Where Did We Come From? Where Do We Go?
India in Global Value Chains: Participation and Position

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DECLARATION BY STUDENT

I hereby declare that the data presented in this Dissertation report entitled, **"Where Did We Come From? Where Do We Go? India in Global Value Chains: Participation and Position"** is based on the results of investigations carried out by me in the Economics Discipline at the Goa Business School, Goa University under the supervision of **Dr B P Sarath Chandran** and the same has not been submitted elsewhere for the award of a degree or diploma by me. Further, I understand that Goa University or its authorities will not be responsible for the correctness of observations or other findings given the dissertation.

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COMPLETION CERTIFICATE

This is to certify that the dissertation report **"Where Did We Come From? Where Do We Go? India in Global Value Chains: Participation and Position"** is a bona fide work carried out by **Ms Adithi B N Sharma** under my supervision in partial fulfilment of the requirements for the award of the degree of **Master of Arts** in the Discipline of **Economics** at the Goa Business School, Goa University.

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PREFACE

The contemporary landscape of global trade is characterized by a dynamic interplay between nations and complex production networks known as Global Value Chains (GVCs). This dissertation is driven by a keen interest in understanding how emerging economies like India integrate into these intricate systems. The research investigates India's participation and position within GVCs over the period 2010 to 2022. By employing National Input-Output Tables (NIOTs) sourced from the Asian Development Bank, the analysis delves into crucial GVC indices such as Domestic Value Added in Exports (DVX), Foreign Value Added (FVA), and Forward and Backward Linkages. This exploration aspires to illuminate India's evolving role within the interconnected fabric of global trade, not only by examining its progress to date but also by identifying areas for potential future development. Ultimately, the dissertation aims to contribute to a more comprehensive understanding of India's strategic positioning within the dynamic realm of GVCs.

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Adithi B N Sharma

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ABBREVIATIONS USED:

Entity/ Full Form	Abbreviation
Asian Development Bank	ADB
Average Propagation Length	APL
Borin & Mancini	BM
Business Process Management	BPM
Domestic Value Added in Exports	DVX
Foreign Value Added	FVA
Gross Domestic Product	GDP
Global Value Chains	GVCs
Global Innovation Networks	GINs
Global Production Networks	GPNs
Gross VAlue Added	GVA
Input-Output Tables	IO-T
Information Technology	IT
Koopman, Wang and Wei	KWW
Multi-National Corporations	MNCs
Multi Regional Input-Output Tables	MRIO-T
National Input-Output Tables	NIO-T
Organisation for Economic Corporation and Development	OECD
Pure Double Counting	PDC
Research and Development	R&D
Trade in Value Added	TiVA
Trans-National Corporations	TNCs
United Nations Conference on Trade and Development	UNCTAD
Value Added in Exports	VAE
Value Added in Imports	VAI
Value Added Trade Balance	VATB
Vertical Specialisation	VS
World Integrated Trade Solutions	WITS
World Trade Organisation	WTO

ABSTRACT:

Global Value Chains (GVCs) are a linking platform between various production stages, across countries and continents. In a time when the world is a global economy, promoting trade in those sectors that each country specializes in, helps every party involved in the procurement, manufacturing, distribution, marketing, and other related services provided in the trade. Developing and under-developed countries can benefit from being involved in Global Value Chains and getting access to international markets to promote their trade activities. Taking the case of India, a country developing at a fast pace, this paper aims to identify the current scenario of India's Integration into GVCs through its GVC Participation, and identify which sectors have a strong position(s) and; what has been India's performance through exports and imports? The data is collected from ADB, OECD, Eora, RBI, UNCTAD, World Bank, and OECD TiVA (Trade in Value Added) database, among other sources.

Keywords: GVCs, India, Participation, Position, Trade in Value Added (TiVA), Forward Linkage, Backward Linkage, Upstreamness, Downstreamness, Input-Output tables

CHAPTER 1: INTRODUCTION:

INTRODUCTION:

"The ability to access and participate in Global Value Chains has become an important determinant of economic success in the 21st century." - David Dollar (2021)

Ever since opening its economy and integrating openly into international trade in 1991, India has been a key player in various sectors of trade and services. The country has come a long way on its path of development, emerging as one of the most powerful economies growing at a fast rate. This growth, undeniably, comes from an overall growth in a variety of sectors but it is also true that expanding trade in both goods and services, internationally, has benefitted India's image and played a key role in the country's economic achievements. Now, it is key to analyse what role India has played through its participation and what position it has secured for itself in the distribution of Global Value Chains around the world.

1.1 Background:

The Internet made the world a smaller place by means of 'communication', and International Trade did that through 'Linkages'. These linkages could be made because of the integration of regions and countries and the promotion of Free and Fair Trade, globally. Tracing its origins to the rise of Japan and the flying geese pattern of development in the East Asian region in the 1950s, GVCs can be simply understood as fragmentation and dispersion of economic activities, with different countries undertaking specialised tasks in the production of a final good (Trimmer,2014).

1.1.1 Value Chain Creation

The phenomenon of Global Value Chains (GVCs) marks a significant evolution in international trade and economic development strategies, transcending the traditional theories

of absolute and comparative advantage proposed by Adam Smith and David Ricardo, respectively. Smith's theory of absolute advantage explains how nations can benefit from trading if they can produce goods with fewer resources than other nations. Meanwhile, Ricardo's theory of comparative advantage suggests that even if a country does not have an absolute advantage, it can still benefit from trade by specialising in the production of goods for which it has a relatively lower opportunity cost than its trading partners. The advent of GVCs has further nuanced these theories by highlighting how countries can integrate into the global economy through specialised segments of production processes.

GVCs initiated as multinational corporations began to dissect their production processes across borders, seeking to optimise costs and efficiency by leveraging comparative advantages of different countries. This fragmentation and geographical dispersion of manufacturing and services processes have enabled countries to participate in international trade more deeply, not just through the export of final goods but by contributing specialised intermediate inputs and services. As countries integrate into GVCs, they can significantly enhance their economic growth, diversify their export base, and accelerate technological learning and skill development among their workforce.

1.1.2 India's Role in Global Value Chains – An Historical Perspective

India’s trajectory within the Global Value Chains (GVCs) provides a compelling narrative of evolution, transition, and strategic repositioning in the global marketplace. Historically, India's economy was predominantly agrarian, with limited industrial activity and engagement in global trade being constrained by various factors including colonial legacies, restrictive trade policies, and a focus on self-reliance post-independence. The turning point came with the economic liberalisation policies initiated in 1991, aimed at integrating the

Indian economy with the global market by reducing trade barriers, encouraging foreign investments, and promoting exports.

In the immediate aftermath of these reforms, there was a noticeable shift in how India participated in GVCs. Initially, India's involvement was centred around low-end manufacturing and assembly operations in sectors such as textiles and garments, leveraging its abundant labour force. The success in these fields laid the groundwork for India's foray into more skill-intensive sectors. In particular, the Information Technology (IT) and IT-enabled services sector, marked India's ascent up the value chain, transforming the country into a global hub for software development and back-office operations.

The pharmaceutical sector further exemplifies India's evolving role in GVCs. Starting with the production of generic medicines in the 1970s, India has emerged as a significant player in the global pharmaceutical industry, contributing to both the R&D and manufacturing of drugs. Similarly, the automotive sector witnessed India becoming a pivotal part of the global supply chain, both as a manufacturer of auto-components and a destination for assembling vehicles for global markets.

India's entry into the global value chains can be traced back to the economic liberalization initiated in the early 1990s. The opening up of the Indian economy, coupled with reforms targeting the enhancement of competitiveness and integration with the global economy, paved the way for India's active participation in GVCs. Since then, India has increasingly positioned itself as an important player in various GVCs, notably in sectors such as textiles, pharmaceuticals, information technology services, and automotive components.

For developing countries, such as India, raising industrial employment has always been a policy challenge. The share of India's manufacturing sector in employment was virtually stagnant in the 1980s, but it grew in the 1990s following the trade liberalisation

reforms of 1991 (Goldar, 2000). The literature has traditionally captured the impact of integrating into value chains using trade data for manufacturing industries to construct ratios for export and import penetration. However, these ratios are riddled with problems of double counting, in which the value of an intermediate product is captured more than once while crossing international boundaries. The drawback of using such trade data is further highlighted in the present economic scenario wherein the share of trade in tasks is increasing and services are occupying an important position in value chains (Deardorff, 2011).

However, over the last decade, there has been a slow growth of manufacturing employment, giving rise to serious concerns. The services sector has fared better, with an increasing sectoral share in gross domestic product and total employment. Since September 2014, the Indian government has adopted the core policy initiative of Make in India in a national attempt to integrate into the global economy, productively. Following this, greater emphasis has been placed on foreign and local investments to transform India into a global manufacturing powerhouse. With the aim of improving employment rates and skill enhancement, this programme is considered to be a major step in further integrating India into the global economy, which is increasingly being defined by Global Value Chains (GVCs). With India launching national programs, such as Make in India (2014), to increase its participation in GVCs, understanding the manner in which trade occurs in GVCs and its employment effects is important. {Banga, 2016}. For a rapidly growing country like India, the services sector is an important contributor to the economy in terms of growth and exports. In fact, the rate of growth of services is much higher than that of manufacturing and overall GDP. India has witnessed services-driven growth since the early 1990s, after the deregulation and liberalisation of the economy. The sector grew at about 8 percent from 2012 to 2014, and at 10 percent between 2014 and 2016 (Economic Survey 2015–2016, Government of India).

The service sector growth rate in GVA currently stands at 9.1% as of FY23 (Economic Survey 2022–2023, Government of India).

1.1.3 GVC Access

Both the importance and efficiency of Global Value Chains were put to task when there were incidences of market failures that vastly impacted the global economy in the past years. Policy-makers were alerted to just how coordinated trade patterns are by the dramatic decline in global trade flows in the wake of the 2008 global financial crisis. Trade had never before been so responsive to plummeting income. Since then, new estimates suggest that around 80% of all trade takes place within the international production networks of transnational corporations (TNCs) which includes contractual relationships between firms; but around one-third of global trade is now estimated to be intra-firm trade – occurring within the ownership structure of a single firm, or TNC (UNCTAD, 2013) In more recent times, the COVID-19 pandemic which had lasting effects on all spheres of life globally, also had a significant impact on international trade. Companies worldwide started looking more intensively, at diversifying their stages of procurement, manufacture, assembly, distribution, etc. in order to spread the possible risks that could arise.

Research on spillovers from MNCs overseas innovation activities has concentrated on competence spillovers and other externalities, rather than on capability building in indigenous firms or the consequences of re-organizing the innovation process in MNCs for supplier capabilities. The GVC approach has the merit of bringing buyer–supplier relations and the role of emerging country firms into the debate on the globalisation of innovation. However, as many lead firms are MNCs that have relocated innovation activities in emerging economies, the GVC approach is less useful for understanding the possible dynamic interactions between intra- and inter-firm linkages. The merit of the recent Global Innovation

Networks (GINs) and Global Production Networks (GPNs) literature lies in the creation of a morphology of global networks devoted to innovation in and of itself as well as in production. (Lema et al., 2015).

Countries and sectors can be linked to each other in the GVC through backward, forward, or total linkages. The backward linkage of a sector measures the inducement to production in other sectors, which is absorbed as an input to the former. On the other hand, a sector's forward linkage measures the extent to which it provides inputs for utilisation by other sectors. The sectors with the highest total linkages are referred to as the key sectors (Pattnayak & Chadha, 2019).

Past studies have shown that despite India's steady efforts to open up its economy, its trade and investment regime remains restrictive relative to other countries at similar levels of development. While the nation's vibrant export oriented services market is relatively open in certain sectors (computer, audio-visual and engineering), there is ample room for improvement in others, including basic infrastructure, legal and air transport services. It should also be noted that GVC participation leads to job creation in developing countries, provided it occurs with increased and high-skill value addition. Hence, to substantially gain from GVCs, India needs an education system that focuses on skill development, prudent competition policy, tax system, and intellectual property laws. Similarly, regulatory reforms need to be accelerated, particularly in services such as telecommunication, transport, courier, banking and insurance. (Lema et al., 2015)

The existing literature on GVCs is extensive, with a growing body of work focusing on how countries integrate and upgrade within these chains. Previous research has explored the determinants of GVC participation, the impacts of GVC integration on economic development, and the policy interventions required to navigate the challenges and

opportunities presented by GVCs. However, there remains a need for deeper analytical insights into India's evolving position and participation in GVCs, especially concerning its top sectors and trading partner countries.

With this background, the study aims to find out, the position India has, in Global Value Chain Integration, in recent years, which are the sectors that make India stand out in the International Market, which countries do these sectors trade with, and what opportunities lie ahead, in the coming years.

1.2 Aims and Objectives:

The research aims at achieving the following two major objectives:

i. Participation: To visualise India's Participation in GVCs
ii. Position: To identify India's position in the Global Value Chains

1.3 Research Question:

i. What is India's degree of participation in GVCs?
ii. What is India's position in GVCs?

1.4 Scope:

This research on the topic of "Impact of Policy Reforms on India's Participation in Global Value Chains: Where We Are & Where Can We Go" aims to look at the current position of India in GVC Participation, the recent developments in the country's integration into Global Value Chains, what factors have played key roles, which sectors of the economy have contributed the most and which sectors can improve their participation. The study aims

to be useful to anyone who wishes to analyse India's GVC pattern; and contribute to the existing knowledge pool.

1.5 Limitations:

i. The study is being conducted with limited access to resources because some data is not freely available to the general public.
ii. Most international and some national data is behind a paywall, adding financial constraints to the field of study.
iii. The study is time-bound to approximately ~6 months.
iv. Data availability through the years of study may not match across different databases causing a lack of uniformity in the data structure.
v. The software used is unpaid and thus its functionality is limited.

1.6 Chapter Scheme:

Chapter 1: Introduction, Objectives and Methodology

Chapter 2: Literature Review

Chapter 3: India in Global Value Chains

Chapter 4: Analysis

Chapter 5: Findings and Conclusion

CHAPTER 2: LITERATURE REVIEW

REVIEW OF LITERATURE:

2.1: Introduction:

The scholarly investigation into Global Value Chains (GVCs) brings forth a multitude of perspectives that collectively elucidate the intricacies of global production, trade dynamics, and economic development. Central to understanding these multifaceted dimensions is the evolving role of nations like India within the GVC framework. This literature review delves into an expanded corpus of twenty-eight seminal and recent publications, systematically unravelling the theoretical constructs, empirical findings and critical evaluations that shape our comprehension of GVCs.

2.2: Literature Review:

Gereffi, Humphrey, and Sturgeon (2005) lay the groundwork with their seminal discussion on the governance of GVCs, identifying the power dynamics and control mechanisms within buyer- and producer-driven chains. This analytical lens is pivotal for dissecting how developing nations integrate into global markets through strategic positioning within these chains. Expanding on Gereffi's contributions, **Ponte and Sturgeon (2014)** delve into the environmental and social governance within GVCs, spotlighting the sustainability and ethical considerations that increasingly influence GVC participation and the strategic responses from nations like India.

Koopman, Wang and Wei (2014) (hereafter KWW) provide a useful accounting framework to decompose a country's aggregate gross exports into domestic value added (DVA), foreign value added (FVA) and pure double-counting (PDC) components. **Borin and Mancini (2017)** (hereafter BM) further provide accounting frameworks for such decomposition with respect to each trading partner and sector. (Chang & Nguyen, 2020)

Hummels, Ishii and Yi (2001) proposed the Vertical Specialisation (VS) index which measures the fraction of imported inputs used in a country's gross exports. This original definition could possibly include the country's domestic contents that were re-imported. **Chang & Nguyen, (2020)** modify the definition such that the VS index captures only the fraction of foreign contents (foreign value-added and foreign pure double-counted) in a country's gross exports. By the decomposition, the VS index for country s corresponds to:

$$VS_s = \sum_s r \neq s \ (FVA+PDC)/Exports$$

Borin and Mancini (2017) further added to the above the domestic contents in a country's gross exports that are absorbed by bilateral importers but only after additional processing stages abroad. These additional components may also be considered as contents involved in the GVC, as they are not traditional trade but cross-country borders more than once via the exporter's forward linkages. In sum, the GVC^{BM} index measures the fraction of gross exports that require more than one international shipment (and hence are not traditional trade) The modification by Chang and Nguyen (2020) give the following formulae for GVC^{BM} where s and r are bilateral importer countries and Es is the Exports of country s :

$$GVC^{BM}\ s = \sum r \neq s \ [E_s - (DVA_{sr} + FVA_{sr})]/E_s$$

The current measures for evaluating a country/industry's position in the GVC include the upstreamness index proposed by **Antràs, Chor, Fally and Hillberry (2012)** and **Fally (2012**), where a country/industry is considered by the index to be located relatively upstream if it is more distant from final demand (or if it sells a disproportionate share of outputs to relatively upstream industries). In a similar spirit, Fally (2012) and **Miller and Temurshoev (2017)** consider a country/industry to be relatively downstream if it is located farther away from its source of value-added (or if it buys a disproportionate share of inputs from relatively downstream industries). Conceptually, these two indices should move in opposite directions

if they provide a good measure of the absolute position of a country/industry in the GVC. However, **Antràs and Chor (2018)** find a counter-intuitive, positive correlation between the upstreamness and the downstreamness indices. In this chapter, we propose an alternative index to measure a country s's downstream ness as follows:

$$Ds = FC_S * / (FC_S * + DC_S * - T T_S *) = VS_S / GVC_S^{BM}$$

where F Cs∗ is country s's foreign contents in its gross exports (to all destinations indicated by ∗), while F Cs∗ + DCs∗ − T Ts∗ is the country's GVC-related exports (i.e., gross exports net of traditional trade, T Ts∗, while gross exports equal the sum of foreign contents, F Cs∗, and domestic contents, DCs∗). We may regard F Cs∗ as country s's backward linkages and DCs∗ − T Ts∗ its forward linkages in the GVC. Thus, a country is considered relatively downstream, if its GVC-related gross exports consist of relatively more backward linkages than forward linkages. Note that the definition above (the fraction of foreign contents in a country's GVC related gross exports) is equivalent to the ratio of the VS and GVC^{BM} mentioned above**.**

In a comparative perspective, Chang and Nguyen (2021) explore Singapore's integration into GVCs, offering valuable insights into the strategies and policies that have enabled Singapore to achieve a high level of value addition and maintain a competitive edge in the global market. While focusing on Singapore, the study provides critical lessons on the importance of strategic policy interventions, skill development, and innovation in enhancing GVC participation, which are pertinent to the Indian context as well **(Chang & Nguyen, 2020)**

Building on the empirical aspect, **Taglioni and Winkler (2016)** explore the determinants and impacts of GVC involvement for developing countries, emphasising the critical role of domestic policy environments in enabling effective integration and upgrading

within GVCs. This aligns with **Jha and Chaturvedi (2018)**, who advocate for nuanced policy frameworks to bolster India's engagement with GVCs, targeting both depth and value capture.

The significance of services in GVCs, especially in relation to India, is critically examined by **Krishna and Mitra (2016).** Their insights into the service sector's unique dynamics within GVCs highlight India's evolving comparative advantage beyond traditional manufacturing sectors. This thematic focus is complemented by **Jensen and Kletzer (2012)**, who assess the labour market implications of services offshoring, a subject profoundly relevant to India's GVC narrative due to its IT and software prowess.

Banga (2016) and Veeramani and Dhir (2019) contribute methodologically to the literature by advancing the quantitative analysis of GVC participation. Their works, offering a granular assessment of India's sectoral engagement and benefits from GVCs, enrich the empirical discourse with nuanced findings on value addition and upward mobility within global chains.

Antràs and Chor (2013) introduce the concept of Global Value Chain Contracts, unravelling the underlying contractual and institutional frameworks that orchestrate international production and trade. This perspective gains further depth with the inclusion of studies like NASSCOM (2020), which document the contractual intricacies and strategic alliances shaping India's success in IT and software services within GVCs.

Further broadening the discussion, **Amador and di Mauro (2015)** contextualise GVC participation within the macroeconomic landscape, providing a critical vantage point for situating individual country experiences, including India's, within global economic shifts. This macroscopic view is instrumental for interpreting the diverse pathways through which nations integrate and ascend within GVCs.

The social dimensions of GVC participation, particularly the labour market outcomes in developing countries, are meticulously examined by **Farole and Winkler (2014).** Their exploration into the employment and wage impacts of GVC integration offers essential insights into the socio economic ramifications for India, complemented by the focused inquiries into labour conditions by **Posthuma and Nathan (2010)**.

Recent contributions by **Kowalski et al. (2015)** further the quantitative assessment of GVC integration, introducing innovative metrics for gauging participation and position. Their methodology sheds light on evolving trends in global trade and production, offering a contemporary lens through which India's ongoing integration can be assessed.

The length of the GVCs is assessed through the "average propagation length" (APL). According to **Dietzenbacher and Romero (2007)** APL is one if there is a single production stage in the final industry and increases when inputs from the same industry or other industries are used. The index of the length of GVC is calculated as: $N_{i\,k} = u.\ (I - A)\text{-}1$, where $N_{i\,k}$ is the index for industry k in country i, u is the unit vector, I is the identity matrix and A is the Leontief inverse. The index is similar to the calculation of the backward linkage in the input-output literature. A distinction can be made between the domestic and the foreign production stages. **Fally (2011)** suggested that the distance to final demand be calculated using the concept of the length of the chain when looking forward. **(Ray & Miglani, 2018)**.

In her work titled "Impact of Global Value Chains on Employment in India" (2016), Banga provides an insightful analysis of the impact of GVCs on employment in India, capturing both the quantitative and qualitative dimensions of job creation and transformation as the country integrates deeper into global trade networks. The study emphasises the dualistic impact of GVC participation, highlighting the potential for job creation in certain sectors while underscoring the challenges of low-wage employment and the need for

upgrading skills and productivity to harness the full benefits of GVC integration **(Banga, 2016).**

Lema, Quadros, and Schmitz published an article on ‘Reorganising Global Value Chains and Building Innovation Capabilities in Brazil and India’, in 2015; delving into the comparative reorganisation of GVC distributions and the building of innovation capabilities in both Brazil and India. Their research sheds light on how these emerging economies are navigating the challenges and opportunities presented by GVCs to build up their innovation systems and move up the value chain. This work underscores the significance of fostering domestic innovation ecosystems as a critical element in securing a more beneficial position in GVCs. **(Lema et al., 2015)**

Pattnayak, Chadha, and an assistant professor at the Xavier School of Economics (2019) examine India's participation in the Global Services Value Chain, with a particular focus on the Information Technology and Business Process Management (IT-BPM) sector. Their findings illuminate the strategic moves and policy measures that have propelled India to a leadership position in the global IT-BPM landscape, demonstrating the potential of services GVCs as a driver of economic transformation**. (S. S. Pattnayak et al., 2019)**

Saon Ray and Smita Miglani’s 2018 book ‘Global Value Chains and the Missing Links: The case of Indian Industry’ comprehensively investigates into the "missing links" in India's engagement with GVCs critically evaluating the barriers and challenges that constrain the country's potential to leverage GVCs for industrial upgrading and economic development. This book provides a granular analysis of specific sectors, identifying key areas for policy intervention to enhance India's integration and upgrading within GVCs. **(Ray & Miglani, 2018)**

Lastly, Timmer et al. (2014) conceptualise the dissection of global production processes in their seminal work on "Slicing Up Global Value Chains". By offering a macro perspective on the fragmentation of production and the methodology to measure the participation and position of countries in GVCs, this study lays the foundation for understanding the economic and strategic imperatives of GVC integration. Their analytical framework and empirical findings contribute significantly to the discourse on global trade and production networks, offering insights that are directly relevant to understanding India's GVC participation **(Timmer et al., 2014)**

The academic discourse on Global Value Chains (GVCs) and their implications on the global economy, especially in the context of emerging economies like India, has been profound and multifaceted. Numerous publications have delved into the complex dynamics of GVCs, examining their impact on economic growth, employment, industrial organisation, innovation capabilities, and the positioning of countries within these chains. This discussion reviewed selected publications that significantly contribute to understanding the intricacies of GVCs and India's role therein.

These publications collectively enrich the understanding of GVCs, offering a tapestry of theoretical and empirical insights that are crucial for analysing India's evolving role and strategies within these global networks. The examination of these works sheds light on the multifaceted implications of GVC integration, not only for economic growth and industrial development but also for the broader objectives of employment creation, skill enhancement, and sustainable development in the face of shifting global trade dynamics.

