

Upgrading within Global Value Chains and Innovation Capabilities: Lessons from Indian Information Technology Sector

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Abstract: *This study examines the process, nature, and drivers of upgrading among Indian information technology (IT) services firms in the global value chain (GVC) by analysing the sector as a whole and examining three cases – Tata Consultancy Services (TCS), Infosys and Wipro. It uses a qualitative research approach and data obtained from secondary sources such as the Organization for Economic Co-operation and Development (OECD) Trade in Value Added (TiVA) online database, company websites and annual reports. The study found that the contribution of India's IT sector to GVC is relatively high among service sectors. It is increasingly delivering high-value products, reflecting its upgrading within the GVC. Indian IT firms have gradually transformed from being subcontractors providing low-value-added products and services to providing complete projects and solutions. The three cases show that upgrading of India's IT firms was mainly due to continuous efforts to build innovation capacity by forging partnerships with other technology leaders, start-ups, and academic institutions, and through acquisitions. India needs to design specific industrial policy with enabling institutions to increase domestic value-added (DVA) and develop a foreign direct investment (FDI) policy that focuses on attracting multinational corporations (MNCs) with GVC linkages.*

Keywords: Global value chain (GVC); Innovation capabilities; Upgrading; Indian Information Technology (IT) industry; India

JEL Classification: F13, N75, O30

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1. Introduction

Continuous technological progress, greater integration of economies through means of transport, information and communication technologies (ICTs), greater mobility of finance, etc., are changing the pattern of the production process. The production process, based on the principle of division of labour, is breaking down into the smallest tasks with differentiated mechanisms of “value creation” that define comparative advantages. Cost competitiveness and technological progress are the two major strategies contributing to value chains. The literature on ‘Global Value Chains’ (GVCs)¹ (Hopkins & Wallerstein, 1977; Porter, 1990; Gereffi, 1999; Kaplinsky, 2000; Gereffi & Fernandez-Stark, 2001; Gereffi et al., 2005; Bair, 2005; Gereffi, 2019) has started assuming a distinct branch of understanding production processes, industrial organisation, and industrial locations. GVC encompasses a range of activities involved in the production and distribution of the product for final consumption, which may span national boundaries (Prete et al., 2018). Therefore, industry and nations are striving to add more value to the production chain to achieve long-term profits and sustainability. Economies of scale, favourable business environment, availability of resources and market reach can determine some aspects for locational proximity between regions. The increasing internationalisation of companies also leads to fragmentation of production processes in different geographical locations, resulting in greater interdependence of production capabilities. In GVC terminology, firms are said to be linked either through backward linkages, forward linkages, or re-exports. The “import share of exports” is referred to as backward linkages, while exports from one country to another country that are further exported are referred to as forward linkages from the perspective of the original exporter (OECD-TiVA). In some production processes, some complex products are imported and exported without any value added, which is referred to as “complex backward linkages” or “re-exports” (Wang et al., 2017). These import-export linkages are expected to increase productivity and efficiency by creating competitive advantages. But the COVID-19 outbreak caused severe disruptions to production chains and forced companies to find alternatives. Geographical concentrations of supply chains choked production flows, leading to arguments for restructuring the value chains (Rojas et al., 2022).

Over the years, the ‘manufacturing hubs’ have shifted towards Asian economies, especially China, Taiwan, South Korea, Vietnam, Malaysia, India, etc. (Mehta, 2018). However, after about four decades of increasing globalisation, the world economic order has also begun to turn inwards towards ‘glocalisation’, combining ‘globalisation’ and ‘localisation’ (Roudometof, 2016). The literature on GVC participation (Pietrobelli & Rabellotti, 2006; Ray & Miglani, 2018), especially in developing countries, has also increased. However, there is still a knowledge gap on various aspects of GVC participation, especially in service sector in developing countries. The literature on GVC in the Indian context (Mitra et al., 2020; Veeramani & Dhir, 2022; Subrahmanya & Loganathan, 2021; Sudan, 2020; Bagaria, 2022; Reddy & Sasidharan, 2021) has limited focus on the service sector, despite its critical importance for India’s development.

In this context, this paper aims to examine the process of upgrading within the GVC, focusing on the Indian services sector. Using three major Indian information technology (IT) services companies as examples – TCS, Infosys and Wipro – the nature and drivers of their upgrading within the GVC over the years are examined. This paper contributes to drawing some lessons from the Indian IT sector in terms of upgrading within value chains by building innovation capacity and strengthening participation in GVCs. We also build a conceptual framework by combining the idea of upgrading with the literature on innovation capacity.

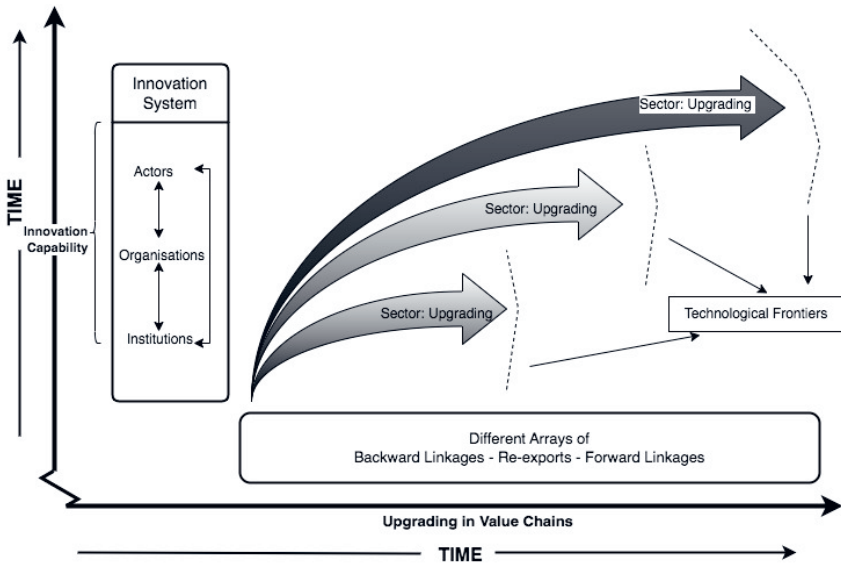
2. Upgrading within Value Chains and Innovation Capabilities: Conceptual Framework

