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A Study of Macroeconomic Dynamics and Manufacturing Productivity in India: Integration with Structural breaks

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ABSTRACT
This study examines India's macroeconomic and structural transformation and its association with economic growth and manufacturing productivity during 1985-2022. Using secondary data and descriptive analysis, it evaluates capital formation, human capital, financial development, FDI, trade, technology, R&D, infrastructure, and macroeconomic conditions. The main finding is that, despite substantial improvement in India's structural and macroeconomic foundations, manufacturing total factor productivity remained low and highly volatile, recording an average growth of only about 0.38% over the study period. Major fluctuations in productivity were associated with periods of economic reforms and domestic and global shocks. The findings highlight the need to strengthen productive investment, technological adoption, innovation, human capital, financial intermediation, and macroeconomic stability to achieve sustained improvements in manufacturing productivity and economic growth.

Keywords: Economic Growth, Manufacturing productivity, Structural transformation, Macroeconomic variables, structural breaks and Indian economy

1. Introduction:

India has experienced substantial economic and structural transformation over the past few decades, particularly since the economic reforms of 1991. Liberalization, global integration, financial development, technological advancement and changes in the policy environment have significantly influenced the country's growth structure and productive capacity. Against this background, an assessment of key macroeconomic and structural variables is important for understanding the changing economic conditions and their association with economic growth.

Macroeconomic variables such as GDP growth, inflation, fiscal deficit public debt, trade and the BOP outline the stability and performance of the economy. Alongside these, structural and supply side factors such as capital formation, human capital, financial expansion, and technological upgrading are important for strengthening productive capacity; human capital enhances labour quality and skills, financial development facilities the mobilization and allocation of resources and technological advancement contributes to efficiency and productivity. Together, these factors provide a broader framework for assessing the growth and productivity performance of the Indian economy.

The assessment of these variables is particularly relevant in the context of manufacturing productivity, which represents an important component of India's structural transformation and economic development. Change in investment, labour quality, financial conditions, technology and macroeconomic stability can influence the capacity of manufacturing industries to improve efficiency and generate output. Manufacturing productivity, in turn, has wider implications for employment, investment, exports, industrial competitiveness, and overall economic growth. Thus examining the trends and movements of macroeconomic and structural variables alongside manufacturing productivity and growth can provide useful insights into the evolving economic structure of India.

The Indian economy has also experienced several significant structural changes and economic shocks, including the 1991 economic reforms, financial and policy reforms, the introduction of the goods and services tax, technological transformation, and the investment conditions, production structures and productivity patterns at different points in time. Recognizing such structural changes is therefore important in interpreting the trends and movements of economic and productivity growth indicators over different periods.

1.2. Rationale of study:

The rationale of this study lies in providing a systematic descriptive and analytical assessment of India's macroeconomic and structural conditions and their broader relationship with economic growth and manufacturing productivity. Rather than estimating causal or econometric relationships, the study brings together key indicators to examine their trends, patterns, changes and interrelationships over time. Particularly is given to capital formation, human capital formation, financial development, technological improvement and major macroeconomic indicators along measures of economic growth and manufacturing productivity.

Such assessment is relevant because India's growth process has been accompanied by substantial structural transformation and periodic economic disruptions. Analyzing these indicators in a common framework can help identify major phases of change, highlight improvements and emerging challenges and provide a broader understanding of the factors associated with India's growth and manufacturing productivity. The study therefore contributes to the existing literature by providing a contextual and comprehensive assessment of India's macroeconomic and structural transformation, rather than focusing on estimation of specific causal relationships.

Therefore, the assessment of macroeconomic variables in India is essential for understanding the overall performance, stability and growth prospects of the Indian economy. In the context of India, the assessment of these variables is particularly significant because of the country's large and diverse economy, evolving structural changes and increasing integration with the global system.

