

# **Trend Analysis of India's Foreign Direct Investment Inflow in Computer Software & Hardware**

**Dr Neelu Kumari**

Assistant Professor

University Department of Economics

Ranchi University, Ranchi

**Sweta Kumari**

Research Scholar

University Department of Economics

Ranchi University, Ranchi

Email-id: [Ksweta9801@gmail.com](mailto:Ksweta9801@gmail.com)

## **Abstract**

Investment in the Computer Software and Hardware sector by Foreign Direct Investors (FDI) has become an important source of innovation, economic growth, and international competitiveness, especially in the fast changing digital economy. This research offers an in-depth analysis of the FDI trends in the computer software and hardware sector of India between 2000 and 2021, including growth trends and macroeconomic and technological factors that affect investment decisions

The study reveals several periods of FDI inflows, starting with initial fluctuations during the dot-com bubble and then stabilisation, followed by a downturn during the global financial crisis (2007-2009) and post-global financial crisis resurgence. In particular, a major growth is noted post 2014, with digital transformation programs, regulatory reforms and global IT services expansion, with an all-time high in 2020-21 attributed to a rapid digitalisation during the COVID-19 pandemic.

The research uses trend analysis, moving averages, and growth rate analysis, backed by a linear regression model, which shows a moderate correlation between time and FDI inflows, and the significance of other factors such as policy reforms, technological change and the international economic environment. The study highlights the critical role of FDI in promoting technology absorption, human capital development, employment generation and participation of domestic industries in the global value chain. Moreover, the research highlights the role of conducive policy regimes such as liberalization, fiscal incentives, regulatory regimes and intellectual property rights (IPR) protection in promoting long-term FDI inflows.

In summary, the study reveals that FDI in the computer software and hardware industry is crucial for building a knowledge-based economy and enhancing India's status as an IT hub. But for long-term growth, the issues of infrastructure, cyber security and regulatory stability need to be overcome

**KEY WORDS:** Computer software and hardware, FDI, Economic Growth

## **INTRODUCTION**

Foreign Direct Investment (FDI) in the Computer Software & Hardware industry is a critical source of funding for nations seeking to enhance technological capacity, build competitiveness and promote innovation. In recent decades, the rapid pace of technological development and its growing global dependence on software and hardware applications have attracted considerable foreign investment. With increasing technology reliance in both business and consumer markets, FDI has emerged as a critical mechanism for knowledge and technology transfer, as well as building human

capital in the field of computer software and hardware. FDI in the computer software and hardware sectors offers host countries access to international capital, advanced technologies and business models that are difficult to acquire otherwise. FDI in the software and hardware industry bring along capital and technology such as advanced research and development (R&D), improved manufacturing processes, and efficient supply chains. This transfer of knowledge and capital not only facilitates technological innovation but also expands the capacity and competitiveness of the host economy (Choudhury, 2020)<sup>1</sup>. Besides promoting technological innovation, FDI also supports the ability of local firms to engage in high-value activities, such as software programming, product design and hardware manufacturing. Through joint ventures, partnerships, or wholly owned subsidiaries, foreign investors typically enable technology localization, enabling companies to develop software and hardware products that meet local demands. This allows host countries to build a more sophisticated tech ecosystem that can meet international standards and norms (Hitt et al., 2002)<sup>2</sup>. Furthermore, the software and hardware industries play a key role in economic growth in the digital economy, as almost every other sector of the economy (such as healthcare, finance, and manufacturing) depends on information technology. FDI helps countries to build their digital economies by offering a more diverse range of services and products to cater to local demand (Brynjolfsson & Hitt, 2003)<sup>3</sup>. FDI also helps to upgrade the local workforce through the transfer of technology, management and innovation practices, which all contribute to human capital development and productivity improvements (Brynjolfsson & Hitt, 2003)<sup>4</sup>. Software and hardware FDI is also driven by an increasingly globalised economy. As technology plays an increasingly important role in business, countries are looking to stay competitive by accessing global knowledge resources. Multinational corporations (MNCs) play a pivotal role in transferring knowledge of cutting-edge software tools, hardware products and production processes, ensuring that host countries remain on the cutting edge of the digital revolution. This is especially true for developing nations, where foreign direct investment (FDI) helps countries skip over traditional barriers to development and provides quicker access to the global digital economy (Cairncross, 2001)<sup>5</sup>. For example, India and China have attracted significant FDI in the software and hardware sectors due to their vast pool of skilled workers and burgeoning digital economies. Consequently, both nations have become leading destinations for software outsourcing, Information Technology (IT) services and hardware manufacturing, attracting more foreign investment and generating thousands of jobs. Likewise, smaller developing countries are attracting FDI in these industries to build technological capabilities and become part of the global digital supply chain (Dunning, 1993)<sup>6</sup>.

#### LITERATURE OF REVIEW:

Raj and Suvakkin (2025)<sup>7</sup> examined the impact of FDI inflows in the service sector and computer software–hardware sector on Gross Domestic Product (GDP) at factor cost for the period 2010–2011 to 2020–2021 using regression analysis. The study found that FDI inflows in both sectors have a positive and statistically significant effect on GDP growth, indicating their important role in enhancing economic performance. These findings are consistent with the broader literature, which emphasizes that sector-specific FDI contributes to economic growth through capital accumulation, technology transfer, and productivity improvements.

Ananda kumar (2012)<sup>8</sup> analysed sectoral FDI inflows in India in a comparative manner of services, telecommunications, and computer software and hardware. The research discovered that computer software and hardware industry is among the top-most beneficiaries of FDI because it is highly export-oriented and technologically advanced. The author concluded that the liberalization policies played a major role in the increase in the FDI inflows in this sector.