In summarising such multifaceted literature on GVCs, it becomes evident that the complex interactions between governance structures, policy environments, sectoral

transformations, and socio-economic impacts underpin the dynamics of global trade, production, and economic development. The contributions reviewed provide a comprehensive foundation for understanding the nuanced mechanisms of GVC participation, the critical role of policy and institutional frameworks, and the unique challenges and opportunities faced by countries like India. This literature review sets the stage for a deeper exploration of India's past, present, and future engagements with GVCs, informed by a rich theoretical and empirical backdrop.

2.3: Research Gap:

Despite the wealth of literature examining Global Value Chains (GVCs) and India's participation therein, a notable gap persists in comprehensive, panoramic understanding. Predominantly, existing research has concentrated on dissecting India's involvement within specific sectors of the GVC, such as textiles, IT services, or pharmaceuticals, offering valuable but fragmented insights. While the reviewed publications provide comprehensive insights into the dynamics of Global Value Chains (GVCs) and India's participation and positioning within them, certain gaps and areas for further research emerge. A critical examination of the existing literature reveals a predominant focus on macro-level analyses and sector-wide studies, which, while invaluable, often overlook the micro-dynamics and firm-level strategies that underpin successful GVC integration. This omission underscores the necessity for a deeper exploration of how individual firms, particularly small and medium-sized enterprises (SMEs), navigate the complexities of GVC participation, including the barriers they face and the strategies they employ to overcome these challenges and climb up the value chain.

Similarly, studies have often zeroed in on particular aspects of GVC integration, such as economic impacts, labour market dynamics, or policy frameworks, without weaving these perspectives into an integrated narrative. Further, most studies have been conducted on data in a pre-coronavirus-pandemic world, and similar analyses has to be done in a post-COVID 19 era. This sectoral and thematic fragmentation, along with the time gap of before and after 2019, limits our capacity to capture a holistic view of India's engagement with GVCs, neglecting how various sectors interlink and influence each other within the broader GVC ecosystem.

Moreover, existing research extensively covers the quantitative aspects of India's GVC participation, such as trade in value-added terms and employment impacts. However, there is a noticeable scarcity of studies that critically analyse the qualitative impacts of GVC integration on India's economic structure, especially in terms of technological upgradation, skill development, and innovation capabilities at the firm level, especially in the more recent times after the impact of the COVID-19 pandemic. This represents a significant gap, given the pivotal role of technological and skills advancement in enhancing competitiveness and ensuring sustainable integration into GVCs.

Another observed research gap is the temporal analysis of India's GVC participation. While current literature provides snapshots of India's role in GVCs at specific points in time, there is a lack of comprehensive longitudinal studies that track the evolution of India's participation over time. Such analyses are crucial for understanding the changing dynamics of GVCs and India's adaptive strategies in response to global economic shifts, policy changes, and technological advancements.

Additionally, the role of policy interventions in facilitating or hindering GVC integration has been somewhat underexplored in the context of India. Existing works tend to

focus on broad policy recommendations without delving into the specifics of policy effectiveness, implementation challenges, and the interaction between domestic policies and international trade norms in shaping India's GVC engagement.

By addressing these gaps, this paper aims to contribute to a more nuanced understanding of India's participation and positioning in GVCs, especially post 2019. Specifically, it seeks to explore the micro-level dynamics of firm-level strategies, the qualitative impacts of GVC integration on innovation and skills development, the evolution of India's participation over time, and the role of policy in facilitating successful GVC engagement. This approach will not only add to the existing body of knowledge but also provide actionable insights for policymakers, industry stakeholders, and firms looking to navigate the intricacies of global value chains, the strength of interconnections between the participating countries, interdependency and ripple effects in times of global challenges.

CHAPTER 3: INDIA IN GLOBAL VALUE CHAINS; The Methodology

INDIA IN GLOBAL VALUE CHAINS

Global Value Chains (GVCs) represent the full range of activities that firms and workers perform to bring a product from its conception to its end use and beyond. This includes design, production, marketing, distribution, and support to the final consumer. The inception of GVCs can be traced back to the post-World War II era when economies started to recover and global trade began to intensify. However, it was not until the late 20th and early 21st centuries that GVCs gained prominence, accelerated by technological advancements, transportation and communication cost reduction, and the liberalisation of trade policies worldwide.

The idea of GVCs became increasingly popular as researchers and policymakers acknowledged the complex interdependencies and the dispersal of production processes across borders. This shift marked a departure from traditional trade theories which focused primarily on end products being traded between countries. Instead, GVCs emphasised how different stages of production could be spread across multiple countries, each adding value in the process of bringing a product to market.

India's participation and position in GVCs have evolved significantly, especially post the economic liberalisation of 1991. India embraced the GVC phenomenon by gradually integrating its economy with the global market, leveraging its comparative advantage in certain sectors to attract foreign investments and technology transfers. Measurements of GVC participation can be broadly classified into two categories: forward and backward linkages. Forward linkages refer to the domestic value-added content that is exported, while backward linkages measure the foreign value-added content in a country's exports. India's position in GVCs, thus, is a complex interplay of its increasing competence in both forward and backward dimensions across various sectors.

3.1: Methodology:

This paper adopts a comprehensive and systematic methodology to analyse India's engagement with GVCs. Firstly, the author utilises the National Input-Output Table of India from the Asian Development Bank's website, covering the period from 2010 to 2022. The analysis focuses on calculating the Domestic Value Added in Exports (DVX), the Foreign Value Added (FVA) component of exports, the Forward and Backward Linkages within GVCs, and the overall GVC Participation and Position Index. The formulae used for these calculations, both overall and sectoral, are as follows:

1. Domestic Value Added in exports (DVX)= Total Output - Imports
2. Foreign Value Added (FVA)= Total Exports - DVX
3. $Forward\ Linkages = \frac{Intermediate\ inputs}{total\ output} \times 100$
4. $Backward\ Linkages = \frac{\Sigma(intermediate\ inputs\ from\ other\ industries)}{total\ exports} \times 100$
5. $GVC\ Participation = \frac{(Forward\ Linkages + Backward\ Linkages)}{Exports} \times 100$
6. Value Added Trade Balance= (Value Added Exports - Value Added Imports)
7. $GVC\ Position = \frac{VATB}{GDP} \times 100$

These metrics will enable an in-depth evaluation of India's role and progress in GVCs, examining how various sectors and bilateral trade relationships with key partner countries have evolved. Through this methodology, this study aims to contribute significantly to the understanding of India's integration into GVCs, establishing a foundation for further informed policy suggestions and future research directions in this field.

Research Approach: A mixed methods approach is one in which the researcher tends to base knowledge claims on the pragmatic ground. It employs strategies that involve collecting data simultaneously or sequentially to understand research problems best. The data collection involves gathering both numeric information and text information so that the final database represents quantitative and qualitative information.

The first objective is achieved through sectoral contribution to forward and backward linkages in India's annual trade, from 2010 to 2022, and the results are presented through visual aids like graphs, charts and tables. The sectoral contribution is calculated through the Vertical Specialisation method given by Koopman, Wang And Wei, for a single country in its sectoral contribution in Global Value Chain Participation. (Koopman et al., 2012)

The second objection is achieved through the upstream-ness and downstream-ness of each key sector (S Pattnayak & Chadha, 2019) identified in a year and its contribution to Value Added Trade Balance, which is further used to calculate the Global Value Chain Position of India in each year.

As mentioned earlier, the study covers a period spanning 12 years from 2010 to 2022, for the purpose of identifying key sectors of India in International Trade and to analyse the pattern of movement in GVC Participation and Position over more than a decade. The primary source of data for this study, is from the Asian Development Bank, using the National Input-Output Tables of India, from 2010-2022. The Bank, in its data, divides the economy into 35 sectors; namely:

1. Agriculture, hunting, forestry, and fishing
2. Mining and quarrying
3. Food, beverages, and tobacco
4. Textiles and textile products
5. Leather, leather products, and footwear

6. Wood and products of wood and cork
7. Pulp, paper, paper products, printing, and publishing
8. Coke, refined petroleum, and nuclear fuel
9. Chemicals and chemical products
10. Rubber and plastics
11. Other nonmetallic minerals
12. Basic metals and fabricated metal
13. Machinery, nec
14. Electrical and optical equipment
15. Transport equipment
16. Manufacturing, nec; recycling
17. Electricity, gas, and water supply
18. Construction
19. Sale, maintenance, and repair of motor vehicles and motorcycles; retail sale of fuel
20. Wholesale trade and commission trade, except of motor vehicles and motorcycles
21. Retail trade, except of motor vehicles and motorcycles; repair of household goods
22. Hotels and restaurants
23. Inland transport
24. Water transport
25. Air transport
26. Other supporting and auxiliary transport activities; activities of travel agencies
27. Post and telecommunications
28. Financial intermediation
29. Real estate activities
30. Renting of M&Eq and other business activities

31. Public administration and defense; compulsory social security
32. Education
33. Health and social work
34. Other community, social, and personal services
35. Private households with employed persons

The I-O tables have been made use of, in this study especially because they eliminate the problem of double-counting the transaction of goods or services when crossing borders multiple times between nations. Since the author is making use of NIO tables, it makes the process of calculating the aforementioned metrics from the set of sectors, far simpler. This study makes use of data mostly in numeric form i.e, collected data from the National I-O Tables from ADB which is used to derive measures to calculate participation and position of the country in GVCs.

The paper also makes use of Qualitative data to establish the literature behind the quantitative approaches made use of. The Qualitative data for this research is sourced from articles published on various journals, book chapters, and research papers including The Journal of Economic Integration, Journal of Southeast Asian Economies, Elsevier Science Direct, and Elsevier Research Policy, among others. Meanwhile the Quantitative data is collected from databases of the ADB, World Bank, UNCTAD, RBI and other data sources.

3.2 Theoretical framework and empirical measurements

Understanding the dynamics of Global Value Chains (GVCs) involves dissecting the intricacies of international trade and production processes through diverse theoretical frameworks and empirical measurements. These models not only illuminate how value is created, enhanced, and distributed across different stages and actors within the chains but also

provide insights into the positioning and participation of countries in the global trade ecosystem.

One of the seminal theoretical frameworks that have been widely referenced in the context of GVC analysis is the *concept of "slicing up the value chain,"* (not to be misunderstood with the title of the book by Timmer et al.) which was articulated by Krugman (1995). This theory posits that the production process is fragmented across borders, where different segments of the production line are allocated to countries based on their comparative advantage, thereby maximising efficiency and reducing costs. This fragmentation and international dispersion of production processes underscore the essence of GVCs, emphasising the interdependency of global economies and the multifaceted nature of trade that transcends mere exchange of final products.

Empirically, GVC participation and position can be measured through several indicators, primarily focusing on value-added trade statistics. The most commonly used measurements include the Domestic Value-Added (DVA) content of exports, Foreign Value-Added (FVA) content of exports, and the GVC participation index. These indicators help in assessing the extent to which a country contributes to and benefits from GVCs, distinguishing between the value generated domestically and that added by other countries in the production chain.

In the context of India, empirical studies have applied these frameworks and measurements to gain insights into the country's role and evolution within GVCs. A case in point is the study “Global Value Chains and the Missing Links: A Case Study of Indian Industries” (Ray & Miglani, 2018), which explores the limitations and opportunities faced by Indian industries in integrating more deeply into GVCs. Further, the analysis presented in “Slicing Up the Value Chains”(Timmer et al., 2014) provides a conceptual understanding of

how countries like India can strategise to enhance their position in GVCs by leveraging their strengths and addressing the gaps identified in empirical assessments.

Comparative studies, such as “Singapore in the Global Value Chains” (Chang & Nguyen, 2020), offer valuable lessons on the strategies employed by other countries to enhance their GVC participation and position. By examining such comparative frameworks, policymakers and stakeholders in India can identify viable pathways to foster deeper and more beneficial integration into GVCs, leveraging empirical measurements to track progress and identify areas requiring targeted interventions.

In conclusion, India's journey within the global value chains is reflective of a strategic alignment with global production processes, where sector-specific advancements and sustained trade relationships underpin its evolving participation and position. The measurement and analysis of such engagement remain key to understanding the broader implications of GVCs for India's economic trajectory.

3.3 India in International Trade, thus far

To understand the sectors where India has historically shown considerable GVC participation, an analysis of its top 5 sectors from 2010 to 2022 reveals a dynamic and evolving landscape. Notably, the sectors that consistently emerge as front runners in India's GVC engagement include Information Technology (IT) and IT-enabled services, pharmaceuticals, textiles, automotive components, and gem and jewellry industries in the earlier years of the decade. These sectors have not only demonstrated robust growth but have also shown substantial integration into international production networks.

Simultaneously, India's trade relationships with its top 5 trading partner countries have been instrumental in shaping its GVC dynamics. These partnerships have been critical

in providing access to key markets, sourcing inputs for domestic industries, and facilitating technology exchanges. Countries such as the United States, China, the United Arab Emirates, Saudi Arabia, and Singapore have remained significant in this context, with each playing a vital role in the continuous reconfiguration of India's GVC participation.

Previous studies around the world and in India have adopted various methodologies to assess the extent and nature of GVC participation. These include the use of national input-output tables to compute direct and indirect value-added exports, the employment of trade in value-added (TiVA) indicators developed by the OECD, and the application of the Eora global supply chain database. Such works have offered valuable insights into sector-specific GVC activities, the impact of trade policies on GVC integration, and the implications of GVC participation for economic development and employment.

India's GVC participation has not been without challenges. Issues such as infrastructure bottlenecks, regulatory hurdles, and skill mismatches have posed persistent barriers to further integration and upgrading within GVCs. Despite these challenges, India continues to strategise and adapt its policies to enhance its GVC participation, aiming towards not just deeper integration, but also towards moving up to higher value-added activities in its quest for economic growth and development.

3.3.1 The Statistics of India

The Gross Domestic Product of India for the time period of 2010-2022 is given on the following graph:

Figure 3.1: India's GDP from 2010-2022 at current prices (in billion US $)

Source: IMF- World Economic Outlook Database October 2023

India's steady growth through its annual Gross Domestic Product is shown here in Billion US$ from 2010-2022, in current prices. The GDP increased steadily from $1.7 trillion in 2010 to $2.7 trillion in 2018. This growth reflects India's economic boom during this period, fueled by factors like rising service industries, particularly information technology (IT) and business process outsourcing (BPO), which experienced significant growth during this time. This was driven by a global demand for skilled labor and India's large pool of English-speaking graduates (World Bank, 2023). Another possible reason could be the Indian government's implementation of various reforms to improve the business environment, such as simplifying regulations and investing in infrastructure. This made India more attractive to domestic and foreign businesses (IMF, 2023).

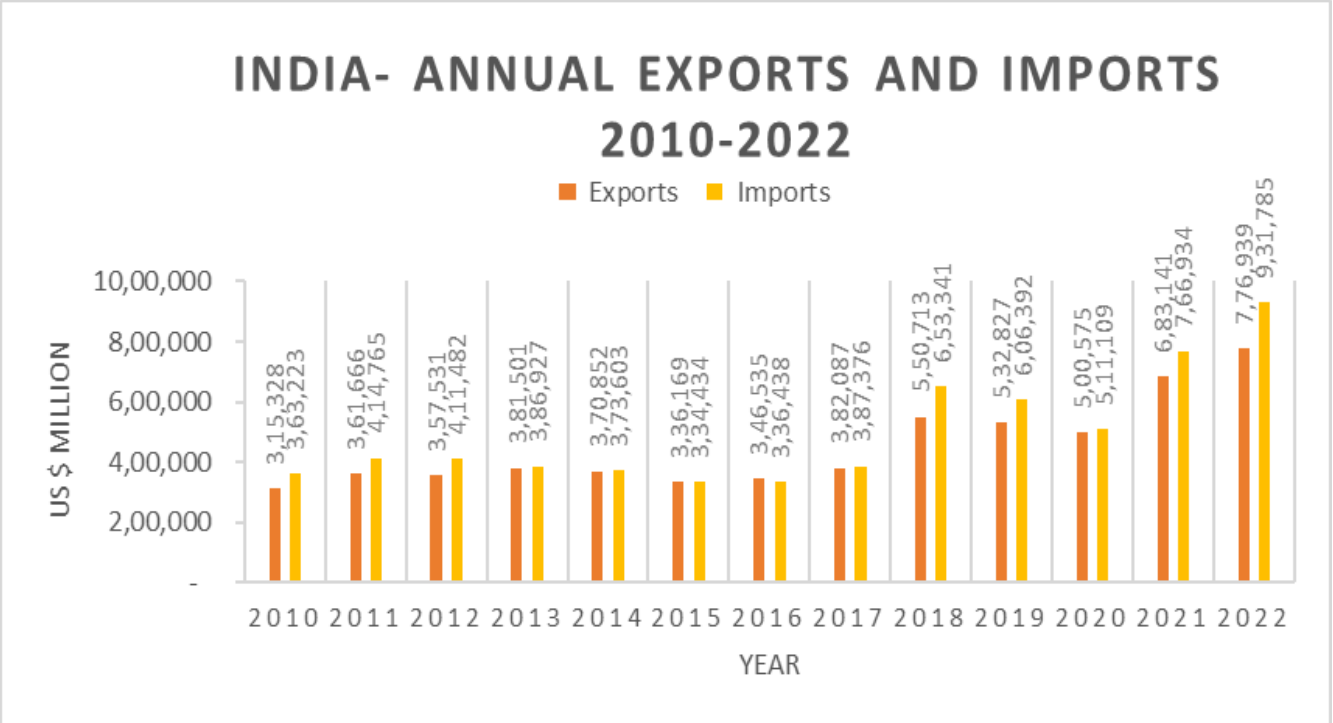
This period was followed by a slowdown in 2019 when India slowed slightly in GDP growth in 2019 to $2.8 trillion. This could be attributed to several factors, including the COVID-19 Pandemic which led to a global economic slowdown. The global economy weakened in 2019, impacting demand for Indian exports. (The Hindu Business Line, 2019). In the face of the pandemic was also the

situation of tightening financial conditions: The Indian central bank raised interest rates to curb inflation, which may have slowed down economic activity (RBI, 2019)

Followed by the only fall in GDP growth in a decade's time, in 2020; there has been a sharp growth towards 2021 and 2022. It was soon after the shock of the pandemic that the economy grew at such a rate, that India crossed the $3 trillion dollar mark in 2021. Despite a brief contraction in 2020 due to the COVID-19 pandemic, the GDP rebounded sharply in 2021 and 2022, reaching $3.4 trillion. This recovery can be partly explained by timely government stimulus. The Indian government introduced fiscal stimulus packages to support businesses and households during the pandemic. This helped to mitigate the economic impact of the lockdowns (KPMG, 2020). Another possible reason in addition to the stimulus packages would be the Country's resilient IT sector. The IT sector, a major driver of the Indian economy, remained relatively resilient during the pandemic as demand for its services increased due to the shift to remote work (Business Today, 2020).

Thus, India has been maintaining a steadily increasing growth rate over a decade and only continues to grow. An important part of a country's growth also come from its external trade and India's imports and exports for the same period can be seen in the graph below:

Figure 3.2: India's Annual Exports and Imports from 2010-2022, at current prices (in billion US $)



Source: ADB National Input-Output Tables 2010-2022

The graph above shows India's annual exports and imports in current prices from 2010 to 2022, with the y-axis representing the value in US million dollars, and the x-axis representing the year. Rising trends can be seen both in the exports and imports, though at different rates of their respective growths.

In exports, there seems to be a gradual increase throughout the period, with some fluctuations. Exports start at around $300 billion in 2010 and reach over $760 billion by 2022. Imports also appear to have an increasing trend, with some fluctuations. Imports start at around $360 billion in 2010 and reach over $930 billion by 2022.

Possible Reasons for the trends in exports could be due to several factors, including factors like growth of the service sector. India's service sector, particularly IT and business process outsourcing (BPO), has grown significantly in recent years. This sector contributes significantly to India's exports (World Bank, 2023). Another factor to be taken into account

would be new trade agreements that India has entered into in the past decade: India's participation in free trade agreements (FTAs) with other countries may have reduced trade barriers and boosted exports (Economic Times, 2023).

The increase in imports could be attributed to factors like rising domestic demand. India's economic growth has led to an increase in domestic demand for goods, including imports (IMF, [*india's gdp growth ON International Monetary Fund* imf.org], 2023). A factor that cannot be ignored while discussing growth in International Trade are the Oil Prices, internationally. Increased global oil prices have also contributed to increased imports, since India imports a significant amount of oil, global oil price hikes can significantly impact import figures (World Bank,, 2023).

Overall, the graph suggests a growth in both India's exports and imports over the period 2010-2022. This trend is likely linked to India's economic growth and its increasing integration with the global trade system.

However, the graph only shows the value of exports and imports, not the volume or composition of traded goods. Without this information, it's difficult to provide a more detailed analysis of the reasons behind the trends. Hence, in the next chapter, the author delves deeper into the annual data from National Input-Output Tables, which break down the contribution of each industry into India's external trade and value chain participation.

CHAPTER 4: ANALYSIS

ANALYSIS

4.1: Indian Industries around the World

With the background built up thus far, it is but evident that global value chains are a crucial component of the economy that is not national but global today, representing the intricate network of production and distribution processes that involve multiple countries. India's participation and position in global value chains have become increasingly significant in recent years as could be seen with the growth of India's international trade.

India actively participates in global value chains across various industries such as information technology, pharmaceuticals, textiles, and automotive. The goods and services produced by Indian industries play a vital role in these chains by contributing to different stages of production and adding value through innovation and cost-efficiency. Through their participation, Indian industries have been able to expand their reach globally, tapping into new markets and gaining access to resources.

Currently, India holds a notable position in global value chains compared to other countries, leveraging its skilled workforce and competitive advantages in certain sectors. However, challenges such as infrastructure bottlenecks, complex regulations, and limited technological capabilities hinder its full potential.

Imports and Exports however, do not capture the GVC participation of a country. They need to be fragmented to know the various metrics like Forward and Backward Linkages, Domestic value Added in Exports (DVX) and Foreign Value Added (FVA) etc to know what the imports and exports are comprised of. The author now breaks down into calculating such metrics for annual data collected from the national input-output tables provided by the Asian Development Bank. The Author also delves deep into the top 5

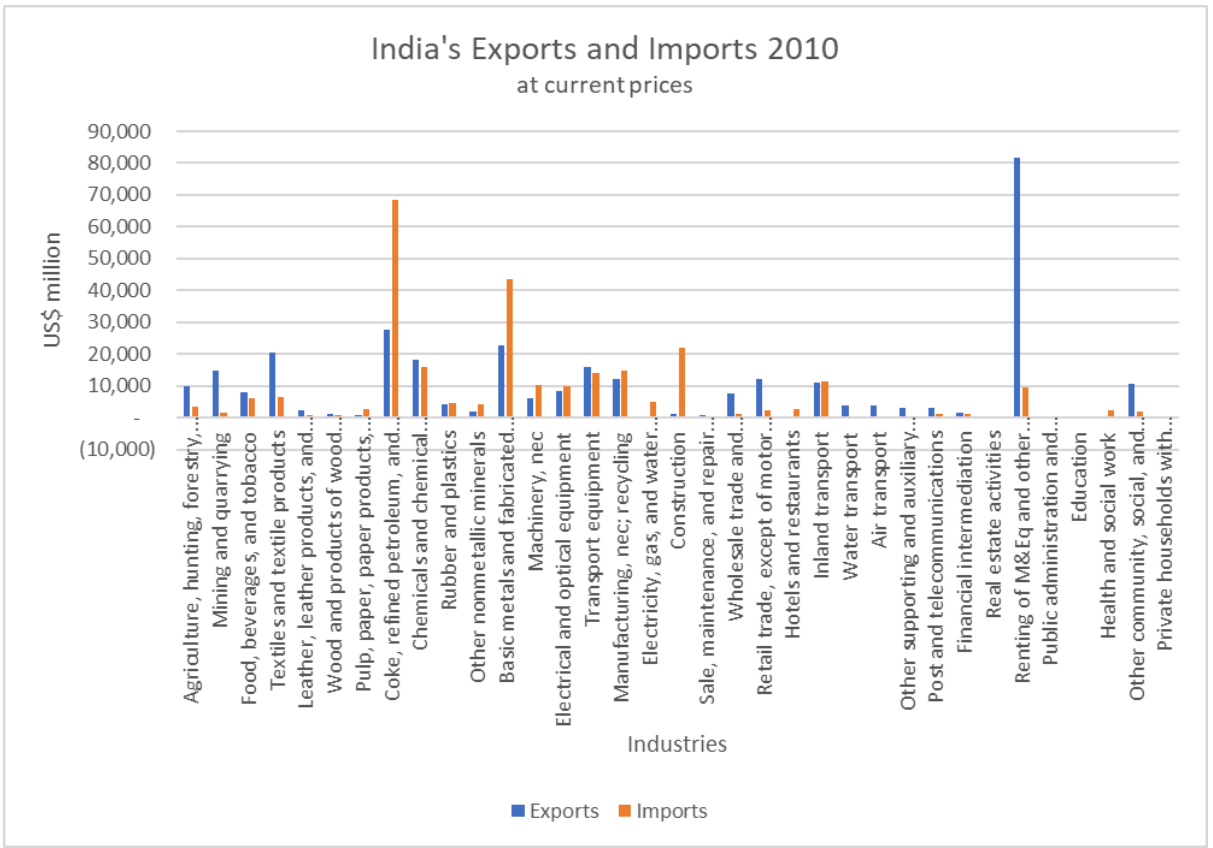
Exporting and Importing industries of India, each year, which together give the position of India in GVCs for those sectors.