2. Review of Literature:

The existing literature demonstrates that India's macroeconomic performance is shaped by structural reforms, financial integration, domestic macroeconomic conditions, and external shocks. **Suresh and Shylajan (2015)** establish an important perspective by examining structural breaks in India's GDP, GNP, and major economic sectors. Their findings indicates that the economic reforms of the 1980s and particularly the extensive liberalization reforms of the 1990s produced significant structural changes in GDP, GNP, trade, finance and public administration. However, the relatively limited impact of these reforms on agriculture and manufacturing suggests that the benefits of economic linearization were not uniform across sectors. Their study therefore establishes that structural reforms can alter the trajectory of

macroeconomic growth, while also highlighting the need for sector specific policy intervention. Building on the importance of economic and financial integration, **Sunil et al (2019)** examine the interrelationship among FDI, FPI, Sensex, exchange rates, GDP and balance of payments. The study findings reveal strong relationships among GDP, the Sensex, and exchange rates, while FDI, FPI and BOP conditions significantly influence economic and financial performance. The study also demonstrates that India's increasing integration with international capital markets has strengthened the linkages between domestic economic activity and external financial factors. This indicates that changes in international capital flows and exchange rate conditions can have wider implications for economic growth and financial-market stability. The role of external shocks becomes more prominent in the study of **Rizvi and Itani (2022),** analysed in their study that crude oil market volatility during the COVID-19 pandemic in comparison with the global financial crisis and SARS outbreak. The findings of GARCH and GJR_GARCH models reveal substantial volatility clustering, asymmetric effects and elevated tail risks during the COVOD-19 period. The study demonstrates that global crises can generate exceptionally high uncertainty in energy markets, with important implications for oil importing economies such as India. Thus, external energy shocks represent an important channel through which global disturbances can influence domestic macroeconomic stability. Further **Kalluraya and Aswani (2024**) broaden the analysis by examining the trends in major macroeconomic indicators, including GDP, inflation, CPI, government revenue and expenditure. This study emphasizes that these variables are closely interconnected and collectively reflect both the short-run condition and long-run development path of the Indian economy. The authors underline the importance of continuous monitoring of macroeconomic indicators for identifying emerging imbalances and designing appropriate policy responses. The analysis also reinforce the significance of the post 1991 liberalization period in shaping India's transition towards a more market-oriented economy and sustained economic growth. Similarly, **Vagadia (2024**) focuses on the relationship between GDP growth and external sector variables such as exports, imports and tariff rates, along with unemployment. Using correlation and regression techniques, the study establishes significant relationships between economic growth and international trade and investment variables. The findings suggest that greater integration with global economy, supported by appropriate trade and investment policies, has played an important role in India's growth process. More recently, **Bhardwaj et al. (2026)** provide a more comprehensive assessment of India's vulnerability to global shocks by examining the dynamic interaction among oil prices, wholesale price inflation, industrial output and exchange rates. Using VECM, impulse response functions, variance decomposition, quantile regression, and ARCH-GARCH models, the study identifies significant long-run relationships and short-run transmission mechanisms. The findings show that oil price shocks are transmitted through inflation and exchange rate channels and subsequently affect industrial output. Importantly, the distributional analysis indicates that these effects become stronger during periods of economic stress, while the volatility analysis confirms persistent volatility clustering during crisis periods. This highlights the continuing sensitivity of Indian economy to developments in global energy and financial markets.

The existing literature largely focuses on conventional macroeconomic variables such as GDP, inflation, exchange rates, FDI, trade, oil prices and financial flows, while structural variables have received limited attention. The present study addresses this gap by incorporating structural variables along with macroeconomic indicators to examine their combined influence on growth and productivity. It further explores how structural transformation, investment, technology and industrial development can enhance

manufacturing productivity and, in turn, contribute to GDP growth. Thus, the study provides an integrated framework linking macroeconomic conditions, structural transformation, manufacturing productivity and economic growth in India.