Arora (2021)<sup>9</sup> examined the determinants of FDI. The analysis found skilled labor supply, good government policies and low costs to be among the driving forces of FDI inflows. It further highlighted that the fact that India is a global hub in IT has had positive effects on the growth trend of foreign investment in this area.

In the article by Singh (2021)<sup>10</sup>, the trend analysis of FDI inflows into India by sector was carried out in 2000-2020. The results showed that there is a steady growth in the total FDI inflows, and the computer software and hardware industry has retained a considerable portion. Nevertheless, the research has observed the variations in growth rates based on the economic conditions in the world and changes in the sector.

Robert and Nirmala (2022)<sup>11</sup> studied how FDI affects the computer software and hardware industry in India. In their research, they found out that FDI is a positive contributor to productivity, innovation, and job creation. The authors concluded that persistent inflows of FDI are essential in the growth persistence in the industry.

The article by Islam and Beloucif (2023)<sup>12</sup> presented a review of the determinants of FDI in developing economies. The analysis revealed that macroeconomic stability, infrastructure development and trade openness are critical to attracting FDI. The above considerations are especially applicable to the trend of FDI in the technology-based industries in India.

Javed and Javed (2017)<sup>13</sup> applied the panel data analysis to examine the FDI inflows to India between 1991 and 2015. The findings indicated that the market size, infrastructure and policy reforms are key determinants of FDI inflows. The paper has also brought out the role of the IT sector as an area that is getting more and more significant in terms of foreign investment.

## METHODOLOGY

The research design is quantitative and time-series based, and examines the trends of Foreign Direct Investment (FDI) inflows to India's Computer Software and Hardware sector for the period 2000-2025, using secondary data sourced from credible sources like the Department for Promotion of Industry and Internal Trade, Reserve Bank of India and India Brand Equity Foundation. The data are arranged on an annual basis and, if required, log-transformed for consistency and to mitigate heteroscedasticity. Trend analysis is applied using a linear trend model to estimate the trend and growth of FDI in the sector, complemented by compound annual growth rate (CAGR) and year-on-year growth rates to capture long-term and short-term trends, respectively. Smoothing techniques, including moving averages, and visual aids such as line and semi-log plots, are used to interpret the data. To further empirically verify the results, optional econometric analysis, including unit root tests and cointegration analysis, can be conducted. This approach, therefore, allows a holistic analysis of the restructuring, growth and fluctuation of FDI inflows, connecting the trends with policy initiatives, technological changes and global economic factors.

### Objective of the study

1. To analyze the trend of FDI inflow in computer and software sector.
2. To identify the challenges faced by India in FDI Inflow.
3. To examine the effectiveness of the policies related to FDI inflow in automobile sector.

### Trend Analysis of FDI Inflow in Computer Software & Hardware (2000-2021)

The Foreign Direct Investment (FDI) data in the Computer Software & Hardware sector over the period 2000-2021 shows multiple phases, in line with global and industry-specific trends. This data shows the rise and fall in response to market dynamics, recessions and technological revolutions. In this article, we split the analysis into several phases based on the growth rate and moving averages.

Table:1 FDI inflow in Computer Software &amp; Hardware

| YEAR/SECTOR | FDI inflow in Computer Software & Hardware | Moving Average | Percentage Growth Rate |
|-------------|--------------------------------------------|----------------|------------------------|
| 2000-01     | 228.39                                     | #N/A           |                        |
| 2001-02     | 419.39                                     | #N/A           | 83.62                  |
| 2002-03     | 314.24                                     | 320.67         | -25.07                 |
| 2003-04     | 368.32                                     | 367.31         | 17.2                   |
| 2004-05     | 527.9                                      | 403.48         | 43.32                  |
| 2005-06     | 1359.97                                    | 752.06         | 157.61                 |
| 2006-07     | 2613.33                                    | 1500.4         | 92.16                  |
| 2007-08     | 1382.25                                    | 1785.18        | -47.1                  |
| 2008-09     | 1543.34                                    | 1846.3         | 11.65                  |
| 2009-10     | 871.86                                     | 1265.81        | -43.5                  |
| 2010-11     | 779.81                                     | 1065           | -10.55                 |
| 2011-12     | 796.35                                     | 816            | 2.12                   |
| 2012-13     | 485.96                                     | 687.37         | -38.97                 |
| 2013-14     | 1126.27                                    | 802.86         | 131.76                 |
| 2014-15     | 2296.04                                    | 1302.75        | 103.86                 |
| 2015-16     | 5904.36                                    | 3108.89        | 157.15                 |
| 2016-17     | 3651.71                                    | 3950.7         | -38.15                 |
| 2017-18     | 6153.2                                     | 5236.42        | 68.5                   |
| 2018-19     | 6415.21                                    | 5406.7         | 4.25                   |
| 2019-20     | 7673.32                                    | 6747.24        | 19.61                  |
| 2020-21     | 26144.69                                   | 13411.1        | 240.72                 |