To understand the relationship between upgrading within value chains and innovation capacity, two strands of literature need to be understood: (i) evolutionary growth theories (Nelson and Winter, 1982) with the ‘systems of innovation’ approach focusing on continuous ‘learning’ (Freeman, 1987; Lundvall, 1992; Edquist, 2005), and (ii) the literature on global value chains (Gereffi, 1994); and also the combination of the two (Jurowetzki et al., 2018; Pietrobelli & Rabellotti, 2009; 2011). Technology and its commercial application as innovation is considered an important factor of economic growth that remains largely exogenous and in the “black box” (Rosenberg, 1982). Endogenous growth theories (Romer, 1990; Grossman & Helpman, 1991) argue that investment in research and development (R&D) and human

capital can generate innovation capabilities. At the same time, Nelson and Winter (1982) noted that building innovation capabilities is a continuous process that depends on numerous historical, socio-economic and political aspects.

Figure 1 illustrates the process of upgrading within value chains. The term 'value chains' is used to summarise production linkages at local, national, and global levels. In the contemporary era of globalisation, companies and countries are striving to contribute more to value chains to create sustainable growth and employment opportunities. However, the 'value creation capabilities of firms depend on the type of 'innovation capabilities' that are continuously built up with the inter-linkages and dynamic components of innovation systems. In this context, the term 'innovation systems' is used to group together the various offshoots such as 'national innovation system' (Lundvall, 1992), 'sectoral innovation system' (Breschi & Malerba, 2005), 'regional innovation system' (Cooke et al., 1996) and 'technological innovation system' (Carlsson & Stankiewicz, 1991). Edquist (2005) has stated that the 'system' of 'innovation' consists of two main components, namely organisations and institutions and the relationships in between. Organisations are actors, such as suppliers, customers, educational institutions, research institutes, financial institutions, and ministries, while institutions are rules of the game consisting of laws, policies and norms at local, national and global levels. The continuous evolutionary inter-relationships of organisations with the dynamics of institutions generates innovation capacities to participate profitably in value chains. There is thus a relationship between innovation capacity and upgrading within value chains. Specifically, participation in value chains involves a series of combinations of backward linkages, re-exports, and forward linkages. The literature describes that in the initial stage, firms participate in GVCs with increasingly backward linkages, while in the advanced stage, participation in GVCs is with increasingly forward linkages, which is associated with a continuous accumulation of technological and innovative capabilities (Lee et al., 2018; Mehta 2022). In other words, upgrading within GVC reflects innovation capabilities accumulated over time.

Figure 1: Innovation Systems and Upgrading in Value Chains: A Conceptual Framework



Notes: Major components of Innovation Systems are depicted as actors, organisations and institutions and their inter-relationship that build Innovation Capability while the participation in GVC happens with the array of different means, backward linkages, re-exports and forward linkages. As for sectoral, upgrading chase the frontier of technologies that are themselves dynamic and move forward continuously. The conceptual ideas are drawn from Innovation Systems (Edquist, 1997); Upgrading within GVC (Lee et al., 2018; Mehta, 2022)

Source: Drawn by authors from above conceptual sources.

3. Methodology and Data Sources

The study adopts a qualitative approach to understand innovation capacity and upgrading within GVC in IT sectors. The narrative approach and the case study approach (Sonday et al., 2020; Rae, 2005) are the crucial methods suitable for the study as they are particularly beneficial in analysing the complex nature of interaction within GVCs. In particular, the study uses narrative analysis methods based on analytical clusters by interpreting the available information from data obtained from secondary sources such as company websites and annual reports. Value added data from the Organisation of Economic Co-operation and Development (OECD) online database - Trade in Value Added (TiVA) - was used to support

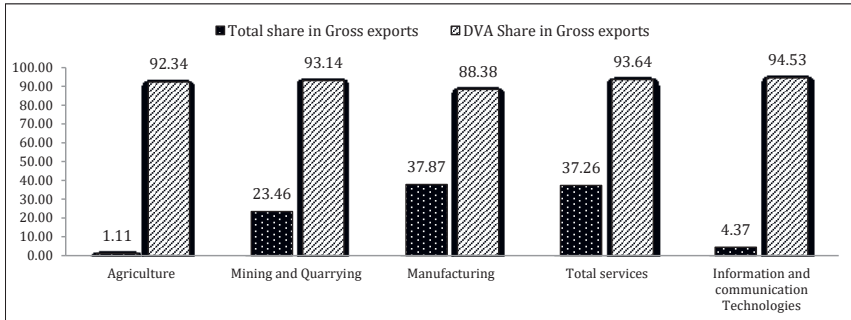
the interpretation. The narrative approach involves the interpretation of information and data to thematise and structure the understanding of the issues to provide deeper and more comprehensive information. It also enables the triangulation of different information to conceptualise the drivers and link between innovation and upgrading. Combining a narrative approach with case studies allows us to understand the processes of upgrading at the firm level and their crucial link to innovation. Since we aim to explore the linkages between innovation and upgrading, we have selected three successful companies that have upgraded in the IT industry: TCS, Infosys and Wipro.

4. Findings

4.1 *India's Participation in Value Chains*

In 1991, India liberalised the economy and opened all sectors except three (defence, nuclear and railways) to the private sector (Kathuria et al., 2014). This shift was expected to lead to more competition and increase flexibility for the accumulation of technological capabilities, which in turn was expected to increase production, productivity, and participation in the value chains of various goods and services. In this context, it is interesting to analyse the share of the various major sectors of the economy in gross exports from India. It is equally important to examine the share of domestic value added (DVA) in the gross exports of the various sectors of the economy. It is important to emphasise that gross exports can come from either the DVA share, or the foreign value added (FVA) share. We have found that the share of total manufacturing in India's gross exports in 2020 is about 37.9%, while the share of total services is about 37.3% (Figure 2). We have also found that the DVA share in total manufacturing gross exports in 2020 is 88.4%, while that of the services sector is 93.6%. In the services sector, the DVA share in gross exports of ICTs is 94.5%, which shows that the contribution of India's information technology and information technology enabled services industry (IT & ITeS) to the GVC is relatively high.

