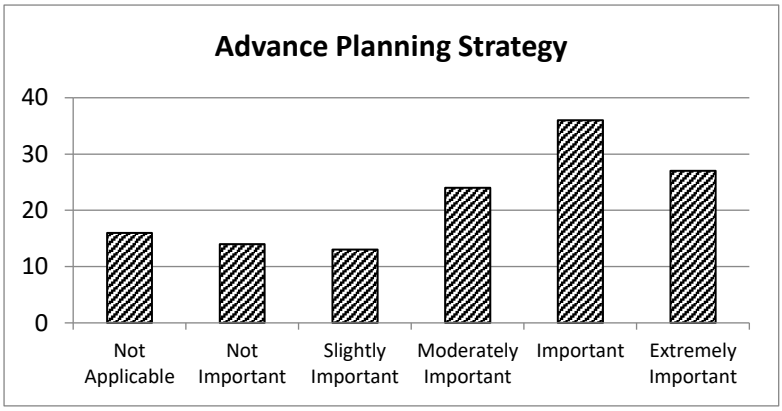


Figure 25: Importance of Advance Planning Strategy (Source: Based on Survey Findings)

There is high emphasis on advance planning strategy as well in businesses for not only premeditated future operations but also for meeting exigencies arising out of unforeseen events. Since ventures in this sector require heavy investments and quick turnovers, without proper planning and vision, operating in a value chain can prove to be challenging. Most firms (48.1%), feel that advance planning was an important determinant for participation in Electronics GVCs (Fig 25). This was an interesting insight because when deciding suppliers, buyers tend to look at their prospective plans of future in order to decide the sustainability of the relationship.

A1.3.2. Structure of Sector

Certain traits of the sector themselves affect participation like consolidation within sector (if high then leads to fewer firms surviving in each segment) as well as the importance of brands (which leads to additional impetus on creating a brand image first) and technology (which inspires constant upgradation to the latest technology in the market) in the sector.

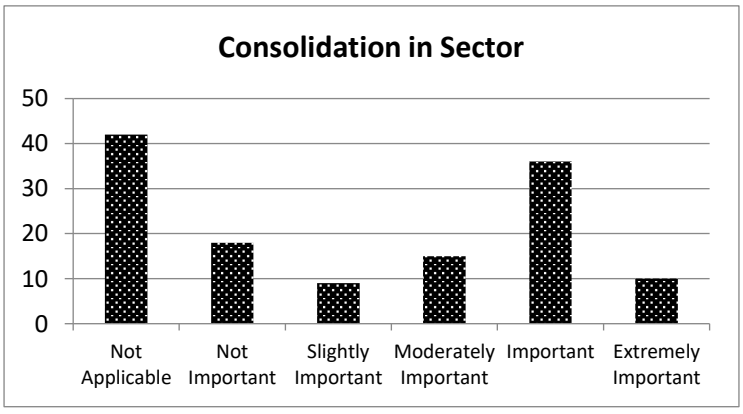


Figure 26: Importance of Consolidation in Electronics Sector (Source: Based on Survey Findings)

Most respondent electronics firms (46%) felt that consolidation in the sector was not an important determinant for participation in Electronics GVCs, although about a third of firms (35%) considered it important (Fig 26). Higher consolidation will mean tougher norms for participation. But the electronics sector is yet to witness

the level of consolidation that automotives sector has, especially in the OEM segment. The electronics GVC is highly consolidated with hardly any new entrants and several mergers & acquisitions in the last few decades in the semiconductor and raw materials segments of the GVC. The most important reasons cited for the consolidation in these segments are – (a) the pressure of operating margins (with fewer end products, demand for chips is plateauing and the cost of developing a leading-edge chip is usually in millions of dollars; hence mergers help in cost-sharing); (b) consolidation enhances the firms' capabilities in diversifying their product line; as a result companies are able to develop better all-round product profiles and (c) several cash-rich companies tend to buy out smaller firms in order to enter into a new segment in the value chain which is easier and cheaper than developing their own in-house capability from ground up. But for other segments in the Electronics Value chain in all the four sub-sectors under study maturity, which is typically marked by consolidation within the sector, is yet to set in.

The OEMs are the brand owners in the Electronics GVC. Branding helps in establishing familiarity, sets expectations of customers and differentiates a firm from its competitors. Customer perception is highly brand dependent, hence the electronics sector is highly brand driven.

The responses exhibit a bi-modal perception of the importance of brand. While nearly 43% of the firms feel that this is an important factor for participation, around one-third of the firms (38%) feel it is either not applicable or not important. Brands inspire confidence not only in end customers but also in buyer firms. However certain lower value-addition activities (like sub-components manufacturing) are not highly brand –driven since these are standardized operations and any firm with the pre-requisite capacity can manufacture the goods. The end-product market in Electronics, though, is highly brand-driven with certain brands having become synonymous with the product. High importance of branding gives the established players an edge over newer entrants (first mover advantage). Many small firms tend to neglect

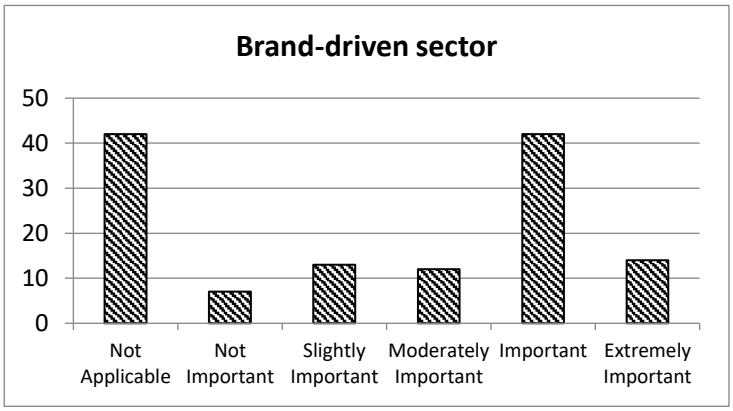


Figure 27: Importance of Brands in Electronics Sector (Source: Based on Survey Findings)

the significance of developing a brand image, which should not be the case when competing globally.

The Electronics sector is highly technology dependent and technology constantly keeps changing to meet revised consumer expectations. Due to this constant flux, there is need for firms to be flexible enough to constantly upgrade their technology to the latest in the market.

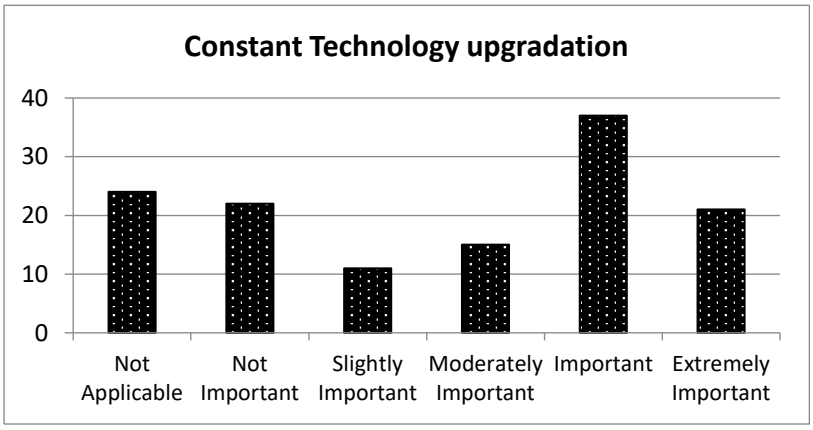


Figure 28: Importance of Technology Upgradation (Source: Based on Survey Findings)

As expected, most firms (50%) felt that this was an important factor for participation but was usually a deterrent since keeping up with the latest technological innovations required large investments either in research & development (R&D), or in mergers & acquisitions (M&A) or in technological agreements. Usually, OEMs and ODMs (to some extent) are the pioneers of new technology in the sector, targeted at meeting customer expectations or creating new markets.

The Government has also come up with various schemes to promote technology upgradation in the sector, especially in the SMEs. For instance, the Ministry of Small Scale Industries (SSI) has initiated the Credit Linked Capital Subsidy Scheme (CLCSS) that facilitates technology upgradation in SSI units by providing direct capital subsidy on credit availed by them for modernisation of their production equipment (plant and machinery) and techniques. Under the modified SIPS scheme, subsidy up to 20-25% for 10 years on capital expenditure has been introduced to promote not only manufacturing but also R&D investment.

A1.3.3. Nature of products

Analogous to projects, the products in these sectors also have certain unique traits that can affect participation. The Electronics sector highly values Quality, Delivery and Cost criterions (QDC) since all three dimensions are extremely critical for the success of the end-product. Integration in global value chains in Electronics places great emphasis on the quality of products, thereby necessitating certification and standards-related compliance; timely delivery of products and ease of diversification of products on the request of the customer.

At the global level, there are several established standards for various electronics sub-sectors. IPC- Association Connecting Electronics Industries (IPC) is one such widely recognized association that has propagated industry standards in electronics manufacturing and assembly processes. IPC-India offers internationally recognized training to technical personnel and also provides certification of industry standards in six major areas of electronics manufacturing and basic and advanced PCB design. IPC also provides validation services at the enterprise and product level that verifies and certifies the capability of manufacturers and service providers to produce products in accordance with IPC standards. Two new supplier qualification programs - Qualified Products List (QPL) (product-specific information and access, including product test reports that enables better product selection) and Qualified Manufacturers List (QML) (list of certified suppliers and their site location information for better supplier selection) – have been introduced to ease the necessities of supplier information, capabilities and performance to be shared with all supply chain partners; as a result build trust with buyers and establish brand image for suppliers as well as mitigate risk. Most firms (52.3%) realise the importance of certification and standards compliance for participation in Electronics GVCs (Fig 29).

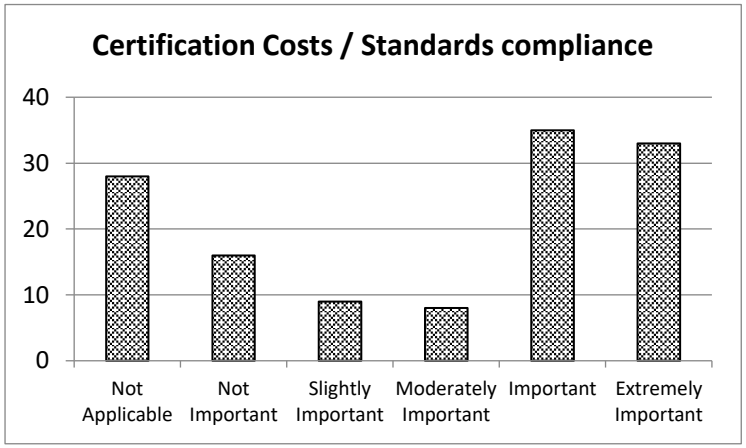


Figure 29: Importance of Certification and Standards (Source: Based on Survey Findings)

Apart from the IPC standards, Government of India has initiated the development and mandating of safety-related standards in accordance with the National Policy on Electronics (NPE). As per MEITY's order[77], around fifteen categories of electronics items have been mandated for registration under the Compulsory Registration Scheme of Department of Consumer Affairs based on their compliance to Indian safety standards and is applicable to both importers and domestic manufacturers. The list of items includes consumer electronics like TVs (LED/LCD/Plasma), Optical Disc players, microwave ovens; IT hardware like Laptops, Tablets, notebooks, printers; Telecom apparatus like telephones, answering machines etc. As per the guidelines, the firms have to get their products tested in laboratories recognized

[77] Ministry of Electronics and Information Technology (MEITY)'s Electronics and Information Technology Goods (Requirement for Compulsory Registration) Order, 2012"

by Bureau of Indian Standards (BIS), and on meeting the mandatory standards a unique registration number is issued identifying the product. Other safety standards commonly adhered to include the CE Mark (European health, safety and environmental standards), FCC Technical standards (US safety standards) and UL Certification (global safety and sustainability standards). The ISO 9001 is the global standard for quality management while the new PAS 7000 standard is a supplier pre-qualification standard aimed at managing supply chain risk. The focus of the industry is definitely on embracing global best practices. Such steps that ensure firms in India meet international standards improve the prospects of these firms for joining or upgrading along the global value chain.

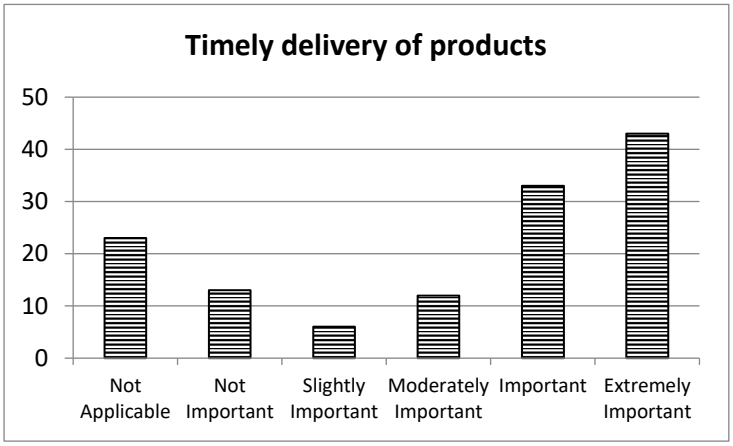


Figure 30: Importance of Timely Delivery (Source: Based on Survey Findings)

Timely delivery of products is yet another aspect for measuring reliability of a supplier. With Just-in-Time (JIT) inventory practices in vogue and quick turnaround times, timely delivery assumes even more significance. Delay in any segment in the value chain tends to have domino effect downstream. Majority of the firms (58.5%) deem this factor extremely important for participation (Fig 30). Firms have issues with structural delays like long clearance times at ports, and transportation due to poor infrastructure. Firms also prepare themselves for unwarranted delays resulting from unforeseen events like natural calamities, labour strikes or accidents.