3.1. Research and Methodology:

Research Design, Data Source and Analysis:

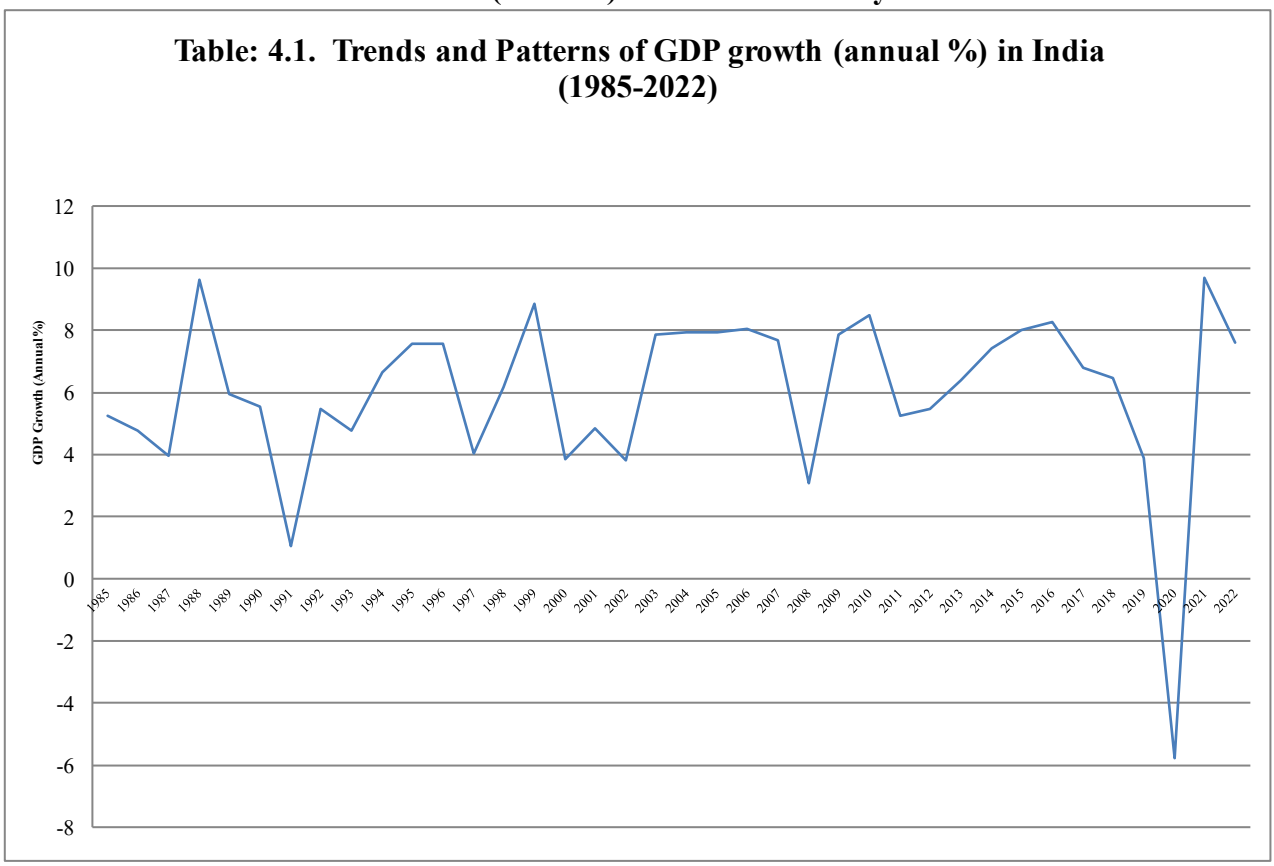
This study is descriptive cum empirical in nature that provides insights into and an understanding of manufacturing productivity and macroeconomic and structural pattern change. Descriptive research design helps to identify and collect the facts and figures accompanying with a phenomenon or characteristics of population (for example, structure and pattern of Indian manufacturing productivity, macroeconomic and structural variables). The study usages data that are retrieved from secondary data sources, which are obtained from various reliable and authentic sources. The described analysis requires data has been collected from World Intellectual Property Organization (WIPO) and World Development Indicators, PENN World Table Version 10.0, Federal Reserve Bank of St. Louis, 2020, and RBI Handbook of India. This study has been taken data from financial year 1985-2022. This study is basically a descriptive analysis which is analysed with the help of graphical representation and tabulation using Ms Excel.