### Phase 1: Initial Growth and Volatility (2000-2004)

Total FDI inflows in the IT sector between 2000-01 and 2005-06 reflect global economic and technological change. In 2000–01 to 2001–02, the sector saw a remarkable 83.63% increase in FDI, with inflows rising from \$228.39 million to \$419.39 million. This period coincided with the peak of the dot-com era when the IT sector, especially software and hardware companies, received considerable inflows because of the rapid need for computer-based programs (Brynjolfsson & Hitt, 2003)<sup>14</sup>. But the lack of a moving average for 2000-01 restricts further analysis with a longer time horizon. The period 2002-03 to 2003-04 was marked by turbulence as the dot-com bubble burst began to have an impact. FDI inflows declined by -25.07% in 2002-03 to \$314.24 million, but the period saw a slight recovery in 2003-04 with a 17.21% growth, signifying the beginning of market stabilisation (Cairncross, 2001)<sup>15</sup>. The peak growth was recorded in the years between 2004-05 and 2005-06 when FDI inflows jumped to \$1359.97 million (157.62% growth). This growth reflected the turnaround in the sector, due to the emergence of broadband internet, increased demand for enterprise software, and early signs of globalisation in the IT sector (Hitt et al., 2002)<sup>16</sup>. The accompanying growth in the moving average also signals a shift towards more stable investment patterns in the sector.

### Phase 2: Stabilization and Moderate Growth (2005-2009)

The years 2006-07 to 2009-10 witnessed a marked fluctuation in FDI inflows in the software and hardware sector, reflecting the global economy. In 2006–07, FDI inflows reached \$2613.33 million, followed by a strong increase of 92.16% in 2007–08, rising to \$1382.25 million. But this was quickly followed by a -47.11% fall in the same year,

which marked the beginning of volatility probably driven by early signs of the global financial crisis. This was not the end of investor interest in the industry, as the digital sector continued to expand, and there was a demand for IT solutions (Brynjolfsson & Hitt, 2003)<sup>17</sup>. The financial crisis had a greater effect in the following years. In 2009-10, inflows witnessed a -43.51% decline to \$871.86 million, reflecting the slowdown in global investment. The moving average of this period also indicated a decline, revealing the role of a recession in reducing investor confidence and capital inflow to the tech industry (Cairncross, 2001)<sup>18</sup>.

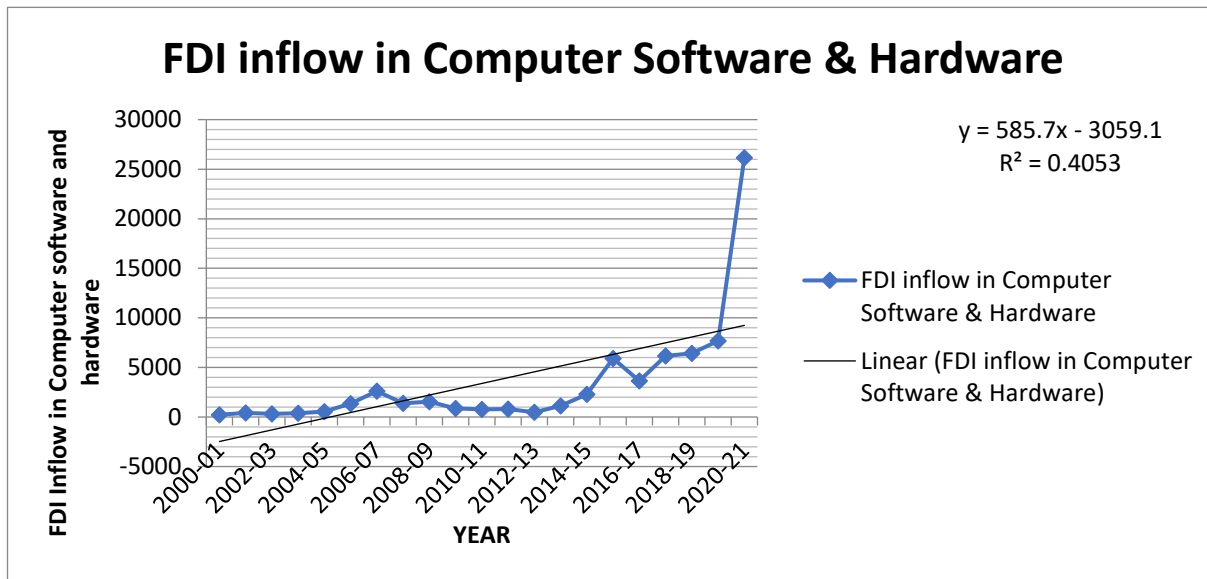
### **Phase 3: Post-Crisis Recovery and Growth (2010-2014)**

The years 2010-11 to 2014-15 represent a recovery and resurgence in FDI inflows for the software and IT services sector, post the global financial crisis. In 2010-11, FDI stood at \$779.81 million and gradually increased to \$1126.27 million by 2013-14, reflecting a cumulative growth of 131.76%. This increase marked a renewed investor confidence, as the world economy started recovering from the recession and companies increasingly adopted technology to enhance efficiency and innovation. The use of cloud computing, mobile applications and e-commerce were particularly important during this period, as the world began to embrace digital business models (McKinsey, 2011)<sup>19</sup>. This growth continued in 2014-15, with a 103.86% increase in FDI inflows to \$2296.04 million. This staggering growth was driven by a greater focus on digital transformation, particularly in emerging economies. Nations such as India became prominent software development and IT outsourcing destinations, as multinational companies expanded their presence and took advantage of affordable yet highly skilled technological talent (Dunning, 1993)<sup>20</sup>. This era demonstrates the impact of technology and globalisation on the resurgence of the sector and the steady growth in foreign investment.