As technology upgradation is an important trait of the Electronics industry, ease of diversification of the product range is also a typical feature of this industry that firms should have the ability for. This is an important factor for participation according to most firms (46.2%) (Fig 31). With constant flux in technology in the industry and rapid evolution of cutting-edge technology in both hardware and software, product features also

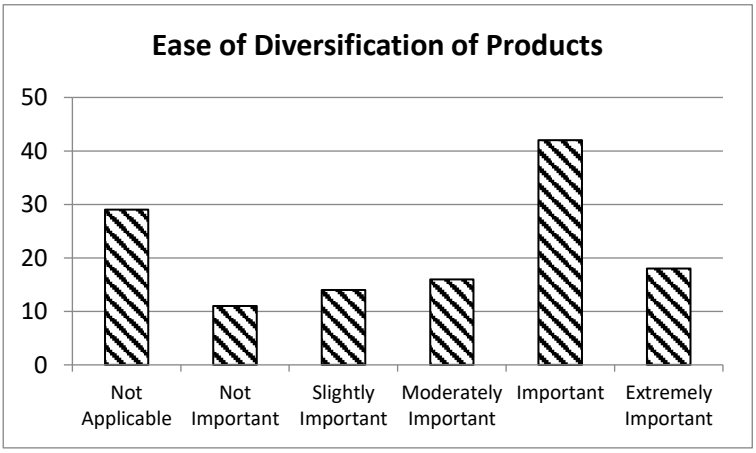


Figure 31: Importance of Ease of Diversification (Source: Based on Survey Findings)

change rapidly. OEMs feel this is an important trait for participation in GVCs, because they are engaged in product differentiation at their end and flexibility for manufacturing components on demand is one of the vital criteria for them to decide their suppliers.

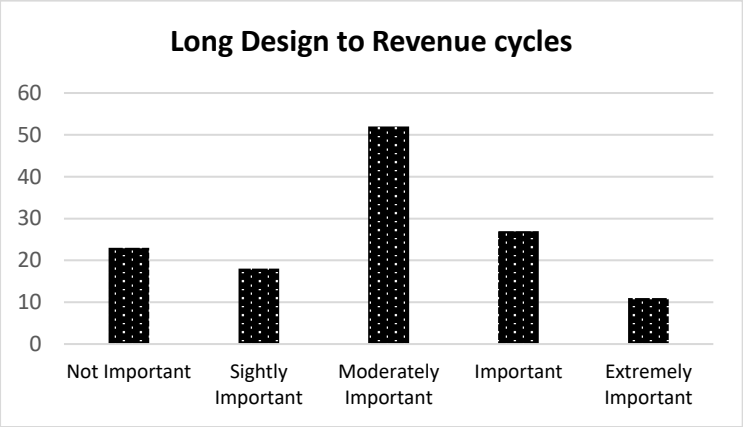


Figure 32: Importance of Design to Revenue Cycles (Source: Based on Survey Findings)

Long design to revenue cycles for electronics products is at best a moderately important factor for participation according to a majority of firms (54%) (Fig 32). OEMs feel this is an important factor for participation, mostly because the product design at their level is highly complex and sophisticated. This demands foresight about market expectations, ability to develop a desirable product and manage processes and costs effectively. Most component manufacturers/assemblers, on the other hand, are expected to meet the specifications set in the drawings provided to them by OEMs or ODMs; hence do not feel the long interval between the design process and revenue earnings.

A1.4. TRADE RELATED FACTORS

Trade-related factors are related to the ease or difficulty of undertaking trade with foreign countries. Since participation in sectoral GVCs requires involvement in trade (both imports and exports), most firms would have experience in trading and procedures involved thereof. Amongst the firms which were not active on the trade front (neither importing nor exporting or engaged in only imports or exports), exploring the reasons for "why so" will reveal deeper insights into what factors deter trade participation.

A1.4.1. Tariff Measures

These comprised of the basic trade measures that are applicable to imports and exports –import and exports tariffs in India, import tariffs of trading partner nations. As a follow up question, firms were asked to mention the basic rates of tariff that they experienced for their products. This has been included under the taxes faced by firms.

As seen earlier, the import policy of India was deemed as highly significant (with negative impact) for participation by majority of the respondent firms while the export policy did not seem to have a major impact on participation. Inbound tariffs for the sector seem to affect be affecting it highly, especially for manufacturing across all the segments of the Electronics GVC. Due to the presence of the inverted duty structure of electronics imports, the general trend in the sector has been for firms to import final goods (or ready-to-assemble kits) and engage in assembly rather than import (or locally source) components and manufacture the final product domestically. Additionally, the raw materials supplier- and components manufacturing- base in the country is very small; hence is unable to meet the demand of the industry for intermediate products in terms of low cost, high quality, fast delivery and large volumes resulting in high dependence on imports.

According to the Central Board for Excise and Customs (CBEC), the peak rate of Customs Duty for most electronics items (final goods and components for Consumer Electronics, Telecom hardware and solar electronics) is 10% while almost all IT Hardware items (217 tariff lines) are exempt from Basic Customs Duty. There have been certain announcements by the Government in the latest budget (Budget 2016-17)[78] in order to reverse the effect of low (or non-existent) Customs Duty and promote indigenous manufacturing. Specified raw materials, parts and accessories for manufacturing of certain items have been exempted from import-related tariffs like the Basic Customs Duty (BCD), Countervailing Duty (CVD) and Special Additional Duty (SAD) while a higher duty has been imposed on the final products. The Import Duty on select items of the Electronics sub-sectors under this study are provided below (Table 37)

TARIFF ITEM	CUSTOMS DUTY ON ELECTRONICS AND IT HARDWARE (PRODUCTS AND COMPONENTS)[79,80]	Import Duty (in %)
8415	AIR CONDITIONING MACHINES	10%
8418	REFRIGERATORS, FREEZERS AND OTHER REFRIGERATING OR FREEZING EQUIPMENT	
	Commercial type	7.5%
	Refrigerators, household type	10%
8422	DISH WASHING MACHINES	10%

[78] Latest Budget Announcements (Budget 2016-17) provided in the Annex
[79] http://www.cbec.gov.in/resources//htdocs-cbec/customs/cs-tariff2015-16/chap-85.pdf
[80] http://www.cbec.gov.in/resources//htdocs-cbec/customs/cs-tariff2015-16/chap-84.pdf

8443	PRINTING MACHINERY USED FOR PRINTING BY MEANS OF PLATES, CYLINDERS AND OTHER PRINTING COMPONENTS (Eg: Printers, FAX Machines)	
	Printers (Line, Dot Matrix, Laser, Ink Jet)	Free
	Electrostatic photocopying apparatus operated by reproducing the original image directly onto the copy	7.5%
	Ink cartridges, with/without print head assembly	Free
8450	HOUSEHOLD OR LAUNDRY-TYPE WASHING MACHINES, INCLUDING MACHINES WHICH BOTH WASH AND DRY	
	Fully-automatic machines	10%
	Machines, each of a dry linen capacity exceeding 10 kg	7.5%
	Parts of household type machines	10%
8471	AUTOMATIC DATA PROCESSING MACHINES AND UNITS THEREOF (Eg. Personal Computers, Printer, Keyboard, Scanners, Mouse, Storage units like Floppy Disc drives, hard Disc drives, Magnetic tape drives, CD-ROM Drives etc)	Free
8473	PARTS AND ACCESSORIES SUITABLE FOR USE SOLELY OR PRINCIPALLY WITH MACHINES OF HEADINGS 8469 TO 8472 (like Microprocessors, Motherboards, Mounted PCBs, Head stack, Graphic and intelligence based script technology (GIST) cards	Free
8517	TELEPHONE SETS, INCLUDING TELEPHONES FOR CELLULAR NETWORKS OR FOR OTHER WIRELESS NETWORKS (Eg : Line and Cordless Telephones, Mobile Sets, Modems, Multiplexers, Routers, Set top boxes for internet, Printed Circuit Boards)	Free
8519	SOUND RECORDING OR REPRODUCING APPARATUS (Eg : CD Players, MP3 Players)	10%
8523	DISCS, TAPES, SOLID-STATE NON-VOLATILE STORAGE DEVICES, "SMART CARDS" AND OTHER MEDIA FOR THE RECORDING (Eg: Cassettes, CDs, DVDs, SIM Cards, Smart Cards, Memory Cards etc)	
	Smart cards like SIM cards, Memory Cards, Proximity cards & Tags	Free
	Magnetic media, cassettes, Optical media like CDs, DVDs	10%
8525	TRANSMISSION APPARATUS FOR RADIOBROADCASTING OR TELEVISION, TELEVISION CAMERAS, DIGITAL CAMERAS AND VIDEO CAMERA RECORDERS	
	Transmission apparatus	7.5%
	Two way radio communication equipment	Free
	Television cameras, digital cameras and video camera recorders	10%
8528	MONITORS AND PROJECTORS (Eg : Television Sets, Computer Screens)	10%
8541	DIODES, TRANSISTORS AND SIMILAR SEMICONDUCTOR DEVICES; PHOTOSENSITIVE SEMICONDUCTOR DEVICES, INCLUDING PHOTOVOLTAIC CELLS WHETHER OR NOT ASSEMBLED IN MODULES OR MADE UP INTO PANELS; LIGHT EMITTING DIODES; MOUNTED PIEZO-ELECTRIC CRYSTALS	Free
8542	ELECTRONIC INTEGRATED CIRCUITS	Free

Table 39: Customs Tax on Imports for Electronics Industry in India (CBEC - 2016)

As import policies of trading partner nations (Fig 15) have been deemed highly important by the majority of firms, import tariffs of trading partners have been deemed as not important for participation by an overwhelming majority of firms (75%) (Fig 33). This could be because of three reasons – (a) Firms actually do not face any discriminatory taxes, charges or fees on electronics exports (thereby violating the WTO principle of National Treatment; (b) the tariffs are already zero for a large number of product lines in this sector in main markets; or (c) the electronics exports from India is not yet significant in terms of volumes, value-addition, sophistication or diversity of markets.

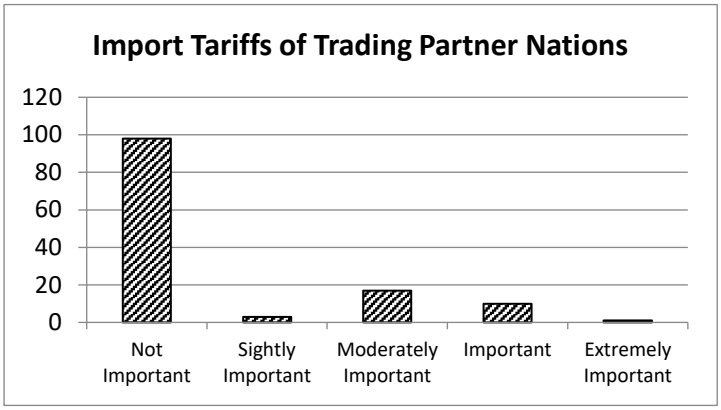


Figure 33: Importance of Import Tariffs of Trading Partners (Source: Based on Survey Findings)

Additionally, most respondent firms (56.1%) are also in favour of more trade agreements with trading partners for increasing GVC participation (Fig 34). Cross border flows of products are highly affected by both tariff and non-tariff measures. Tariff barriers (for product lines with non-zero tariff rates) and non-tariff barriers (like standards, procedures, documentation etc) are highly significant for participation in GVCs because of the very nature of transactions involved to make the value chain global. Ease of trade can be improved through Bilateral or Multilateral Trade Agreements with trading partner nations, although the Government would prefer to propose a list of sensitive items to be put under negative list under such agreements in order to provide impetus to domestic value addition.

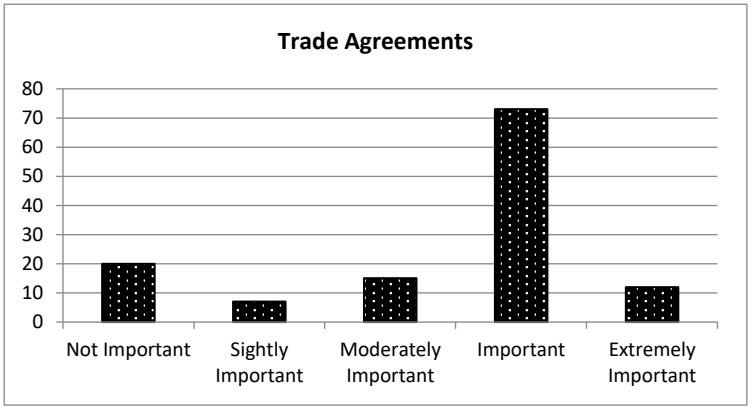


Figure 34: Importance of Trade Agreements (Source: Based on Survey Findings)

A1.4.2. Non-tariff Measures

Engaging in trade means following procedures, practices and documents as laid out by the Government to regulate trade. Procedural norms that majorly constitute the non-tariff barriers include documentation process (for clearances, Customs), licences (Import and Export

Licenses), Certification and Standards of Trading Partner Nations, non-trade barriers (like Anti-Dumping Measures, Countervailing Duties) and import quotas or prohibition.