4.2: Metrics through the years

The following section deals with measuring each of the metrics; Domestic Value Added in Exports (DVX), Foreign Value Added (FVA), Forward Linkages, and Backward Linkages, across the 35 sectors listed by the Asian Development Bank in their National Input-Output Tables. The study begins from the year 2010 up until 2022, which is the latest year's data available on ADB's database, covering a total of 13 years of annual trade data.

I. Year: 2010

Figure 4.1: Exports and Imports of India in US $ Million (at current prices) 2010



Source: ADB National I-O Table 2010

The above graph shows India's International Trade data in terms of Exports and Imports by the 35 industries in million US Dollars. This data is used further to derive the top 5 Importing and Exporting Industries in the country and derive their GVC participation and position. As can be seen in the graph, the top 5 Exporting Industries of India in 2010 were Renting of M&Eq (Machinery and Equipment) and other business activities(30) at the highest, followed by Coke, Refined Petroleum and nuclear fuel (8), Basic metals and Fabricated metals(12), Textiles and Textile Products(4) and Chemicals and Chemical Products(9). It is easily seen that there exists a vast gap between the first highest exporting industry (Renting of M&Eq and other business activities) and the second in order. This shows how heavily India's Services sector, especially in the IT and Business Process Management, drives the country's participation in International trade as was also proven by (Pattanayak et. al. 2016) The Country's Imports for the same year came mainly from Coke and Refined Petroleum(8), Basic Metals and Fabricated metal(12), Construction(18), Chemicals and Chemical Products(9), and Manufacturing, NEC(Not Elsewhere Classified); Recycling(16). Again, a gap can be seen between the highest importer and the rest of the importing industries. Using these Trade figures, further metrics can be calculated as given below.

Table 4.1:India's Forward Linkages, Backward Linkages, DVX and FVA (35 industries) 2010

Industry	forward linkages	backward linkages	DVX	FVA
Agriculture, hunting, forestry, and fishing	24.29090541	12.68486423	369410.9366	-359358.0183
Mining and quarrying	20.21593538	3.198492346	55826.79098	-40974.30975
Food, beverages, and tobacco	86.96096124	25.43884596	168447.4674	-160332.2284
Textiles and textile products	76.69372199	24.64249448	117800.8688	-97508.74759
Leather, leather products, and footwear	78.72255454	2.238586689	11964.59369	-9502.435711

Wood and products of wood and cork	64.05981392	1.384155288	14401.27406	-13398.79501
Pulp, paper, paper products, printing, and publishing	72.70588683	5.231294871	26079.3082	-25147.71996
Coke, refined petroleum, and nuclear fuel	78.61971406	15.45611998	80597.15631	-52919.05497
Chemicals and chemical products	74.21027828	22.52047578	103241.6312	-85192.72135
Rubber and plastics	75.19121821	8.448819587	39540.10282	-35494.20261
Other nonmetallic minerals	64.66825366	8.260501395	42787.22567	-40782.13508
Basic metals and fabricated metal	75.52142349	40.57484708	183516.5001	-160934.3198
Machinery, nec	72.39198486	12.19785109	57042.60925	-50820.44345
Electrical and optical equipment	73.95488322	14.7000214	66156.94888	-57952.01506
Transport equipment	76.72297123	20.29707979	87726.55433	-71674.05805
Manufacturing, nec; recycling	76.92839764	11.71721693	53589.3595	-41418.93564
Electricity, gas, and water supply	55.88455077	9.440390695	57237.44589	-57234.5386
Construction	62.03369229	62.33185154	342085.9485	-340898.6518
Sale, maintenance, and repair of motor vehicles and motorcycles; retail sale of fuel	15.40953163	0.623828133	13712.82884	-12755.61454
Wholesale trade and commission trade, except of motor vehicles and motorcycles	15.40953162	4.846747782	106539.9575	-99103.01108
Retail trade, except of motor vehicles and motorcycles; repair of household goods	15.40953159	7.914399292	173972.2808	-161828.2606
Hotels and restaurants	66.58351015	9.413731294	68589.54121	-
Inland transport	52.86379733	30.72019224	199695.614	-188508.1072
Water transport	35.02227781	0.291282734	3389.179786	405.9472564
Air transport	47.36929066	0.539403138	4035.784476	-388.6920525
Other supporting and auxiliary transport activities; activities of travel agencies	38.91422573	1.401642518	12020.14229	-9038.694194
Post and telecommunications	22.39675439	1.300639278	22014.94504	-19112.07472
Financial intermediation	16.82336608	5.378990666	107473.8897	-105821.9493
Real estate activities	8.755299651	2.746228094	100415.3096	-100402.149
Renting of M&Eq and other business activities	30.38152755	7.329580321	98022.01404	-16162.37406

Public administration and defense; compulsory social security	0.037366883	0	129541.8941	-129493.3779
Education	10.00558791	1.993518717	68971.7572	-68967.28238
Health and social work	35.35169544	3.541055459	36475.66881	-
Other community, social, and personal services	17.78250581	2.077467213	46104.65142	-35316.118
Private households with employed persons	-	0	0	

Source: Author's Calculations from ADB India's NIOT 2010

As can be seen in the table above, India has quite a few significant Forward and Backward Linkages. These are calculated as a percentage of intermediate inputs in each sector; out of the total output of that sector for forward linkages and out of total exports for backward linkages, and is multiplied by 100. The DVX and FVA are in absolute values as the difference in Intermediate Inputs from Total Inputs of that sector would give the Domestic Value Added and the difference of DVX from Total Exports of the sector would give the Foreign Value Added. The significant Industries in terms of Forward Linkages are Food, Beverages and Tobacco(3), Leather, Leather Products and footwear(5), Coke Refined Petroleum and Nuclear Fuel(8), Manufacturing, NEC, and Recycling(16) and Transport Equipment(15). In Backward Linkages, some of the major industries are Construction(18), Basic Metal and Fabricated Metal(12), Inland Transport(23), Food, Beverages and Tobacco(3), and Textiles and Textile Products(4). The industries that contribute highly to Domestic Value Added, and into Exports are Agriculture, Hunting Forestry, and Fishing(1), Construction(18), Inland Transport(23), Basic Metal and Fabricated Metal(12), and Retail Trade except of motor vehicles and motorcycles and repair of household goods(21). It can be noted that it is industries like water transport (24), Air Transport (25), Other supporting and auxiliary transport activities; activities of travel agencies(26), Leather, Leather Products and Footwear (5), and Sale, Maintenance, and repair of motor vehicles and motorcycles, retail sale of fuel (19) that have some of the significant contributions from Foreign Value Added.

Table 4.2: GVC Participation of India in 2010, through major 5 Exports and Imports

Export 5	GVC Participation	Import 5	GVC Participation
Renting of M&Eq and other business activities	0.04607	Coke, refined petroleum, and nuclear fuel	0.33989
Coke, refined petroleum, and nuclear fuel	0.33989	Basic metals and fabricated metal	0.51411
Basic metals and fabricated metal	0.51411	Construction	10.47468
Textiles and textile products	0.49939	Chemicals and chemical products	0.53594
Chemicals and chemical products	0.53594	Manufacturing, nec; recycling	0.72837
Total GVC Participation	1.93539		12.59299

Source: Author's Calculations

The table above shows the GVC participation of the top 5 Exporting and Importing Industries. This figure is calculated by adding the forward and backward linkages of a sector and dividing the sum by the exports of that sector before multiplying by 100. Using this way, the author can arrive at numbers that show how integrated that particular industry is, into the GVC of that sector. It is noticed that even though the industries are ranked in the order of highest exports and imports, the order is not the same when it comes to GVC participation. Chemicals and Chemical products, though is the 5th highest exporting industry, has a higher GVC participation than Renting M&Eq and other business activities that are the highest when it comes to exporting in India. Similarly, Construction has a much higher rate of participation in GVC than Coke, Refined Petroleum, and Nuclear Fuel. The total GVC Participation through exports was 1.94% and through Imports was 12.59%.

Table 4.3: India's GVC Position in 2010 through the top 5 Exporting and Importing Industries

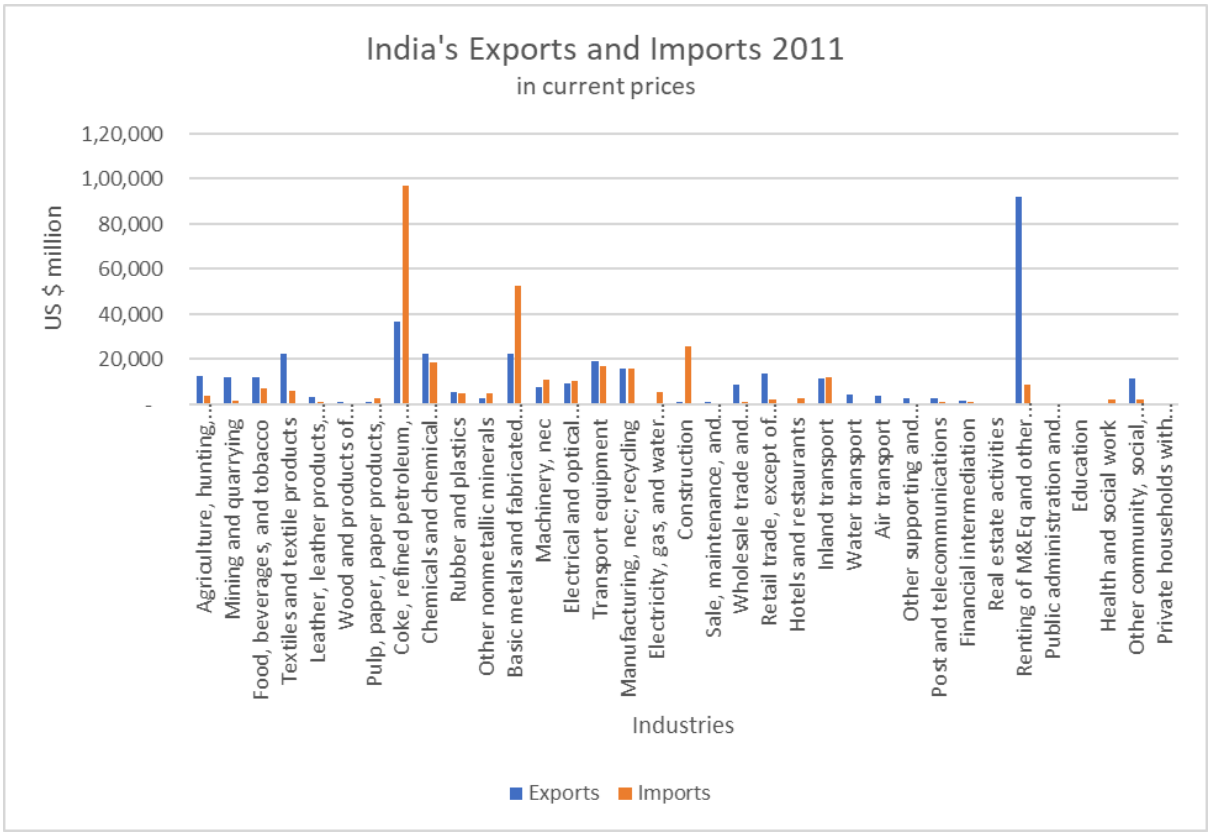
GVC Position	
VAE= total DVX of exporting industries	583178.17
VAI= total DVX of importing industries	763030.60
VATB=VAE-VAI	-179852.43
GDP=	1708460.00
GVC Position= (VATB/GDP)*100	-10.53

Source: Author's Calculations

The above table analyzes India's GVC Position through the DVX of the top five exporting and importing Industries; first to find the Value Added in Exports (VAE) and Value Added in Imports (VAI) to arrive at Value Added Trade Balance (VATB). By dividing VATB by the GDP of 2010, and multiplying the figure by 100, we get the Position India had in GVCs back in 2010. The value of -10.53 indicates that India was in a significantly downstream position, possibly because of the higher imports than exports.

II. Year: 2011

Figure 4.2: Exports and Imports of India in US $ Million (at current prices) 2011



Source: ADB National I-O Table 2011

The graph above shows the Quantity of Exports and Imports of India in million US $ in 2011, at current prices. As can be inferred from the figure, Renting of M&Eq and Other business activities(30) continues to be the highest exporter, followed by Coke, Refined

Petroleum and Nuclear fuel(8), Textiles and textile products(4), Basic Metals and Fabricated Metals(12) and Chemical and Chemical Products(9) in that order. Among the Industries that constitute the top 5 Importers of India are Coke, Refined Petroleum and Nuclear fuel(8) at the highest, Basic Metals and Fabricated Metals(12) comes second, Construction(18) at third, followed by Chemical and Chemical Products(9) and Transport Equipment(15). There still exists a substantial difference between the highest exporting industry and its subsequent ranking industries as well as the highest importing industries and its subsequent rankings.

Table 4.4: India's Forward Linkages, Backward Linkages, DVX and FVA (35 industries) 2011

Industry	forward linkage	backward linkage	DVX	FVA
Agriculture, hunting, forestry, and fishing	23.74994485	12.45002397	409925.1771	-397314.7678
Mining and quarrying	20.13558625	2.999611806	59683.78698	-47520.83879
Food, beverages, and tobacco	86.87460432	28.11998339	207409.6864	-195410.5897
Textiles and textile products	78.01824634	22.02939119	119653.1946	-96961.97678
Leather, leather products, and footwear	79.05233092	2.91043048	15610.20437	-12123.34005
Wood and products of wood and cork	62.51812742	1.276031684	15285.98437	-14075.20605
Pulp, paper, paper products, printing, and publishing	75.14502992	5.395363312	29596.60788	-28577.26094
Coke, refined petroleum, and nuclear fuel	83.56191913	18.20023859	97847.92998	-61019.21385
Chemicals and chemical products	72.64473926	24.88151528	133289.6789	-110713.4842
Rubber and plastics	78.38419485	8.933348744	45471.04568	-40184.94994
Other nonmetallic minerals	64.75916569	8.466086754	50106.21809	-47541.15612
Basic metals and fabricated metal	74.08865334	41.70091072	222047.0071	-199405.4317
Machinery, nec	71.35583884	11.34887624	61977.29343	-54502.88636
Electrical and optical equipment	74.10490403	12.28149629	63619.82881	-54199.79367
Transport equipment	77.55348054	21.51602697	105368.9013	-86295.51397
Manufacturing, nec; recycling	78.26402112	12.54262546	63650.60414	-47702.76101

Electricity, gas, and water supply	55.92871159	9.199307955	63863.46839	-63860.51521
Construction	62.08933483	64.69500756	405713.6588	-404755.1957
Sale, maintenance, and repair of motor vehicles and motorcycles; retail sale of fuel	15.42331128	0.633400724	15720.53111	-14620.11666
Wholesale trade and commission trade, except of motor vehicles and motorcycles	15.42331123	4.921120721	122138.527	-113589.0042
Retail trade, except of motor vehicles and motorcycles; repair of household goods	15.42331125	8.035845093	199443.6511	-185482.8731
Hotels and restaurants	66.5610874	9.789670416	79907.14909	-79701.91403
Inland transport	53.05187068	31.3888736	231055.8545	-219665.2899
Water transport	34.02091931	0.301360727	3924.072114	363.2969143
Air transport	47.37771166	0.558988295	4694.08531	-1086.114431
Other supporting and auxiliary transport activities; activities of travel agencies	38.62858284	1.421252671	13868.51254	-10969.42234
Post and telecommunications	22.30864821	1.194278838	24058.68469	-21343.05764
Financial intermediation	16.83514549	5.463974748	124079.9049	-122517.376
Real estate activities	8.897473476	2.840980849	117098.284	-117084.6825
Renting of M&Eq and other business activities	30.41018278	8.507224106	121922.1481	-30002.0317
Public administration and defense; compulsory social security	0	0	147433.8027	-147433.8027
Education	10.01435989	2.001424981	77896.60037	-77896.60037
Health and social work	35.38567307	3.276043244	38279.32031	-38279.31645
Other community, social, and personal services	18.04989755	2.087325546	50869.94777	-39372.46366
Private households with employed persons	-	0	0	

Source: Author's Calculations from ADB India's NIOT 2011

The above calculations show India's Forward Linkages, Backward Linkages, Domestic Value added in Exports (DVX) and Foreign Value Added (FVA) in the 35 industries as specified in the National Input-Output Table of Asian Development Bank, for

the year 2011. The industries with significant forward linkages are Food, Beverages and Tobacco(3), Coke Refined Petroleum and Nuclear Fuel(8), Leather, Leather Products and footwear(5), Rubber and Plastics(10) and Manufacturing, NEC, and Recycling(16). Important Backward Linkages come into the country through Construction(18), Basic Metal and Fabricated Metal(12), Inland Transport(23), Food, Beverages and Tobacco(3), and Chemical and Chemical Products(9). The DVX in 2011 was mainly through Agriculture, Hunting Forestry, and Fishing(1), Construction(18), Inland Transport(23), Basic Metal and Fabricated Metal(12) and Food, Beverages and Tobacco(3). A similar trend is seen in the Foreign Value Added with industries like water transport (24), Air Transport (25), Other supporting and auxiliary transport activities; activities of travel agencies(26), Leather, Leather Products and Footwear (5), and Sale, Maintenance, and repair of motor vehicles and motorcycles, retail sale of fuel (19).

Table 4.5: GVC Participation of India in 2011, through major 5 Exports and Imports

Export 5	GVC Participation	Import 5	GVC Participation
Renting of M&Eq and other business activities	0.04234	Coke, refined petroleum, and nuclear fuel	0.27631
Coke, refined petroleum, and nuclear fuel	0.27631	Basic metals and fabricated metal	0.51140
Textiles and textile products	0.44091	Construction	13.22788
Basic metals and fabricated metal	0.51140	Chemicals and chemical products	0.43199
Chemicals and chemical products	0.43199	Transport equipment	0.51941
GVC Participation	1.70295		14.96699

Source: Author's Calculations

GVC Participation through the top 5 Industries in Exports and Imports; for the year 2011 had a slight decrease through exports at 1.70% and saw an increase through imports at 14.97%. The top industries participating in GVCs were not seen in the top Exporting or Importing industries, However, most of the industries in the list saw an increased GVC

Participation. It should also be noted that these participation numbers are calculated as compared to the sector of the industry and not the Gross Exports or imports of the country.

Table 4.6: India's GVC Position in 2011 through the top 5 Exporting and Importing Industries

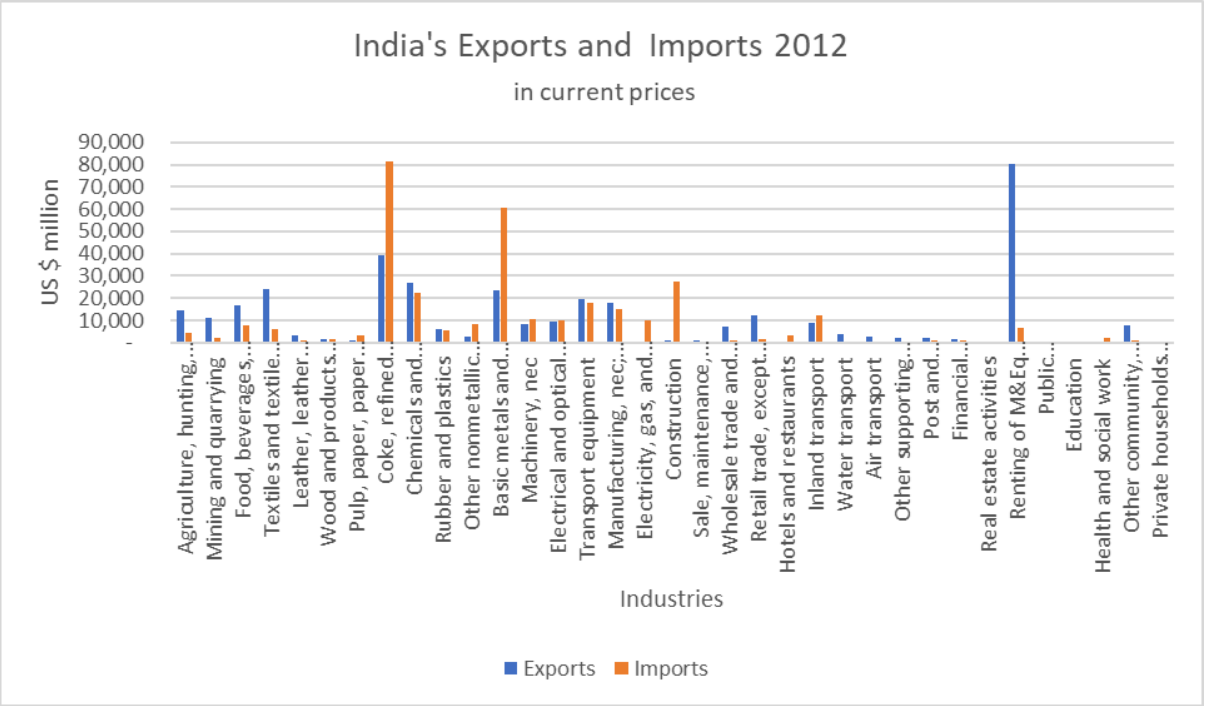
GVC Position	
VAE= total DVX of exporting industries	694759.9587
VAI= total DVX of importing industries	964267.1761
VATB=VAE-VAI	-269507.2174
GDP=	1823050
GVC Position= (VATB/GDP)*100	-14.78331463

Source: Author's Calculations

India saw a fall in its GVC position from -10.53 in 2010 to -14.78 in the year 2011. The Value in Trade Balance (VATB) was in a bigger deficit as compared to the previous year, because of a higher increase in the DVX of importing industries than the increase of DVX in the exporting industries. This slow growth of Domestic value Added in the country and its exports led to a further downstream position for India in GVCs.