Figure 2: India’s Share of Domestic Value-Added Content of Gross Exports in Different Sectors (2020)

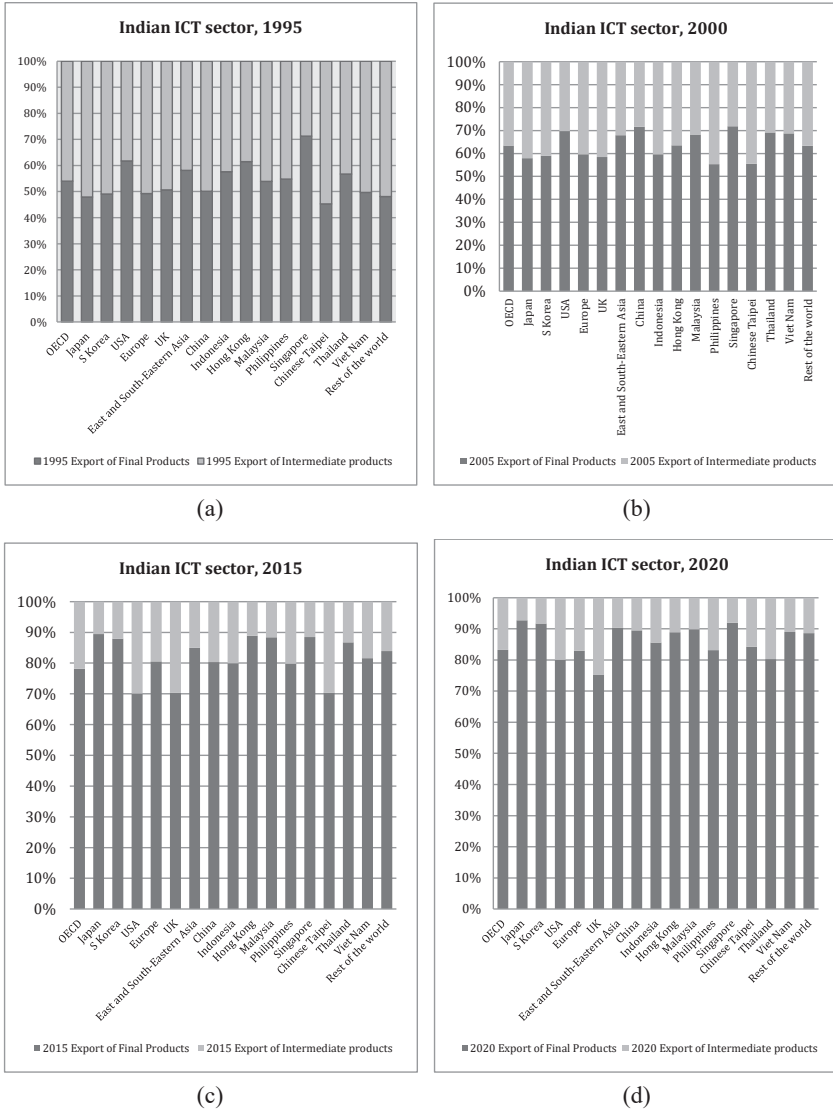


Notes: 1. The total share of three major sectors: Agriculture, Mining & Quarrying, Manufacturing and Total services is presented along with the share of ICT service sector. 2. Domestic value added (DVA) share in gross exports is presented, which when combined with foreign value added share in gross exports adds up to gross exports.

Source: Authors estimation of percentages using the data extracted from OECD-Trade in Value Added (TiVA) online database.

Further, we have tried to understand the nature of GVC participation by Indian industry. We found that India’s gross exports of goods and services as a percentage of gross domestic product (GDP) have increased significantly from about 12% in 2000 to 20.8% in 2021. Interestingly, the proportion of final products and intermediate products in gross exports has also changed over the years. Figure 3 shows that compared to 1995 (Figure 3a), the share of final products in gross exports to almost all the different countries in the OECD, Europe, East and Southeast Asia and the rest of the world has systematically increased over the years from 2000 (Figure 3b) to 2015 (Figure 3c) and 2020 (Figure 3d). Notably, it was observed (Figure 3) that the share of final goods in gross exports to neighbouring Asian countries such as China, Indonesia, Hong Kong, and the Philippines has also increased since 1995, indicating that the Indian ICT sector is increasingly supplying final goods to various countries. This change in the structure of India’s ICT services industry gross exports reflects its upgrading within GVCs.

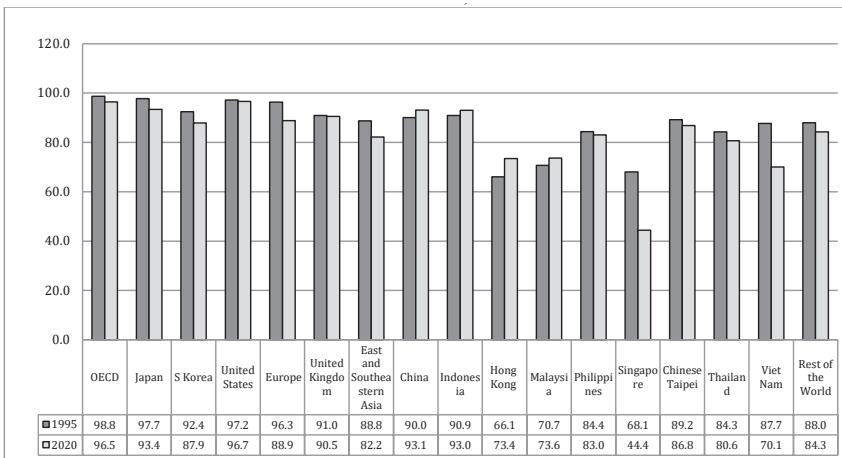
Figure 3: Dynamics of Exports of Final and Intermediate Products from Indian ICT Sector



Source: Authors estimations using OECD- TiVA online database.