### **Phase 4: High Growth and Technology Boom (2015-2020)**

Between 2015-16 to 2020-21, the software and hardware industries witnessed a dynamic shift, marked by substantial fluctuations and technological advancements, which had a profound impact on FDI. FDI inflows hit a peak of \$5904.36 million in 2015-16, soaring by 157.15%. This growth was driven by the global shift towards cloud computing, artificial intelligence and big data analytics, as businesses invest to transform their operations and stay competitive using digital technologies (Choudhury, 2020)<sup>21</sup>. The rise in the moving average during this time period demonstrates a continued upward trend. But between 2016-17 and 2019-20, FDI growth slightly slowed. In 2016-17, a decline (-38.15%) in inflows was possibly due to market corrections and regulatory reform in major economies. However, growth resumed in the subsequent years, at 68.50% in 2017-18 and 19.61% in 2019-20, driven by the continuing growth of the digital economy, e-commerce and cloud-computing services. These developments were indicative of a robust response of businesses to new digital business models (Choudhury, 2020)<sup>22</sup>. The most significant growth occurred in 2020-21, with an increase of 240.72% in FDI inflows to \$26,144.69 million. This remarkable growth was driven by the COVID-19 pandemic, which has pushed digital transformation across the globe. This increased demand for remote work tools, cloud services and digital platforms facilitated huge inflows in the technology sector, and underscored the importance of the tech sector in facilitating business continuity during the pandemic (Choudhury, 2020)<sup>23</sup>.

Figure:1 FDI Inflow in Computer Software & Hardware, 2000–2021



Source: Department for Promotion of Industry and Internal Trade (DPIIT), Government of India.

Figure shows the Foreign Direct Investment (FDI) in India's Computer Software & Hardware sector from 2000-01 to 2020-21. The curve in the figure shows a clear upward trend, especially in recent years.

X (Independent Variable): The x in the equation stands for time in years (in this case the sequence of financial years from 2000-01 to 2020-21).

Y (Dependent Variable): Y is the Foreign Direct Investment (FDI) inflows in the Computer Software and Hardware sector (in million USD, depending on the data source selected).

In the above graph, you can see the regression line with the equation which indicates a reasonable fit for time explaining the FDI inflows in this sector. FDI inflows in the computer software and hardware sector have been low in the early 2000s, as India was in the early phases of its digital economy. From 2000-01 to 2005-06, inflows remained less than 3,000 million USD annually with slight fluctuations. This was consistent with the country's shift towards a free digital economy and the early growth of its Information Technology (IT) services sector (NASSCOM, 2020)<sup>24</sup>. There was a steady positive trend after 2006-07, which was in line with the growth in global outsourcing, the growth of domestic IT infrastructure and the adoption of liberal FDI policies under the automatic route (DPIIT, 2021)<sup>25</sup>. The period 2014-15 to 2019-20 witnessed a significant growth in line with the Government of India's "Digital India" program, which sought to build a digitally empowered India and transform it into a knowledge-based economy (MeitY, 2019)<sup>26</sup>.

The most notable growth was between 2020-21 when FDI inflows reached almost 27,000 million USD. This record surge can be explained by the rapid global digitalization trend during the COVID-19 pandemic, which led to a higher demand for IT-enabled services, cloud computing and cyber security. In addition, IT-focused FDI inflows spiked in response to India's burgeoning startup culture, and the shifting global IT supply chains from China (World Bank, 2021)<sup>27</sup>.

The coefficient of determination ( $R^2$ ) is 0.4053, which suggests that 40.53% of the annual FDI inflows can be explained by time. This moderately strong association suggests that while time is a critical factor, other variables such as policy reforms, world demand, technological factors, and macroeconomic indicators also play a critical role in FDI inflows. The trend in FDI inflows in this sector indicates India's increasing position as a global destination for software development, IT services, digital innovations and IT-enabled services. The robust growth in post-2014 aligns with policy initiatives, including 100% FDI under the automatic route for most IT services, incentives for software parks,

and creation of Special Economic Zones (SEZ) for electronics and computing (DPIIT, 2021)<sup>28</sup>. The sharp growth in 2020-21 highlights its resilience and geo-strategic importance in the post-pandemic digital world. With global companies diversifying supply chains and embracing digital transformation, the availability of IT talent and cost-effective services make India an appealing investment destination for FDI. However, the sector needs to overcome infrastructural constraints, cybersecurity issues and regulatory ambiguities (particularly data localization and privacy regulations) to maintain and build on these inflows (Sharma & Raghavan, 2020)<sup>29</sup>.