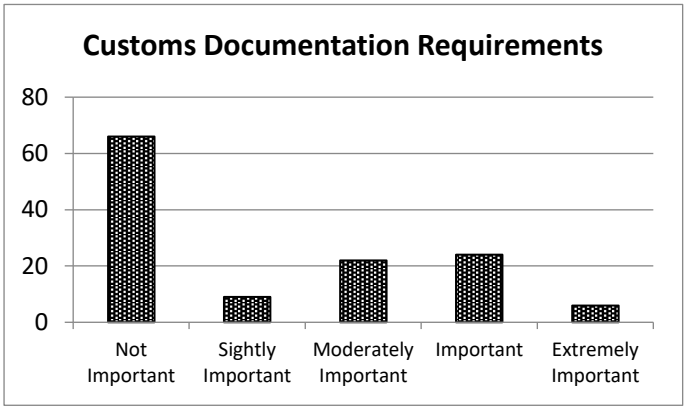


Figure 35: Importance of Customs Documentation (Based on Survey Findings)

Customs clearance formalities at ports requires a lot of documentation, which adds unnecessary complexities, time delays and high costs (agent fees, pick up fees, Bill of Lading fees, cargo filling charges). This factor has been considered as not important for participation by more than half of the respondent firms, indicating the processes as not as cumbersome as they are for the Automotives sector. On an average, it takes roughly 6.2 days to clear imports from customs and 5.9 days to clear direct exports through customs at any Indian port for the Electronics Industry, which is significantly lower than the Automotives Industry.[81] At present, the standard list of documents filed for customs clearance includes the following:

(a) Bill of Entry: the legal document filed by the importer that declares the exact nature, quantity and value of the goods that are being imported or exported.

(b) Commercial Invoice: assessable value of the imported or exported good is based on this invoice that states the market value of goods

(c) Bill of Lading/Airway Bill: It is the detailed list of cargo carried by the ship/aircraft along with the terms of delivery that is issued by the carrier

(d) Licenses: Import or export licences as provided by government guidelines. electronics products are exempt from licences (except for a small negative list).

(e) Insurance Certificate: Document for insurance of goods, also acts as a supporting document for the trader's claims.

(f) Technical Write up: In case of complex goods, a statement on the function and design of the good is required.

(g) Other documents, if applicable: These include documents when an importer/exporter intends to avail special provisions like duty exemption, import benefit etc. These include industrial license, schemes document (like DEEC/ECGC/Central Excise), Registration cum Membership Certificate etc

[81] World Bank Enterprise Survey (2014)

There are specific requirements for different commodities which make the process even more cumbersome. Firms desire easy and early clearance of customs dealings, preferably through a one-window approach and e-filing. The Ministry of Finance (Govt. of India) has announced faster clearance procedures (24x7 clearance systems) and freedom from documentation checks (under Facilitated Bills of Entry and Free Shipping Bills) for faster turnaround times at select air cargo complexes and seaports. Plans are being chalked out to reduce the average 6 days clearance time to less than 4 days.

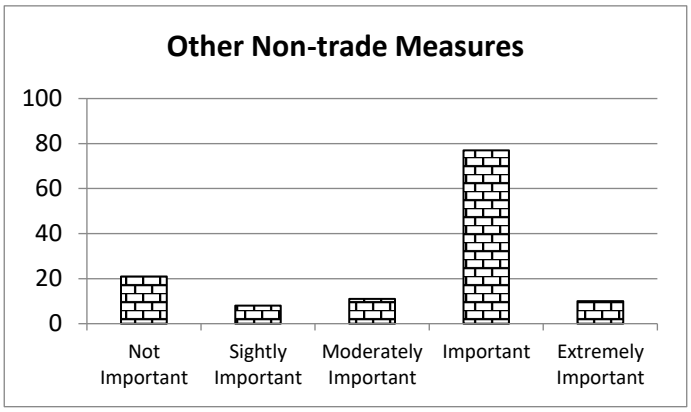


Figure 36: Importance of Non-Trade Measures (Based on Survey Findings)

Other non-trade measures like Anti-Dumping Measures, Countervailing Duties can also create potential problems for participation. These have been considered as important by a majority of firms (59%) (Fig 36), because a Countervailing Duty of 12.5% and Special Additional Duty (SAD) of 4% is imposed on most electronics products (excluding those covered under ITA-1), thereby making the peak effective rate equivalent to 28.8%. CVD and SAD exemptions have been granted to a few items to promote domestic manufacturing (like components and inputs required for manufacturing of Tablets, semiconductor wafer fabrication). A major portion of these firms feel that anti-dumping duty on basic inputs (raw materials and intermediates) to the industry are actually affecting their access to cheaper inputs and thereby affecting their participation in the Electronics GVCs. Non-trade measures raise their input costs and hence affect further production and competitiveness. So till the domestic ecosystem for raw materials and intermediates is self-sufficient to meet the demands of the industry at home, firms should be allowed access to cheaper inputs from abroad. Only then would they manage to enhance their participation in global value chains.

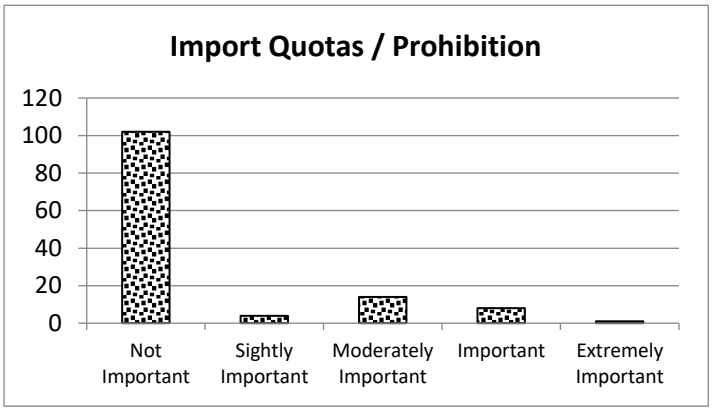
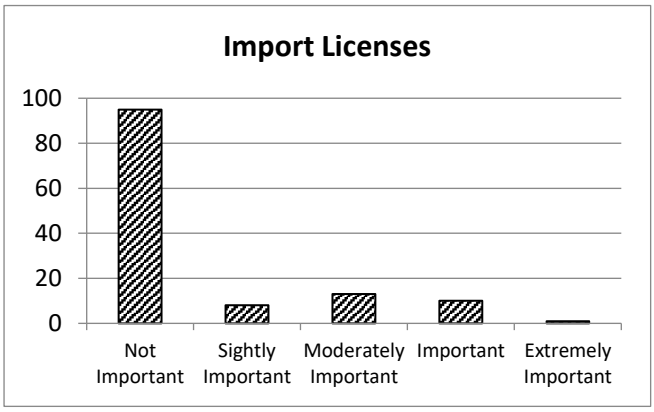


Figure 37: Importance of Import Quotas (Based on Survey Findings)

Other possible non-tariff measures like import quotas and licenses do not seem to affect participation, according to most firms. Electronics trade, according to the Indian Government, does not require any licenses and at present, no quantitative restrictions have been imposed.



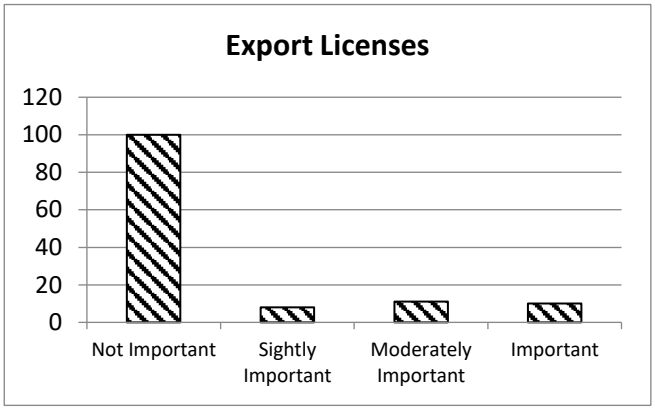


Figure 38: Importance of Licenses (Based on Survey Findings)

Almost all Electronics goods are freely tradeable except for a small negative list pertaining to the Defence-related items. Hence most firms do not feel any impact of such non-tariff measures (Figs 37, 38).

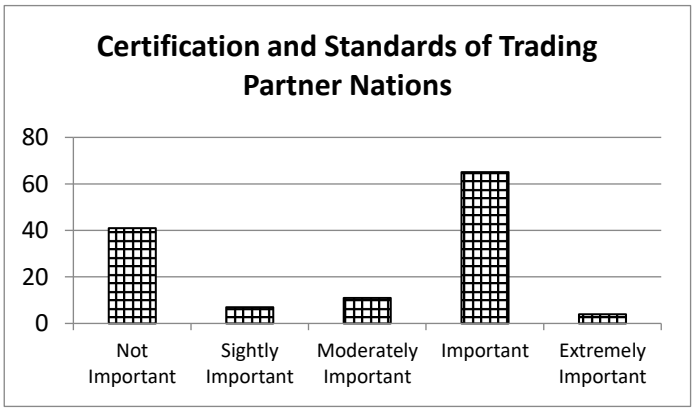


Figure 39: Importance of Standards of Trading Partners (Based on Survey Findings)

Since the electronics industry has strong preferences for standards, firms are expected to meet the standards set by trading partners and their industries. About half of the firms consider this a very important factor for participation in Electronics GVCs, which is in tandem with the prominence of standards in the sector. About a third of the respondent firms (31%) feel that this is not an important factor because these firms are not exporter firms; hence do not face the need to adhere to international standards. However, in order to be competitive both in the domestic and the

international markets, firms need to adhere to industry standards which are gradually converging to uniform global standards.

A1.5. FINANCIAL FACTORS

Financial Factors are related to various facets of financial resources and expenditures that are associated with conducting business. These include availability, ease of access, quality and quantity of finance for participating in GVCs, tax rates, access to foreign currency, exchange rates, and investment environment.

A1.5.1. Credit

Credit (Loans) is an important input for business and ease of access to finance is the most important financial factor that affects participation in Electronics GVCs. Finance is available through formal channels of commercial banking as well as informal credit sources. The formal source of credit is usually more reliable and cheaper but requires extensive paperwork on information about the firm and collaterals, which many firms (mostly SMEs) find difficult to obtain/meet.

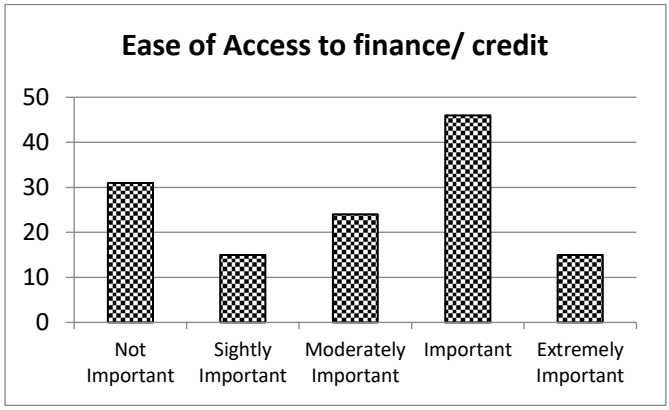


Figure 40: Importance of Ease of Access to Finance (Source: Based on Survey Findings)

The financial creditors are normally predisposed to lend to firms with good credit history and first time applicants usually find it harder to get higher corpus of loans at competitive rates. Hence the process of obtaining credit and the cost of credit has been deemed as a deterrent to participation by most firms (Fig 15). Smaller firms that do not have easy access to credit desire government intervention in the matter, for instance through direct financial assistance, directives to public sector banks for priority lending to SMEs, allowing SME cohorts to apply for joint loans etc. According to E&Y estimates[82], the average business in India faces a significantly higher cost of borrowed capital at 12% -14% as opposed to ~ 5 % to 7% global average.

[82] E&Y Report on "Make in India", April 2016

The general investment climate in an economy also affects participation as it defines the quality and quantity of capital accessible to businesses. The Electronics sector in India is quite an open sector in terms of flow of foreign investments. 100% FDI is allowed under the automatic route (subject to applicable regulations and laws) and automatic approval for foreign equity investment up to 100% with no minimum investment criteria is present. Government and domestic private investments are also important elements of the investment climate. The Government has announced several financial packages to attract investment in the Electronics sector as well as to support domestic manufacturing. For instance, the M-SIP Scheme provides subsidy on capital expenditure, Electronics Development Fund (EDF) promotes venture capitalist investment in R&D. Similarly, special zones have been created for promoting various sub-sectors of the electronics industry – Electronics Manufacturing Clusters (EMCs) where the Govt. will invest in infrastructure and Information Technology Investment Regions (ITIRs) where initial investments of nearly US$20 billion has been planned. Respondent firms are divided between moderately important (33%) and important (37%) with respect to the investment environment as a determinant of participation.