Further, Figure 4 primarily focuses on the ‘domestic value-added content of exports as a ratio of gross exports’ from Indian ICT sector to various countries during 1995 and 2020 with the aim to compare the changes therein. It was found that the DVA content of ICT exports as a ratio of total ICT exports from India to OECD countries declined marginally from 98.8% in 1995 to 96.5% in 2020. A similar pattern was observed in India’s ICT exports to other developed economies, such as Japan, South Korea, and the United States (US). Moreover, the DVA share of ICT exports as a ratio of gross ICT exports from India to East and Southeast Asia also declined from 88.8% in 1995 to 82.2% in 2020, but with an exception for China, Indonesia, Hong Kong, and Malaysia. However, an inverse pattern of DVA content of India's ICT exports as a ratio of gross ICT exports to other neighbouring countries such as the Philippines, Singapore, Chinese Taipei, Thailand, and Vietnam was observed. This clearly shows that India needs to focus on increasing its domestic value-added share in the global production process.

Figure 4: Domestic Value-Added content of Export as a Ratio of Gross Exports from Indian ICT Sector, 1995 and 2020



Source: Authors estimation using OECD-TiVA online database.

4.2 Indian IT Sector: Upgrading Within GVC Since Early 1990s

Indian IT & ITES industry consists of four segments (Table 1): (i) IT services, (ii) business process management (BPM), (iii) software products and engineering services, and (iv) hardware. The Indian Information Technology – Business Process Management (BPM) – IT Enabled Services sectors are global leaders with a combined market size of \$227 billion and exports of \$178 billion in 2022. The BPM sector in India employs more than 1.4 million people, while IT and BPM together employ more than 4.5 million people as of 2021. The industry directly or indirectly employs over 10 million people and plays an important role in the national economy. In 2022, the market size of IT services was \$116 billion, BPM \$44 billion, software products \$13 billion, hardware \$17 billion and ER &D \$36 billion (Invest India, 2022; India Brand Equity Foundation (IBEF), 2023). This is a significant growth since 2013, when total revenues were \$108 billion. In terms of national GDP, the sector grew from 1.2% to 8 % between 1998 and 2013 (Noronha et al., 2016).

Table 1: Segments of India’s IT Industry

IT Services	Business Process Management (BPM)	Software products and engineering services	Hardware
<ul style="list-style-type: none"> ▪ Market Size: \$97b in FY2020. ▪ Over 81% revenue comes from the export market. ▪ BFSI continues to be the key vertical for the IT sector. ▪ IT services accounted for about 50% of the IT& BPM market revenue in India in FY2020. 	<ul style="list-style-type: none"> ▪ Market size: \$38b in FY2020. ▪ Market size of BPM industry expected to reach \$54b by FY2025. ▪ About 87% revenue comes from the export market. ▪ BPM had a 19.79% share of the IT&BPM market revenue in India in FY2020. 	<ul style="list-style-type: none"> ▪ Market size: \$34.39b during FY2019. ▪ Over 83.9% of revenue comes from export. ▪ It had around 19% revenue share in the Indian IT space in FY2019. 	<ul style="list-style-type: none"> ▪ Market size: \$14.48b in FY2019. ▪ The domestic market accounts for a significant share. ▪ Hardware exports from India was estimated to grow at 7-8% in FY2019.

Source: India Brand Equity Foundation (IBEF), 2023.

About 50% of all Global Capability Centres (GCCs) are in India (over 1570) with a market size of \$35.9 billion and a total installed GCC capacity of over 1.38 million in 2021. Data centres in India have attracted investments of \$10 billion since 2020 (Invest India, 2022). GCC facilities handle global enterprise operations (back-office functions, corporate business support functions and contact centres) and IT support (app development and maintenance, remote IT infrastructure and helpdesks) to sustain productivity growth. Some are also used as centres of excellence for automation, innovation, and analytics (Banerjee et al., 2020). While the Indian IT industry is known for providing cost-effective IT services, it is also increasingly moving up the value chain with several global IT companies setting up their innovation hubs in India (Pattnayak & Chadha, 2019). For example, the leading global IT companies such as Intel, Texas Instruments, Bosch, Yahoo, SAP Labs. and Continental have opened research centres in India (Felayati & Susanto, 2018).

Indian IT companies have emerged as global leaders by gradually upgrading in the GVC and now they offer all services, including information technology outsourcing (ITO), business process outsourcing (BPO), and knowledge process outsourcing (KPO). This has changed the nature of India's IT industry, which in turn has increased the scope for highly/deep skilled jobs. In other words, upgrading and increasing participation in IT industry GVCs have increased the demand for highly/deep skilled labour (Noronha et al., 2016).

Currently, Indian IT & BPM industry is well diversified across verticals like banking, financial services and insurance, telecommunications, and retail. Strategic alliances between domestic and international companies have increased to deliver solutions across the globe. The computer software and hardware sectors in India attracted cumulative foreign direct investment (FDI) worth \$88.94 billion between April 2000 and June 2022 (IBEF, 2022). Table 2 shows the key characteristics of India's IT and BPM companies. It shows that both large and mid-sized companies have established capabilities in a full or broad range of services and are present in 60 and 30 countries respectively. This indicates that these firms are active participants in GVCs.

Table 2: Indian IT & BPM Firms: Major Characteristics

Firm category	Number of firms	Percentage of total export revenue	Percentage of total employees	Focus of work/operation
Large	11	47-50%	~35-38%	<ul style="list-style-type: none"> ▪ Fully integrated players offering complete range of services ▪ Large scale operations and infrastructure ▪ Presence in over 60 countries
Medium	120-150	32-35%	~28-30%	<ul style="list-style-type: none"> ▪ Mid-tier Indian and MNC firms offering services in multiple verticals ▪ Dedicated captive centres ▪ Nearshore and offshore presence in more than 30-35 countries
Emerging	~1,000 - 1,200	9-10%	~15-20%	<ul style="list-style-type: none"> ▪ Players offering niche IT&BPM services ▪ Dedicated captives offering niche services ▪ Expanding focus towards sub Fortune 500/1,000 firms
Small	~15,000	9-10%	~15-18%	<ul style="list-style-type: none"> ▪ Small players focussing on specific niches in either services or verticals ▪ Includes Indian providers and small niche captives.