4. Results and Discussion

This study section describes the macroeconomic and structural shift variables for India over the study period.

4.1. Trend of Gross Domestic Product (Growth) in Indian Economy:

Table: 4.1. Trends and Patterns of GDP growth (annual %) in India (1985-2022)



Data Source: WDI, 2024

The figure 4.1 presents the annual GDP growth rate of India for the period 1985-2022 and highlights substantial fluctuations in economic growth, indicating different phases of expansion, slowdown, and recovery. From a structural break perspective, the series doesn't follow a uniform growth path; rather, several periods show noticeable changes in the level and volatility of GDP growth.

During 1985-1990, GDP growth remained broadly positive but fluctuated between moderate and relatively high levels, with a sharp increase in 1998. A significant downward movement occurred in 1991, when growth declined to ground 1 %. This period coincides with India's balance of payments crisis and initiation of major economic reforms in 1991. The subsequent recovery during 1992-1996, with growth generally remaining above 5%, suggests a change in the growth trajectory following the reform period. Thus 1991-92 can be considered an important potential structural break, although formal statistics testing would be required to establish a break conclusively.

A further phase can be observed during 1997-2002, characterized by greater volatility. Growth increased to nearly 9% in 1999 but subsequently declined during 2000-2002. This period included the Asian financial crisis and domestic economic adjustments, which affected investment and external economic conditions. From 2003 to 2007, India entered a relatively strong and sustained growth phase, with GDP growth remaining close to or above 7% for most of the period. This represents a notable change from the more volatile pattern of the preceding years and can be viewed as another important period in India's growth trajectory.