The year-on-year analysis from 2001-02 to 2020-21 illustrates the evolving landscape of FDI inflows in the software and hardware industries in India, influenced by both domestic and global factors. FDI inflows spiked by 83.63% to 419.39 million USD in 2001-02 due to positive economic reforms and liberalisation initiatives (Das & Mookerjee, 2018)<sup>30</sup>. But the growth was not sustained in 2002-03 when inflows fell by 25.07% to 314.24 million USD, possibly due to global or domestic uncertainties. In 2003-04, inflows had improved by 17.21% to 368.32 million USD, which marked the beginning of economic recovery. The growth continued in 2004-05 with a 43.33% growth in inflows to 527.90 million USD, reflecting increased investor trust. This was followed by a staggering 157.62% increase in 2005-06 to 1359.97 million USD likely due to strong economic growth and policy reforms to promote foreign investment (Gandhi & Gupta, 2015)<sup>31</sup>. The growth continued in 2006-07 with a 92.16% increase to 2613.33 million USD. But 2007-08 witnessed a dramatic fall of 47.11% to 1382.25 million USD, as the global financial crisis was beginning and investor confidence was hit around the world (Bekaert & Harvey, 2017)<sup>32</sup>. In 2008-09, there was a marginal growth of 11.65% to 1543.34 million USD, but the impacts of the global financial crisis caused another drop of 43.51% in 2009-10, to 871.86 million USD. A lesser decline of 10.56% was observed in 2010-11, suggesting the sector had recovered. This was followed by a modest rebound of 2.12% in 2011-12 with FDI at 796.35 million USD. But in 2012-13, FDI inflows dropped substantially by 38.98% to 485.96 million USD, possibly due to global economic factors or policy uncertainties in India. There was a significant recovery in 2013-14 with a jump in FDI by 131.76% to 1126.27 million USD, reflecting a strong return of confidence in the economy. This trend persisted in 2014-15, with inflows more than doubling to 2296.04 million USD at a growth rate of 103.86% due to ongoing commitment to digital growth and reforms. A dramatic surge came in 2015-16 with FDI increasing by 157.15% to 5904.36 million USD, largely due to the reforms and global interest in the Indian tech sector (Banga, 2017)<sup>33</sup>. However, there was a dip in 2016-17 with a 38.15% fall in inflows to 3651.71 million USD, possibly due to market adjustments and uncertainties. This was followed by a solid rebound in 2017-18 when FDI grew by 68.50% to 6153.20 million USD and a moderate but steady growth by 4.26% in 2018-19 to 6415.21 million USD. The growth continued in 2019-20 with a decent 19.61% increase to 7673.32 million USD. The most recent record-breaking growth was in 2020-21 with a 240.72% increase in FDI inflows to 26144.69 million USD. This unprecedented growth was attributed to the COVID-19 pandemic, which significantly expedited the digital transformation and boosted global investments in tech-based industries (Sharma, 2021)<sup>34</sup>.

### **Significance of FDI Inflow in Computer Software & Hardware**

The Computer Software & Hardware industry is a critical sector for both advanced and emerging markets, especially in the information technology era, and Foreign Direct Investment (FDI) in this sector is of paramount importance. This industry includes the development and production of both software and hardware products, including computers, mobile phones, networking devices and semiconductors. FDI plays a vital role in driving growth, innovation and competitiveness in this fast-evolving sector. The importance of FDI inflows in this sector can be understood from multiple key angles: technological innovation, economic development, employment and skills development, and integration into the global market.

#### **1. Driving Technological Advancements**

The main importance of FDI inflow in the computer software and hardware sector is that it leads to development of technology. The advancement of technologies, innovative software programs, and the state of art hardware products are common in the host country when foreign investments are involved. Foreign capital and expertise inflow contribute to the modernization of local companies and their integration with the latest technologies, increasing their competitiveness in the global market. Multinational companies usually set up research and development centre (R&D)

through FDI, which is concerned with the development of new technologies or enhancement of the existing products. This helps in the transfer of technology which allows local companies to access advanced tools, techniques and processes that otherwise would not have been easily developed locally (Dunning, 1993)<sup>35</sup>. Foreign investment in the country transfers knowledge and technology that boosts innovation in the domestic industry, especially in the rapidly changing technology industry. As an example, such companies as Intel, Microsoft and Google have invested a lot of money in R&D facilities in many areas, promoting software development; cloud computing, artificial intelligence and hardware design. Such investments are not only profitable to the companies but also assist host nations to enhance their technology base, new startups, and development of their digital economies (Brynjolfsson & Hitt, 2003)<sup>36</sup>.

## **2. Economic Growth and Infrastructure Development**

The main implication of FDI in the computer software and hardware industry is technology development. FDI typically introduces new technologies, software products and hardware goods to the recipient country. The inflow of foreign investment and know-how assists local companies to upgrade their operations and adopt new and advanced technologies to improve their competitiveness. FDI facilitates the establishment of research and development (R&D) facilities by multinational enterprises that are dedicated to developing new technologies or upgrading products. This allows technology transfer, giving local companies access to advanced tools, technologies, and processes that they may not otherwise have access to (Dunning, 1993)<sup>37</sup>. Knowledge and technology spillovers from foreign investors help the local industry to innovate, which is essential in rapidly changing industries such as technology. For example, investments by firms such as Intel, Microsoft, and Google in research and development (R&D) facilities worldwide have led to innovations in software programming, cloud computing, artificial intelligence, and hardware design. Such investments benefit not only the firms but also help the host countries in building their technological capabilities, encouraging entrepreneurship and developing their digital economies (Brynjolfsson & Hitt, 2003)<sup>38</sup>.

## **2. Economic Growth and Infrastructure Development**

Computer software and hardware FDI plays a crucial role in economic growth. Foreign investment in high-tech sectors supports the growth of these industries, which play a vital role in GDP growth in many economies. FDI in the computer software and hardware industry creates economic opportunities for multinational firms, such as the setting up of new plants, infrastructure development, and supply chain development. FDI also facilitates infrastructure building, such as data centers, software development, hardware manufacturing and telecom networks. This infrastructure creates opportunities for economic diversification and sustainable economic growth. FDI in the IT and tech sector has been instrumental in countries such as India and China becoming global tech leaders. The investment by multinational firms also leads to increased investment in other industries, which has a multiplier impact on the economy (Choudhury, 2020)<sup>39</sup>.

## **3. Employment and Skills**

FDI in computer software and hardware results in job creation. When multinational enterprises invest in the host country, they set up research and development facilities, manufacturing facilities and service centers, which in turn lead to job creation. This, in turn, creates jobs for skilled professionals in software development, hardware engineering, IT services and management. In addition, FDI helps in human skills development by transferring global best practices, training and exposure to new technologies to local workers. This helps build a skilled workforce, which is key to competitiveness in the global digital economy. For instance, in India, FDI in software and hardware industries has contributed to the development of the IT services sector which has generated millions of jobs and helped make India a global hub for outsourcing (Cairncross, 2001)<sup>40</sup>. Additionally, these inflows have helped Indian workers gain skills in software programming, hardware design and IT management that has in turn increased productivity in the industry.