Source: IBEF, 2023.

Exports of IT services account for more than 51% of total IT exports (including hardware) in 2021. Export of BPM, engineering, research and development (ER&D) and software products accounted for 20.78% each in 2021. The United States (US) was the largest importer in 2021 (61.73%) and countries outside US-United Kingdom (UK) accounted for only 21.38% of total IT & BPM exports. However, there is growing demand from Asia-Pacific, Latin America, and Middle East Asia regions (IBEF, 2023).

Table 3 illustrates the evolution of India's IT industry since the early 1990s. India joined the IT GVC as an assembler for the US companies who outsourced the routine work to reduce production costs, which proved to be a 'window of opportunity. In the initial phase (in the 1990s), India's IT firms were not able to differentiate their products and competed mainly on cost. Over time, they have risen significantly in the GVC by investing in human

resources development which helped build a pool of English-speaking workers ready for the industry. Foreign companies recruited some trained employees either for their Indian branches or for overseas branches, which enhanced the learning process of the workforce. The accumulated knowledge encouraged some to start their own IT companies. Another important factor is the crucial role played by the “diaspora returning to India, which has become the architect of the main foundation of the IT sector” (Felayati & Susanto, 2018: 298). Leading companies such as TCS, Infosys and Wipro benefited significantly from the Indian diaspora.

Indian IT firms began by providing low-skill software services and gradually moved on to more complex business services. Increasingly, they have started providing high-skilled R&D services in vertical industries. During the dot.com bubble in 2001, leading Indian firms such as TCS, Wipro and Infosys started diversifying by offering solutions to business problems instead of simple programming services. Software services companies began to shift towards R&D services such as the sale and transfer of intellectual property (Pattnayak & Chadha, 2019). For example,

Infosys within a decade from 1997–2007 had moved up from providing staffing services to Application Development services. It had shifted its operating model from supplying labour for one portion of a job to designing, managing and delivering complete software projects... Infosys’s new positioning kept it in direct competition with established players like IBM and Accenture (Karunakar, 2016: 64).

Similarly, Wipro entered IT services through the engineering (hardware) route in the 1980s and offered services as an “Engineering Lab on Hire” to IT multinationals in the 1990s. Eventually, it expanded the lab on hire business and became the world’s largest third-party R&D provider (Karunakar, 2016). The big three, TCS, Wipro and Infosys, also developed the Global Delivery Model to leverage resources across a network of global development centres in different countries.

Table 3: Evolution of Indian IT-ITeS Industry

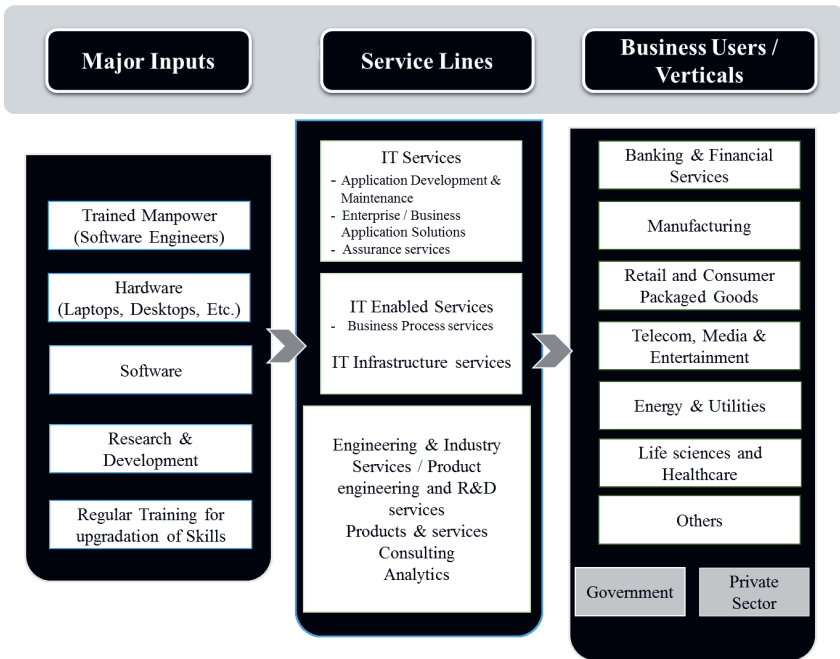
<p><i>Phase 1 (Early 1990s)</i> Emergence of India as IT and ITeS outsourcing destination</p>	<ul style="list-style-type: none"> ▪ Initiated with US based companies which started outsourcing work to India. ▪ Availability of low-cost skilled workers and English language proficiency attracted outsourcing.
<p><i>Phase 2 (Late 1990s)</i> Indian IT Industry started expanding its offerings</p>	<ul style="list-style-type: none"> ▪ Indian companies started investing in R&D and infrastructure to meet the increasing outsourcing demand. ▪ Emerged as a product development destination. ▪ High sector growth led to new job opportunities for young high skilled talents.
<p><i>Phase 3 (2000 to 2005)</i> Arrival of Captives in India</p>	<ul style="list-style-type: none"> ▪ Low-cost benefits and high skills attracted MNCs to establish captives. ▪ As they gained more experience Indian companies started offering more complex services such as product management and go-to market strategy. ▪ State level policies were introduced to develop the industry in different regions. ▪ Indian firms grew in terms of their size and scope of services offered as more and more western companies set up their bases in India.
<p><i>Phase 4 (2005-2010)</i> Evolution of new business models</p>	<ul style="list-style-type: none"> ▪ Firms in India became multinational companies with delivery centres across the globe. ▪ Increasing competition from other countries and global economic downturn led to new business models such as non-linear and outcome-based pricing models. ▪ This affected manpower as they required capable human resources and less personnel.
<p><i>Phase 5 (2010 to 2020)</i> Building Innovation capabilities</p>	<ul style="list-style-type: none"> ▪ Increasing focus on shared and managed service; offering industry specific solutions. ▪ Increasing focus on innovation to drive growth. ▪ Customers are demanding more complex services. ▪ Demand for employees with skills suitable for new generation technologies such as cloud computing, big data analytics, social media. ▪ India's rankings improved six places to the 40th position in the 2022 edition of the Global Innovation Index (GII).