III. Year: 2012

Figure 4.3: Exports and Imports of India in US $ Million (at current prices) 2012



Source: ADB National I-O Table 2012

India's Exports and Imports saw a similar trend in 2012 as in the past 2 years. The highest exporter was Renting of Of M& Eq. and other business activities whereas the highest importer was Coke, refined petroleum and nuclear fuel. The remaining four industries in the exporting sector were the same, with Chemicals and Chemical products switching places with Basic metals and fabricated metal to reach the 3rd position from the 5th. The importing 5 industries remained in the same order as the previous year. Still keeping a substantial gap between the first and the rest, the top exporter is still the services sector whereas the import nearly none of it. While there was a gap observed in the highest Importer as compared to the remaining four, in the past two years, in 2012, Basic Metals and Fabricated Metal(12) industry began catching up to Coke, Refined Petroleum and Nuclear Fuel(8). The further metrics were calculated as follows:

Table 4.7: India's Forward Linkages, Backward Linkages, DVX and FVA (35 industries) 2012

Industry	forward linkages	backward linkages	DVX	FVA
Agriculture, hunting, forestry, and fishing	24.35877058	12.91679323	398098.761	-383392.392
Mining and quarrying	22.0384974	3.148023265	57642.92663	-46498.18274
Food, beverages, and tobacco	86.54487358	25.44354699	183963.497	-167118.0008
Textiles and textile products	74.93434186	21.76095983	120746.5418	-96875.0266
Leather, leather products, and footwear	76.00384975	2.881045134	15758.39642	-12283.32905
Wood and products of wood and cork	58.12863252	2.244563711	26143.79601	-24362.54703
Pulp, paper, paper products, printing, and publishing	75.02428068	5.055807207	27175.84534	-26117.51028
Coke, refined petroleum, and nuclear fuel	78.80424251	9.625284609	65594.45321	-26137.79457
Chemicals and chemical products	74.34494569	23.14488316	120939.9328	-94107.39577
Rubber and plastics	78.49321078	8.650535177	43474.01587	-37596.49083
Other nonmetallic minerals	64.98843908	7.289198003	44756.80672	-42225.95087
Basic metals and fabricated metal	75.1412887	30.9639242	167503.5824	-144062.6504
Machinery, nec	69.17725759	9.935390484	56025.43081	-47804.52652
Electrical and optical equipment	72.82063615	11.47338579	60087.5491	-50591.34174
Transport equipment	75.98341511	20.39051738	101634.7655	-82189.4055
Manufacturing, nec; recycling	73.96737517	20.59101284	106241.5171	-88572.37209
Electricity, gas, and water supply	57.04050488	8.371545813	59944.42897	-59940.71962
Construction	61.68341019	57.89675066	362432.3717	-361644.2669
Sale, maintenance, and repair of motor vehicles and motorcycles; retail sale of fuel	15.0720125	0.658604004	16336.77635	-15391.62612
Wholesale trade and commission trade, except of motor vehicles and motorcycles	15.0720125	5.116934185	126926.3606	-119583.1474
Retail trade, except of motor vehicles and motorcycles; repair of household goods	15.07201248	8.355594745	207261.8477	-195270.8863
Hotels and restaurants	66.42668886	9.481764972	76809.15563	-76607.05332
Inland transport	52.18948628	31.31532751	232537.7315	-223595.9461
Water transport	35.85280002	0.269504892	3535.170234	467.156357

Air transport	19.73331793	0.227905878	4759.690021	-1805.635363
Other supporting and auxiliary transport activities; activities of travel agencies	36.40948414	1.304145052	13330.80072	-10960.74394
Post and telecommunications	21.16790949	1.129743766	23581.21954	-21318.43539
Financial intermediation	16.35518793	5.354537339	122688.4818	-121341.2696
Real estate activities	8.060484732	2.687387067	120520.4732	-120500.273
Renting of M&Eq and other business activities	29.35008892	8.645581752	121169.7494	-40635.61406
Public administration and defense; compulsory social security	0	0	139448.254	-139448.1213
Education	10.01938386	2.05157695	77642.43331	-77642.28613
Health and social work	35.22852325	3.278431729	38075.075	-38075.04803
Other community, social, and personal services	18.05387159	2.309903969	51365.45949	-43392.96753
Private households with employed persons	-	0	0	

Source: Author's Calculations from ADB India's NIOT 2012

From the above table of calculations it can be inferred that in the year 2012 the major contributors to forward linkages in India's GVC participation were Food, Beverages and Tobacco(3), Coke Refined Petroleum and Nuclear Fuel(8), Leather, Leather Products and footwear(5), Rubber and Plastics(10) and Manufacturing, NEC, and Recycling(16), whereas the backward linkages came from Construction(18), Basic Metal and Fabricated Metal(12), Inland Transport(23), Food, Beverages and Tobacco(3), and Chemical and Chemical Products(9). The DVX are mainly contributed by Agriculture, Hunting, Forestry, and Fishing(1), Construction(18), Inland Transport(23), Basic Metal and Fabricated Metal(12) and Food, Beverages and Tobacco(3). A similar trend is seen in the Foreign Value Added with water transport (24), Air Transport (25), Other supporting and auxiliary transport activities; activities of travel agencies(26), Leather, Leather Products and Footwear (5), and Sale, Maintenance, and repair of motor vehicles and motorcycles, retail sale of fuel (19).

Table 4.8: GVC Participation of India in 2012, through major 5 Exports and Imports

Export 5	GVC Participation	Import 5	GVC Participation
Renting of M&Eq and other business activities	0.04718	Coke, refined petroleum, and nuclear fuel	0.22412
Coke, refined petroleum, and nuclear fuel	0.22412	Basic metals and fabricated metal	0.45265
Chemicals and chemical products	0.36333	Construction	15.17313
Textiles and textile products	0.40507	Chemicals and chemical products	0.36333
Basic metals and fabricated metal	0.45265	Transport equipment	0.49561
GVC Participation	1.49234		16.70884

Source: Author's Calculations

India's GVC Participation through exports fell further by 0.21% to 1.49%, as compared to 1.70% of the previous year. On the other hand, Import participation in GVCs increased by 1.83% to 16.71% in the same year. However, the participation of each of the industries in both Exports as well as imports has increased as compared to the previous year. Construction(18) was still one of the leading GVC Participants in the country though it ranks below Coke, Refined Petroleum and Nuclear Fuel (8) and Basic Metal and fabricated metal (12) in terms of Imports. These figures give backing to the idea that construction plays an important role through its domestic value added in exports (DVX) as well as Foreign Value Added (FVA) and is a major contributor to the country's GVC Participation and Position.

Table 4.9: India's GVC Position in 2012 through the top 5 Exporting and Importing Industries

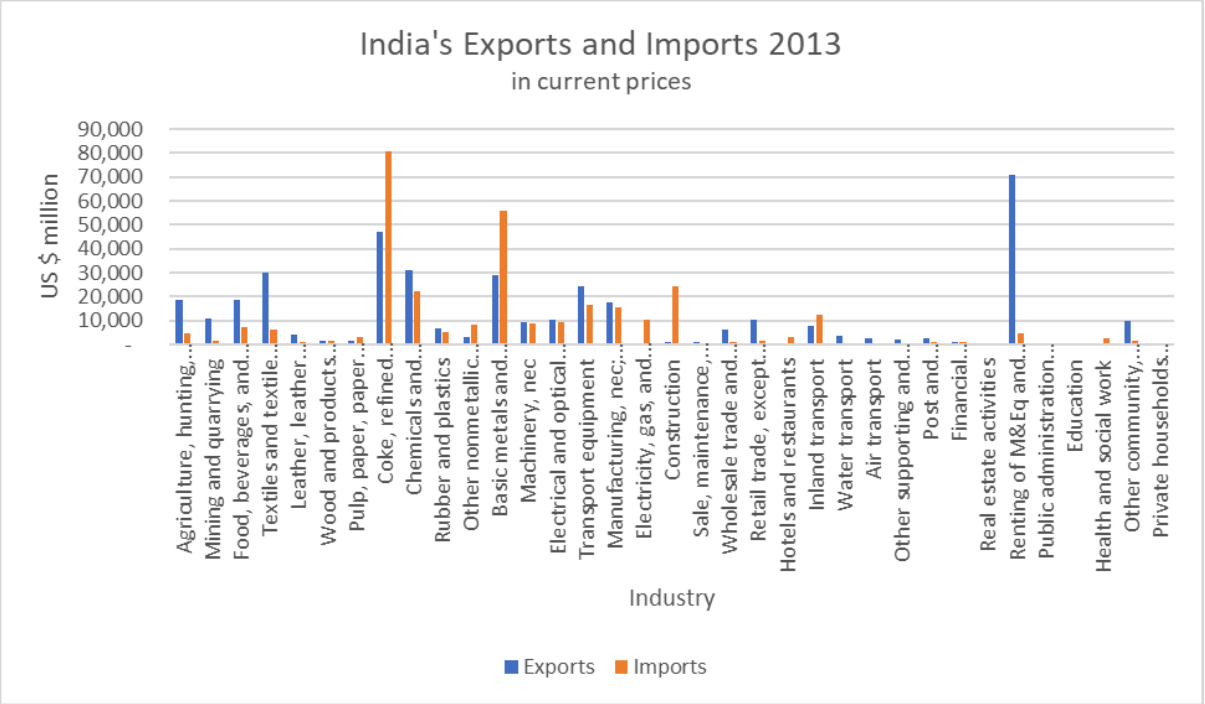
GVC Position	
VAE= total DVX of exporting industries	5,95,954
VAI= total DVX of importing industries	8,18,105
VATB=VAE-VAI	(2,22,151)
GDP=	1827640
GVC Position= (VATB/GDP)*100	-12.16

Source: Author's Calculations

The GVC Position analyzed for the year 2012 through the difference in Domestic Value Added of Exporting and Importing industries is given in the above table. Even though VAE increased in this year, VAI increased at a much higher rate. This gave a bigger gap in the VATB. However, this year's VATB was not as vast as the previous year, and due to the increased GDP in 2012, India could rise in its GVC Position as compared to 2011; from -14.78 to -12.16- a rise of 2.62. Though this GVC Position is still downstream, it is still a rise as compared to the previous year.

IV. Year: 2013

Figure 4.4: Exports and Imports of India in US $ Million (at current prices) 2013



Source: ADB National I-O Table 2013

The above graph shows what the exports and imports of India were in 2013, at current prices. It can be seen how the highest imports have overtaken the highest exports of the country which had been the leading industry in India's International Trade, i.e, Coke, Refined Petroleum and Nuclear Fuel(8) overtook Renting of M&Eq and Other Business Activities

(30). The other 4 industries in Export and Import each, have remained the same as in the previous years. It has been noted that since Coke, Refined Petroleum, and Nuclear Fuel(8) has been a part of both Imports and Exports, consistently and it participates more rigorously in GVCs; both through Forward as well as Backward Linkages; given its multifaceted nature of application.

Table 4.10: India's Forward Linkages, Backward Linkages, DVX and FVA (35 industries) 2013

Industry	forward linkage	backward linkage	DVX	FVA
Agriculture, hunting, forestry, and fishing	24.79762487	12.88893002	411505.5101	-392997.2835
Mining and quarrying	22.55319637	2.94333954	55788.14169	-44922.86951
Food, beverages, and tobacco	86.58626408	23.88517777	182318.2979	-163763.6246
Textiles and textile products	74.86183334	20.88128379	123751.0321	-93918.73632
Leather, leather products, and footwear	75.85147429	2.758803181	16129.23935	-11772.21081
Wood and products of wood and cork	58.11303933	2.111428261	24900.09296	-23110.12909
Pulp, paper, paper products, printing, and publishing	74.81172409	4.70764507	26956.93619	-25659.70607
Coke, refined petroleum, and nuclear fuel	77.81609947	8.690841262	65575.66034	-18559.6052
Chemicals and chemical products	74.16426048	21.95832435	122741.0365	-91742.73969
Rubber and plastics	78.20756886	8.079667802	43515.63941	-36794.14584
Other nonmetallic minerals	64.42868796	6.693295008	44244.40951	-41046.26975
Basic metals and fabricated metal	75.02347038	29.16174794	166927.0369	-138078.9421
Machinery, nec	68.9635668	9.533854614	56730.72084	-47583.4312
Electrical and optical equipment	72.53796723	10.97873933	61235.06234	-50791.1204
Transport equipment	75.70593512	19.46519114	103375.3318	-78848.37457
Manufacturing, nec; recycling	73.76440885	18.40529131	101966.2837	-84326.50794
Electricity, gas, and water supply	56.41903703	8.027172196	62068.81633	-61996.39716
Construction	61.3856721	54.04410677	360032.403	-359268.6496
Sale, maintenance, and repair of motor vehicles and	14.75028878	0.659288241	18016.63167	-17212.89098

motorcycles; retail sale of fuel				
Wholesale trade and commission trade, except of motor vehicles and motorcycles	14.75028877	5.206360035	140298.6559	-134069.1014
Retail trade, except of motor vehicles and motorcycles; repair of household goods	14.75028877	8.501620911	229097.8684	-218925.4455
Hotels and restaurants	66.5657919	9.049800632	77885.34999	-77696.8183
Inland transport	52.32752043	30.1280625	237811.4833	-230099.0765
Water transport	33.29633301	0.20032707	3180.443447	269.9951182
Air transport	33.56418851	0.348558307	4404.991955	-2015.602322
Other supporting and auxiliary transport activities; activities of travel agencies	37.90775976	1.274089972	13309.45874	-11372.35662
Post and telecommunications	15.12205294	0.785117608	24699.44748	-22192.53699
Financial intermediation	15.75233077	4.908891133	124331.1448	-123170.7023
Real estate activities	8.344956783	2.782586354	128448.0841	-128447.7674
Renting of M&Eq and other business activities	23.58718855	6.899110635	127025.5314	-56415.47356
Public administration and defense; compulsory social security	0	0	129662.2437	-129657.0089
Education	9.777073892	2.046645918	84669.45344	-84649.96241
Health and social work	35.03053159	3.321384851	41495.09065	-41483.62599
Other community, social, and personal services	17.76349356	2.32256822	56026.89295	-46304.4281
Private households with employed persons	-	0	0	

Source: Author's Calculations from ADB India's NIOT 2013

Using the imports and exports data of 2013 from the previous graph, the author could calculate the following measures. In Forward Linkages, the highest contributors include Food, Beverages and tobacco (3), Rubber and Plastics (10), Coke, refined Petroleum and nuclear fuel (8), Leather, Leather Products and footwear (4) and Transport equipment(15), in order. The industries that bring in the highest backward linkages are Construction(18), Inland Transport(23), Basic Metal and Fabricated Metal(12), Food, Beverages and Tobacco(3), and Chemical and Chemical Products(9). Domestic Value Added to exports for the year was

highly contributed by Agriculture, Hunting, Forestry, and Fishing(1), Construction(18), Inland Transport(23), Food, Beverages and Tobacco(3) and Basic Metal and Fabricated Metal(12). Foreign Value Added in the country came mainly from, water transport (24), Air Transport (25), Leather, Leather Products and Footwear (5), Other supporting and auxiliary transport activities; activities of travel agencies(26) and Sale, Maintenance, and repair of motor vehicles and motorcycles, retail sale of fuel (19).

Table 4.11: GVC Participation of India in 2013, through major 5 Exports and Imports

Export 5	GVC Participation	Import 5	GVC Participation
Renting of M&Eq and other business activities	0.04318	Coke, refined petroleum, and nuclear fuel	0.18399
Coke, refined petroleum, and nuclear fuel	0.18399	Basic metals and fabricated metal	0.36115
Chemicals and chemical products	0.31009	Construction	15.11349
Textiles and textile products	0.32094	Chemicals and chemical products	0.31009
Basic metals and fabricated metal	0.36115	Transport equipment	0.38803
GVC Participation	1.21935		16.35675

Source: Author's Calculations

The above table shows the GVC participation through the exports and imports of the top 5 industries in India. The GVC Participation through exports decreased from the previous year as compared to the GVC participation through Imports which has increased. The rate of export participation in GVCs was at 1.22% while that of Import participation was 16.36% The share of each participating industry however has increased, with Basic metal and Fabricated metal (12) leading the export participation in GVCs and Construction leading the Import Participation in GVCs. The list of top 5 industries in both Exports as well as imports however, remains the same as the previous years.

Table 4.12: India's GVC Position in 2013 through the top 5 Exporting and Importing Industries

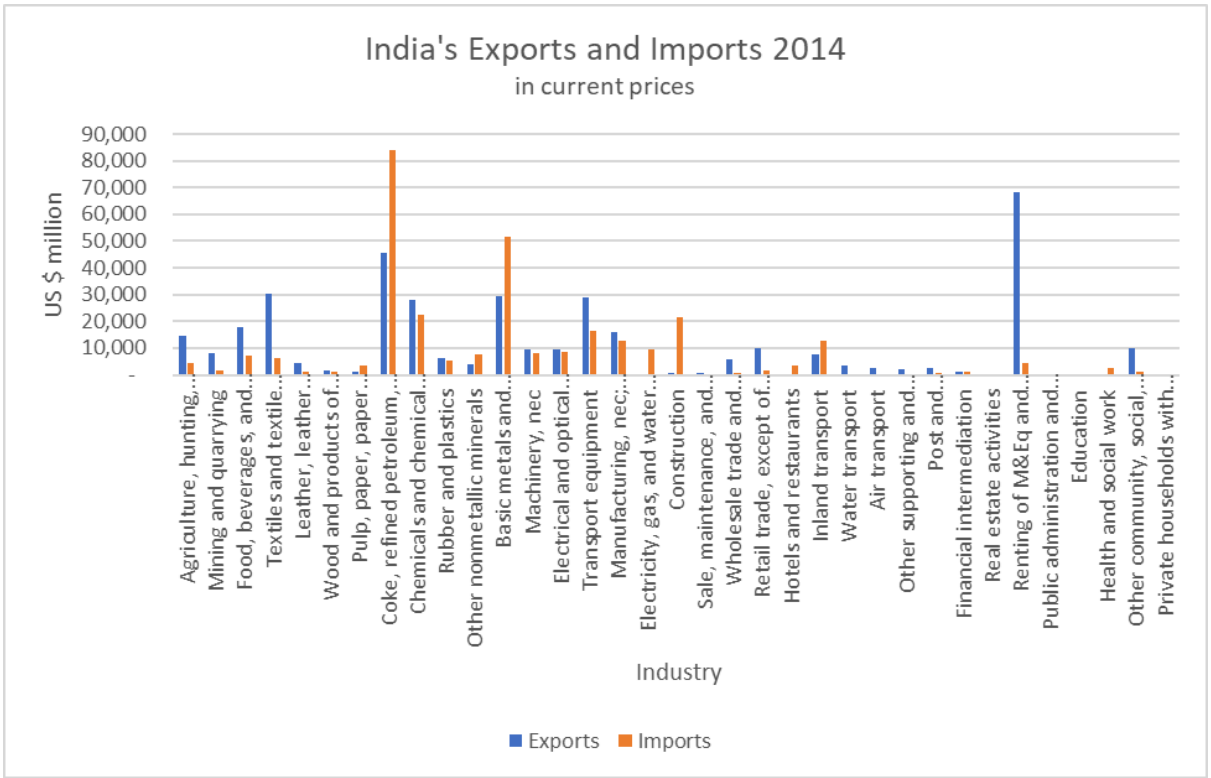
GVC Position	
VAE= total DVX of exporting industries	6,06,020
VAI= total DVX of importing industries	8,18,651
VATB=VAE-VAI	(2,12,631)
GDP=	1856720
GVC Position= (VATB/GDP)*100	-11.45198

Source: Author's Calculations

GVC position was calculated as shown above using the Domestic Value Added in Exports of the Top 5 Exporting and Importing industries. The VAE was at $6,06,020 million and the VAI was at $8,18,651 million, giving a VATB of -2,12,631, which was lesser than the VATB of the previous year. Therefore, when divided by the GDP of 2013, the GVC position thus arrived at, is -11.45; which is higher than that of the previous year.

V. Year: 2014

Figure 4.5: Exports and Imports of India in US $ Million (at current prices) 2014



Source: ADB National I-O Table 2014

The above table shows the Imports and Exports of India in the year 2014. It is observed that imports continue to rise at a rate faster than exports and the industry which contributes the highest towards India's International Trade is the import of Coke, refined petroleum and nuclear fuel (8). The exports of the same industry however, also are among the top 5 Exports of the country. The Imports and Exports of Basic Metal and Fabricated Metal (12) is also another significant industry both in terms of Imports as well as exports, thus proving as a major player in INdia's GVC participation and Position; along with Basic Metal and Fabricated Metal (12).

Table 4.13: India's Forward Linkages, Backward Linkages, DVX and FVA (35 industries) 2014

Industry	forward linkage	backward linkage	DVX	FVA
Agriculture, hunting, forestry, and fishing	24.9007727	13.70393036	410834.5976	-396272.7715
Mining and quarrying	22.64275523	2.702319174	49412.73099	-41122.79744
Food, beverages, and tobacco	86.64208153	26.42346958	191495.7207	-173886.0056
Textiles and textile products	74.86904948	22.78460305	130104.7425	-99563.80959
Leather, leather products, and footwear	76.07032685	3.011320346	16965.34491	-12606.16856
Wood and products of wood and cork	58.12549175	2.35521589	26208.62968	-24504.51137
Pulp, paper, paper products, printing, and publishing	74.73676396	5.121247101	28414.58633	-27110.43019
Coke, refined petroleum, and nuclear fuel	78.23837396	9.689476136	69304.85219	-23500.11878
Chemicals and chemical products	74.21093413	24.02655963	129884.0463	-101716.4988
Rubber and plastics	78.02051467	8.743763103	45700.23166	-39282.85201
Other nonmetallic minerals	64.69187789	7.565949479	47597.27842	-43592.90386
Basic metals and fabricated metal	75.3156288	33.52930961	182117.0308	-152572.2718
Machinery, nec	68.91072532	10.5542662	60546.05766	-51189.42277
Electrical and optical equipment	72.4683031	12.13131592	65360.90806	-55970.17205
Transport equipment	75.64916071	21.16314287	109105.5533	-80227.57662
Manufacturing, nec; recycling	73.90267073	20.82041321	110339.8241	-94144.39877

Electricity, gas, and water supply	56.7717891	9.505938317	69333.19195	-69209.01584
Construction	61.33906308	57.6705577	371154.2819	-370448.4558
Sale, maintenance, and repair of motor vehicles and motorcycles; retail sale of fuel	14.72197421	0.749916294	19586.26299	-18807.5019
Wholesale trade and commission trade, except of motor vehicles and motorcycles	14.71848748	5.826372586	152172.8048	-146149.6847
Retail trade, except of motor vehicles and motorcycles; repair of household goods	14.71849355	9.514057937	248487.5211	-238618.6843
Hotels and restaurants	66.63753493	10.27040053	84445.98517	-84221.46798
Inland transport	51.99981432	33.53787592	258212.7797	-250633.0147
Water transport	33.42000836	0.275361853	3639.089143	-215.9666256
Air transport	34.06668257	0.40985507	4858.095061	-2444.341643
Other supporting and auxiliary transport activities; activities of travel agencies	37.85677981	1.435066036	14486.3909	-12568.43173
Post and telecommunications	15.10974931	0.907559714	26891.63544	-24393.88764
Financial intermediation	15.72613247	5.536398862	136039.6634	-134951.4963
Real estate activities	8.334652331	3.136157057	140488.1558	-140487.8581
Renting of M&Eq and other business activities	23.56930232	7.848929318	138273.5761	-70162.09598
Public administration and defense; compulsory social security	0	0	141013.5047	-141001.5089
Education	9.808912564	2.290858907	92089.36808	-92050.34559
Health and social work	35.00262966	3.735945922	45211.67878	-45188.98358
Other community, social, and personal services	17.79909076	2.659960543	61183.03036	-51291.48024
Private households with employed persons	-	0	0	

Source: Author's Calculations from ADB India's NIOT 2014

India's Forward Linkages, Backward Linkages, Domestic Value Added in Exports (DVX) and Foreign Value Added (FVA) for the year 2014, across 35 sectors are calculated and shown in the above table. This gives us the significant industries in terms of all the mentioned measures. Forward Linkages were mainly added to, by Food, Beverages and

tobacco (3), Coke, refined Petroleum and nuclear fuel (8), Rubber and Plastics (10), Leather, Leather Products and footwear (4) and Transport equipment(15). Backward Linkages come from Construction(18), Inland Transport(23), Basic Metal and Fabricated Metal(12), Food, Beverages and Tobacco(3), and Chemical and Chemical Products(9). Domestic Value of the Country is mainly added by Agriculture, Hunting, Forestry, and Fishing(1), Construction(18), Inland Transport(23), Food, Beverages and Tobacco(3) and Basic Metal and Fabricated Metal(12), whereas Foreign Value is added through water transport (24), Air Transport (25), Leather, Leather Products and Footwear (5), Other supporting and auxiliary transport activities; activities of travel agencies(26) and Sale, Maintenance, and repair of motor vehicles and motorcycles, retail sale of fuel (19).

Table 4.14: GVC Participation of India in 2014, through major 5 Exports and Imports

Export 5	GVC Participation	Import 5	GVC Participation
Renting of M&Eq and other business activities	0.04613	Coke, refined petroleum, and nuclear fuel	0.19196
Coke, refined petroleum, and nuclear fuel	0.19196	Basic metals and fabricated metal	0.36841
Textiles and textile products	0.31975	Chemicals and chemical products	0.34876
Basic metals and fabricated metal	0.36841	Construction	16.86104
Transport equipment	0.33525	Transport equipment	0.33525
GVC Participation	1.26149		18.10541

Source: Author's Calculations

India's GVC Participation in the year 2014 saw an increase in the Imports participation in GVCs by 1.75% at 18.16% and an increase in Exports participation in GVCs by 0.05% at 1.26%. There was an overall increase in GVC participation in all importing and exporting industries. The highest industry participating in GVCs through its exports was Basic metals and Fabricated metals and on the other hand construction was still leading the GVC Participation through Imports.

Table 4.15: India's GVC Position in 2014 through the top 5 Exporting and Importing Industries

GVC Position	
VAE= total DVX of exporting industries	6,28,906
VAI= total DVX of importing industries	8,61,566
VATB=VAE-VAI	(2,32,660)
GDP=	2039130
GVC Position= (VATB/GDP)*100	-11.40977

Source: Author's Calculations

The above table calculates GVC Position of India through VATB, which is the difference of VAI from VAE. The VATB stood at $ -2,32,660 million which is a significant worsening of the negative VATB from the previous year. Therefore, even with a significant growth of the GDP, the GVC Position was at -11.41 as compared to -11.45 in 2014.