#### 4. Globalisation

A further important factor of FDI in software and hardware manufacturing sectors is the globalisation of host economies. FDI inflows provide opportunities for domestic firms to access global markets, link with foreign customers and engage in international competition (Bresciani and Epifani, 2005)<sup>41</sup>. FDI inflows enable countries to become integral players in the global digital economy and become part of global business networks (Hitt et al., 2002)<sup>42</sup>. For instance, nations such as China and South Korea have leveraged FDI in the hardware industry to build robust export capabilities in semiconductors, mobile phones and consumer electronics. This has enabled local enterprises to partner with multinational firms, gain access to critical technologies and enter global markets, which has helped the countries grow and become more influential in the world.

#### 5. Enhancing Knowledge-Based Economies

FDI in software and hardware industries supports the creation of knowledge economies, where the economy is driven by knowledge, innovation and technology. Through the promotion of R&D and innovation, FDI helps to produce high-tech products and services, which are fundamental to the development of knowledge-based economies. Such economies are more sustainable and adaptable to global economic changes. Software and hardware industries are fundamental components of knowledge-based economies, as every industry, including education, health care and finance, depends on information technology. By introducing new technologies and know-how in the host country, FDI helps local businesses and workers build up their knowledge and innovation capabilities. This supports the transition from traditional to high-tech, information-based industries (Brynjolfsson & Hitt, 2003)<sup>43</sup>

#### Policies Related to FDI Inflow in Computer Software & Hardware

FDI in software and hardware industries supports the creation of knowledge economies, where the economy is driven by knowledge, innovation and technology. Through the promotion of R&D and innovation, FDI helps to produce high-tech products and services, which are fundamental to the development of knowledge-based economies. Such economies are more sustainable and adaptable to global economic changes. Software and hardware industries are fundamental components of knowledge-based economies, as every industry, including education, health care and finance, depends on information technology. By introducing new technologies and know-how in the host country, FDI helps local businesses and workers build up their knowledge and innovation capabilities. This supports the transition from traditional to high-tech, information-based industries (Brynjolfsson & Hitt, 2003)<sup>44</sup>

#### 1. Liberalization Policies and Open Market Access

Liberalization policies have been implemented in many countries, especially in the emerging markets, to liberalize their economies and to attract foreign investments, especially in the computer software and hardware industry. These policies generally remove restrictions on foreign investment, such as restrictions on foreign ownership, repatriation of profits and approval process. The aim is to improve the investment environment by increasing transparency and decreasing red tape. For example, the New Economic Policy (1991) in India had a profound impact on liberalising India's economy by lifting restrictions on the flow of FDI. The Indian government granted 100% foreign ownership in the software sector under the Software Technology Parks of India (STPI) scheme and went on to liberalize its policies in 2000 by allowing investments in the hardware sector (Ghosh, 2010)<sup>45</sup>. These reforms helped transform India into a leading software development and IT services destination, with global giants such as Microsoft, IBM, Oracle, and others setting up their research and development (R&D) facilities in India.

#### 2. Incentives for FDI in the Technology Sector

Incentives are frequently provided by governments to foreign investors in the computer software and hardware sectors to encourage investment and promote innovation. These incentives can include tax credits, subsidies, and grants to fund R&D, infrastructure and manufacturing activities. In the US, the Research and Experimentation (R&E) tax credit enables companies to claim a tax credit against their income tax liability for investments in technological innovation.

Likewise, tax breaks are available to foreign firms investing in technology and innovation in markets such as Singapore and Ireland. These policies make these markets more attractive for foreign companies, resulting in increased FDI, which in turn supports the growth of the nation's digital economy (Harrison & Rainer, 2007)<sup>46</sup>. Finally, some governments have free trade zones or technology parks. For instance, China's government created the Zhongguancun Science Park in Beijing, which provides an attractive policy environment for foreign tech firms, such as tax exemptions, low customs duties and grants for R&D investments. This initiative has helped several multinational companies like Intel, Microsoft and Nokia to invest in China's computer software and hardware industries (Dunning, 1993)<sup>47</sup>.

### **3. Regulations and Restrictions**

Liberalisation measures promote foreign investment, but countries may also have restrictions and controls to protect their interests. These may include security policies to safeguard critical technologies and foreign ownership restrictions. For example, many countries have restrictions that prohibit foreign investors from acquiring controlling interests in companies engaged in technologies related to national security, or in critical infrastructure. For example, in India, foreign investment in the defense and aerospace industries is capped at 49% to avoid foreign control in sensitive areas. Likewise, in the European Union, EU member countries have introduced regulations to safeguard the local software and hardware sector, especially in areas related to privacy, data protection and cybersecurity. The General Data Protection Regulation (GDPR), for instance, has stringent rules about data privacy in relation to the personal data of EU citizens, which could impact foreign tech firms in Europe (Kuner, 2020)<sup>48</sup>. Other countries also require technology transfer, in which foreign investors are required to transfer certain technologies or expertise to domestic firms. These regulations seek to ensure host countries gain more from FDI than just capital inflows, such as technological know-how and skills transfer (Choudhury, 2020)<sup>49</sup>.