Sources: Pattnayak & Chadha, 2019; IBEF, 2023.

Figure 5 illustrates the value chain of the IT industry. The liberalisation of the economy, availability of low paid and relatively highly skilled labour has opened the market for customised software services. Over time, the industry underwent a gradual change and Indian companies were no longer subcontractors providing technical labour and low value-added products

and services but started offering new services such as “product design, writing and testing of software, and delivery and installation” (Bhatnagar, 2006). Indian IT firms increasingly focused on product quality and meet international quality standards through incremental innovations (Tschang, 2001). The upgrading of the Indian software industry has been the result of numerous and continuous efforts to build innovation capacity.

Figure 5: The Value Chain of the IT Industry



Source: Karunakar (2016, p. 60).

One of the strategies adopted by Indian companies to enter and ascend in the GVCs is the acquisition of foreign companies. Overall, the industry made over 290 mergers and acquisitions in 2022, mostly focused on digital services (Ministry of Finance, 2023). In addition, IT firms have been investing significantly in R&D to innovate in the changing landscape and train employees to create an efficient workforce and improve productivity and quality. For instance, TCS launched new Google Cloud Garages for its enterprise customers in 2021 and Jile5.0, a SaaS-based agile tool for

enterprises, with enhanced portfolio features. In November 2021, Wipro partnered with TEOCO to develop solutions for communication service providers (CSPs) to improve network automation, efficiency, flexibility, and reliability (IBEF, 2023). The Indian IT industry has increased its activities in R&D and innovation. According to the Economic Survey (2022-23):

In recent years, India has emerged as a global powerhouse for Engineering R&D (ER&D) and innovation and is steadfastly committed to ushering future growth and innovation for global enterprises. Many Global Competency Centres (GCCs) have been incorporated in India in the last six years. GCCs in India are increasingly performing complex R&D functions and are leveraging futuristic technologies and developing digitally innovative products as well building either the largest or the second-largest ER&D hubs in India. Patent filing has increased drastically, with over 138,000 patents filed between 2015-2021, with over 85,000 filed in emerging technologies. (Ministry of Finance, 2023: 304).

4.3 Case Findings

4.3.1 Case 1: Tata Consultancy Services (TCS)²

TCS is a leading IT company in India with a global presence. It provides IT services, consulting, and business solutions across various industries such as banking, capital markets, healthcare and public sector. TCS was founded in 1968 by Fakir Chand Kohli, by employing some IT professionals who had returned from the US. It undertook its first offshore project in 1973 (the US) and opened a branch in New York in 1979. In 1989, the company signed a \$10 million contract with the Swiss Securities Clearing Corporation. In 2002, the company signed its first \$100 million contract with GE Medical Systems, the largest contract won by an Indian software company. In 2007, TCS signed its first \$1 billion contract. In 2020, revenue reached an all-time high of \$25.7 billion and the number of employees increased to 545,000. Currently, TCS employs “over 614,000 of the world’s best-trained consultants in 55 countries” (TCS, 2022-2023), and they are “highly localised” (154 nationalities). Of these, 171,000 are “deeply skilled” (‘whole person’ skills) and 35.8% are women. The company operates in

131 countries. TCS has invested in “an unprecedented number of new engineers – over 110,000 in 2022 and over 44,000 in 2023 – and trained them in the most in-demand technologies” (TCS, 2022-23, pp. 9). Over “53,000 earned certifications in hyperscaler cloud skills, bringing the total to over 110,000 and making TCS one of the top partners of the largest cloud providers” (TCS, 2022-2023, pp.10). In terms of building innovation and technological capabilities, TCS has continuously built and upgraded internal R&D capabilities, forged links with external partners such as start-ups, academic institutions, and strategic alliances, and acquired other companies. TCS established its first research centre, the Tata Research Development and Design Centre, in Pune, India in 1981. TCS Research has produced a strong portfolio of new technologies and innovative solutions through its own and collaborative research projects. The company leverages two organisations: (i) TCS Research, which generates fundamental inventions; (ii) TCS Pace™, which focuses on TCS’ intellectual content, innovation assets, capabilities, and practices to clients. TCS’ research and innovation ecosystem include over 5,500 researchers, 2,878 patents granted/ 7,305 filed (cumulative), over 40 research centres around the world, over 80 academic partners, over 2700 startup partners and 5 Pace Ports (New York, Toronto, Tokyo, Amsterdam, and Pittsburgh) (TCS, 2022-2023, pp.20).

In the words of K Ananth Krishnan, EVP & CTO, TCS:³

Historically, gaining leadership in IT services on any new technology required just training sufficient numbers of people in that technology, ahead of market demand. In the last decade, we not only did that at scale on the entire class of digital technologies, but also invested in higher order capabilities ...We scaled up our Research and Innovation... We expanded COIN, created new innovation frameworks and set up Pace Ports, our co-innovation hubs, across the world. Today, we not only have a large number of patents, but also the largest portfolio of products and platforms in our peer set, helping win large transformational engagements that uniquely distinguish us.