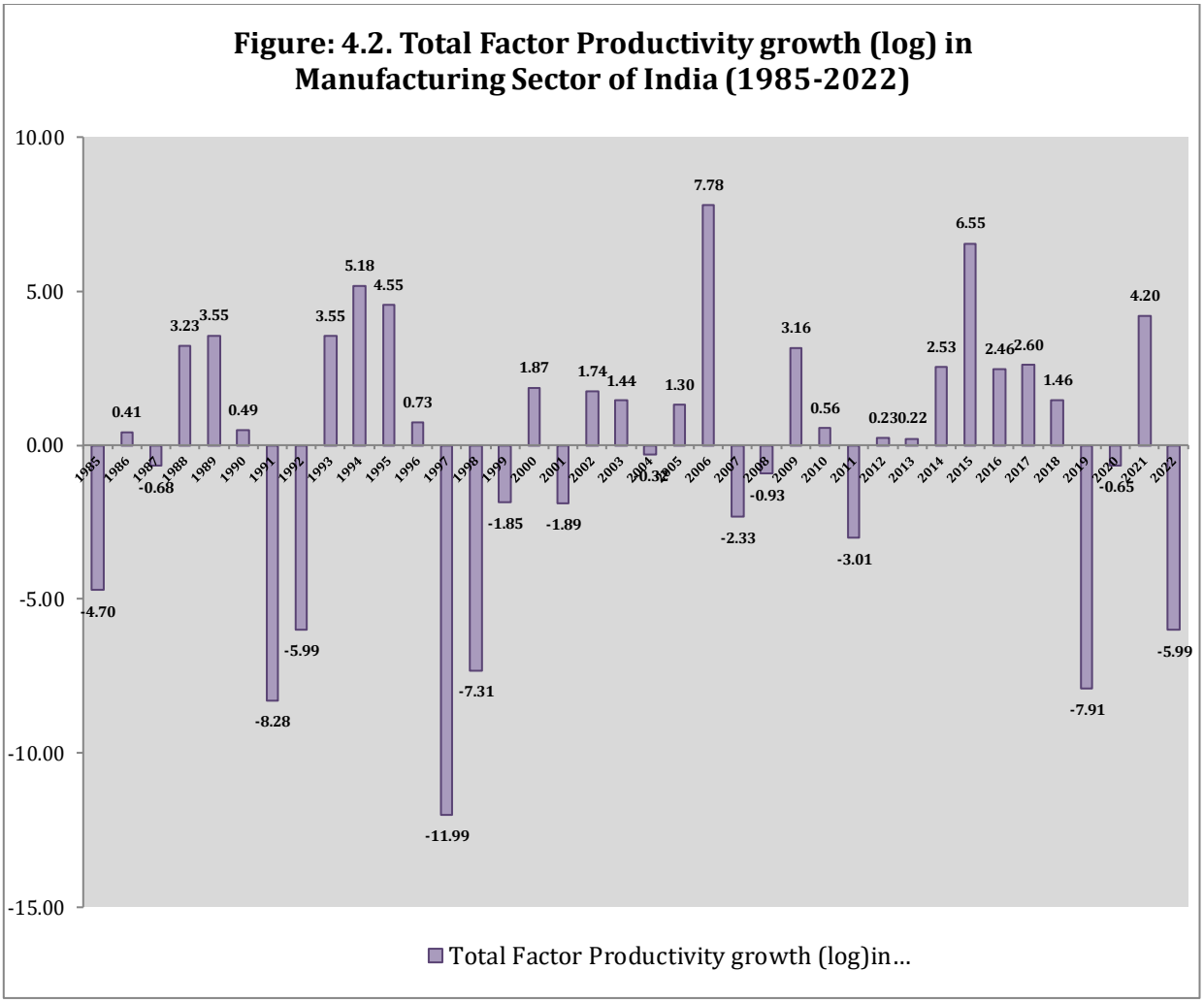
The 2008-09 period represents a particularly visible structural disruption. GDP growth fell sharply in 2008, followed by recovery in 2009-10. This movement corresponds with the global financial crisis, which adversely affected international trade, investment, and economic activity. Although India's economy recovered relatively quickly, growth subsequently moderated during 2011-2013. Growth improved again during 2014-16, reaching above 8% in 2016, before slowing during 2017-19. The slowdown after2017 occurred alongside major policy and structural developments, including the implementation of GST in 2017, although the chart alone can't establish that GST caused the change in growth.

The most pronounced structural disruption in the series occurs in 2010, when GDP growth became strongly negative, reaching approximately -6%, reflecting the severe economic disruption associated with the COVID-19 pandemic and nationwide restrictions. Thus represents the clearest break in the observed series. The sharp rebound in 2021, followed by moderation in 2022, indicates a strong post-pandemic recovery and subsequent normalization of economic activity.

Overall, the GDP series can be broadly divided into several phases: (i) pre-reform growth and volatility (1985-1990), (ii) reform and post reform adjustment (1991-1996), (iii) moderate and volatile growth (1997-2002), (iv) high growth phase (2003-2007), (v)global financial crisis and recovery (2008-2010), (vi) post crisis slowdown and recovery (2011-2016), (vii) growth moderation (2017-2019), and (viii) pandemic induced contraction and recovery (2020-2022). These changes indicate that India's growth performance has been shaped by both domestic policy transformations and external shocks.

4.2. Trend of Manufacturing Productivity in Indian Economy:

Figure: 4.2. Total Factor Productivity growth (log) in Manufacturing Sector of India (1985-2022)