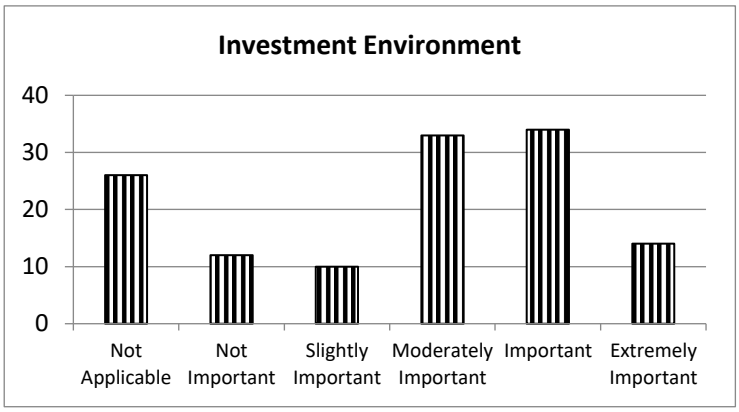


Figure 41: Importance of Investment Environment (Based on Survey Findings)

A1.5.2. Costs

The cost of doing business refers to the operating costs involved in running the firms and participating in GVCs. This includes operational expenses (procurement, logistics, manufacturing costs), taxes, labour (salaries, compensation, skilling), R&D etc.

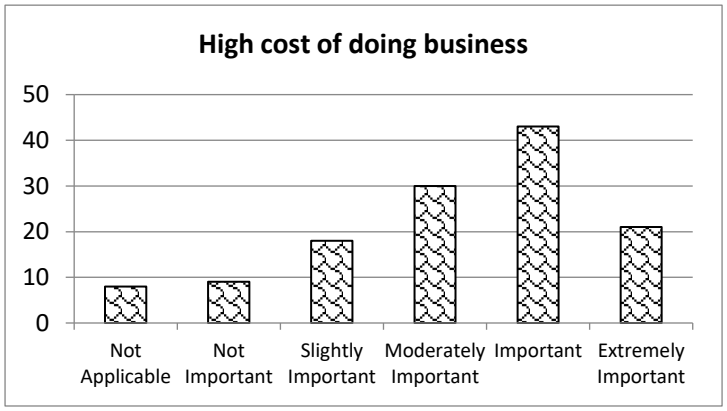


Figure 42: Importance of High Cost of Doing Business (Source: Based on Survey Findings)

The high cost of doing business adversely affects participation in GVCs as firms tend to focus on survival instead of adopting

measures that enable them to integrate into GVCs. An alternate impact might be that firms learn to be cost-effective and operate at lower costs. A majority of firms (50%) felt this was important while another 30% felt this was moderately important. (Fig 42)

A follow-up question to gauge the degree of costs involved in doing business was posed. Since cost data is highly classified by firms, especially the unlisted ones, respondent firms were asked to indicate the range of costs under various operational cost heads as a percentage of their total operational costs. Information provided by the listed firms was crosschecked against information in the Prowess Database and company annual reports, wherever available. Since most of the respondent firms were un-listed, data on costs was not available in the public domain.

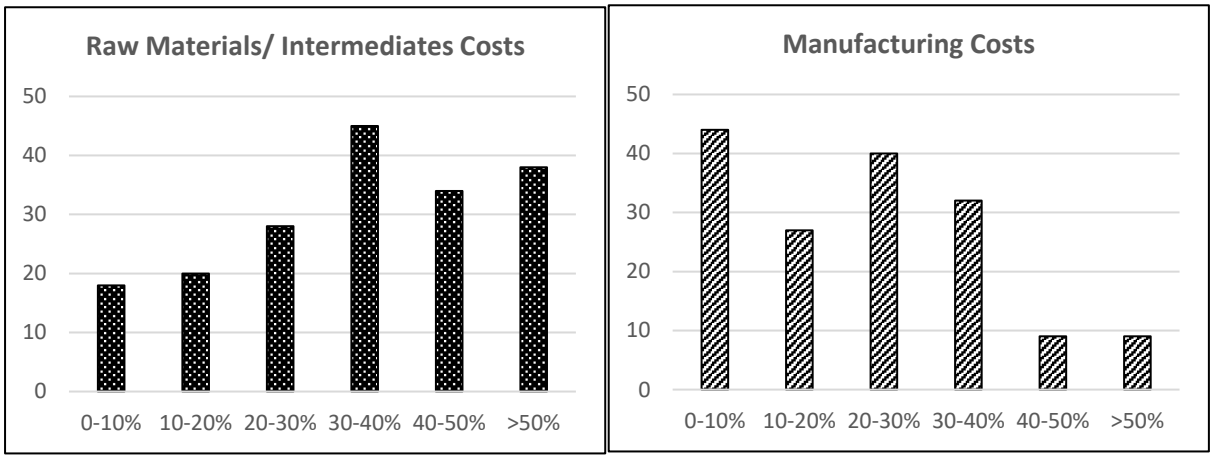


Figure 43: Various Operational Costs for Electronics Firms (Source: Based on Survey Findings)

The highest cost incurred by most firms was for raw materials or intermediates that were direct inputs for production. The input costs were quite high and typically in the range of 30-40% but a few firms reported this cost as being more than 50% of their total operating costs. This cost is highly dependent on global commodity prices and exchange rates since a lot of firms depend on imports for their inputs. The past few years have witnessed high prices for raw materials, and subsequently for intermediates. The next significant cost is manufacturing costs which included the costs associated with production like cost of spares consumed, utilities (power and fuel), and maintenance of plant and machinery. These ranged from below 10% up to a third of the total operating costs for most firms. This corroborates the fact that value addition through manufacturing in the country is low, as a result associated costs are also lower than those of the electronics sector.

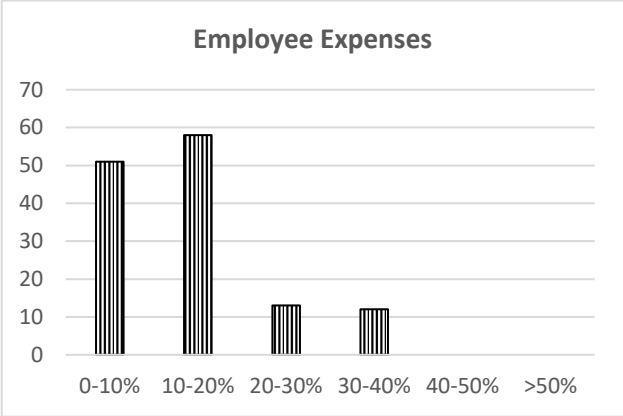


Figure 44: Employee Expenses (as % of Total Cost) (Source: Based on Survey Findings)

Employee expenses were the next most important cost item. This included the cost of hiring, salaries (wages), compensation, insurance and training & skilling. Firms typically spend around 10-20% of their total operating cost on employees. Although India still has cheap labour compared to other nations, employee expense is poised to rise in the near future owing to the rise in minimum wages (in accordance with Minimum Wages Act), rising scarcity of skilled labour and need for more training and skilling.

Transport and Logistics accounted for upto 10% of the total operating costs for majority of firms. These included freights (road, rail, ocean, air) freights, distribution costs and investment in resource planning systems. Though transport costs might account for a low share of the total operating costs, there is still scope to further reduce it. Roads are considered to be the most expensive mode of transport in the country owing to rising fuel prices, poor conditions and relatively long distances of firms from the port of landing. But road transport is indispensable as it provides last mile connectivity and other forms of transport have very little coverage. Introducing dedicated freight corridors will reduce both time and cost of transport even further, thereby lowering overall costs.

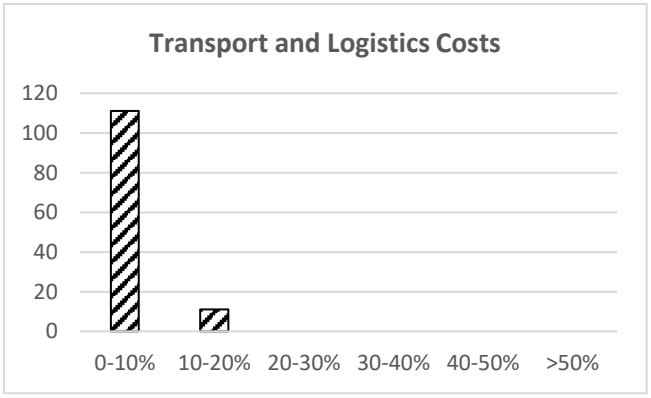


Figure 45: Transport and Logistics Cost (as % of Total Cost) (Source: Based on Survey Findings)

For instance, at present, a 40 feet fully loaded container (weighing around 25 tonnes) of electronics parts from Shanghai, China to Chennai, India costs approximately US$ 720-795 (Rs 48,240 – 53,265), averaging roughly around Rs 2000 per tonne.[83] Truck charges per tonne between Chennai and New Delhi roughly are around Rs 3,375 – 3500.[84] The railway freight per tonne is around Rs 950 (around Rs 1100 with busy season surcharge)[85] for the same distance between Chennai and New Delhi.

[83] Calculated from World Freight Rates Calculator (worldfreightrates.com/freight)
[84] From freightratesindia.com
[85] From Ministry of Railways, Government of India

The most important expenditure is that on Research and Development (Fig 46). Firms need to invest in R&D to remain competitive in the market. OEMs most typically spend the highest amounts on R&D for innovation in products and processes. Majority of the firms had very little investment (0-5% of total operating costs) in research, which is an indicator of the need for more proactive action to encourage more investment in R&D. One possible way is to create mechanisms for joint research and sharing of costs. The Government has also introduced measures to promote R&D in form of tax deductions. For instance, tax deduction for expenditure (capital and revenue) towards scientific R&D has been granted, incubator cells and centres of excellence are being promoted to stimulate R&D. For firms engaged in in-house R&D, concessional excise and customs duty are available for certain products. Such moves can help reduce R&D costs and increase the returns on investment for R&D.

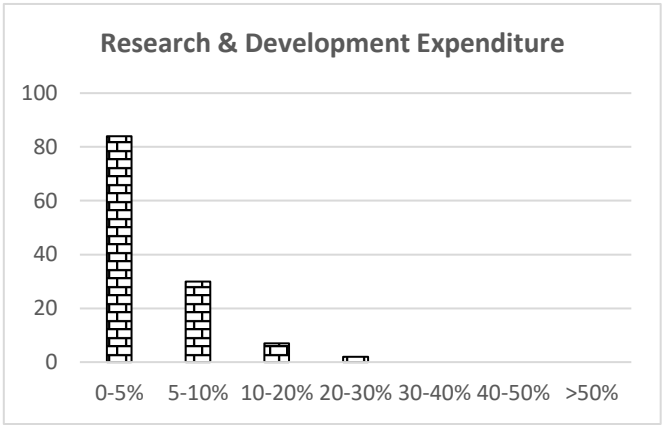


Figure 46: R&D Expenditure (as % of Total Costs) (Source: Based on Survey Findings)

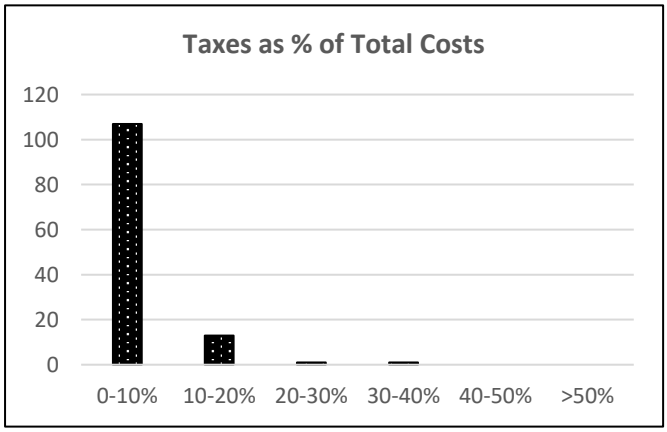


Figure 47: Taxes (as % of Total Costs) (Source: Based on Survey Findings)

Taxes also contribute to operational costs. There are various direct and indirect taxes that firms face including Customs Duty, Excise Duty, Value Added Tax (Central and State), Service Tax etc. These constitute about one-tenth of the total operating costs for almost all firms. According to E&Y estimates, the industry had nearly 30% base direct tax incidence. Such high proportions of taxes was making Indian electronics exports less competitive in international markets. Follow up questions on importance of tax rates and the incidence of various taxes faced by firms has been asked to gauge the impact of taxes in participation.