VI. Year: 2015

Figure 4.6: Exports and Imports of India in US $ Million (at current prices) 2015

Source: ADB National I-O Table 2015

The bar graph above shows India's Exports and Imports across 35 industries in India during the year 2015. India's International trade was led by Imports of Coke, refined

petroleum and nuclear fuel(8) which is also a key exporting industry. India's Exports were led by Renting of M&Eq and other business activities(30). It can also be noted that the import of Basic metal and fabricated metal (12) was reduced in this year and so was the export of Coke, refined petroleum and nuclear fuel(8). Over all in the observed period of time, 2015 was among the slow years of India's participation in International Trade as well as GVCs.

Table 4.16: India's Forward Linkages, Backward Linkages, DVX and FVA (35 industries) 2015

Industry	forward linkage	backward linkage	DVX	FVA
Agriculture, hunting, forestry, and fishing	25.81359	15.50273	416922.24182	-404532.85151
Mining and quarrying	38.06421	6.00995	57084.33147	-48944.24628
Food, beverages, and tobacco	87.15160	30.58748	201737.93794	-186255.76273
Textiles and textile products	75.23522	28.83107	148186.31546	-119206.09939
Leather, leather products, and footwear	76.35664	3.78365	19166.98791	-15079.08372
Wood and products of wood and cork	58.29906	2.62180	26984.73721	-25524.06212
Pulp, paper, paper products, printing, and publishing	74.47435	6.04568	30409.71854	-29260.61193
Coke, refined petroleum, and nuclear fuel	83.54257	17.39276	86008.77647	-44046.32903
Chemicals and chemical products	74.84381	29.56291	141888.52729	-116755.56372
Rubber and plastics	77.55036	10.28076	48938.55298	-43288.01425
Other nonmetallic minerals	64.72273	8.97715	50269.16725	-46810.81796
Basic metals and fabricated metal	73.53292	31.42307	155983.48885	-135821.28596
Machinery, nec	69.03926	14.31978	73432.91827	-64115.56088
Electrical and optical equipment	72.95078	17.31751	83147.07794	-73327.02353
Transport equipment	76.26726	30.47399	139760.23160	-109447.18794
Manufacturing, nec; recycling	74.40927	27.97706	132555.85129	-116522.67261
Electricity, gas, and water supply	57.82104	12.68469	80410.25733	-80293.12108
Construction	60.38960	61.01552	361671.92827	-361100.43657
Sale, maintenance, and repair of motor vehicles and motorcycles; retail sale of fuel	14.55099	0.84752	20175.73375	-19502.86903

Wholesale trade and commission trade, except of motor vehicles and motorcycles	14.54749	6.58436	156751.46507	-151547.36745
Retail trade, except of motor vehicles and motorcycles; repair of household goods	14.54750	10.75180	255964.15549	-247437.28840
Hotels and restaurants	66.78661	11.94093	89153.87485	-88960.50912
Inland transport	50.27813	37.38023	268173.04849	-261626.37041
Water transport	33.57741	0.29454	3397.90591	-748.53302
Air transport	34.85111	0.77490	8007.27657	-4687.66225
Other supporting and auxiliary transport activities; activities of travel agencies	37.49382	1.54554	14206.90381	-12632.50480
Post and telecommunications	15.13226	1.17087	30308.29306	-27956.57126
Financial intermediation	15.58292	6.38401	142491.23170	-141535.44380
Real estate activities	8.27332	3.65934	149536.11032	-149535.87142
Renting of M&Eq and other business activities	23.41460	9.39520	148003.44428	-87127.63546
Public administration and defense; compulsory social security	0	0	145016.07066	-145007.10000
Education	9.76883	2.75248	99931.29151	-99895.65984
Health and social work	35.02323	4.60604	49495.67352	-49474.94457
Other community, social, and personal services	17.55687	3.20320	66570.91465	-57565.93173
Private households with employed persons	-	0	0	

Source: Author's Calculations from ADB India's NIOT 2015

Forward linkages, backward linkages, DVX and FVA for the year of 2015 were calculated as given above. Major contributors to forward linkages were Food, Beverages and tobacco (3), Coke, refined Petroleum and nuclear fuel (8), Rubber and Plastics (10), Leather, Leather Products and footwear (4) and Transport equipment(15). Backward Linkages come from Construction(18), Inland Transport(23), Basic Metal and Fabricated Metal(12), Food, Beverages and Tobacco(3), and Transport Equipment (15). Domestic Value of the Country is mainly added by Agriculture, Hunting, Forestry, and Fishing(1), Construction(18), Inland Transport(23), Retail Trade, except of motor vehicles and motorcycles; repair of household goods(21) and Food, Beverages and Tobacco(3), whereas Foreign Value is added through Water transport (24), Air Transport (25), Other supporting and auxiliary transport activities;

activities of travel agencies(26), Leather, Leather Products and Footwear (5), and Sale, Maintenance, and repair of motor vehicles and motorcycles, retail sale of fuel (19). The new industry which was among the top 5 industries to add Domestic Value into exports was Retail Trade, except of motor vehicles and motorcycles; repair of household goods(21).

Table 4.17: GVC Participation of India in 2015, through major 5 Exports and Imports

Export 5	GVC Participation	Import 5	GVC Participation
Renting of M&Eq and other business activities	0.05390	Coke, refined petroleum, and nuclear fuel	0.24054
Coke, refined petroleum, and nuclear fuel	0.24054	Basic metals and fabricated metal	0.52056
Transport equipment	0.35213	Chemicals and chemical products	0.41542
Textiles and textile products	0.35909	Transport equipment	0.35213
Chemicals and chemical products	0.41542	Construction	21.24355
GVC Participation	1.42108		22.77219

Source: Author's Calculations

The above table shows the GVC participation of the top 5 industries that export from and import in India. The increase in participation through exporting industries increased by 0.16% to 1.42% and the increase in GVC Participation through Importing industries increased by 4.66% to 22.77%. A significant observation made was that, even though Construction(18) increased its GVC participation to 21.24% in 2015, it was only the 5th highest in India's imports, and thus made the highest contribution to India's GVC participation that year. Chemicals and Chemical Products were the highest in terms of GVC participation among the top 5 Exporting Participants in GVCs.

Table 4.18 India's GVC Position in 2015 through the top 5 Exporting and Importing Industries

GVC Position	
VAE= total DVX of exporting industries	6,63,847
VAI= total DVX of importing industries	8,85,313
VATB=VAE-VAI	(2,21,466)
GDP=	2103590
GVC Position= (VATB/GDP)*100	-10.53

Source: Author's Calculations

This table captures India's Position in GVCs for the year 2015. The VAE stood at $6,63,847 million, the VAI at $8,85,313 million, which gives a VATB of $-2,21,466 million. The resulting VATB is an improvement from the previous year's figures which was $-2,32,660. This improvement, along with the higher GDP in 2015, gave India a slightly higher GVC Position of -10.53 as compared to -11.41 of the previous year.

VII. Year: 2016

Figure 4.7: Exports and Imports of India in US $ Million (at current prices) 2016

Source: ADB National I-O Table 2016

The above graph depicts the imports and exports of India in 2016, at current prices. A significant difference in the leading International Trade sector of India came about as Inland

transport(23) took over as the highest Importing industry in the country, overtaking even the export of Renting of M&Eq and other business activities(30). Coke, refined petroleum and nuclear fuel(30) has a fair balance between exports and imports while Basic metal and fabricated metal (12) reduced both in exports as well as imports. Another Industry with significant imports to enter the top 5 importing Industries of the country was Hotels and restaurants (20). It also contributed significantly in the GVC participation, through backward linkages. 2016 showed an improvement in the participation in international trade and in GVCs as compared to the previous year.

Table 4.19: India's Forward Linkages, Backward Linkages, DVX and FVA (35 industries) 2016

Industry	forward linkage	backward linkage	DVX	FVA
Agriculture, hunting, forestry, and fishing	25.37015	15.49496	441727.95053	-428908.80024
Mining and quarrying	38.73788	6.77918	62501.31928	-53981.31049
Food, beverages, and tobacco	87.33288	29.14644	200705.32806	-185689.74460
Textiles and textile products	75.23262	28.63720	151865.81299	-123038.69901
Leather, leather products, and footwear	76.35405	3.77559	19694.31009	-15628.00290
Wood and products of wood and cork	58.25242	2.85331	30106.86343	-28552.16900
Pulp, paper, paper products, printing, and publishing	74.27881	6.52798	33725.84820	-32502.77782
Coke, refined petroleum, and nuclear fuel	83.35142	31.45435	139310.82395	-94647.39811
Chemicals and chemical products	74.72057	33.97925	164439.45019	-137688.76278
Rubber and plastics	77.31926	11.09741	54329.09013	-48314.84498
Other nonmetallic minerals	64.50353	10.19442	57320.03015	-53639.07998
Basic metals and fabricated metal	72.57272	30.48547	159290.22508	-138998.60708
Machinery, nec	68.51881	15.03541	78913.78726	-69408.59414
Electrical and optical equipment	72.47413	18.22823	89611.80515	-79593.78141
Transport equipment	75.84847	32.26362	151387.29004	-120463.13825
Manufacturing, nec; recycling	74.27998	30.60148	148211.93338	-131146.74811
Electricity, gas, and water supply	57.65735	12.55085	82537.98852	-82419.91862

Construction	59.68739	57.79999	358031.20557	-357477.74595
Sale, maintenance, and repair of motor vehicles and motorcycles; retail sale of fuel	14.49408	0.88542	21421.86637	-20724.69223
Wholesale trade and commission trade, except of motor vehicles and motorcycles	14.49055	6.87775	166423.52874	-161031.64151
Retail trade, except of motor vehicles and motorcycles; repair of household goods	14.49055	11.23103	271758.47996	-262923.91299
Hotels and restaurants	66.76573	9.31808	79894.62200	-79694.82909
Inland transport	49.45077	18.31324	210838.57358	-204222.59481
Water transport	33.26806	0.26998	3086.40917	-781.03545
Air transport	34.44911	0.77185	7942.03357	-4793.41848
Other supporting and auxiliary transport activities; activities of travel agencies	37.35855	1.59197	14958.75668	-13347.55032
Post and telecommunications	14.97577	1.25936	30956.24954	-28639.44707
Financial intermediation	15.44902	5.94892	138842.44981	-137930.02834
Real estate activities	8.25394	3.75405	158534.00298	-158533.73755
Renting of M&Eq and other business activities	23.33839	9.94922	158020.40506	-94862.33608
Public administration and defense; compulsory social security	0	0	162664.84136	-162654.99149
Education	9.76951	2.97792	109613.04772	-109562.97787
Health and social work	34.95540	4.69745	53539.95137	-53517.73889
Other community, social, and personal services	17.50338	3.54589	73422.51493	-63772.80540
Private households with employed persons	-	0	0	

Source: Author's Calculations from ADB India's NIOT 2016

The above calculations of Forward Linkages, Backward Linkages, DVX and FVA come from India's National Input-Output Table as given by ADB for the year 2016. The significant industries in terms of Forward Linkages were Food, Beverages and tobacco (3), Coke, refined Petroleum and nuclear fuel (8), Rubber and Plastics (10), Leather, Leather Products and footwear (4) and Transport equipment(15). Backward Linkages come from Construction(18), Chemicals and Chemical products(9), Transport Equipment(15), Coke, refined Petroleum and nuclear fuel (8) and Manufacturing, NEC, recycling(16). Domestic

Value of the Country was mainly added by Agriculture, Hunting, Forestry, and Fishing(1), Construction(18), Retail Trade, except of motor vehicles and motorcycles; repair of household goods(21), Inland Transport(23) and Food, Beverages and Tobacco(3). Industries which had Foreign Value Added were Water transport (24), Air Transport (25), Other supporting and auxiliary transport activities; activities of travel agencies(26), Leather, Leather Products and Footwear (5), and Sale, Maintenance, and repair of motor vehicles and motorcycles, retail sale of fuel (19).

Table 4.20: GVC Participation of India in 2016, through major 5 Exports and Imports

Export 5	GVC Participation	Import 5	GVC Participation
Renting of M&Eq and other business activities	0.05271	Inland transport	1.02425
Coke, refined petroleum, and nuclear fuel	0.25705	Coke, refined petroleum, and nuclear fuel	0.25705
Transport equipment	0.34960	Basic metals and fabricated metal	0.50789
Textiles and textile products	0.36032	Hotels and restaurants	38.08134
Chemicals and chemical products	0.40634	Construction	21.22781
GVC Participation	1.42602		61.09833

Source: Author's Calculations

The GVC Participation of the top 5 exporting and importing industries are given in the above table. A significant new entry on the list of top 5 imports and also on the top GVC participants is the Hotels and Restaurants(22) industry. Leading India's GVC participation through Domestic Value addition and creating more backward linkages in its history in the observed period, the Hotels and restaurants industry has played a key role with a rate of 38.08% in boosting India's GVC participation through imports to added up to 61.10%; the highest in the study's period.

Table 4.21: India's GVC Position in 2016 through the top 5 Exporting and Importing Industries

GVC Position

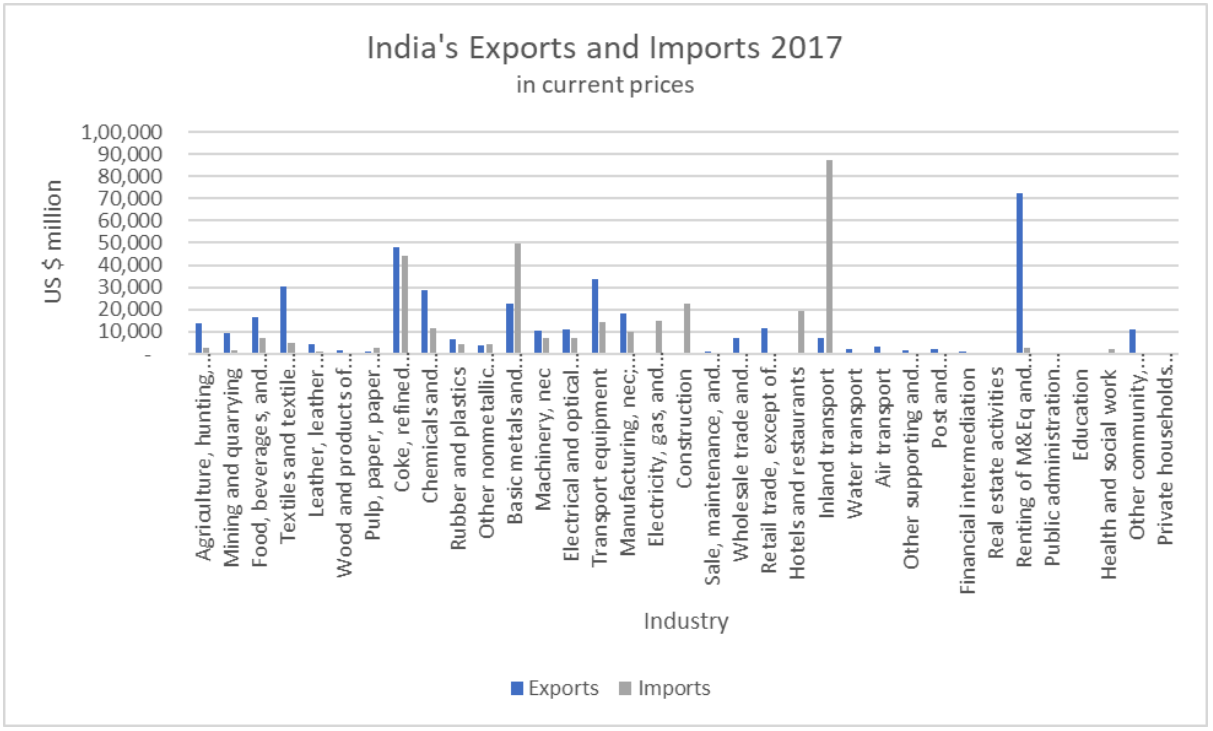
VAE= total DVX of exporting industries	7,65,024
VAI= total DVX of importing industries	9,47,365
VATB=VAE-VAI	(1,82,342)
GDP=	2294800
GVC Position= (VATB/GDP)*100	-7.94586

Source: Author's Calculations

The table above shows India's GVC Position in the year 2016. With a VAE of $7,65,024 million and a VAI of $9,47,365 million, the VATB stood at $ -1,82,342 million which is a very significant improvement as compared to the previous year. Along with the improvement in GDP, The GVC Position for the year rose up to -7.95 which is still downstream, but much higher as compared to -10.53 in 2015, and still much higher as compared to the previously recorded years.

VIII. Year: 2017

Figure 4.8: Exports and Imports of India in US $ Million (at current prices) 2017



Source: ADB National I-O Table 2017

The graph above depicts India's exports and imports for the year 2017, where Inland transport (23) was the leading importer and Renting of M&Eq and other Business activities

(30) was the leading exporter in the country. Coke, refined petroleum and nuclear fuel(8) maintained its balance in exports as well as imports but this year, the exports of the industry overtook its imports as opposed to the previous year. The imports of the other industries in the top 5 remained in a similar position with Hotels and Industries still playing an important role in imports.The top 5 exporting industries grew in their respective exports and thus maintained their ranks.

Table 4.22: India's Forward Linkages, Backward Linkages, DVX and FVA (35 industries) 2017

Industry	forward linkage	backward linkage	DVX	FVA
Agriculture, hunting, forestry, and fishing	25.27863	15.58461	4,64,501.21558	-450635.0188
Mining and quarrying	38.32978	6.49346	66,970.98780	-57547.18066
Food, beverages, and tobacco	87.38647	28.87903	2,10,852.63660	-194472.09117
Textiles and textile products	75.11826	26.44684	1,54,042.15182	-123906.73611
Leather, leather products, and footwear	76.24473	3.48847	19,971.14893	-15720.29475
Wood and products of wood and cork	57.94879	2.81684	31,550.72396	-29873.64269
Pulp, paper, paper products, printing, and publishing	73.67601	6.17227	35,370.22244	-34050.87096
Coke, refined petroleum, and nuclear fuel	82.80028	29.69305	1,46,233.78996	-98054.42249
Chemicals and chemical products	74.29993	32.15379	1,72,413.80711	-143557.28358
Rubber and plastics	76.64144	10.47570	56,965.13781	-50477.44635
Other nonmetallic minerals	63.79788	9.61418	60,212.07361	-56241.35602
Basic metals and fabricated metal	71.85660	26.68669	1,61,322.79827	-138779.1651
Machinery, nec	67.90811	14.23540	83,485.88267	-73058.09653
Electrical and optical equipment	71.92070	17.29453	94,802.32862	-83811.93549
Transport equipment	75.36237	30.60438	1,59,927.42241	-126001.7107

Manufacturing, nec; recycling	73.84228	28.93075	1,55,392.67725	-136984.1066
Electricity, gas, and water supply	57.35555	11.00776	84,276.62031	-84146.02562
Construction	59.70482	61.09814	4,18,382.20309	-417711.6646
Sale, maintenance, and repair of motor vehicles and motorcycles; retail sale of fuel	14.21651	1.01947	27,426.17028	-26508.29492
Wholesale trade and commission trade, except of motor vehicles and motorcycles	14.21297	7.91807	2,13,066.78551	-205968.0133
Retail trade, except of motor vehicles and motorcycles; repair of household goods	14.21298	12.92968	3,47,923.22063	-336291.9354
Hotels and restaurants	66.58635	8.69908	81,955.14558	-81740.64533
Inland transport	48.24900	14.34469	2,10,599.80045	-203544.324
Water transport	32.62124	0.22290	2,848.57971	-664.4074045
Air transport	33.71207	0.67608	7,831.68835	-4635.443248
Other supporting and auxiliary transport activities; activities of travel agencies	36.99375	1.49945	16,062.95906	-14256.81315
Post and telecommunications	14.27140	0.98687	28,780.11375	-26553.79264
Financial intermediation	15.04492	5.94054	1,54,410.81378	-153368.5778
Real estate activities	7.83402	3.60473	1,75,864.24569	-175863.9425
Renting of M&Eq and other business activities	22.96446	10.01915	1,75,927.91354	-103784.0484
Public administration and defense; compulsory social security	-	-	1,78,029.68074	-178017.6095
Education	9.35050	2.88207	1,19,696.09918	-119639.8959
Health and social work	34.55859	4.89309	59,559.19912	-59534.26567
Other community, social, and personal services	17.05043	3.51146	80,392.14825	-69560.37528
Private households with employed persons	-	-	-	

Source: Author's Calculations from ADB India's NIOT 2017

The table above gives the author's calculations of forward linkages, backward linkages, DVX and FVA for the year 2017, across 35 industries as specified in the National I-O Tables of ADB. The major contributors in each of the aforementioned measures are described as follows. The Forward Linkages mainly came from Food, Beverages and tobacco (3), Coke, refined Petroleum and nuclear fuel (8), Rubber and Plastics (10), Leather, Leather Products and footwear (4) and Transport equipment(15). Backward Linkages came from Construction(18), Chemicals and Chemical products(9), Transport Equipment(15), Coke, refined Petroleum and nuclear fuel (8) and Manufacturing, NEC, recycling(16). Domestic Value of the Country was mainly added by Agriculture, Hunting, Forestry, and Fishing(1), Construction(18), Retail Trade, except of motor vehicles and motorcycles; repair of household goods(21), Wholesale Trade and Commission Trade, except of motor vehicles and motorcycles(20) and Food, Beverages and Tobacco(3). Industries that had Foreign Value Added were Water transport (24), Air Transport (25), Other supporting and auxiliary transport activities; activities of travel agencies(26), Leather, Leather Products and Footwear (5), and Sale, Maintenance, and repair of motor vehicles and motorcycles, retail sale of fuel (19).

Table 4.23: GVC Participation of India in 2017, through major 5 Exports and Imports

Export 5	GVC Participation	Import 5	GVC Participation
Renting of M&Eq and other business activities	0.04572	Inland transport	0.88716
Coke, refined petroleum, and nuclear fuel	0.23349	Basic metals and fabricated metal	0.43712
Transport equipment	0.31235	Coke, refined petroleum, and nuclear fuel	0.23349
Textiles and textile products	0.33703	Construction	18.01581
Chemicals and chemical products	0.36891	Hotels and restaurants	35.09806
GVC Participation	1.29749		54.67165

Source: Author's Calculations

The author calculated the above table using the measure of DVX, linkages, and exports to arrive at the GVC Participation Rate. The list constituted of the same industries in the top 5 export participants which adds up to 1.30%. The importing Industries were the same as the previous year, and although Hotels and Restaurants (22) moved to the 5th spot, it still leads as the industry with the highest GVC participation on the top 5's table. The GVC participation through Imports was at 54.67% in 2017.

Table 4.24: India's GVC Position in 2017 through the top 5 Exporting and Importing Industries

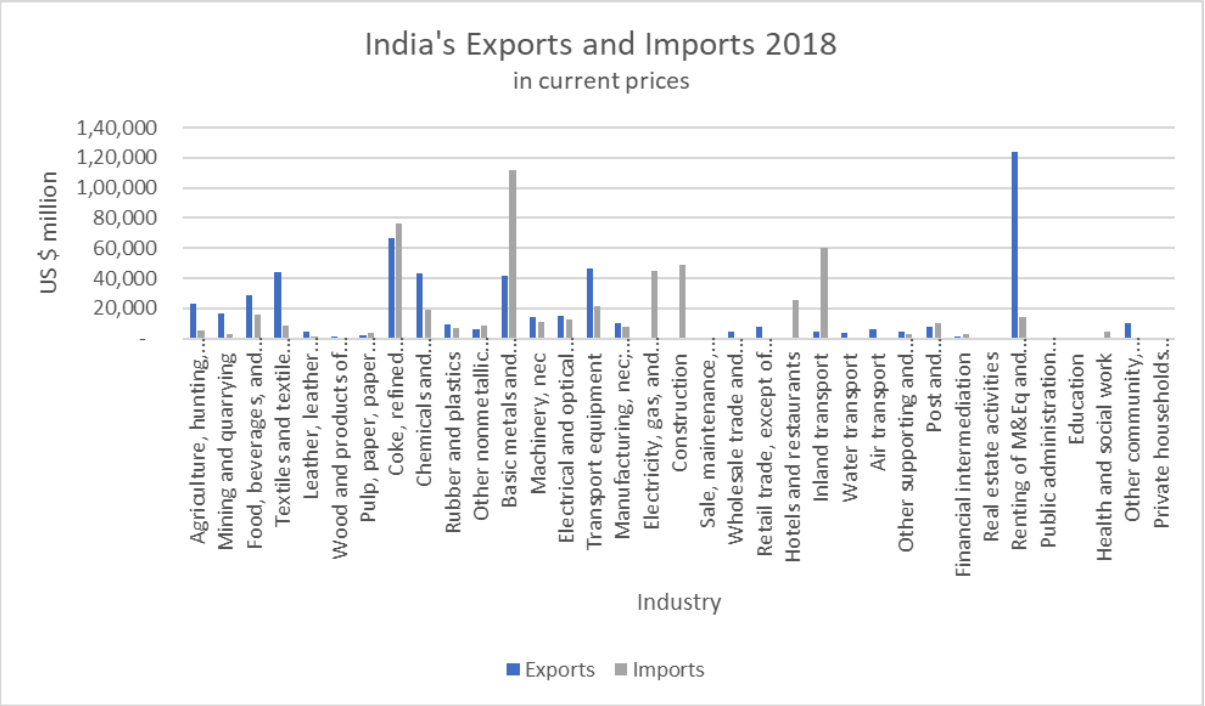
GVC Position	
VAE= total DVX of exporting industries	8,08,545
VAI= total DVX of importing industries	10,18,494
VATB=VAE-VAI	(2,09,949)
GDP=	2651470
GVC Position= (VATB/GDP)*100	-7.91820

Source: Author's Calculations

The above table depicts India's GVC position for the year 2017 when India's VATB (the difference between VAE and VAI) stood at $-2,09,949 million; a slight increase as compared to the VATB in 2016. When divided by the P of that year, and multiplied by 100, the GVC position of India was -7.92 which is a relatively higher downstream position as compared to the position held by India in 2016.