In 1997, to address the Y2K problem (millennium bug), TCS developed ‘the concept of software factory’, which helped reach global markets. In 2006, the Co-innovation network (COIN) was launched to bring the best

available technology to the startup ecosystem. It now has over 2500 startups and 50 academic partners (including Stanford and Massachusetts Institute of Technology (MIT) in the US and various Indian Institutes of Technology (IITs) in India). By 2012, TCS had set up 19 innovation labs in India, the UK and the US. TCS has built technology and innovation capabilities that have helped develop new technology products and platforms such as TCS BFSI Platforms, TCS ERP on Cloud, TCS OmniStore and TCS MasterCraft. This in turn seems to have helped the company to participate in GVCs. In 2009, for example, TCS offered a cloud-based business model to the UK insurance industry, “such a compelling value” that TCS has since been “considered number one in the UK market”. In 2011, the company founded iON to provide cloud-based services for SMEs. In the area of technology alliances, TCS has “built deep relationships with cloud hyperscalers, leading enterprise application providers and niche technology specialists to create a robust and extensive network of leading technology companies”. These include global leaders such as IBM, Intel, Microsoft, Oracle, SAP, SAS, Thales, and ScienceLogic. One of the avenues TCS is pursuing to strengthen its technological capabilities and enhance its GVC participation is to acquire companies around the world. By the end of 2018, the company had acquired 16 companies. As of mid-2023, TCS has 51 subsidiaries around the world.

4.3.2 Case 2: Infosys⁴

Infosys is a global leader in digital services and consulting, with clients in 56 countries. With over 336,000 employees and more than 1880 customers, the company currently generates revenues of \$18.38 billion. The company was founded in 1981 by Narayana Murthy and 6 engineers in Pune, India with \$250. It started its global journey with its first customer Data Basics Corporation in New York. In 1987, Infosys opened its first international office in Boston (US). In the 1990s, the company opened additional offices in Canada, the UK, Belgium, Germany, Sweden, and Australia. In the 2000s, Infosys opened additional international offices in the Netherlands, Singapore, Switzerland, Argentina, and the United Arab Emirates. Over the years, Infosys has seen remarkable revenue growth: \$200 million in 2000, \$1 billion in 2004, \$4 billion in 2008, \$10 billion in 2016 and over \$18 billion in 2023. From a capital of \$250 in 1981, the company’s market capitalisation has grown to about \$67 billion in 2023. The number of highly skilled

employees has also grown remarkably: to over 50,000 by 2006, to over 100,000 by 2009 and to 336,000 by 2023. Overall, 91% of the workforce is employed locally in the various regions.

In 1999, Infosys Business Consulting Services was founded. It was the 21st company in the world to achieve CMM Level 5 certification. Infosys was also the first Indian IT company to be listed on NASDAQ. From 2013, the company was traded on the New York Stock Exchange (NYSE), Euronext, London, and Paris. By 2023, it became one of the top three IT services brands in the world. To build R&D capabilities and technological upgrading, Infosys has set up development centres in various countries since the early 1990s. In 1994, the company opened its first global development centre in Fremont, US. This was followed by two more development centres in the US in 1999. Subsequently, three global development centres were established in the US, as well as in the UK, Canada and Japan. The company has successfully developed new technologies and solutions over the years, which appear to have played an important role in expanding its participation in GVC. For example, the company pioneered the Global Delivery Model. In 2002, it launched Progeon, a business process outsourcing services; in 2016, it developed Skava Commerce, a new standard for modular e-commerce platforms; in 2021, the Infosys Cortex (AI first and Cloud first) customer engagement platform. Infosys currently has a portfolio of 735 patents and over 840 registered trademarks in 51 countries (Infosys, 2022-23, pp. 49).

Infosys works with experts, partners, academics, and other stakeholders to develop new products and services. Through the Infosys Centre for Emerging Technology Solutions, the Living Labs and the Infosys Innovation Network, a portfolio of innovative solutions has been developed. Infosys forged technology collaborations and alliances with startups and other partners. For example, in 2015 Infosys set up a \$250 million Innovate in India fund to support startups. The company invested in early-stage technology ventures like Waterline Data and Tidal Scale (2016). Infosys Innovation Network fosters partnerships between startups, universities and hyperscalers to promote emerging tech innovations from around the world. Currently, 250 startups are involved (Infosys, 2022-23: 49).

Like TCS, Infosys has also started acquiring other companies to strengthen its technology portfolio and intellectual capital. “Infosys is pursuing a systematic M&A approach aimed at strengthening its digital services capabilities, deepening its industry expertise and expanding its

geographic footprint” (Infosys, 2022-23, p. 64). Some notable acquisitions include: Lodestone Holding AG in Switzerland in 2012; Noah Consulting LLC (leading provider of advanced information management consulting to the oil and gas industry) and Panaya Inc. (leading provider of automation technology) in 2015; Fluido (leading Salesforce consulting partner in the Nordics and leader in cloud consulting) in 2018; Simplus (fastest growing Salesforce Platinum partner in the US and Australia) and Kaleidoscope Innovation (product design and development company) in 2020; and BASE Life Science (leading provider of life sciences consulting and technology) in 2022. Infosys also set up subsidiaries in various countries in North America, Europe, Asia, and Africa, enabling it to increase its participation in GVCs. As of March 2023, Infosys had 28 direct subsidiaries and 70 affiliates (Infosys, 2022-23, p.64). These include: EdgeVerve Systems (a global leader in AI and data analytics); Infosys BPM, which provides finance and accounting outsourcing services; Infosys Consulting (in 19 countries), which provides technology solutions for digital transformation; Infosys Public Services (North America), which helps public sector organisations with digital transformation.

4.3.3 Case 3: Wipro⁵

Wipro is one of the largest IT services companies in the world serving the digital transformation needs of clients across more than 10 industries. It currently operates in 66 countries, with revenues of \$11.3 billion and more than 250,000 employees (144 nationalities; 36.4 per cent women). Wipro was founded by Azim H. Premji in 1945. The company entered the IT sector in 1979. In the 1990s, it really took off by entering IT services and partnering with leading technology companies. In 2000, the company grew to \$1 billion and was listed on the New York Stock Exchange. Wipro was the first company in the world to be rated People Capability Maturity Model (PCMM) Level 5 (certification) in 2001.⁶

Since 2006, Wipro has seen significant growth and transformation through “major acquisitions, investments and technological innovation”. The company has a presence in several countries across all continents of the world. Wipro has invested in and expanded research and innovation capabilities and developed strategic partnerships. The Wipro Innovation Lab (Lab45), established with the “Silicon Valley culture of free-flowing

creativity”, promotes internal research and development of cutting-edge technologies and incubation solutions. In 2017-18, Wipro established the Silicon Valley Innovation Centre in Mountain View, California, the Automotive Centre of Excellence in Timisoara, Romania, and the Texas Technology Centre in Plano, Texas. Wipro maintains tie-ups with academic institutions in various countries to conduct R&D including UT Austin (US), and IIT Patna, IISc Bangalore (India). For instance, in 2017, Wipro and Ramot, the Business Engagement Centre of Tel Aviv University (Israel), partnered to conduct R&D in emerging technologies such as Artificial Intelligence. Wipro holds a portfolio of 1312 patents (over 2000 patents filed) and 342 trademarks (Wipro, 2022-23, pp. 15 & 35).