### **4. Trade Policies and International Agreements**

The computer software and hardware industry has a history of having the FDI policies affected by more general trade policies and international agreements. Cross-border investments can be facilitated through free trade agreements (FTAs) and regional trade blocs as well as multilateral organizations such as the World Trade Organization (WTO) that will ease trade barriers and enhance access of foreign investors to markets. As an illustration, the free flow of capital, technology, and services across the United States, Canada and Mexico has been facilitated by the North American Free Trade Agreement (NAFTA) that was later replaced by the United States-Mexico-Canada Agreement (USMCA). Such agreements have also motivated U.S.-based technology firms to invest in software and hardware manufacturing plants in Mexico due to availability of cheap labor and the ability to access U.S. markets. On the same note, trade liberalization in South Korea and Taiwan have enabled increased foreign investment in the software and hardware sectors. Such nations have entered into several bilateral and multilateral trading agreements which reduce tariffs and ease FDI inflows, which have helped them become the world leaders in technology innovation and production (Harrison & Rainer, 2007)<sup>50</sup>.

### **5. Intellectual Property Protection and Legal Frameworks**

An effective intellectual property (IP) protection system is essential in luring FDI in computer software and hardware industries since investors would be assured of protection of their innovation, software code and hardware designs against unauthorized duplication or imitation. Countries that have an effective system of IP protection in terms of clearly established laws on patents, copyright, and enforcement are more prospective to attract foreign investment. As an example, the TRIPS Agreement (Trade-Related Aspects of Intellectual Property Rights), a part of World Trade Organization (WTO), guarantees the member countries to offer reasonable protection of intellectual property, such as software and hardware innovations. FDI in the software and hardware sector is largely contributed by countries such as the U.S and Japan which have established well structured IP protection systems since foreign firms are in a better position to secure their technological resources there (Maskus, 2000)<sup>51</sup>.

## Conclusion

FDI inflow in Computer Software and Hardware industry is characterized by various stages that are influenced by the global economic cycles, technology and demand. The industry was characterized by a boom (2000-2005) at the beginning because of the dot-com boom but then a downfall amidst the global financial crisis (2007-2009). The process of recovery started after the crisis, and by 2015, the industry was experiencing a boom because of cloud computing, mobile technologies, and digital transformation. Investment was further pushed up by the COVID-19 pandemic, with the level of FDI dramatically increasing in 2020-21. The trend underscores the growing global dependency on technology and the current digital revolution in industries. The role of FDI inflows in the Computer Software and Hardware sector is indisputable. It spurs technological innovations, contributes to economic development, generates high-quality employment, contributes to skills development and assimilates countries into the global technology market. Moreover, FDI expedites the process of building knowledge-based economies, and countries can become more competitive in the digital era. Considering the high-rate of technological growth and the growing need of digital solutions, FDI will remain the key determinant of the future of computer software and hardware industries. FDI inflows policies in the computer software and hardware industries are important to determine the investment environment and technological innovation. Those countries that embrace liberalization policy, give incentives to innovations, and effectively regulate foreign investments and safeguard intellectual property tend to capture high FDI. With the ever changing nature of the global digital economy, governments have to balance between attracting foreign investment and protecting national interests in such a way that they can guarantee that the rewards of FDI are made to translate into sustainable economic growth and technological development.

## References

1. Choudhury, P. (2020). *Digital Transformation and the Future of Work*. Journal of Business Research, 118, 213-225.
2. Hitt, L. M., Wu, D. J., & Zhou, X. (2002). *Investment in Enterprise Resource Planning: Business Impact and Productivity Implications*. Journal of Management Information Systems, 19(1), 71-98.
3. Brynjolfsson, E., & Hitt, L. M. (2003). *Computing Productivity: Firm-Level Evidence*. Review of Economics and Statistics, 85(4), 793-808.
4. Brynjolfsson, E., & Hitt, L. M. (2003). *Computing Productivity: Firm-Level Evidence*. Review of Economics and Statistics, 85(4), 793-808.
5. Cairncross, F. (2001). *The Death of Distance: How the Communications Revolution is Changing Our Lives*. Harvard Business Press.
6. Dunning, J. H. (1993). *Multinational Enterprises and the Global Economy*. Wokingham: Addison-Wesley.
7. Raj, G. J. X., & Suvakkin, M. (2025). Impact of the service sector and computer software hardware sector of foreign direct investment inflows on GDP in India. *The Social Science Review: A Multidisciplinary Journal*, 3(2), 264–266.
8. Ananda. (2012). FDI inflows in India: A comparative analysis with special reference to services sector, telecommunications sector and computer hardware and software sector. *International Journal of Business and Globalisation*, 9(2), 186–194.
9. Arora, A. (2021). Determinants of FDI in the computer software and hardware sector in India. *International Journal of Foreign Trade and International Business*, 3(1), 62–66.
10. Singh, S. (2021). Growth and development of sector-wise foreign direct investment flow in India. *SSRG International Journal of Economics and Management Studies*, 8(10), 106–112.
11. Robert, S., & Nirmala, J. (2022). Does foreign direct investment growth significantly influence the Indian computer software and hardware sector? *Inspira Journal of Commerce, Economics & Computer Science*, 8(4), 35–38.