Tax rates were considered as not important by nearly 30%, slightly to moderately important by 37% and important by 33% of respondent firms (Fig 48), probably because (a) taxes are a relatively lower share of total expenses (b) location-wise incentives (like tax breaks or subsidised taxation by state governments) might be available to these firms (c) import-related duties on a large number of electronics items are almost zero. The responses to the rates of various taxes faced by firms revealed the following picture (Fig 49):

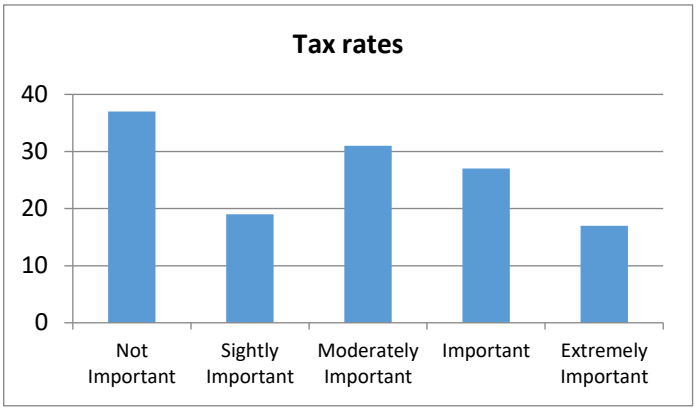


Figure 48: Importance of Tax Rates (Source: Based on Survey Findings)

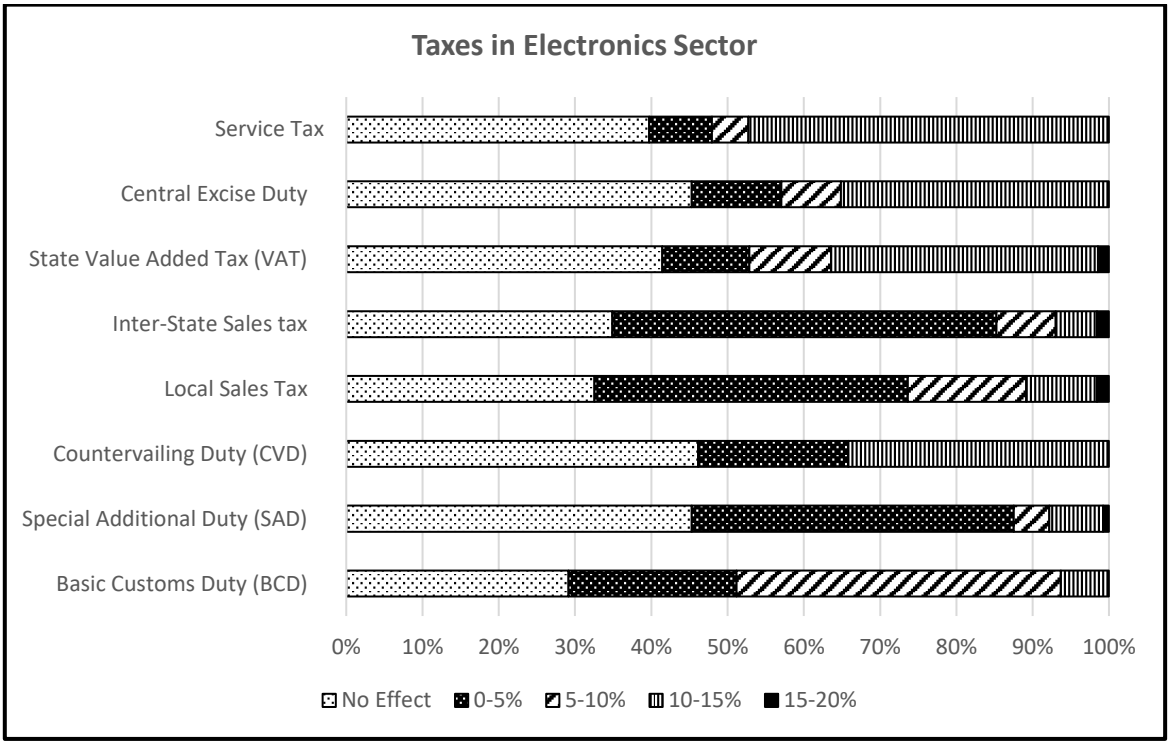


Figure 49: Incidence of Tax Rates for Electronics Firms (Source: Based on Survey Findings)

The highest tax incidence is for the VAT and Sales Tax (at 15-20%) but few firms are affected by this rate. For the majority of firms, the highest incidence of taxes is at 10-15% which is the rate for Service Tax, Central Excise Duty and State VAT. These are probably a major share of the tax burden on firms. Customs Duty faced is between 0 - 10% as these are mostly parts and

components importers. Sales tax has a typical rate of 5% (usually with Form C) but still accounts for a notable portion of total taxes.

With the advent of the Goods and Services Tax (GST), the distortions due to different sales tax rates in different states and the complexity of inter-state sales tax will be done away with. According to industry associations, there are concerns about GST tax rates, implementation details and input tax credit procedures. For instance, the electronics industry would prefer a uniform rate of tax for completely built units and components (inputs) against which input credit can be claimed. Similarly, a common base for Central and State GST would help avoid cascading of taxes, unlike the present system where states taxes (like sales tax) are levied on central taxes (like excise duty). Special incentives provided by states should also be secured under GST. The most fervent appeal by most firms has been the expedition of the process of tax refunds which usually takes a long time at present.

An IESA Taskforce Report in 2009 to stimulate the growth of IT, ITeS and Electronics Hardware Manufacturing industry in India outlined the net impact of taxes and costs on electronics manufacturing in India through an illustrative example and compared it with the manufacturing scene in China. This has been replicated below for a 50% value-added product and a presumed sales price of Rs 100 (Table 38). Modifications for current (average) tax rates and costs also upkeep the below trend – Chinese manufacturers have greater advantage in terms of taxes in form of refunds and cost factors.

Table 40: Impact of Disabilities on Electronics Manufacturing in India (Source: IESA Taskforce Report 2009)

TAX / COST HEAD	INDIA	CHINA	REMARKS
Sales(-CST @ 2%)	100 - 2 = 98	100	The 2% Central Sales Tax (CST) translates to a selling price of INR98.
Raw materials (+ CST@2% on 50% local supplies)	48 + 0.48	48	Assuming 50% value addition, there is an additional CST on local supplies.
Raw material support and logistics	2.5	1	This is due to the impact of logistics, power and financing costs.
Power	5	2	
Finance	5	2.5	
Marketing and other expenditure	15.5	15.5	These are assumed to be equal.
Manpower	12	12	These are assumed to be equal.
Investment	80	80	Initial investment is required.
Profit	9.52	19	Profitability in India is almost half that of Chinese mfg
Return on Investment (ROI %)	11.90	23.75	Low profitability results in low ROI.
Refund on VAT (17% on value addition)	0	8.5	A 17% VAT refund is available in China.
Total ROI (%)	11.90	34.4	Overall, ROI is almost one-third in India

If novel approaches of reducing costs of operations like the input and manufacturing cost, transport costs and tax rates can be discovered and adopted, it will give a huge advantage to electronics firms in India for being cost-competitive globally.

A1.6. TECHNOLOGICAL FACTORS

The Electronics industry is highly technology-intensive. *Technological Factors* are related to technological needs that include factors like Research and Development (R&D), access to existing latest technology and technology transfer restrictions.

The importance of Research and Development (R&D) as perceived by the respondent firms shows a bimodal response (Fig 50). A large proportion of firms (29.2%) does not feel the need to invest in R&D as an important factor for participation. Almost all of these firms are small component makers (lower value-added activities). They probably do not feel R&D is important because their products are highly standardized and do not require much innovation or adaptation. These products are made from drawings provided by ODMs and OEMs, are mass-produced and volumes are targeted for achieving economies of scale. Besides, relatively easier access to intermediates through imports has subdued the need for investment in R&D related activities.

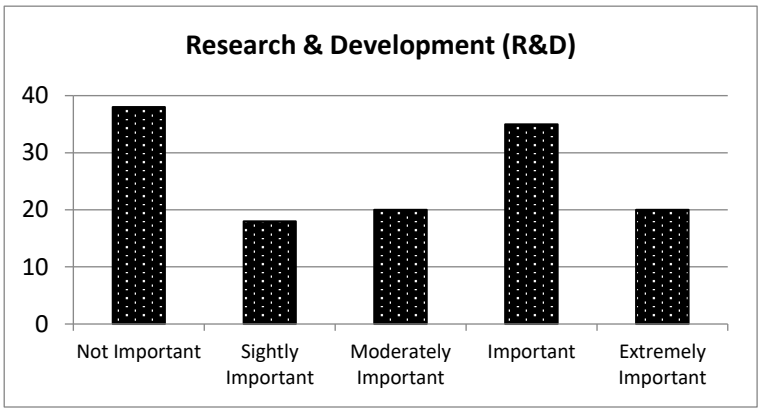


Figure 50: Importance of R&D (Source: Based on Survey Findings)

EMS and ODMs, however, have to work very closely with the OEMs in order to manufacture customized parts or sub-systems. Since these systems are often quite complex, these require quite a bit of innovation and adaptability to produce the best quality products at minimum possible cost and time. These suppliers either have access to OEMs' in-house R&D facilities or have to develop their own R&D setup in order to qualify as a supplier to any major OEM. Several major industry leaders like Samsung, GE, Bosch, Texas Instruments (TI), AMD, Delphi, and Ricoh have their own in-house R&D centres in India while software companies like HCL, Wipro, TCS, Microsoft and Infosys provide R&D services to the electronics industry.

OEMs, on the other hand, always have to invest a lot in R&D for their products as there is pressure from the markets for rapid turnaround of products (product lives having been

shortened to 4-5 years and new products have to be launched every 1-2 years) and high quality products. Being the brand owners, their entire supply chain is dependent on the OEMs as their designs and expectations decide the nature of products upstream. R & D also minimizes the future cost of production (Das, 2012)[86].

Interestingly, India is fast becoming the preferred global destination for VLSI and circuit board design. As part of the "Make in India" campaign, India has attracted more than 30 per cent of the global ER&D centre announcements in 2015, overtaking US, Germany and China[87]. Prior to this, India already had the presence of R&D and design centres of 23 out of the top 25 electronics OEMs (and semiconductor companies) in the world, although there are no semiconductor fabrication units (fabs) in the country. Some of the enterprises, such as electronics manufacturers like Foxconn, Ericsson and LeEco, which have either invested or announced investments in setting up their R&D centres in India have done so as an extension of their manufacturing plans. But there has been no major IP creation in the country mostly because the rights of such research are owned by the parent company which are mostly MNCs. So although Indian workers have the skills for the much required R&D, the benefits are not accruing to domestic manufacturers.

To improve the R&D ecosystem in the country, the Government has declared several initiatives. As part of the Electronic Development Fund (EDF), the government has announced it would increase funds for R&D seed capital and venture capital for start-ups in the ESDM and nano-electronics sectors. The Government has also been promoting R&D in the PPP mode (Public Private Partnership) that can then be made freely available to needy companies that do not have the resources for investing in R&D themselves. As per NASSCOM[88], in 2009 close to 77% of all domestic embedded systems R&D spending was by government labs and PSUs while domestic OEMs contributed the remainder and the trend was expected to continue till the end of next decade. For instance, the development and commercialization of set top box technologies in India has been through the joint efforts of Government research centres like CDAC, NICIT (National Institute of Communications and Information Technology) and private firms. [89]

[86] Subhrabaran Das, Piya Das (2012), Asian-African Journal of Economics and Econometrics
[87] "India top destination for R&D, beats US, China", BusinessLine, June 27, 2016
[88] NASSCOM Report on Embedded Systems Opportunities : Driving Indian IT up the Value Chain (2009)
[89] Shamim, S. (2016), "The state of Set Top Box Industry in India: Issues and road ahead. A Tech-business ecosystem perspective", IOSR Journal of Humanities and Social Science (IOSR-JHSS) Vol. 21, Issue 1, PP 07-17

Under the Electronics Manufacturing Clusters (EMCs) setting up of special incubator cells targeted at innovation, research and testing has been declared. Initiatives have also been taken to promote centres of excellence and R&D in the electronics centres. But these initiatives will need some time before yielding results. The general feeling amongst the electronics firms is that India has started investment in R&D quite late and a lot of ground has to be covered before it can catch up with the rest of the world. The country still looks out to the Western world for new and cutting-edge technology.

Worldwide, electronics OEMs are the some of the largest investors in R&D with figures of investment crossing US$100 billion annually in 2015 and annual R&D allocations are increasing every year. While most foreign OEMs have deeper pockets and excellent research bases back home, the domestic OEMs have not yet developed their research base as they are still in the assembly mode (dependent on imports for meeting their needs for intermediates and sub-assemblies). R&D in the electronics sector is usually categorized into: fundamental research (especially in the semiconductor segment); designing and engineering of a new component/final product, and development (including testing and data analysis). India is already a global hub for all three types of activity, though the IP rights belong mostly to MNCs. There is huge scope for very high value addition to be performed in the R&D segment but that requires higher allocations, a co-research ecosystem involving lower tiers and a wholesome research-oriented environment in the country.

Access to existing latest technology as a factor for participation in Electronics GVCs has elicited mixed responses from most firms. Interestingly, small firms and OEMs have deemed this as not important, most likely because either they do not feel the need of latest technology (make standardized parts) or develop their own technology which is proprietary and a differentiator (OEMs build their brands around their own in-house technology). Most firms in the middle-value addition segments of the electronics GVCs like EMS and sophisticated components manufacturers feel this is a very important factor for participation as it helps them stay competitive in the supplier market.