IX. Year: 2018

Figure 4.9: Exports and Imports of India in US $ Million (at current prices) 2018



Source: ADB National I-O Table 2018

The above table shows the different imports and exports of India, in the year 2018. As can be seen, the spike in imports of Inland Transport(23) in the previous two years has subsided in this year, and the highest share of imports was that of Basic Metals and Fabricated Metal (12) The overall lead in India's International trade was regained by the exports of Renting of M&Eq, and other business activities(30). Coke, refined petroleum, and nuclear fuel (8) had a marginally higher share of imports as compared to its exports. GVC participation and position are further calculated by using the following measures:

Table 4.25: India's Forward Linkages, Backward Linkages, DVX and FVA (35 industries) 2018

Industry	forward linkage	backward linkage	DVX	FVA
Agriculture, hunting, forestry, and fishing	23.57654	10.68860	550299.97679	-527351.72018
Mining and quarrying	35.31723	5.10516	85227.87872	-68324.33965

Food, beverages, and tobacco	84.20759	22.29209	262360.43993	-233639.46427
Textiles and textile products	72.09035	17.76554	160371.31944	-116134.01378
Leather, leather products, and footwear	66.37256	1.52361	15339.82654	-10716.61461
Wood and products of wood and cork	86.57314	1.52946	18398.85285	-17022.69626
Pulp, paper, paper products, printing, and publishing	64.56093	3.42486	33840.95223	-32030.51829
Coke, refined petroleum, and nuclear fuel	80.68090	13.92281	113308.34104	-46843.86682
Chemicals and chemical products	63.03543	19.22786	182265.65170	-138737.14325
Rubber and plastics	68.28866	6.25845	57208.75668	-47847.48118
Other nonmetallic minerals	60.86048	6.93738	68607.27674	-62025.20115
Basic metals and fabricated metal	69.56906	15.17690	169195.24814	-127402.06424
Machinery, nec	62.24368	8.10846	78657.79583	-64320.00327
Electrical and optical equipment	71.91206	10.78171	87592.96222	-72696.30866
Transport equipment	65.65597	16.68154	151230.18351	-104774.50753
Manufacturing, nec; recycling	82.83074	8.48174	59152.35370	-48853.73363
Electricity, gas, and water supply	58.56398	9.67091	122645.58568	-122338.79082
Construction	58.58164	48.01825	500303.63285	-499467.44244
Sale, maintenance, and repair of motor vehicles and motorcycles; retail sale of fuel	23.81902	0.76864	17803.09454	-17203.05559
Wholesale trade and commission trade, except of motor vehicles and motorcycles	23.81562	5.97035	138306.29604	-133665.64436
Retail trade, except of motor vehicles and motorcycles; repair of household goods	23.81564	9.74946	225846.12672	-218242.45360
Hotels and restaurants	65.69028	3.18093	52054.75957	-51889.12923
Inland transport	43.65228	5.34747	147716.04826	-142738.74036
Water transport	56.70605	0.38132	4169.13984	-694.26043
Air transport	80.20548	2.12052	14772.18372	-8496.94404
Other supporting and auxiliary transport activities; activities of travel agencies	54.47773	3.65810	39166.07061	-34560.66684

Post and telecommunications	58.44340	8.76693	89907.06116	-82255.94809
Financial intermediation	26.39089	8.80675	191680.33404	-190364.33601
Real estate activities	10.47646	3.71476	195337.46260	-195337.12253
Renting of M&Eq and other business activities	31.34223	14.75184	290799.43829	-166829.18478
Public administration and defense; compulsory social security	0	0	152760.03299	-152746.51693
Education	20.60836	5.07818	138498.57466	-138432.97494
Health and social work	35.22586	3.38338	62226.32549	-62199.32093
Other community, social, and personal services	27.51588	3.46637	71983.59740	-62138.85815
Private households with employed persons	-	0	0	

Source: Author's Calculations from ADB India's NIOT 2018

The table above shows all the measures required to calculate GVC Participation and GVC Position of India. The Forward Linkages, Backward Linkages, DVX, and FVA of each of the 35 industries specified in the ADB National I-O Table show these measures for the top 5 importing and exporting industries to further calculate India's GVC Participation and Position. The top 5 industries in each of the measures are: Wood and Products of Wood and Cork(6), Food, Beverages and tobacco (3), Manufacturing, NEC, recycling(16), Coke, refined Petroleum and nuclear fuel (8), and Air Transport (25). Backward Linkages came from Construction(18), Food, beverages and Tobacco(3), Chemicals and Chemical products(9), Textiles and Textile Products(4), and Transport Equipment(15). The domestic value of the country was mainly added by Agriculture, Hunting, Forestry, and Fishing(1), Construction(18), Renting of M&Eq and other business activities(30), Food, Beverages and Tobacco(3), and Retail Trade, except of motor vehicles and motorcycles; repair of household goods(21). Industries that had Foreign Value Added were Water transport (24), Air Transport (25), Leather, Leather Products and Footwear (5) Wood and Products of Wood and Cork(6), and Sale, Maintenance, and repair of motor vehicles and motorcycles, retail sale of fuel (19). A significant new entrant in the forward linkages of the country was Wood, and products of

wood and cork (6) that did not show up before but had the highest forward linkages in 2018. The overall backward linkages of the country reduced in the same year, signaling more reduction in imports in most industries.

Table 4.26: GVC Participation of India in 2018, through major 5 Exports and Imports

Export 5	GVC Participation	Import 5	GVC Participation
Renting of M&Eq and other business activities	0.03718	Basic metals and fabricated metal	0.20277
Coke, refined petroleum, and nuclear fuel	0.14234	Coke, refined petroleum, and nuclear fuel	0.14234
Transport equipment	0.17724	Inland transport	0.98446
Textiles and textile products	0.20312	Construction	12.74828
Chemicals and chemical products	0.18899	Electricity, gas, and water supply	22.24121
GVC Participation	0.74887		36.31906

Source: Author's Calculations

The given table shows the author's calculations of GVC participation through the top 5 importing as well as exporting industries. As compared to the previous year, the GVC participation through Exporting industries has reduced further from 1.30% in 2017 to 0.75% in 2018; along with a decrease in import participation in GVCs, for the second time in a row- from 54.67% in 2017 to 36.32% in 2018. This substantial decrease in GVC participation both through exports and imports can be mainly pointed out because of the absence of the Hotels and restaurants (22) industry which contributed to the highest overall GVC participation, for the past two years. This year, the industry which came up to the 5th highest in GVC participation through imports, was, Electricity, gas and water supply(17). Though it was the highest contributor to the participation at 22.24% of the 36%, it still couldn't match up to the share of Hotels and Restaurants(22).

Table 4.27: India's GVC Position in 2018 through the top 5 Exporting and Importing Industries

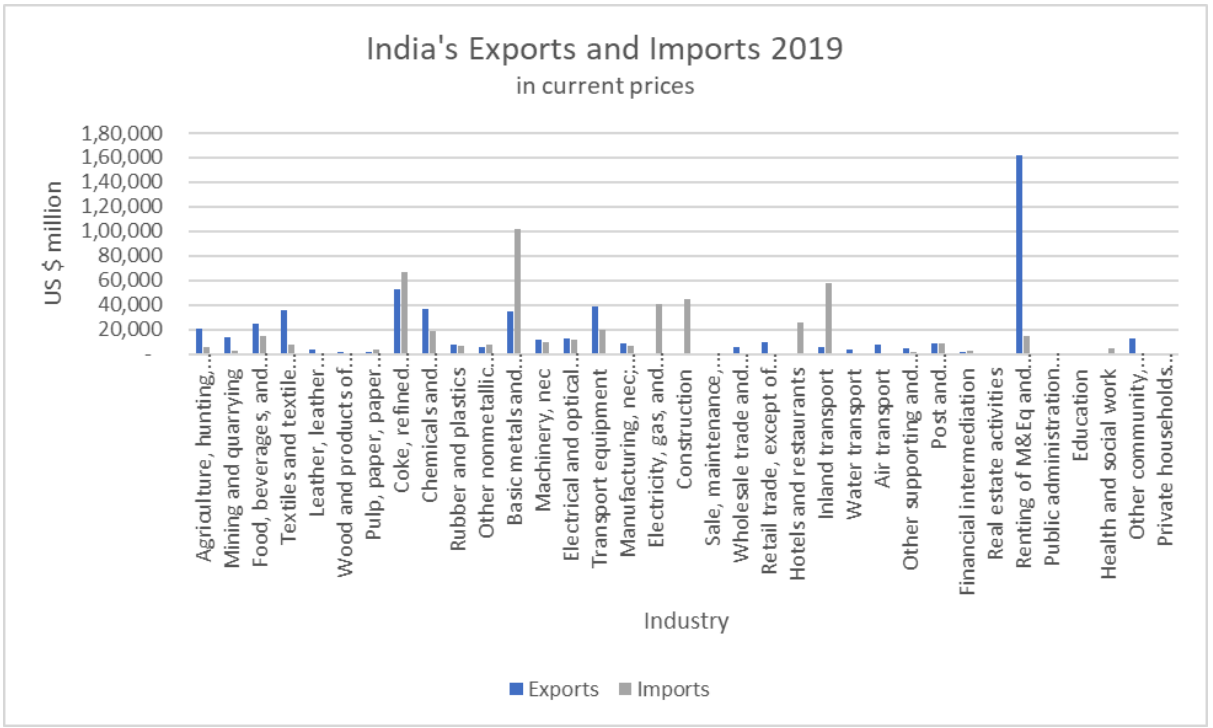
GVC Position	
VAE= total DVX of exporting industries	8,97,975
VAI= total DVX of importing industries	10,53,169
VATB=VAE-VAI	(1,55,194)
GDP=	2702930
GVC Position= (VATB/GDP)*100	-5.74169

Source: Author's Calculations

The author uses VAE and VAI to calculate VATB and further, the GVC Position using these measures. The VATB at $ -1,55,194 million, which is far less than that of the previous year at $-2,09,949 million, Given the growing GDP in 2018, the GVC Position of India could rise up to -5.74, a downstream position but much higher than that of 2017 at 7.92.

X. Year: 2019

Figure 4.10: Exports and Imports of India in US $ Million (at current prices) 2019



Source: ADB National I-O Table 2019

The graph above depicts India's Import and Export composition for the year 2019. It must be noted that it was at the end of this year that the Coronavirus Pandemic struck the

world, severely impacting several aspects of global trade, International trade in goods and commodities being a direct prey to lockdowns across the world. Trade in Value Added through services, especially remote services saw positive effects during the chaos. This can be seen in the case of Renting M&Eq. and other business activities (30) rising to the highest exports, recorded by the industry since 2010. The exports were also contributed to by Coke, refined petroleum and nuclear fuel(8) which still maintains its balance between exports and imports and also its position in GVC participation, along with other industries like Transport Equipment(15), Chemicals and Chemical products (9) and Basic metal and fabricated metal(12). On the importing side, while the top 4 industries remained the same as in the previous years, Electricity, gas and water supply(17) came in as the 5th highest importer in the country.

Table 4.28 India's Forward Linkages, Backward Linkages, DVX and FVA (35 industries) 2019

Industry	forward linkage	backward linkage	DVX	FVA
Agriculture, hunting, forestry, and fishing	23.63589	11.70742	596223.32842	-575136.11468
Mining and quarrying	36.81457	5.24999	80766.56224	-67162.24757
Food, beverages, and tobacco	84.36514	22.22715	259425.33203	-235112.68807
Textiles and textile products	71.64845	17.26492	152695.42550	-116736.16972
Leather, leather products, and footwear	66.92943	1.49511	14519.26292	-10791.30335
Wood and products of wood and cork	62.63800	1.12946	18835.88072	-17639.53114
Pulp, paper, paper products, printing, and publishing	65.60784	3.43753	32322.03982	-30852.53038
Coke, refined petroleum, and nuclear fuel	83.81221	14.90301	107728.20254	-55472.39877
Chemicals and chemical products	66.72220	20.80355	178494.64730	-142110.99436
Rubber and plastics	70.39385	6.45102	55074.34727	-47399.93332
Other nonmetallic minerals	61.14790	7.19816	68018.35474	-62494.53186

Basic metals and fabricated metal	70.64998	17.07523	170938.88363	-136537.86158
Machinery, nec	62.44837	7.94944	73748.65744	-62383.24212
Electrical and optical equipment	71.97482	11.07910	86560.43958	-74093.05414
Transport equipment	68.75920	17.67714	146195.41037	-107954.66732
Manufacturing, nec; recycling	73.58909	7.33613	56416.51030	-48183.68747
Electricity, gas, and water supply	56.33062	10.44783	130208.97853	-129943.00135
Construction	58.81001	49.86499	498690.22715	-497713.03216
Sale, maintenance, and repair of motor vehicles and motorcycles; retail sale of fuel	24.18655	0.85798	18931.45854	-18182.82445
Wholesale trade and commission trade, except of motor vehicles and motorcycles	24.18324	6.66470	147074.56635	-141284.69217
Retail trade, except of motor vehicles and motorcycles; repair of household goods	24.18324	10.88281	240161.51477	-230674.84916
Hotels and restaurants	66.33580	3.80522	58082.49792	-57873.29197
Inland transport	44.08739	6.81342	157781.13004	-151761.92287
Water transport	55.76741	0.38820	4113.76229	-717.68085
Air transport	73.93274	2.19000	16054.25298	-8033.65727
Other supporting and auxiliary transport activities; activities of travel agencies	52.36218	3.41533	36692.65071	-31642.65734
Post and telecommunications	55.38726	8.84621	92360.94815	-83223.09487
Financial intermediation	27.42402	10.08051	203339.85434	-201702.80287
Real estate activities	10.42860	3.92443	200580.61386	-200580.20540
Renting of M&Eq and other business activities	31.49902	17.29126	324052.83931	-162605.08874
Public administration and defense; compulsory social security	0	0	162984.25003	-162971.19670
Education	18.26835	4.95035	147444.90925	-147363.05647
Health and social work	35.34548	3.92992	68877.36713	-68842.44463
Other community, social, and personal services	27.28271	3.88908	78613.99061	-66005.36533
Private households with employed persons	-	0	0	

Source: Author's Calculations from ADB India's NIOT 2019

The above table shows the author's calculations of forward linkages, backward linkages, DVX and FVA for India in 2019. The major contributors in each of these measures are described as follows. Forward linkages were mainly contributed by Food, Beverages and tobacco (3), Coke, refined Petroleum and nuclear fuel (8), Manufacturing, NEC, recycling(16), , Air Transport (25) and Electrical and Optical Equipment (14). Backward Linkages came from Construction(18), Food, beverages and Tobacco(3), Chemicals and Chemical products(9), Transport Equipment(15), and Textiles and Textile Products(4). The domestic value of the country was mainly added by Agriculture, Hunting, Forestry, and Fishing(1), Construction(18), Renting of M&Eq and other business activities(30), Food, Beverages and Tobacco(3), and Retail Trade, except of motor vehicles and motorcycles; repair of household goods(21). Industries that had Foreign Value Added were Water transport (24), Air Transport (25), Leather, Leather Products and Footwear (5) Wood and Products of Wood and Cork(6), and Sale, Maintenance, and repair of motor vehicles and motorcycles, retail sale of fuel (19). Electrical and Optical equipment (14) was the new industry to reach among the top 5 with forward linkages in 2019, while the other industries in the other measures remained similar to the previous year.

Table 4.29: GVC Participation of India in 2019, through major 5 Exports and Imports

Export 5	GVC Participation	Import 5	GVC Participation
Renting of M&Eq and other business activities	0.03022	Basic metals and fabricated metal	0.25501
Coke, refined petroleum, and nuclear fuel	0.18891	Coke, refined petroleum, and nuclear fuel	0.18891
Transport equipment	0.22603	Inland transport	0.84564
Chemicals and chemical products	0.24056	Construction	11.12112
Basic metals and fabricated metal	0.25501	Electricity, gas, and water supply	25.10683
GVC Participation	0.94073		37.51751

Source: Author's Calculations

The given table shows the author's calculations of GVC Participation of the top 5 Exporting and Importing Industries in India in 2019. The export participation in GVCs adds up to 0.94% as compared to 0.75% in the previous year. The import participation in GVCs stood at 37.52 % which is also an increase as compared to the previous year, the major contributor to India's GVC Participation in this year being Electricity, gas and water supply (17) with 25.12% participation of the industry in its sector.

Table 4.30: India's GVC Position in 2019 through the top 5 Exporting and Importing Industries

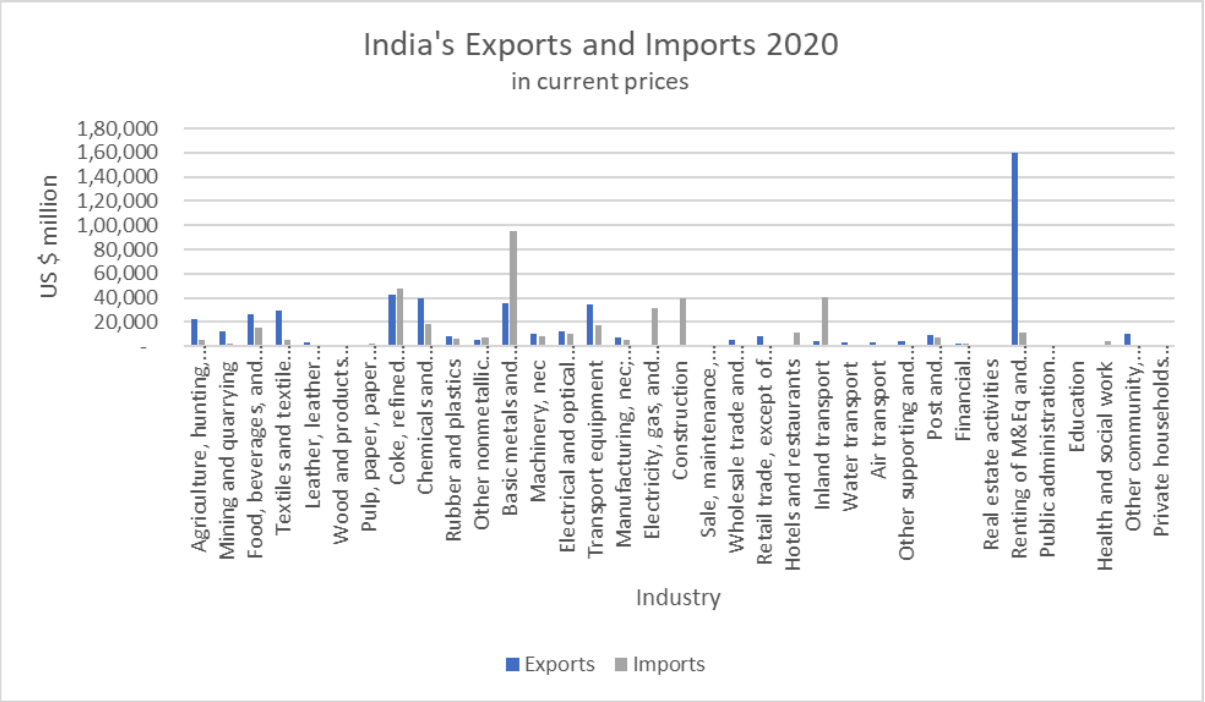
GVC Position	
VAE= total DVX of exporting industries	9,27,410
VAI= total DVX of importing industries	10,65,347
VATB=VAE-VAI	(1,37,937)
GDP=	2835610
GVC Position= (VATB/GDP)*100	-4.86447

Source: Author's Calculations

The GVC Position for 2019 was also calculated by the author, by using Value Added Trade Balance (VATB) method. Using the difference of Value Added in Imports (VAI) from Value Added in Exports (VAE), the author found the VATB to be at $-1,37,937 million, an improvement from the previous year's VATB. The GVC Position also improved as a result of better VATB and GDP and India reached -4.86 as compared to the previous -5.74. This increase marked the third continuous increase in India's GVC Position.

XI. Year: 2020

Figure 4.11: Exports and Imports of India in US $ Million (at current prices) 2020



Source: ADB National I-O Table 2020

The above graph shows India's exports and imports through the year 2020, alongside a pandemic affecting all spheres of life, including international trade. With the background of immense global pressure on physical movements of goods and commodities across borders, amidst the lockdown, India still managed to pull its fair share of deals in the International market. India's exports of services soared higher than ever before as priority was started to be given to remote work and services. The exports of Renting M&Eq and other business activities (30) was reaching its peak in this year, as it has only seen a continuous growth in the past, and was only growing further. Imports reduced in the country in this year, following the lockdowns and mandatory safety precautions, with the highest being Basic metal and fabricated metal (12).

Table 4.31 India's Forward Linkages, Backward Linkages, DVX and FVA (35 industries) 2020

Industry	forward linkage	backward linkage	DVX	FVA
Agriculture, hunting, forestry, and fishing	22.09745	15.80969	613144.31599	-590752.03298
Mining and quarrying	39.32899	5.23371	70816.72746	-58480.58924
Food, beverages, and tobacco	87.38668	23.36961	268000.16597	-242025.41572
Textiles and textile products	68.32739	13.74826	120488.02629	-91271.62664
Leather, leather products, and footwear	62.94162	1.35490	12098.40869	-8907.05181
Wood and products of wood and cork	62.05450	0.73846	15313.26070	-14310.27639
Pulp, paper, paper products, printing, and publishing	63.79731	2.65665	25723.66791	-24521.09071
Coke, refined petroleum, and nuclear fuel	76.88925	11.64459	90204.56918	-47603.19060
Chemicals and chemical products	63.99603	22.07926	186539.19798	-147461.31664
Rubber and plastics	68.72534	7.10113	56592.28469	-48476.89582
Other nonmetallic minerals	59.23734	6.68764	61739.00290	-56588.33634
Basic metals and fabricated metal	67.90914	17.41451	173732.57063	-138660.66502
Machinery, nec	62.76632	7.64839	66126.67274	-55628.37317
Electrical and optical equipment	71.92958	11.04765	81093.69991	-69070.19233
Transport equipment	68.96943	16.67442	129051.15728	-94228.34522
Manufacturing, nec; recycling	73.85887	6.61861	48303.26754	-41033.52161
Electricity, gas, and water supply	53.75895	8.59010	109713.98941	-109486.69322
Construction	58.19158	46.83262	458181.47446	-457256.66159
Sale, maintenance, and repair of motor vehicles and motorcycles; retail sale of fuel	25.77991	0.78094	15193.31971	-14572.48460
Wholesale trade and commission trade, except of motor vehicles and motorcycles	25.77663	6.06631	118033.71027	-113232.22278
Retail trade, except of motor vehicles and motorcycles; repair of household goods	25.77663	9.90578	192740.41504	-184873.21365
Hotels and restaurants	66.93935	1.30828	26246.24797	-26149.18007
Inland transport	43.13244	5.49217	121334.15774	-116659.65268
Water transport	48.83997	0.31592	3598.72083	-699.99344
Air transport	72.35492	0.96196	6828.01878	-3323.48905

Other supporting and auxiliary transport activities; activities of travel agencies	50.11280	2.93182	30894.19862	-26526.00491
Post and telecommunications	51.97313	8.46053	88662.80168	-79685.33266
Financial intermediation	26.58891	10.21216	202125.01150	-200445.93950
Real estate activities	9.69886	3.74186	193230.00353	-193229.59692
Renting of M&Eq and other business activities	28.94478	16.30203	311389.47551	-152117.66406
Public administration and defense; compulsory social security	21.43494	8.84882	207226.37578	-207209.22573
Education	16.97273	4.58484	136425.29957	-136347.05016
Health and social work	35.07200	4.01758	65062.72195	-65028.71456
Other community, social, and personal services	33.12226	4.08225	63768.42956	-53184.61988
Private households with employed persons	-	0	0	

Source: Author's Calculations from ADB India's NIOT 2020

The table given above shows the author's calculations of Forward linkages, backward linkages, DVX and FVA for the year of 2020. The major contributors were Food, Beverages and tobacco (3), Coke, refined Petroleum and nuclear fuel (8), Manufacturing, NEC, recycling(16), , Air Transport (25) and Electrical and Optical Equipment (14). Backward Linkages came from Construction(18), Food, beverages and Tobacco(3), Chemicals and Chemical products(9), BAsic metal and fabricated metal(12) and Transport Equipment(15). The domestic value of the country was mainly added by Agriculture, Hunting, Forestry, and Fishing(1), Construction(18), Renting of M&Eq and other business activities(30), Food, Beverages and Tobacco(3), and Public administration and defence, and compulsory social security(31) & Financial Intermediation(28).. Industries that had Foreign Value Added were Water transport (24), Air Transport (25), Leather, Leather Products and Footwear (5) Wood and Products of Wood and Cork(6), and Sale, Maintenance, and repair of motor vehicles and motorcycles, retail sale of fuel (19). It is an important point to note, how given the situation of a pandemic, the role the government played and the financial institutions did bit by intervening in terms of Domestic Value Added, by the presence of Public administration and

defence, and compulsory social security(31) & Financial Intermediation(28).the composition of the other industries on the listed, remain similar as shown in the previous years.