At Wipro, “strategic partnerships are one of the key pillars” of its business strategy. Wipro has strategic partnerships with more than 90 technology companies, including Adobe, Cisco, BT, Google, Huawei, Intel, Microsoft, Oracle, IBM and SAP. It has forged technology partnerships with hyperscalers (large cloud service providers) such as Microsoft, Google, AWS, and NVIDIA. It has established an AI lab with NVIDIA. In 2016 alone, Wipro entered strategic partnerships with Verveba Telecom (a premiere telecom network engineering company) and with Tableau (a global leader in fast and easy-to-use business analytics) and Etiya (the leading independent software provider).⁷ By March 2023, Wipro Ventures had invested in 30 start-ups in enterprise software and cybersecurity (Wipro, 2022-23, p. 13 & p. 56). In addition, the Wipro Inclusive Supplier Development & Mentorship (WISDOM) programme provides management and technical support to diverse suppliers, and the Wipro Inclusion & Diversity Opportunity for Vendors (WINDOV) creates direct connections with diverse suppliers. In the US, for example, this programme has helped to connect 2,000 diverse suppliers.⁸

Like TCS and Infosys, Wipro also used acquisitions to strengthen its technological upgrading in GVC. Since the early 1990s, Wipro has made 25 acquisitions,⁹ investing over \$4.75 billion in various sectors such as e-Commerce Enablers, Healthcare Payer Tech, and Manufacturing Tech. Some of the key acquisitions are: Rizing and CASS (2022), Edgile (2021), Capco (\$1.45 billion in 2021), HealthPlan Services (\$460 million in 2015), Infocrossing (\$600 million in 2007), Appirio (\$500 million in 2006), Edgile (\$230 million in 2001), Leonia (\$600 million in 1999), Capco (\$1.4 billion in 1998) and Unza (\$246 million in 1992). Like TCS and Infosys, Wipro has

also established about 100 subsidiaries in all continents.

From the three cases of Indian IT firms it is evident that the following drivers played an important role in strengthening and expanding upgrading in GVCs: (i) Continuous technological upgrading; (ii) Continuous investment and efforts to build research, development and innovation capacity; (iii) Building human capital (especially highly/deep skilled talent) and a localised workforce structure; (iv) Strategic partnerships with technology leaders; (v) Investment in and collaboration with start-ups and academic institutions; (vi) Strategic acquisition of companies; (vii) Operation of subsidiaries; (viii) Role of the Indian diaspora; (ix) Foreign IT companies outsourcing R&D to India.

5. Conclusion and Policy Implications

This study examined the process of upgrading of the Indian IT services firms in the GVC. It analysed the IT sector as well as three cases of leading Indian IT service firms (TCS, Infosys and Wipro). The study found that the DVA share in gross exports of IT services in the services sector is around 94.5%, suggesting that the contribution of India's IT sector to GVCs is relatively high. The Indian IT sector is increasingly engaged in supplying final products to various countries. This change in the structure of gross exports reflects its upgradation within GVC. Over time, Indian IT firms have gradually transformed from being subcontractors supplying technical manpower and low value-added products and services to providing complete projects and solutions. The three cases show that the upgrading of India's IT firms has been the result of numerous and continuous efforts to build innovation capacity by forging partnerships with other technology leaders, start-ups and academic institutions, through acquisitions and the crucial role played by foreign companies outsourcing R&D to India and the Indian diaspora.

Several policy implications arise from this observation. These are: (1) India should adopt targeted policies towards enabling Indian firms to upgrade in GVCs; (2) India needs to develop FDI policies that focus on attracting multinationals with GVC linkages and developing linkages between them and local firms to facilitate technological upgrading and knowledge spillovers. (3) India needs to develop a specific policy for the IT industry with enabling institutions to increase DVA within GVC. (4) Indian firms need to invest in continuous and consistent efforts to build innovation

capacity by entering external strategic partnerships with other players to upgrade within GVCs; and (5) Indian start-ups and entrepreneurs should seek to develop new ideas, cutting-edge technologies and continuous innovation to increase DVA within GVCs, taking advantage of global dynamics and domestic policy frameworks.

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Notes

- ¹ It was found in the literature (Bair, 2005) different terms like ‘commodity chain’ (Hopkins & Wallersterin, 1977), ‘value chains’ (Porter, 1990), Global commodity Chain (GCC) etc. but the concept was subsumed in the term ‘Global Value Chains’ (GVC).
- ² Refer to TCS for more details, <https://www.tcs.com/>; <https://brandriddlze.com/tcs-history/>
- ³ Refer to TCS for more details, <https://www.tcs.com/investor-relations/management-commentary/fireside-chat>
- ⁴ Refer to Infosys for more details, <https://www.infosys.com/about.html>
- ⁵ Refer to Wipro for more details, <https://www.wipro.com/>
- ⁶ Refer to Wipro for more details, <https://www.zippia.com/wipro-careers-44752/history/>
- ⁷ Refer to Wipro for more details, <https://www.capitalmarket.com/Company-Information/Information/About-Company/Wipro/614>
- ⁸ Refer to Wipro for more details, <https://www.wipro.com/about-us/supplier-diversity/>
- ⁹ Refer to Wipro for more details, <https://tracxn.com/d/acquisitions/acquisitionsbyWipro>

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