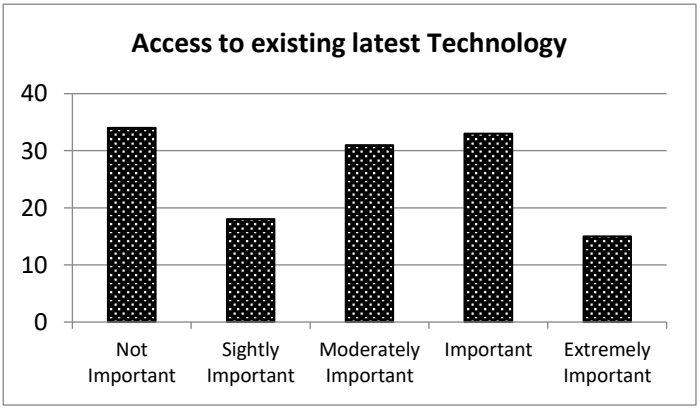


Figure 51: Importance of Access to Technology (Source: Based on Survey findings)

Developing technological capabilities of firms is not dependent only on R&D spends or in-house facilities. It can also be achieved through technology transfers (by importing technology using foreign licences). Technology transfer enables access to latest technology that firms may not be able to develop first hand and can be a vital first step for building skills and internal capability for furthering R&D prospects in future. Most respondent Electronics firms feel that access to latest technology is moderately important for participation (Fig 51) while technology transfer restrictions are not important (Fig 52) as the firms are either not involved in any major technology transfers or probably do not face any major restrictions, when they are involved.

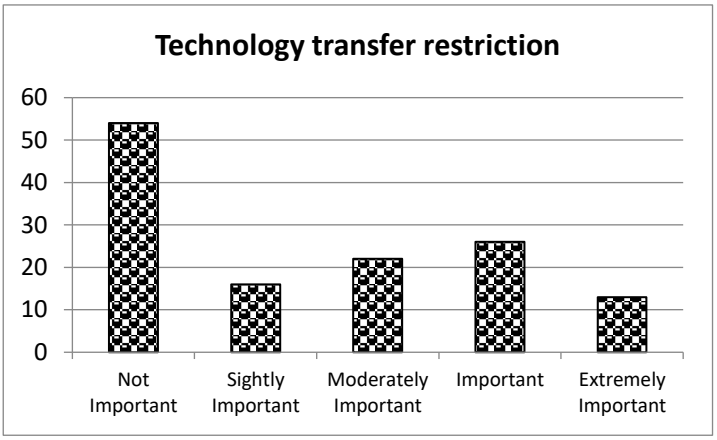


Figure 52: Importance of Technology Transfer restrictions (Based on Survey Findings)

A1.7. INPUT RELATED FACTORS

Input related factors are concerned with the various inputs essential for making a firm efficient and competitive so that it performs or plans to perform well in a global value chain. These include inputs like labour, raw materials/intermediates, technology, basic infrastructure, etc. that might be affecting participation in GVCs. The Quality, Delivery and Cost (QDC) criteria for inputs is a very well-known metric in supply chains. Firms were asked to rate the QDC aspect of major inputs for participation in GVCs.

A1.7.1. Raw Materials/ Intermediates

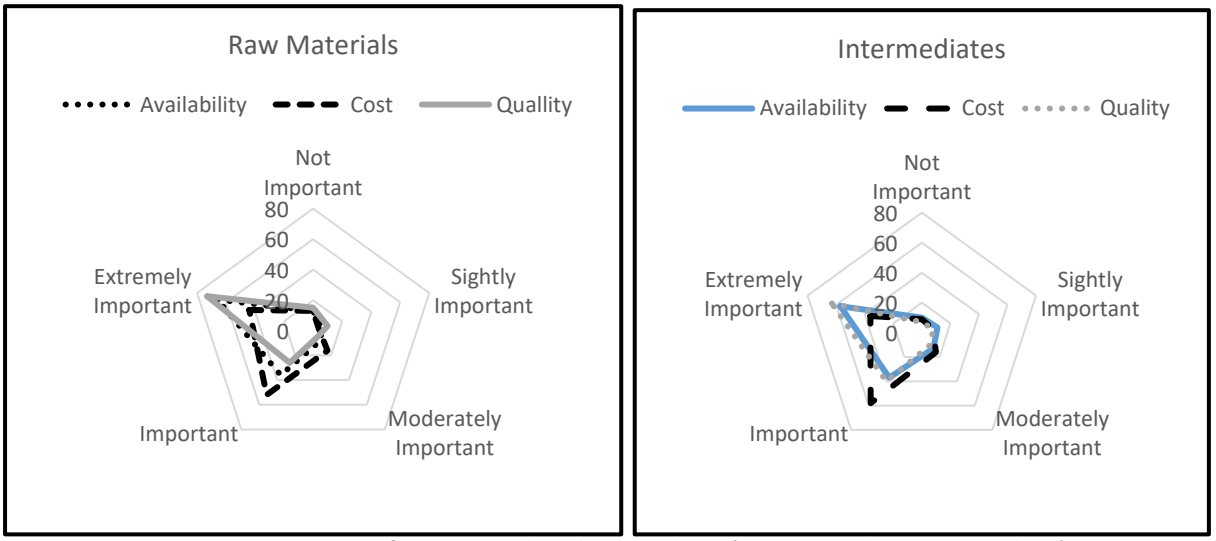


Figure 53: Importance of Raw Materials and Intermediates (Source: Based on Survey Findings)

The quality, cost and availability of raw materials/intermediates are of paramount importance to manufacturing firms as they ensure the quality, cost and lifespan of the output. This can be a major source of competitive advantage to firms that deliver high quality products at lowest possible cost. While all three aspects of the inputs are important, the availability and quality of raw material and intermediates have been deemed as extremely important by majority of firms. In case of quality concerns, firms are also affected by inferior quality and counterfeit parts in the market.

Import of Electronics Items (In US$) by India								
YEAR	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17# (P)
TOTAL	22222.2	27950.1	34130.3	32892.7	32383.80	36857.40	40022	12034.02
Computer Hardware, Peripherals	4051.25	4896.15	6834.54	7005.01	6885.63	7246.37	7508.87	2116.28
Consumer Electronics	2555.68	3230.14	3802.34	4244.23	3665.56	4122.09	4106.49	1267.85
Electronics Components	3524.79	4151.65	6838.30	6120.57	5434.39	5383.29	7115.42	2239.39
Electronics Instruments	3521.76	4223.19	5490.11	5393.87	5178.04	5408.32	5888.50	1795.24
Telecom Instruments	8568.65	11449	11165	10129	11220.17	14697.34	15402.6	4615.25

Table 41: Imports in the Indian Electronics sector (Source: India Stat Database. Figures in US$ Million, # Estimates)

According to E&Y estimates[90], more than half of the demand for electronics products (50%-60%) and more than three-quarters of the demand for electronics components (70%-80%) is met through imports. The steadily increasing imports of Electronics items over the past decade only proves the over-dependence of the industry on imports for inputs, which is a case of concern for value addition in the country (Table 39). The components imports have outstripped the exports for several years now. There is huge scope in the components industry to increase value addition in the country by improving its capacity utilization, quality standards and R&D competence.

A1.7.2. Labour

Labour is one of the most important inputs to value addition and also the leading source of comparative advantage for India. Labour in India is abundant (owing to the demographic dividend) and is considered cheap as compared to the rest of the world. But Electronics is a skill-intensive industry; hence the quality of labour is also an important criterion for firm

[90] Ernst & Young (E&Y) Report on "Make in India", April 2016

performance. The firms rated the availability, quality and cost of skilled and semi-skilled labour as important factors for participation in Electronics GVC.

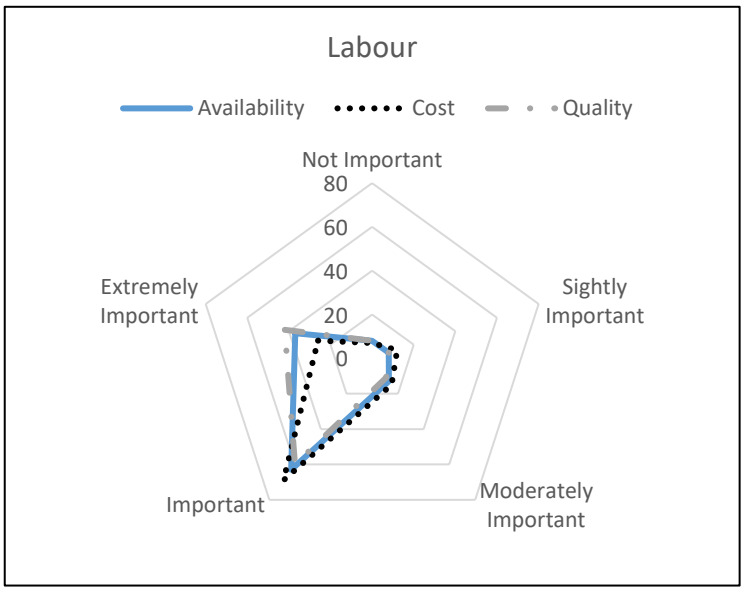


Figure 54: Importance of labour in Electronics GVC participation (Source: Based on Survey Findings)

On a scale of 0-7 (with 7 being most important, 1 being Least Important and 0 being No Impact), most of the firms ranked labour-cost, labour-availability and labour-quality a very high six for Labour Availability, Quality and Cost. This signifies that firms want more labour and of better quality preferably at lower cost.

As the Electronics sector is highly technical and skill-intensive, it requires a high volume of skilled workers who can handle the intricate processes. A report by the National Skill Development Corporation (NSDC)[91] estimates that the Electronics and IT Hardware industry will grow at a rate of 17% (CAGR) and will need around 4 million workers by 2022. This includes personnel at all levels and with skills ranging from highly specialized skills like doctorates to skills that can be acquired with modular and directed intervention like factory floor level workers. Although India boasts of a vast labour force, the demand for skilled labour is already exceeding the supply and without adequate measures for improving skilling standards and avenues in the country the gap will only grow.

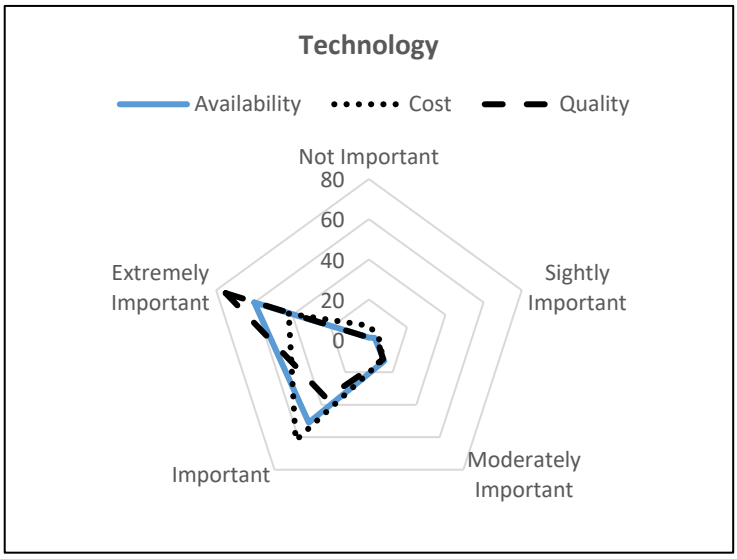
Ease of access to labour market and Labour Laws are the other important Labour-related factors that have affected participation in Electronics GVCs. Most firms prefer to locate themselves in regions or locations where they have easy access to the labour force of skilled and semi-skilled labour. This is one of the primary reasons for this industry to mostly operate out of clusters. Clusters provide positive externalities in the form of a common labour pool, which similar firms can dip into. Thus there are several advantages – (a) access to a large pool of specialized labour and varied skills which come handy since most firms do not know what

[91] National Skill Development Corporation (NSDC) Report 2013-17, 2017-22 (http://www.nsdcindia.org/sites/default/files/files/Electronics-and-IT-Hardware.pdf)

kind of labour skills they need in the future, (b) knowledge spill-over occurs when workers from different firms interact informally and (c) there are considerable savings in terms of lower costs of recruitment, reduced training and low relocation costs (since workers already live nearby)

For India which considers itself labour-intensive and labour as a rich resource, the quality and availability of labour are also perhaps not at par with the expectations of the industry. If labour laws are proving to be a major deterrent to the participation of firms in India in Global Value Chains for both sectors, then a closer look at Labour and Skilling Policies is imperative.