Table 4.32: GVC Participation of India in 2020, through major 5 Exports and Imports

Export 5	GVC Participation	Import 5	GVC Participation
Renting of M&Eq and other business activities	0.02841	Basic metals and fabricated metal	0.24328
Coke, refined petroleum, and nuclear fuel	0.20782	Coke, refined petroleum, and nuclear fuel	0.20782
Chemicals and chemical products	0.22027	Inland transport	1.04021
Basic metals and fabricated metal	0.24328	Electricity, gas, and water supply	27.43075
Transport equipment	0.24594	Construction	11.35627
GVC Participation	0.94572		40.27833

Source: Author's Calculations

The GVC Participation for the year of 2020 is interesting to look at, given the situation of a pandemic and India's healthy participation through its varied sectors. The export participation in GVCs stood at 0.95% whereas the import participation of GVCs totalled up to 40.28%. This shows that the Export as well as Import participation in GVCs has increased for India, as compared to 2019, even though their rates of increase might be different. This shows that India's boost through Public Administration and Defence and compulsory social security (31) and Financial Intermediation(28) in different forms, have helped India successfully maintain its position in the GVC Participation even amidst a pandemic.

Table 4.33: India's GVC Position in 2020 through the top 5 Exporting and Importing Industries

GVC Position	
VAE= total DVX of exporting industries	8,90,917
VAI= total DVX of importing industries	9,53,167

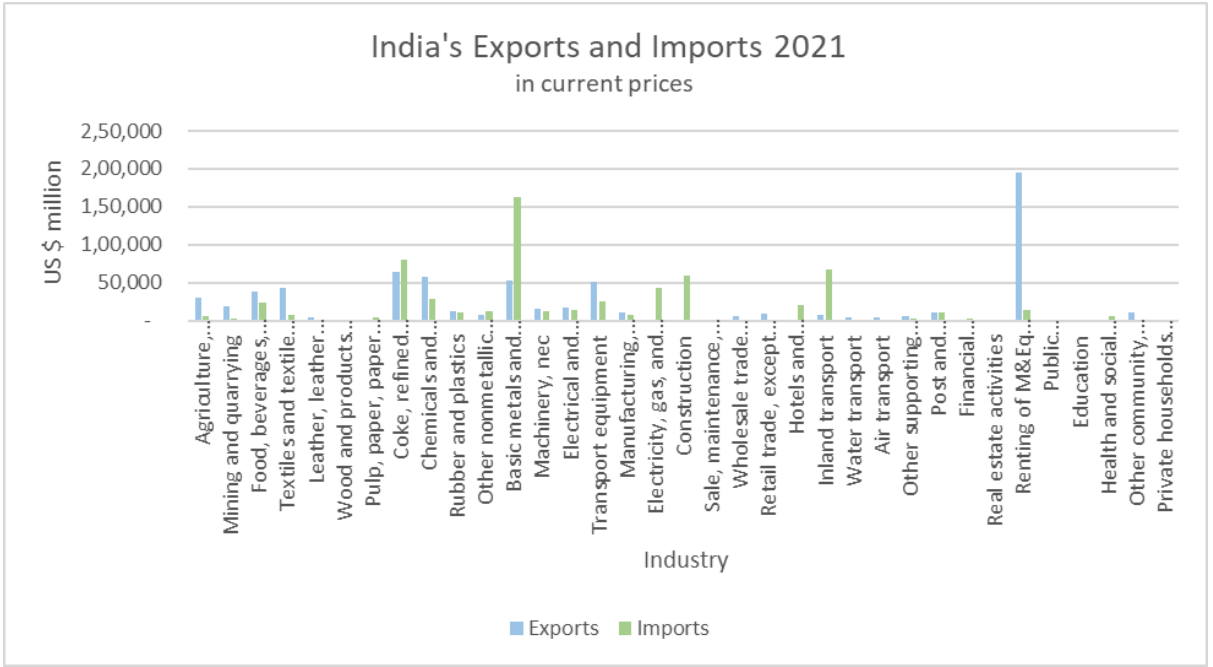
VATB= VAE-VAI	(62,250)
GDP=	2671600
GVC Position= (VATB/GDP)*100	-2.33

Source: Author's Calculations

The table above consists of Value Added in Exports, Value Added in Imports, their difference called the Value in Trade Balance (VATB), to calculate India's GVC Position; whether it is upstream or downstream. Due to heightened exports and lower imports, the VATB for 2020 stood at only $-62,250 million, less than half the VATB of 2019. This gave rise to India's highest position in GVCs in the study's observed time, at -2.33, a much higher downstream position than any India has had since 2010.

XII. Year: 2021

Figure 4.12: Exports and Imports of India in US $ Million (at current prices) 2021



Source: ADB National I-O Table 2021

The table shows India's performance in international trade in its exports and imports, through the turbid times of the COVID-19 pandemic. It was also in 2021, when the cases of

coronavirus peaked in India,during the second wave of the pandemic. Even through such times, Renting of M&Eq. and other business activities (30) lead India's exports, while on a streak of continuous increase in its value. Imports were led by Basic metal and fabricated metal(12) though far less than its Exports counterpart. Coke, refined petroleum and nuclear fuel (8) had more imports than exports in this year, and Chemicals and Chemical Products (9) exported more than they imported in 2021. The composition of the other industries in the top 5 exports and imports, remained the same as that in 2020.

Table 4.34: India's Forward Linkages, Backward Linkages, DVX and FVA (35 industries) 2021

Industry	forward linkage	backward linkage	DVX	FVA
Agriculture, hunting, forestry, and fishing	22.49528	13.57185	679703.73170	-649247.47307
Mining and quarrying	38.74157	5.05216	94986.98310	-76715.10842
Food, beverages, and tobacco	89.72059	22.60634	362581.48492	-323898.88176
Textiles and textile products	67.41460	13.05866	157987.48855	-115490.77036
Leather, leather products, and footwear	61.71177	1.14530	14199.60917	-9581.05792
Wood and products of wood and cork	67.34103	0.73283	18695.70198	-17191.74250
Pulp, paper, paper products, printing, and publishing	68.49090	2.57075	32268.80672	-30472.20026
Coke, refined petroleum, and nuclear fuel	79.41094	11.27487	117868.31358	-54113.39888
Chemicals and chemical products	68.76845	22.63818	242713.90331	-185372.93874
Rubber and plastics	72.14767	7.53250	78256.75108	-66299.73869
Other nonmetallic minerals	63.78446	7.58608	88860.89799	-81412.37125
Basic metals and fabricated metal	69.81539	15.88294	226008.00822	-173853.83849
Machinery, nec	64.31693	6.81514	79072.88997	-63390.31025
Electrical and optical equipment	73.06606	9.95061	98595.08257	-81270.04540
Transport equipment	70.20503	14.66747	153540.71968	-101522.17423
Manufacturing, nec; recycling	76.88071	6.23335	59327.58575	-48730.00813
Electricity, gas, and water supply	55.94250	6.86123	120550.35652	-120226.16378

Construction	58.80148	44.96367	592102.46559	-590886.73341
Sale, maintenance, and repair of motor vehicles and motorcycles; retail sale of fuel	25.31544	0.66840	18067.88431	-17325.81324
Wholesale trade and commission trade, except of motor vehicles and motorcycles	25.31217	5.19140	140360.61822	-134621.50189
Retail trade, except of motor vehicles and motorcycles; repair of household goods	25.31217	8.47806	229205.01102	-219801.51176
Hotels and restaurants	66.69917	1.35396	39848.07859	-39692.50229
Inland transport	45.17005	5.84625	175824.01618	-168758.49451
Water transport	49.84852	0.31564	4766.81329	-825.15838
Air transport	73.11894	0.82745	7912.38833	-3834.06044
Other supporting and auxiliary transport activities; activities of travel agencies	51.33934	2.69855	37949.79009	-32533.09735
Post and telecommunications	52.94911	7.60345	107463.23399	-96419.75804
Financial intermediation	27.83637	8.66244	222917.78131	-221055.13429
Real estate activities	12.01523	4.02993	229234.25669	-229233.77182
Renting of M&Eq and other business activities	31.48141	16.00108	380228.39029	-184481.59198
Public administration and defense; compulsory social security	25.13319	8.86342	241493.71483	-241473.62537
Education	18.18439	4.62344	175143.99345	-175043.00927
Health and social work	36.08400	3.82632	83286.28353	-83242.12962
Other community, social, and personal services	35.16147	3.03032	60715.17113	-50580.79848
Private households with employed persons				

Source: Author's Calculations from ADB India's NIOT 2021

The table above shows the author's calculations of Forward Linkages, Backward Linkages, DVX and FVA for the year 2021; from 35 industries as mentioned in the National Input-Output Tables for India, provided by the Asian Development Bank. The major industries that contributed highly to these measures are; Forward Linkages were from Food,

Beverages and tobacco (3), Coke, refined Petroleum and nuclear fuel (8), Manufacturing, NEC, recycling(16), , Air Transport (25) and Electrical and Optical Equipment (14). Backward Linkages came from Construction(18), Chemicals and Chemical products(9), Food, beverages and Tobacco(3), Renting of M&Eq and other business activities(30), and Basic metal and fabricated metal(12). The domestic value of the country was mainly added by Agriculture, Hunting, Forestry, and Fishing(1), Construction(18), Renting of M&Eq and other business activities(30), Food, Beverages and Tobacco(3), and Chemicals and Chemical products(9). An important note has to be made on the fact that, even though Public administration and defence, and compulsory social security(31) & Financial Intermediation(28) were not in the top 5 industries contributing to Domestic value added, they were still significant contributors coming in the top 10, as the period required intervention from the government, in the form of policy decisions and financial assistance to the public. Industries that had Foreign Value Added were Water transport (24), Air Transport (25), Leather, Leather Products and Footwear (5) Wood and Products of Wood and Cork(6), and Sale, Maintenance, and repair of motor vehicles and motorcycles, retail sale of fuel (19), showing that the composition of the other industries on the listed, remain similar as shown in the previous years.

Table 4.35: GVC Participation of India in 2021, through major 5 Exports and Imports

Export 5	GVC Participation	Import 5	GVC Participation
Renting of M&Eq and other business activities	0.030	Basic metals and fabricated metal	0.187
Coke, refined petroleum, and nuclear fuel	0.185	Coke, refined petroleum, and nuclear fuel	0.185
Chemicals and chemical products	0.219	Inland Transport	0.872
Basic metals and fabricated metal	0.187	Construction	8.716

Transport equipment	0.243	Electricity, gas, and water supply	26.056
GVC Participation	0.865		36.017

Source: Author's Calculations

The GVC Participation of the top 5 industries through exports and imports is shown in the table above. The GVC participation of the top 5 Exporting industries added up to 0.87%, a 0.07% decline as compared to 0.94% in 2020. The GVC Participation of the top 5 Importing Industries, added up to 36.02%, a 4.26% decline as compared to 40.28% in the previous year. The composition of industries in the list remains the same as the previous year, but only the order of a few changes, to shuffle within the top 5 ranks.

Table 4.36: India's GVC Position in 2021 through the top 5 Exporting and Importing Industries

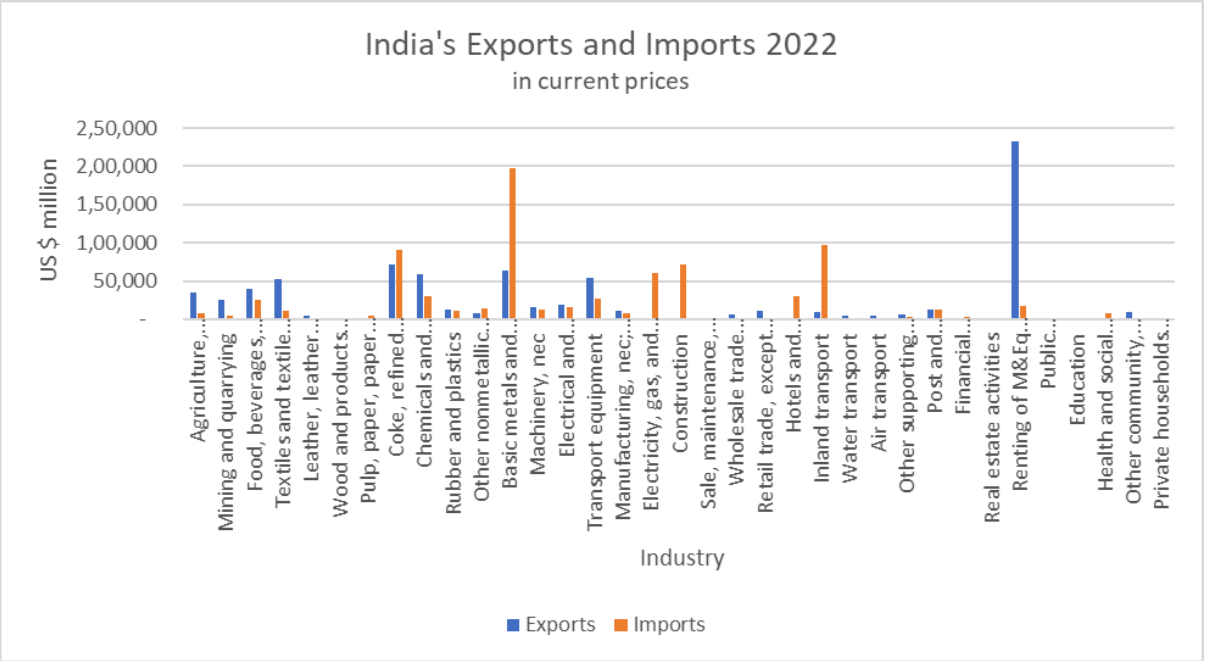
GVC Position	
VAE= total DVX of exp ind	11,20,359
VAI= total DVX of imp ind	12,32,353
VATB=VAE-VAI	(1,11,994)
GDP=	3150310
GVC Position= (VATB/GDP)*100	-3.55501

Source: Author's Calculations

India's GVC Position for the year 2021 is shown in the above table. VAE is calculated by summing up the DVX of top 5 exporting industries and VAI is calculated by the sum of top 5 importing industries for the year. The difference between VAE and VAI gives the VATB which is used to derive GVC Position. In 2021, India took a slight fall from the previous year and reached a position of -3.55, which is a more downstream position, than -2.33 in 2021. This was the first significant fall India had in its GVC position since dropping back in 2011, which could be attributed to the harmful effects the second wave of the COVID-19 pandemic had on India in 2021.

XIII. Year: 2022

Figure 4.13: Exports and Imports of India in US $ Million (at current prices) 2022



Source: ADB National I-O Table 2022

In 2022, India's international trade participation was recovering from the effects of the pandemic, when the exports of Renting of M&Eq and other business activities(30) far crossed the $2,00,000 million mark and continued to lead INdia's international trade. On the other hand, Basic metals and fabricated metal (12) was the highest importing industry, nearly touching the $2,00,000 million mark as well. Coke, refined petroleum and nuclear fuel (8) continued to keep a relative balance of its imports and exports as compared to the other industries which rely heavily either on their exports or imports. The list of other major industries of both exports and imports remained the same as those in the previous years.

Table 4.37: India's Forward Linkages, Backward Linkages, DVX and FVA (35 industries) 2022

Industry	forward linkage	backward linkage	DVX	FVA
Agriculture, hunting, forestry, and fishing	22.64669	12.40134	709771.77127	-675011.27581
Mining and quarrying	38.61349	5.61020	121196.25481	-95647.70414

Food, beverages, and tobacco	89.80837	18.19550	335994.30416	-296561.49756
Textiles and textile products	67.41319	12.67750	174996.41298	-123306.38252
Leather, leather products, and footwear	61.71050	0.99190	14091.94095	-9049.55315
Wood and products of wood and cork	67.25064	0.55375	15894.69458	-14494.79333
Pulp, paper, paper products, printing, and publishing	68.18905	1.94083	28305.53364	-26561.76865
Coke, refined petroleum, and nuclear fuel	79.10629	8.87594	111111.96724	-40314.62282
Chemicals and chemical products	68.57860	18.07196	222790.42516	-164552.27504
Rubber and plastics	71.78670	6.44332	77237.43171	-64165.21298
Other nonmetallic minerals	63.42118	6.74611	91438.49348	-82946.30651
Basic metals and fabricated metal	69.22588	12.73539	231314.49528	-168359.26147
Machinery, nec	63.94720	5.58901	75126.71403	-58603.03941
Electrical and optical equipment	72.70247	8.31911	95009.67302	-76493.69101
Transport equipment	69.91178	12.01917	145257.16381	-90562.95401
Manufacturing, nec; recycling	76.65672	4.75804	51944.82809	-41673.33876
Electricity, gas, and water supply	55.83856	6.75817	144510.71363	-144068.81071
Construction	58.51304	42.18518	640942.70463	-639517.69752
Sale, maintenance, and repair of motor vehicles and motorcycles; retail sale of fuel	25.23649	0.64393	19860.89583	-18986.81573
Wholesale trade and commission trade, except of motor vehicles and motorcycles	25.23320	5.00135	154289.81897	-147529.75571
Retail trade, except of motor vehicles and motorcycles; repair of household goods	25.23320	8.16770	251951.07333	-240874.76016
Hotels and restaurants	66.71592	1.67589	58202.59394	-57956.86986
Inland transport	44.63934	5.64079	225523.60573	-215459.12575
Water transport	49.70297	0.31979	5558.18779	-599.27792
Air transport	72.74172	0.74155	8119.19681	-3620.64438
Other supporting and auxiliary transport activities; activities of travel agencies	51.19532	2.56112	41325.34267	-34971.34913

Post and telecommunications	52.76540	7.09624	115784.19968	-102907.75637
Financial intermediation	27.73693	7.72789	227441.93613	-225403.21774
Real estate activities	11.98785	3.85167	249747.83953	-249747.27349
Renting of M&Eq and other business activities	31.39198	15.33977	419427.32764	-187272.04691
Public administration and defense; compulsory social security	25.13319	7.99364	247691.91776	-247669.83911
Education	18.14938	4.65418	201015.64714	-200891.44293
Health and social work	35.94406	3.77371	95454.99696	-95400.36134
Other community, social, and personal services	34.94421	2.37882	54672.33187	-44882.28893
Private households with employed persons	-	-	-	

Source: Author's Calculations from ADB India's NIOT 2022

The country's forward linkages, backward linkages, DVX and FVA for the year 2022 are shown as above. Using these measures, GVC Participation and Position of the country can be calculated. The major industries in each of these measures are stated as follows; major forward linkages were contributed by Food, Beverages and tobacco (3), Coke, refined Petroleum and nuclear fuel (8), Manufacturing, NEC, recycling(16), , Air Transport (25) and Electrical and Optical Equipment (14). Backward Linkages came from Construction(18), Food, beverages and Tobacco(3), Chemicals and Chemical products(9), Renting of M&Eq and other business activities(30), and Basic metal and fabricated metal(12). The domestic value of the country was mainly added by Agriculture, Hunting, Forestry, and Fishing(1), Construction(18), Renting of M&Eq and other business activities(30), Food, Beverages and Tobacco(3), and Retail trade, except of motor vehicles and motorcycles, repair of household goods(21). It was noticed that, even though Public administration and defence, and compulsory social security(31) & Financial Intermediation(28) were not in the top 5 industries contributing to Domestic value added in 2022, they continued to be significant contributors within the top 10, with continued intervention from the government, in the form of policy decisions and financial assistance to the public. Industries that had Foreign Value

Added were Water transport (24), Air Transport (25), Leather, Leather Products and Footwear (5) Wood and Products of Wood and Cork(6), and Sale, Maintenance, and repair of motor vehicles and motorcycles, retail sale of fuel (19).India's Participation and Position in GVCs was calculated using the above measures, and are given in the tables that follow.

Table 4.38: GVC Participation of India in 2022, through major 5 Exports and Imports

Exports 5	GVC Participation	Imports 5	GVC Participation
Renting of M&Eq and other business activities	0.025	Basic metals and fabricated metal	0.147
Coke, refined petroleum, and nuclear fuel	0.160	Inland Transport	0.578
Basic metals and fabricated metal	0.147	Coke, refined petroleum, and nuclear fuel	0.160
Chemicals and chemical products	0.213	Construction	7.334
Transport equipment	0.227	Electricity, gas and water supply	18.429
GVC Participation	0.772		26.648

Source: Author's Calculations

The GVC Participation of India through major 5 exporting industries was 0.77%, a further decline of 0.10%, from the previous year's 0.87%. The GVC Participation through Imports also declined to 26.65% from 36.02% in 2021. The major industry leading India's GVC Participation was Electricity, gas and water supply(17), contributing 18.43% out of the 26.65% of Import participation in GVCs. The participation of India in GVCs has overall seen a decline in the past few years that have been observed.

Table 4.39: India's GVC Position in 2022 through the top 5 Exporting and Importing Industries

GVC Position	
VAE= total DVX of exp ind	11,29,901
VAI= total DVX of imp ind	13,53,403
VATB=VAE-VAI	(2,23,502)

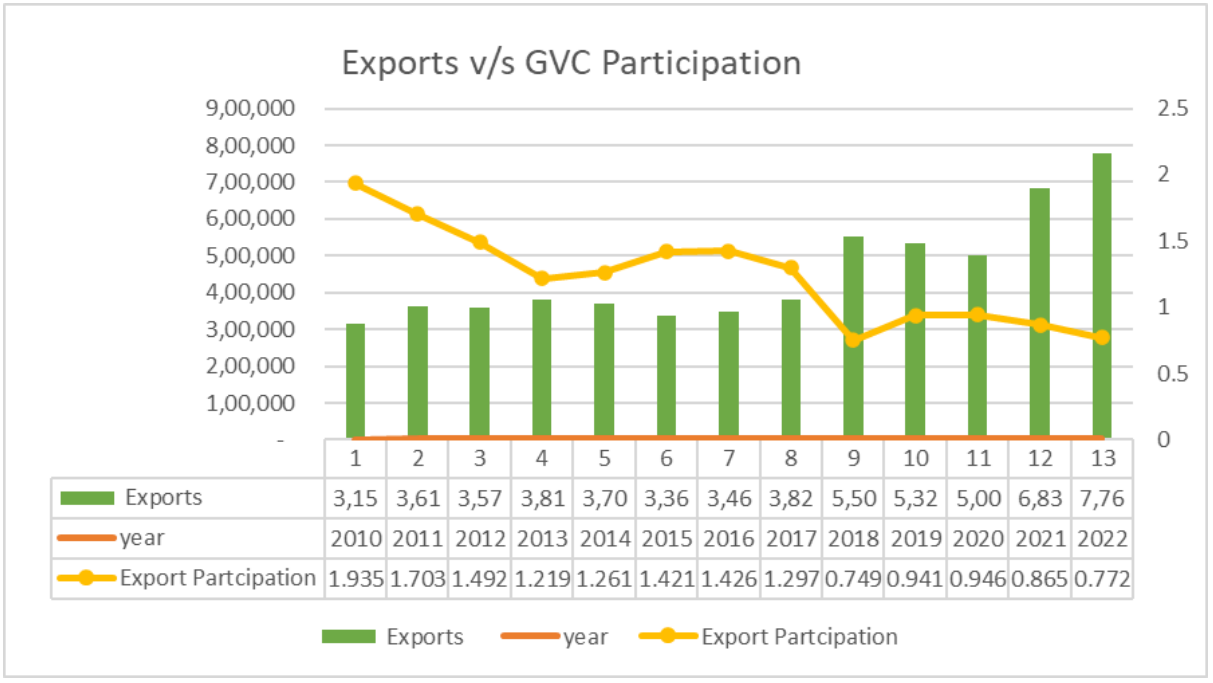
GDP=	3389690
GVC Position= (VATB/GDP)*100	-6.59359

Source: Author's Calculations

India's GVC Position for 2022 was calculated as shown above. VAE stood at $ 11,29,901 million and VAI was at $ 13,53,403 million, giving a VATB (VAE-VAI) of $ -2,23,502 million. Because the VATB worsened as compared to the previous year, India's GVC Position also came further downstream to -6.59 in 2022, from -3.55 in 2021. These results, in the decline of Position in GVCs could possibly be attributed to the aftermath of the COVID-19 Pandemic, from which the economy was just recovering in 2022.