12. Islam, M. S., & Beloucif, A. (2023). Determinants of foreign direct investment: A systematic literature review. *Journal of Developing Areas*, 59(2).
13. Javed, R., & Javed, F. (2017). A panel data analysis of foreign direct investment inflows into India since 1991 to 2015. *Indian Economic Journal*, 65(1–4).
14. Brynjolfsson, E., & Hitt, L. M. (2003). Computing productivity: Firm-level evidence. *The Review of Economics and Statistics*, 85(4), 793–808.
15. Cairncross, F. (2001). *The death of distance: How the communications revolution is changing our lives* (2nd ed.). Harvard Business School Press.
16. Hitt, L. M., Wu, D. J., & Zhou, X. (2002). Investment in enterprise resource planning: Business impact and productivity measures. *Journal of Management Information Systems*, 19(1), 71–98.
17. Brynjolfsson, E., & Hitt, L. M. (2003). *Computing Productivity: Firm-Level Evidence*. *Review of Economics and Statistics*, 85(4), 793–808.
18. Cairncross, F. (2001). *The Death of Distance: How the Communications Revolution is Changing Our Lives*. Harvard Business Press.
19. McKinsey & Company. (2011). *The Digital Tipping Point: Why New Technologies Could Transform Global Growth*. McKinsey Global Institute
20. Dunning, J. H. (1993). *Multinational Enterprises and the Global Economy*. Wokingham: Addison-Wesley.
21. Choudhury, P. (2020). *Digital Transformation and the Future of Work*. *Journal of Business Research*, 118, 213–225.
22. Choudhury, P. (2020). *Digital Transformation and the Future of Work*. *Journal of Business Research*, 118, 213–225.
23. Choudhury, P. (2020). *Digital Transformation and the Future of Work*. *Journal of Business Research*, 118, 213–225.
24. NASSCOM. (2020). *The future of IT in India: 2020 and beyond*. National Association of Software and Service Companies
26. MeitY. (2019). *Digital India Programme Overview*. Ministry of Electronics and Information Technology, Government of India. Retrieved from <https://www.meity.gov.in>
27. World Bank. (2021). *World development indicators: Foreign direct investment and ICT sector performance*. Retrieved from <https://databank.worldbank.org>
28. DPIIT. (2021). *FDI Statistics: Sector-wise inflows*. Department for Promotion of Industry and Internal Trade, Government of India. Retrieved from <https://dpiit.gov.in>
29. Sharma, V., & Raghavan, P. (2020). Data governance and foreign investment: Navigating India's IT policy landscape. *Journal of Technology Policy and Regulation*, 15(3), 101–118.
- UNCTAD. (2022). *World Investment Report 2022: International tax reforms and sustainable investment*. United Nations Conference on Trade and Development. <https://unctad.org>
30. Das, D., & Mookerjee, R. (2018). "Economic Reforms and Foreign Direct Investment: The Indian Experience". *The Indian Journal of Economics*, 97(4), 781–797.
31. Gandhi, R., & Gupta, A. (2015). "India's Foreign Direct Investment Landscape". *Asian Economic Policy Review*, 10(2), 79–92.

32. Bekaert, G., & Harvey, C. R. (2017). "Emerging Markets Finance". *Journal of Financial Economics*, 12(2), 219-266.
33. Banga, R. (2017). "FDI and Economic Growth: Evidence from India". *Indian Economic Review*, 52(1), 1-24.
34. Sharma, R. (2021). "FDI in Post-Pandemic India: A New Wave of Investment". *International Journal of Economic Studies*, 24(5), 35-50.
35. Dunning, J. H. (1993). *Multinational Enterprises and the Global Economy*. Wokingham: Addison-Wesley.
36. Brynjolfsson, E., & Hitt, L. M. (2003). *Computing Productivity: Firm-Level Evidence*. *Review of Economics and Statistics*, 85(4), 793-808.
37. Dunning, J. H. (1993). *Multinational Enterprises and the Global Economy*. Wokingham: Addison-Wesley.
38. Brynjolfsson, E., & Hitt, L. M. (2003). *Computing Productivity: Firm-Level Evidence*. *Review of Economics and Statistics*, 85(4), 793-808
39. Choudhury, P. (2020). *Digital Transformation and the Future of Work*. *Journal of Business Research*, 118, 213-225.
40. Cairncross, F. (2001). *The Death of Distance: How the Communications Revolution is Changing Our Lives*. Harvard Business Press.
- 41.
42. Hitt, L. M., Wu, D. J., & Zhou, X. (2002). *Investment in Enterprise Resource Planning: Business Impact and Productivity Implications*. *Journal of Management Information Systems*, 19(1), 71-98.
43. Brynjolfsson, E., & Hitt, L. M. (2003). *Computing Productivity: Firm-Level Evidence*. *Review of Economics and Statistics*, 85(4), 793-808
44. Brynjolfsson, E., & Hitt, L. M. (2003). *Computing Productivity: Firm-Level Evidence*. *Review of Economics and Statistics*, 85(4), 793-808
45. Ghosh, S. (2010). *India's Policy for FDI in the IT and Software Sectors*. *Economic and Political Weekly*, 45(50), 56-58
46. Harrison, A., & Rainer, G. (2007). *FDI and Development in the Digital Age*. *Journal of International Business Studies*, 38(3), 507-526.
47. Dunning, J. H. (1993). *Multinational Enterprises and the Global Economy*. Wokingham: Addison-Wesley.
48. Kuner, C. (2020). *The General Data Protection Regulation: A Commentary*. Oxford University Press.
49. Choudhury, P. (2020). *Digital Transformation and the Future of Work*. *Journal of Business Research*, 118, 213-225.
50. Harrison, A., & Rainer, G. (2007). *FDI and Development in the Digital Age*. *Journal of International Business Studies*, 38(3), 507-526.
51. Maskus, K. E. (2000). *Intellectual Property Rights in the Global Economy*. Institute for International Economics.