A1.7.3. Technology

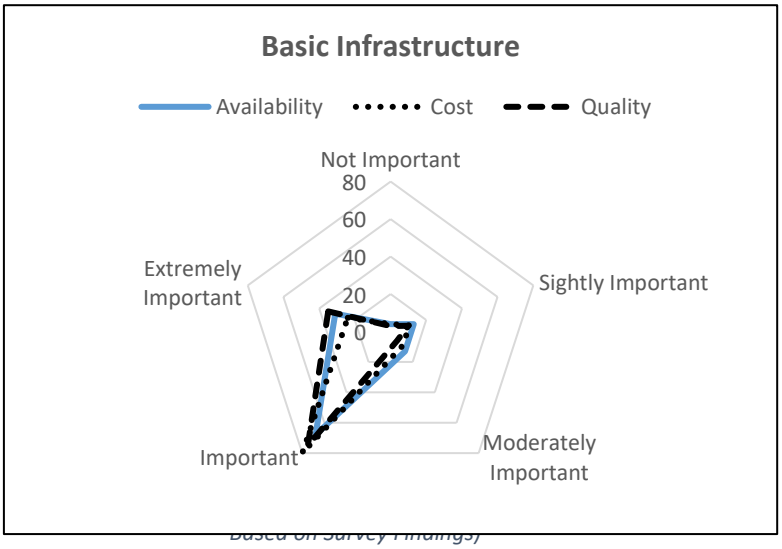


Being highly technology-intensive sector, the availability, cost and quality of technology is a major determinant of GVC participation of firms. Quality and Availability of Technology is deemed as extremely important criteria for electronics firms for participation in GVCs, while cost of technology can be a burden which most firms feel is fine to bear.

Figure 55: Importance of Technology for Participation (Based on Survey Findings)

A1.7.4. Basic Infrastructure

Basic Infrastructure such as land, transportation and connectivity (roads, ports, and airports), utilities (electricity, water) and communication (telephones, internet) is the foundation pillar for establishing firms in any location. Providing healthy basic infrastructure ensures firms do not spend valuable resources in developing basic



Based on Survey Findings)

infrastructure unnecessarily; rather they utilize these resources for achieving greater productivity.

While majority of the firms rated all three aspects of basic infrastructure as important, most firms also feel that this has been a challenge in the country. The poor condition of roads, lack of adequate rail connectivity, long turnaround times at ports, challenges of 24x7 power and water are some of the important factors that have raised costs and affected the productivity of firms. One of the major concerns of a lot of Electronics firms was that due to poor road and rail infrastructure their incoming shipments often arrived in damaged condition, which rendered them unusable and orders for replacement had to be placed resulting in undesirable delays and longer turnaround time of output.

The government has decided to improve the quality of basic infrastructure in the country. For instance, the budgetary allocation for road infrastructure, schemes like Dedicated Freight Corridors and the Pradhan Mantri Gram Sadak Yojana, revitalization of the state power discoms through the UDAY scheme, and for developing waterways as an alternative mode of transport, has been increased.

A1.7.5. Inventory Management

In the era of advanced inventory management systems like Just-in-Time (JIT), inventory is handled as a valuable resource.

Efficient inventory management, through optimization and communication, determines firms' ability to overcome supply-side shocks, meet customer expectations and operate profitably. Most firms have rated availability and quality of inventory management as extremely important while cost has been rated important. For quick turnaround times, reduced costs and proper handling of inputs, inventory management is of paramount importance.

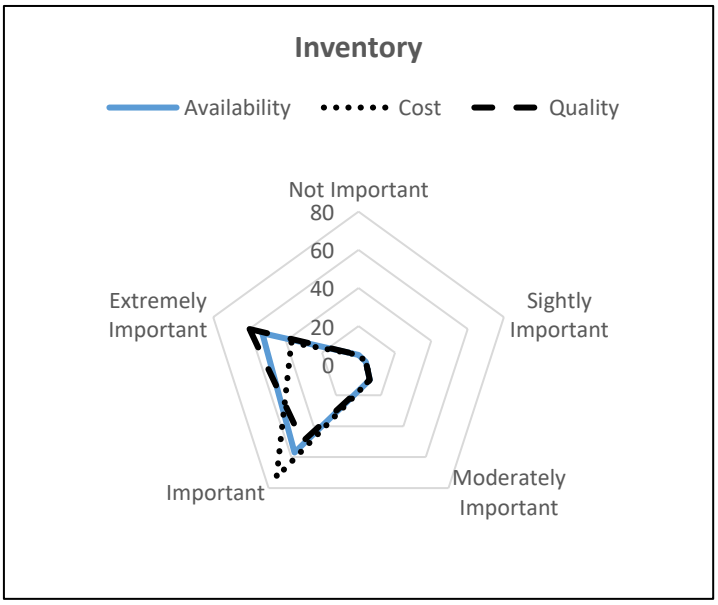


Figure 57: Importance of Inventory Management (Source: Based on Survey Findings)

ANNEXURE 2: FIRMS' PERCEPTION OF SIGNIFICANT FACTORS – DIRECT PARTICIPANTS

In the main paper, PCLR provided insights into how broad factors (determined by PCA) affected participation in Electronics GVCs, giving a sense of the direction (positive or negative) and the relative impact on the odds of participation (Table A2.1). Since the use of PCA abstracted away information regarding individual factors affecting participation in Electronics GVCs that were contained within the survey questionnaire, this section has been included to provide insights into how firms responded to these individual factors that were ascertained as significant in the logistic regression, namely the elements of Sectoral Structure, Trade-related factor and Market Barriers.

			Number of obs = 129 LR chi2(9) = 13.04 Prob > chi2 = 0.0001 Log likelihood = 162.075 Pseudo R^2 = 0.105
Participate in Electronics GVCs	**Coeff (B)**	**Robust Std. Err.**	**Sig.**	**Odds Ratio (exp (B))**
Other Inputs (PC1)	-0.373	0.256	0.145	0.688
Operational (PC2)	-0.015	0.239	0.950	0.985
Institutional (PC3)	0.107	0.233	0.656	1.113
Direct Inputs (PC4)	-0.076	0.209	0.717	0.467
Sectoral Structure (PC5)	**0.498**	**0.217**	**0.022**	**1.645**
Inventory (PC6)	0.254	0.198	0.201	1.289
Non-tariff Measures (PC7)	0.118	0.229	0.606	1.125
Trade-related (PC8)	**0.401**	**0.240**	**0.095**	**1.493**
Market Barriers (PC9)	**-0.372**	**0.211**	**0.079**	**0.689**
Constant	-0.042	0.192	0.827	0.958

Here the firms' responses to the individual factors that constituted the significant principal components in PCLR are outlined. These reactions of the respondent firms to the survey questionnaire have been categorized according to the status of the firm – Participant and Non-participant in GVCs. In the Participant category are firms that both import and export directly. These include 55 Indian firms and 9 MNCs importing inputs and manufacturing components in India for both domestic and international markets. In other words, this section provides insights into the firms' perceptions of their side of the story regarding the facilitation, challenges and opportunities that the firms face for participation in Electronics GVCs.

A2.1. SECTORAL STRUCTURE

A2.1.1. CONSOLIDATION IN SECTOR

Consolidation in a sector refers to the presence of a few major players due to (a) few firms monopolizing the segment, making it extremely difficult for new entrants; (b) several firms leaving the segment due to mergers and acquisitions (M&A) or shutting down or (c) maturing of the market. Consolidation presents both opportunities and challenges. Fewer firms implies improved revenue and profitability for each firm and faster growth in scale and turnaround times. Higher consolidation also means tougher norms for participation.

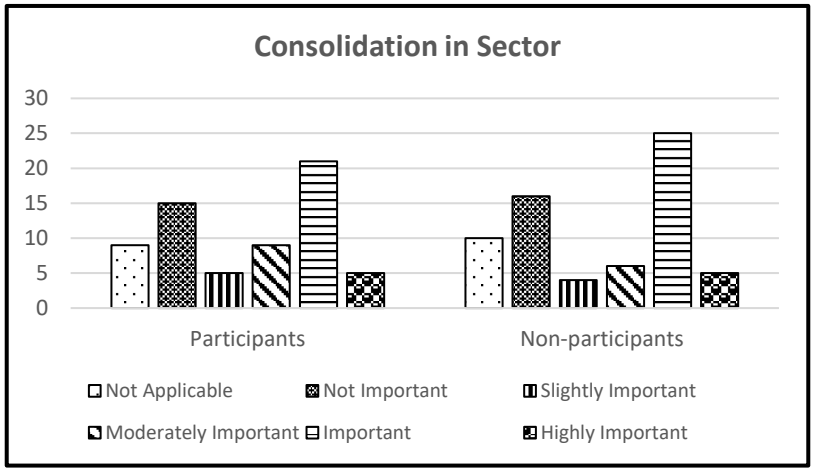


Figure 58: Importance of Consolidation in Electronics Sector (Source: Based on Survey Findings)

Most participant (40.6%) and an overwhelming majority of non-participant electronics firms (44.7%) felt that consolidation in the sector was an important determinant for participation in Electronics GVCs (Fig 1). Most of the firms responded that consolidation in certain segments of the Electronics GVCs made it difficult for them to enter those segments.

About 37.5% participant firms and 39% of the non-participant firms considered it as either not applicable or not important because most of them believed that there was enough business to go around for everyone.

A2.1.2. IMPORTANCE OF BRAND

Brands essentially communicate the standard and quality of a product. While for a finished product the brand is typically owned by the OEMs (e.g. Samsung, LG, Micromax, Intel, Compaq etc), brands also exist for component suppliers.

The participant firms clearly feel that brands have a very important impact for joining in Electronics GVCs. More than half (51.6%) of these firms have cited brands and brand-image as important (Fig 2).

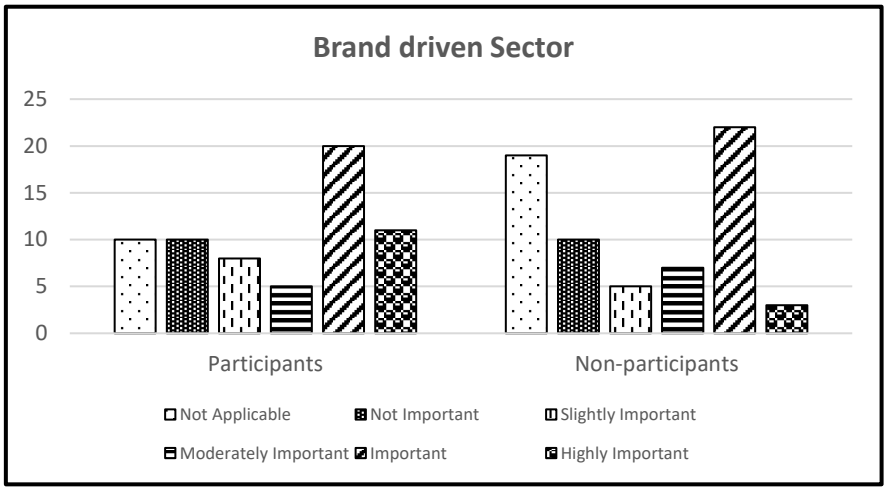


Figure 59: Importance of Brands in Electronics Sector (Source: Based on Survey Findings)

The responses of the non-participant firms exhibit a bi-modal perception of the importance of brand. While nearly one-thirds of the firms (37.31%) feel this factor is important, 43.3% of these firms have rated it as either not applicable or not important. A closer look at these firms reveals that these are mostly generic components (and sub-component) manufacturers that produce standardized products.

A2.1.3. TECHONOLOGY UPGRADATION

The Electronics sector is marked by high technology-intensity and need for constant technology upgradation.

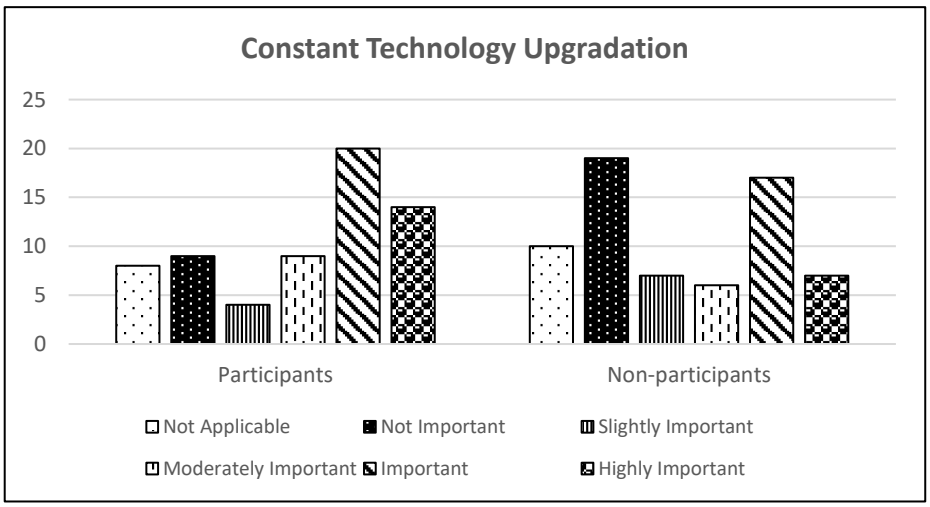


Figure 60: Importance of Technology Upgradation (Source: Based on Survey Findings)

What is interesting to note here is that majority of participant firms (53.1%) placed high importance on the need to remain technologically valid (and updated) for staying relevant in the Electronics GVCs (Fig 3). Non-participant firms, on the other hand, were divided in their opinion of the importance of this factor with 36% feeling this was important while 43.3% citing this as either not-applicable or not important. Ignoring the importance of technology could be one of the major reasons why firms in India have not been able to become significant participants of Electronics GVCs.

A2.1.4. DIVERSIFICATION OF PRODUCTS

Ease of diversification of the product range is also a typical requirement of this industry. With increased customer expectations for varied products, firms need the ability to adapt their products to changing features.