India witnessed modest gains in productivity after a dip in 1985, with positive growth in 1988 (3.23) and 1989 (3.55). Further, especially in 1991, the economy showed a significant contraction or dips with 8.28% in total factor productivity of manufacturing, reflecting inefficiencies under a tightly regulated industrial environment and marked by the balance of payments crisis and structural reforms. A recovery followed in the post-liberalization era, 1992 to 1996, showing improvement in total factor productivity of Indian manufacturing, an average of 3.50%, highlighting the short-term effects of liberalization. Yet, 1997-1999 reflected severe instability with a total factor productivity collapse 1997 of 11.99%, which was attributed to the Asian financial crisis and internal constraints. The early 2000s showed some recovery, and a remarkable spike occurred in 2006, with total factor productivity growth reaching 7.78%, followed by a sharp deterioration in 2007 and 2008, showing the exposure of productivity improvements to the global crisis. In 2009, there was a temporary rebound to 3.16%, but the growth again declined in subsequent years, with a significant contraction of 3.01 percent in 2011. However, the period from 2012 to 2015 saw a gradual recovery in productivity performance, peaking in 2015 at 6.55%. From 2012-2018, the data reflects moderate, consistent productivity growth, with 2009(3.16%), 2014 (2.53%), and 2015 (6.55) being high points reflecting a relatively stable phase. However, 2019 saw another steep decline of 7.91%, followed by the COVID-19 contraction in 2020 (0.65). After showing improvement in 2021 with 4.20 total factor productivity, a sharp decline can be noticed in 2022 (5.99%),

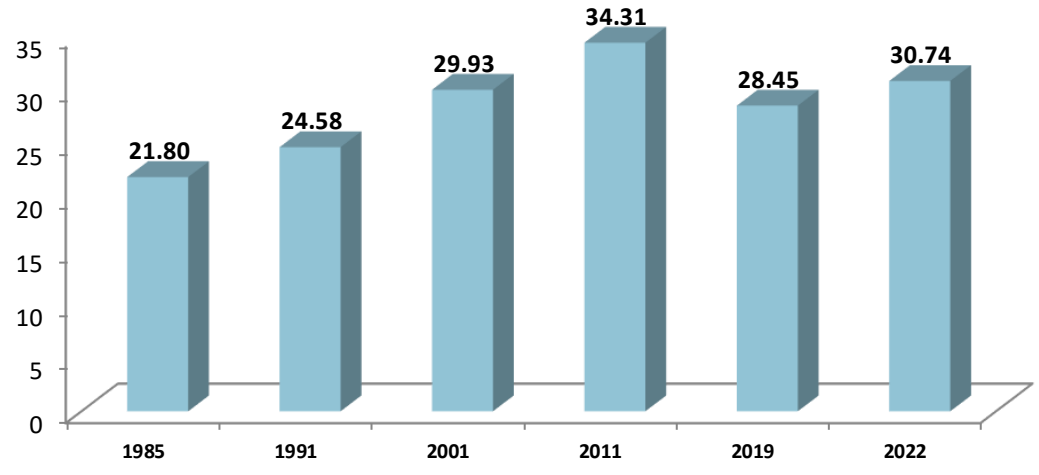
reflecting structural issues, global shocks (post-pandemic effects), and lagging industrial competitiveness.

The overall conclusion underscores the average lot total factor productivity growth during the full period stands at approximately 0.35%, suggesting marginal and inconsistent improvements in manufacturing productivity. The pattern in total factor productivity underscores the partial success of economic reforms in stimulating TFP growth while highlighting persistent volatility, vulnerability to external shocks, and the pressing need for deeper targeted interventions to ensure sustained and robust productivity growth in India's manufacturing sector. This also reflects the association of macroeconomic factors has significant association with the manufacturing total factor productivity. The critical role of eternal and macroeconomic factors as a driver of industrial growth and the pressing need for consistent productivity enhancing strategies in India's manufacturing sector.

4.3. Trend of Gross Fixed Capital formation in Indian Economy:

Gross fixed capital formation represents a nation's investment in long-run productive assets such as machinery, infrastructure, industrial facilities, serving as a key driver of economic expansion and productivity enhancement. Higher capital formation signals expanding productive potential, improved competitiveness, and future output gains, especially essential for economies striving to modernize and reduce structural bottlenecks. In essence, robust GFCF reflects an economy's forward-looking commitment to strengthening its productive base and long-term growth prospects. The **Figure 4.3** describes trajectory of gross fixed capital formation % of GDP in India over the period from 1985 to 2022, serving as a key indicator of long term productive capacity and economic growth potential.