4.3: Trends in Participation and Position with Exports and Imports

Figure 4.14: India's Annual Export Quantity (in million US$) v/s GVC Participation



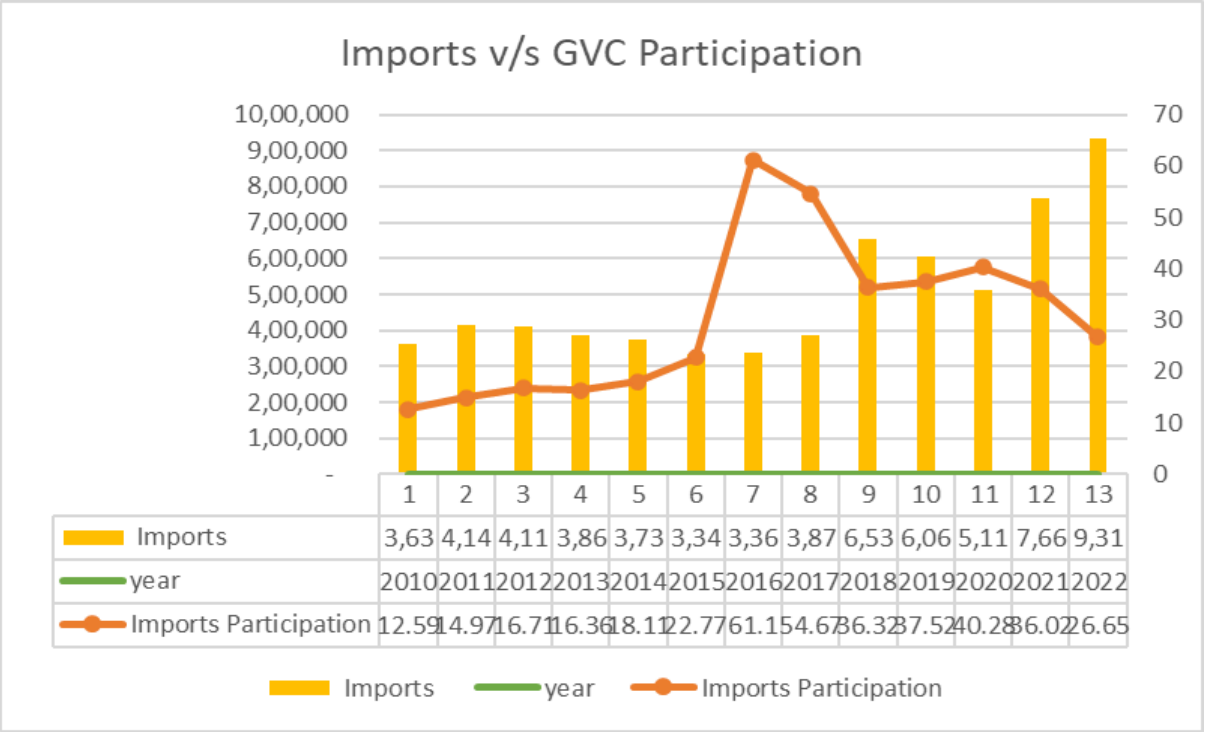
Source: Author's Calculations from ADB NIOT

The figure above is a comprehensive look at the trend of the quantity of Exports (in US $ million) as compared to the GVC Participation of the top 5 exporting industries over the

observed period of 13 years from 2010-2022. The Exports are measured with green bars, on the primary y-axis to the left, in currency value i.e; US $million whereas the GVC Participation rate is measured with a yellow line, on the secondary y-axis to the right, in terms of percentage of the sum of forward and backward linkages to the exports of that sector. Years are shown on the x-axis.

A steep fall in GVC Participation through top 5 exports can be seen at the same time when there was a slow increase in the quantity of all exports from 2010-2013. In the next few years as exports decreased in quantity, the GVC Participation through the top 5 exporting industries saw a rise, until 2017. 2018 saw a further downfall in GVC participation of the top 5 exports as overall exports spiked within an year. Over the next 2 years, the quantity of exports declined marginally but the GVC participation of top 5 exports was a relatively stable increase. In 2021, the quantity of overall exports saw a big jump while the GVC Participation through the top 5 exports started declining again. Thereby giving us a much lower GVC Participation through major 5 exports in 2022, than in 2010; but at the same time period we saw a boom in our exports.

Figure 4.15: India's Annual Import Quantity (in million US$) v/s GVC Participation



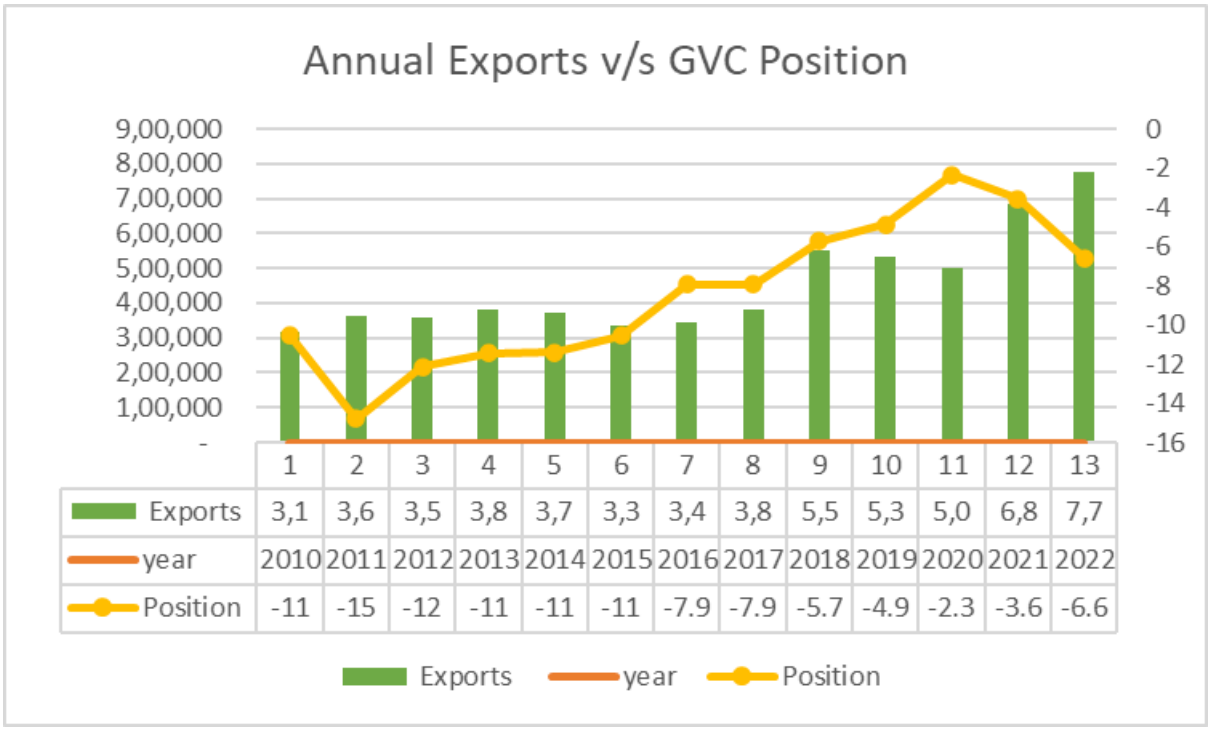
Source: Author's Calculations from ADB NIOT

The figure above shows the trend of the quantity of Imports (in US $ million) as compared to the GVC Participation of the top 5 importing industries over the observed period of 13 years from 2010-2022. The Imports are measured with yellow bars, on the primary y-axis to the left, in currency value i.e; US $million whereas the GVC Participation rate is measured with a red line, on the secondary y-axis to the right, in terms of percentage of the sum of forward and backward linkages to the exports of that sector. Years are shown on the x-axis.

From 2010-2011, the absolute quantity of overall imports increased with an increase in the GVC Participation of top 5 importing industries of the country. Over the next few years, the absolute quantity of imports declined slowly year-on-year but the GVC Participation through the top 5 importing industries remained quite stable, until 2015. In 2016, though the import quantity reduced further, there was a sharp spike in the GVC Participation through top 5 importing Industries, to an all-time-high. This could have been

caused due to the influx of imports in Inland Transport(23) during the year, and the high levels of GVC Participation of the Hotel and Restaurant(22) industry in the same year. 2017 saw a slow growth in the import quantity overall but the GVC Participation through top 5 importing industries saw a slower decline. 2018 was a different year as the import quantity rose sharply but so was the fall in GVC Participation of top 5 imports.But until 2020, when imports saw decreasing growth year-on-year, it was the GVC Participation that steadily increased. And again in 2021 and 2022, when the quantity of imports were beginning to rise at a faster rate, GVC Participation through the top 5 imports declined again. Thus, with such fluctuations, GVC Participation of India through imports ended up slightly higher in 2022 than that in 2010, and overall imports of the country undoubtedly grew a lot more in 2022 as compared to 2010.

Figure 4.16: India's Annual Export Quantity (in million US$) v/s GVC Position



	1	2	3	4	5	6	7	8	9	10	11	12	13
Exports	3,1	3,6	3,5	3,8	3,7	3,3	3,4	3,8	5,5	5,3	5,0	6,8	7,7
year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Position	-11	-15	-12	-11	-11	-11	-7.9	-7.9	-5.7	-4.9	-2.3	-3.6	-6.6

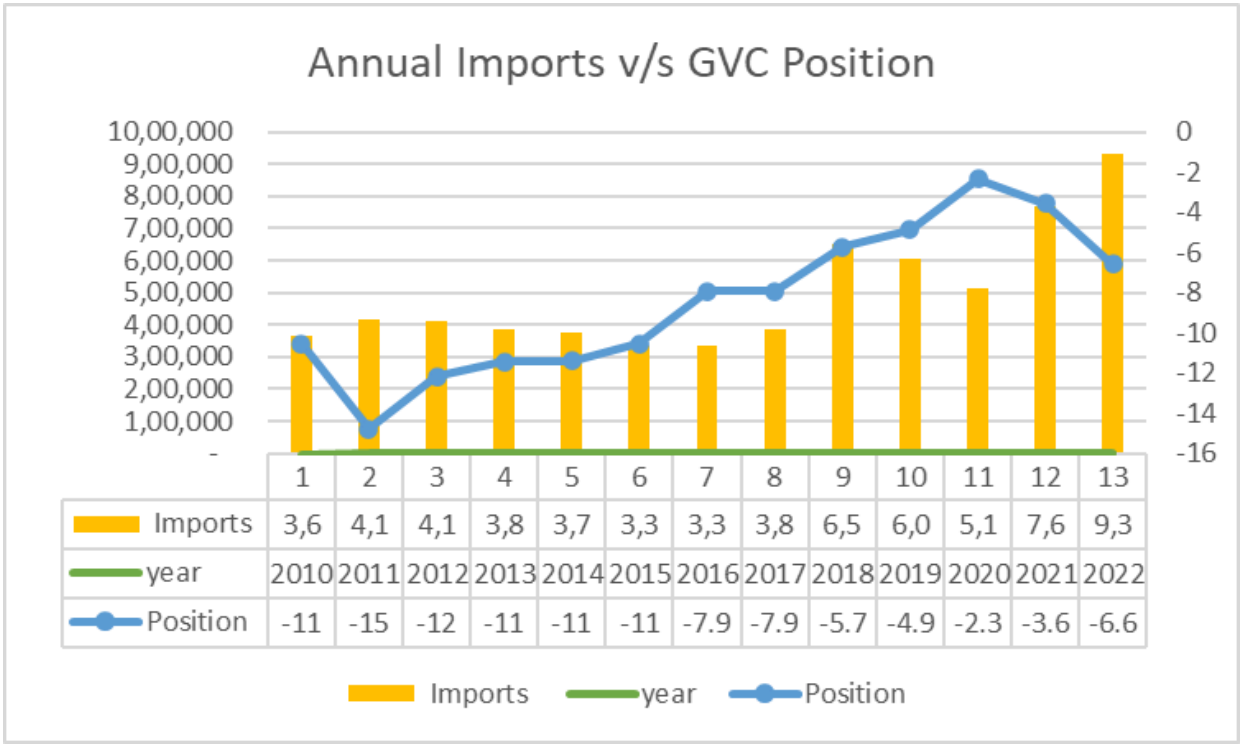
Source: Author's Calculations from ADB NIOT

The figure above shows a comprehensive overview of the trends in quantity of Exports (in US $ million) as compared to the GVC Position of the top 5 exporting industries over the observed period of 13 years from 2010-2022. The Exports are measured with green bars, on the primary y-axis to the left, in currency value i.e; US $million. The GVC Position rate is measured with a yellow line, on the secondary y-axis to the right, in terms of percentage of the difference of Value Added in Imports (VAI) from Value Added in Exports (VAE), called the Value Added in Trade Balance (VATB) to the GDP of the country for that year. It can be noticed that the axis for GVC Position is in negatives, indicating that India has only held a downstream position in Global Value Chains; at least in the observed period of study. Years are shown on the x-axis.

As can be seen in the figure, from 2010-2011, even though the exports grew marginally, there was a steep fall in India's GVC Position. This is an indicator of a negatively high VATB, which topples the GVC Position when the Imports of a country are significantly higher than their exports in their key sectors. Over the next few years however, as the quantity of exports increased, the GVC Position also increased at a steady pace, until 2015. When in 2016, exports quantity was still slow, GVC Position upped a notch ahead. This was the year which saw an influx in the import of Inland Transport (23) and Participation of Hotels and restaurants (22) into the Global Value Chains. From 2017, onwards, India's GVC Position of the top 5 exporting industries steadily increased until 2020, when it reached its peak at -2.33%, this was the highest position India attained in its downstream positions in the observed period. The quantity of exports however, fluctuated and reached its lowest in 2020 since 2015. Conversely, after 2020, the quantity of exports has only increased, peaking in 2022, but it was India's GVC Position of the top 5 exporting industries, at this time that started declining again. A probable reason is the coronavirus pandemic and its aftermath, but

there does seem to be a change in the trend of GVC position of the top 5 exporting industries w.r.t the overall quantity of exports, post 2020.

Figure 4.17: India's Annual Import Quantity (in million US$) v/s GVC Position



Source: Author's Calculations from ADB NIOT

The figure above depicts a comprehensive overview of the trends in quantity of Imports (in US $ million) as compared to the GVC Position of the top 5 importing industries over the observed period of 13 years from 2010-2022. The Imports are measured with yellow bars, on the primary y-axis to the left, in currency value i.e; US $million. The GVC Position rate is measured with a blue line, on the secondary y-axis to the right, in terms of percentage of the difference of Value Added in Imports (VAI) from Value Added in Exports (VAE), called the Value Added in Trade Balance (VATB) to the GDP of the country for that year. It can be noticed that the axis for GVC Position is in negatives, indicating that India has only held a downstream position in Global Value Chains; at least in the observed period of study. Years are shown on the x-axis.

In the year 2011, India's GVC Position saw a downfall due to the negatively high VATB. Yet as shown on the graph above, imports are not that significantly higher than exports. This could mean that either the DVX of the top 5 exporting industries counted for VAE in the year, wasn't close to the overall exports or the DVX of the top 5 importing industries counted for VAI in the year, was overstating the overall imports. From 2011-2015 however, there was steady decrease in overall imports of the country and India slowly regained its position through the major 5 importing industries in GVCs. Over the next two years, the overall imports fell further when GVC position started picking up pace again. The next increase in import quantity came in 2018, when the GVC position through the major 5 importing industries was on a streak of rising, 7 times in a row. Until 2020, even when the overall quantity of imports was falling, GVC Position of the top 5 importing industries continued to rise. It was the first time after 2011, that a fall in GVC Position was seen in 2021, and even as imports quantity increased further in 2022, GVC position of the top 5 importing industries stooped lower. From 2010, the overall imports have seen a boom until 2022; but even though GVC Position of India through its top 5 importing industries saw high downstream positions, we came further downstream but relatively at a better position in 2022 as compared to 2010.

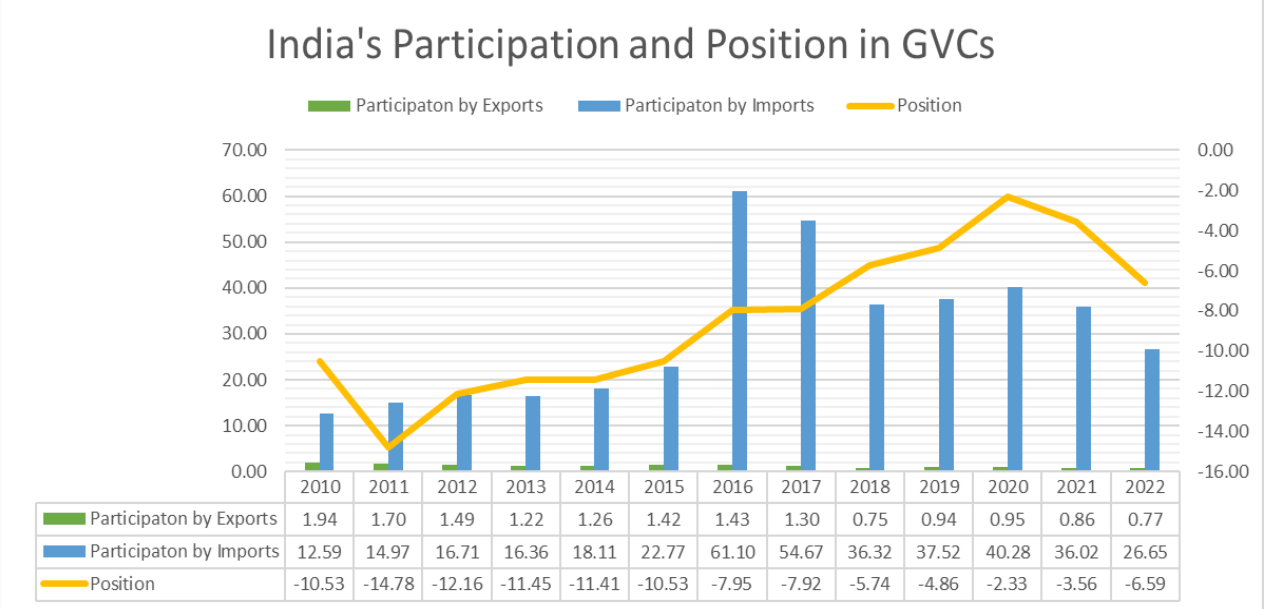
CHAPTER 5: FINDINGS AND CONCLUSION

FINDINGS AND CONCLUSION

5.1: Findings

In the previous chapter, the author looked at details of the forward linkages, backward linkages, Domestic Value Added into Exports (DVX) and Foreign Value Added (FVA) across 35 industries as specified in the National I-O Tables provided by ADB, and used these measures to calculate GVC Participation and Position of India for each year from 2010-2022. The author also analysed some trends and patterns that could be visible from the calculated measures and compared them over the years. We now look at India's GVC Participation as compared to its GVC Position.

Figure 5.1: India's Annual GVC Participation and Position



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Participaton by Exports	1.94	1.70	1.49	1.22	1.26	1.42	1.43	1.30	0.75	0.94	0.95	0.86	0.77
Participaton by Imports	12.59	14.97	16.71	16.36	18.11	22.77	61.10	54.67	36.32	37.52	40.28	36.02	26.65
Position	-10.53	-14.78	-12.16	-11.45	-11.41	-10.53	-7.95	-7.92	-5.74	-4.86	-2.33	-3.56	-6.59

Source: Author's calculations from ADB National I-O Table

The author uses the above figure to reflect India's Participation in GVCs through its 5 major Exporting and Importing industries and compare them to the Position of India in GVCs resulting from those major industries, from 2010-2022. The Participation in GVCs through 5 major exporting industries is shown by the green bars and the participation in GVCs through

5 major importing industries is shown by the blue bars. The GVC Position of India resulting from the difference in domestic value added by the top 5 exporting and importing industries; is depicted by the yellow line. The primary y-axis on the left measures GVC Participation in percentage and the secondary y-axis on the left measures GVC Position in percentage. The secondary y-axis measuring GVC Position shows only negative values, indicating that India has only held downstream positions in the observed study period. The Years are measured on the x-axis and a legend is provided with the exact measures of observed values, through the years.

After the observed trends measured between Exports & GVC Participation, Exports & GVC Position, Imports & GVC Position and Imports & GVC Participation, it can be said that quantitatively, the Exports move independently of GVC Participation and Position but Imports tend to move on hand with GVC Participation and Position. Between GVC Participation and Position however, it is not clear whether any component affects the other, in terms of movement over the years. A further study needs to be done on whether there is a correlation between the two measures but due to the lack of literature on relations between the two, the author could not perform an empirical study.

It should also be kept in mind that both, GVC Participation and GVC Position throughout the years of this study, were calculated based on the top 5 Exporting and Importing Industries, a quantitative measure of Exports and Imports. It is not necessary that these top 5 industries are the same as the top 5 industries with Forward Linkages, Backward Linkages, DVX and/or FVA; and it was observed that in most cases, they are not. The author's purpose in mind while deciding to choose to study top 5 Exporting and Importing industries was to see if, do those industries actually participate in GVCs as rigorously as others and/or what position do they hold in GVCs if they compose the top 5 in India? And it

was thus revealed that, though these major 5 industries in both exports and imports, rank highly in India, they also are the reason we participate in quite a downstream section of Global Value Chains, given the low forward linkages of the top 5 exporting industries and high backward linkages of the top 5 importing industries.

5.2: Conclusion and Suggestions

This study provides a base to understand India's participation and position in GVCs throughout the period of 13 years which also covered the tumultuous times of the COVID-19 Pandemic. As a result of this study, key industries of India in terms of Forward Linkages, Backward Linkages, Domestic Value added in Exports (DVX), and Foreign Value Added (FVA) were identified along with the trends in GVC Participation and GVC Position of the major 5 Exporting and Importing industries.

Further research is needed on whether there is any relation between the behaviour of GVC Participation and GVC Position and if any, what factors do they depend upon. It is also a possibility that these conditions and behaviours of factors influencing GVC Participation and GVC Position change from country-to-country, because GVCs deal with specialisation of processes and tasks rather than the production of final goods and services and their delivery; and that itself differs for each country. Therefore the author suggests that this research can be used as a base to work upon further questions that might involve or require annual data of India in GVCs for Participation and Position, and; to know Where did we come from? Where do we go?

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APPENDIX I: ADB NIOT 2022

APPENDIX II: INDIA'S GDP

India's GDP 2000, 2007-2022
in billion USD
source: Statista GDP of India

Year	GDP in billion$	GDP in million$
2000	476.61	476610
2007	1238.7	1238700
2008	1224.1	1224100
2009	1365.37	1365370
2010	1708.46	1708460
2011	1823.05	1823050
2012	1827.64	1827640
2013	1856.72	1856720
2014	2039.13	2039130
2015	2103.59	2103590
2016	2294.8	2294800
2017	2651.47	2651470
2018	2702.93	2702930
2019	2835.61	2835610
2020	2671.6	2671600
2021	3150.31	3150310
2022	3389.69	3389690