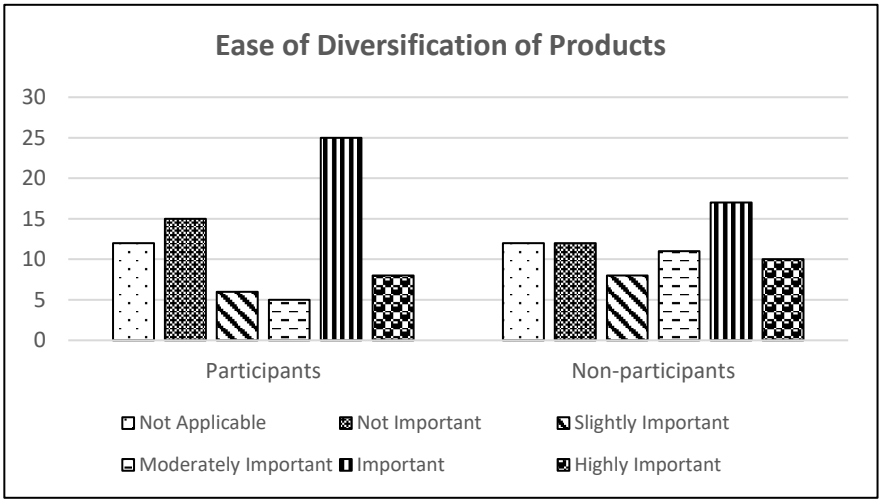


Figure 61: Importance of Ease of Diversification (Source: Based on Survey Findings)

More than half of the participant firms (52%) corroborated this fact (Fig 4). The non-participant firms, on the other hand, were ambivalent in their response. This could either be because of the generic nature of their product line or due to the fact that being absent from the GVC has not exposed them to such expectations.

A2.1.5. ADVANCE PLANNING STRATEGY

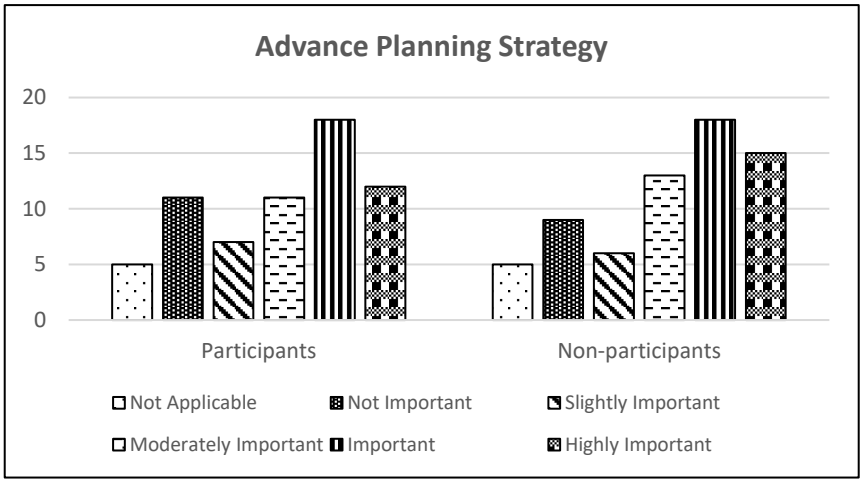


Figure 62: Importance of Advance Planning Strategy (Source: Based on Survey Findings)

All the above factors cannot fructify without proper vision and planning. Advance strategy is essential for both expected and unexpected events.

This is the reason why nearly half of the firms in both the categories have deigned this factor as important - highly important (Fig 5).

A2.2. TRADE RELATED

In the trade-related principal component, the licenses (import and export) and tariffs of trading partner nations were subsumed.

A2.2.1. TRADE LICENSES

Licenses are an integral part of trade procedural requirements. Most Electronics trade, according to the Indian Government, does not require any licenses. However, certain products broadly categorised under consumer goods, products related to safety and security, and certain electronics items require licenses for trade. These licenses issued by the Director General of Foreign Trade (DGFT) are valid for 24 months for capital goods and for 18 months for raw materials, components, consumables and spares.

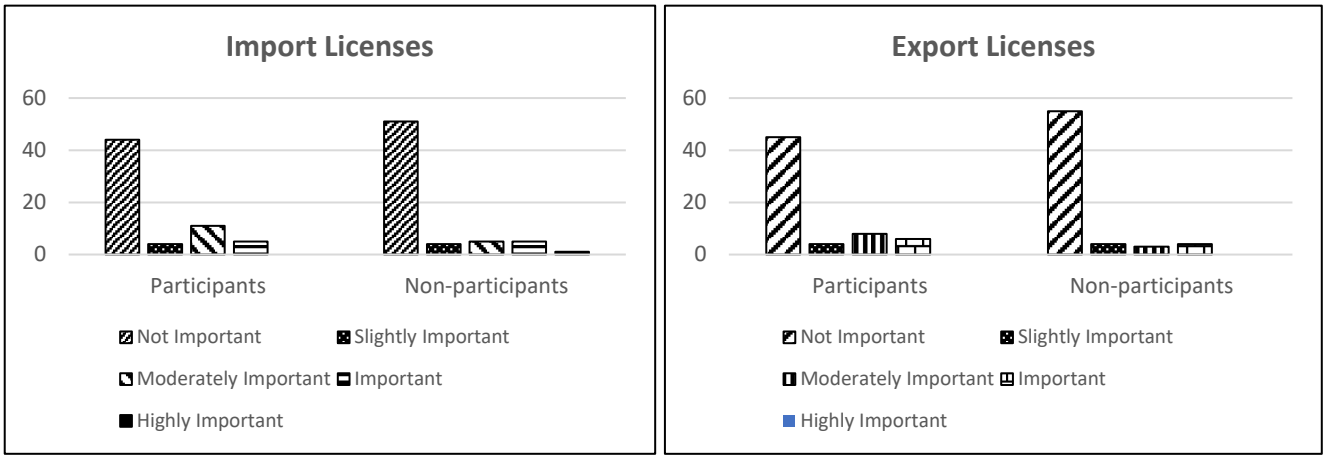
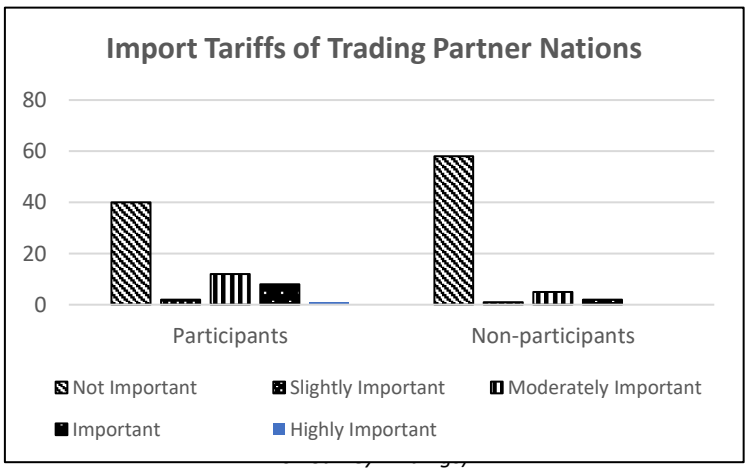


Figure 63: Importance of Licenses (Based on Survey Findings)

An overwhelming majority of firms in both categories have deemed the import and export licenses as not important (Fig 6).

A2.2.2. IMPORT TARIFFS OF TRADING PARTNERS

Policies of trading partners have been deemed an important factor for Electronics trade by majority of firms (Fig 15, Annexure 1). Tariffs of the trading partners, on the other hand, have been cited as not important by majority of firms in both categories (Fig 7). This



could be because almost all Electronics goods are freely tradeable.

What is to be noted here is that the absence of licenses and import tariffs by partner nations has aided Electronics GVC participation.

A2.3. MARKET BARRIERS

The Electronics sector has high market barriers in terms of scale of investments and time for projects. Under the market barriers principal component, market entry costs, capital costs and gestation time of projects were subsumed.

A2.3.1. MARKET ENTRY COSTS

Market entry costs refer to the fixed costs of entry into supply chains that precedes the setup stage.

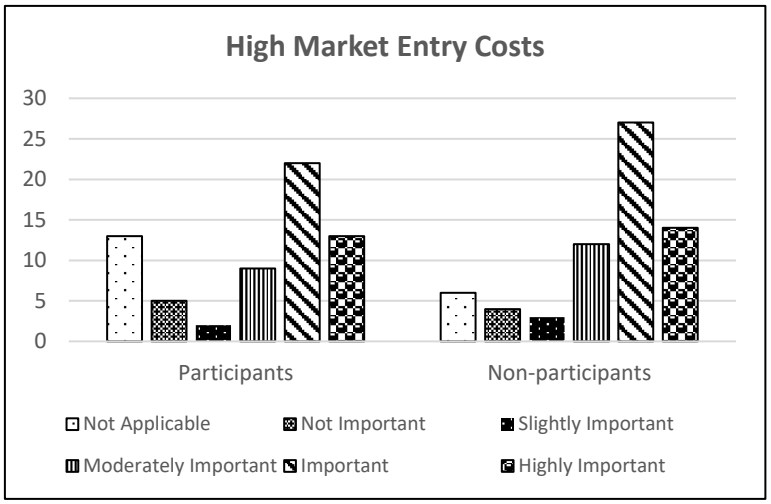


Figure 65: Importance of High Market Entry Costs for participation (Source: Based on Survey Findings)

More than half of the participant firms (55%) and nearly two-thirds of the non-participant firms (62%) felt this was very important for participation (Fig 8). The non-participant firms also cited these high costs as the main deterrent for GVC participation as engaging in trade with firms abroad required a certain degree of market research and the cost was prohibitive for them.

A2.3.2. CAPITAL COSTS

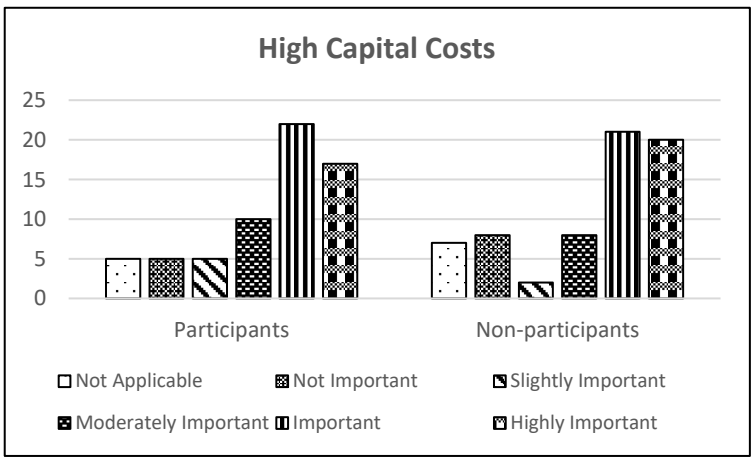


Figure 66: Importance of High Capital Cost for participation (Source: Based on Survey Findings)

Capital costs are the initial costs for setup that includes land, manufacturing plant, equipment, etc. and are very high for this sector. A majority of both participant firms (61%) and non-participant firms (62%) felt capital costs was a very important

determining factor for participation (Fig 9) and the high cost was in fact a deterrent to participation.

A2.3.3. GESTATION TIME

Electronics sector projects typically have long gestation time for setup, skilling and operations. Care also has to be taken that sufficient flexibility for producing diverse products is also present in the production lines. Such goals usually add delays between initiation of the project and commencement of production.

Majority of the respondent firms (56.5% in each category) felt that the long gestation time for projects was very important (Fig 10). Several firms, both participants and non-participants, have also cited that the inherent delays added due to infrastructural bottlenecks (like non-availability of electricity or proper roads), clearance procedures (like hindered availability of land) and workforce (like non-availability of critical skilled manpower) increased the gestation time and adversely affected participation in Electronics GVCs that demanded quick turnaround times.

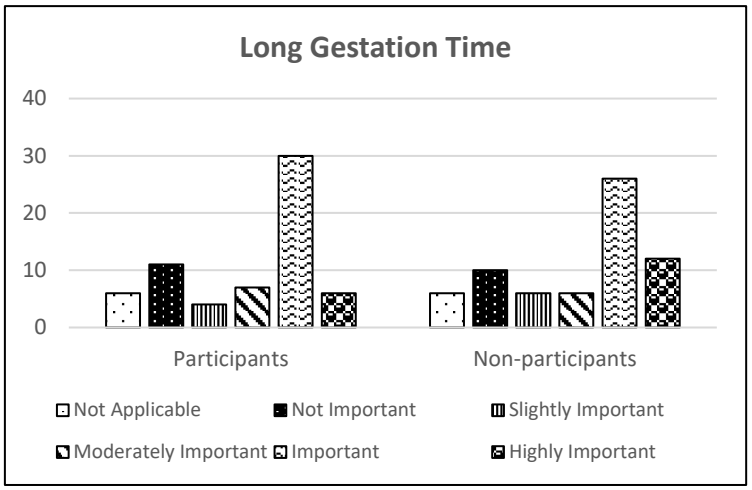


Figure 67: Importance of Gestation Time (Source: Based on Survey Findings)