Figure: 4.3. Trends and Pattern of Gross fixed capital formation (% of GDP) in India



The data show a steady upward trend from approximately 25% in 1985 to a peak nearing 33% in 2011, signifying a period of intensifies infrastructure development, industrial expansion, and policy driven capital accumulation during the post liberalisation era. This peak in 2011 indicates a high level of confidence in long-term economic prospects and a favourable investment climate. However, post-2011, the figure reveals a moderate decline, with gross fixed capital formation falling to around 30% in 2019 and 2022. This slight reduction may be attributed to a slowdown in private investment, global economic uncertainties, or a rebalancing of the Indian economy towards services and consumption led growth. In

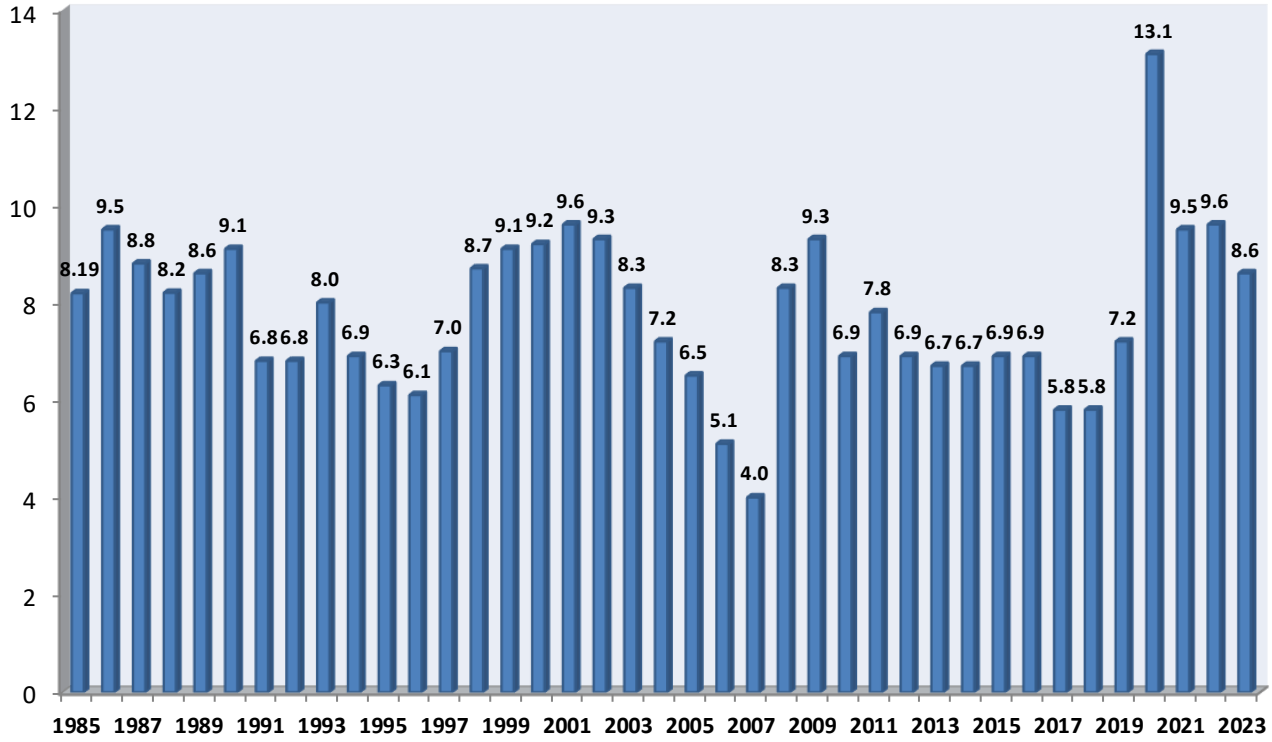
essence, while India's GFCF has shown resilience and remains high by international standards, suggesting a need to reinvigorates investment through structural reforms, ease of doing business, and renewed public private investment strategies to sustain high growth momentum.

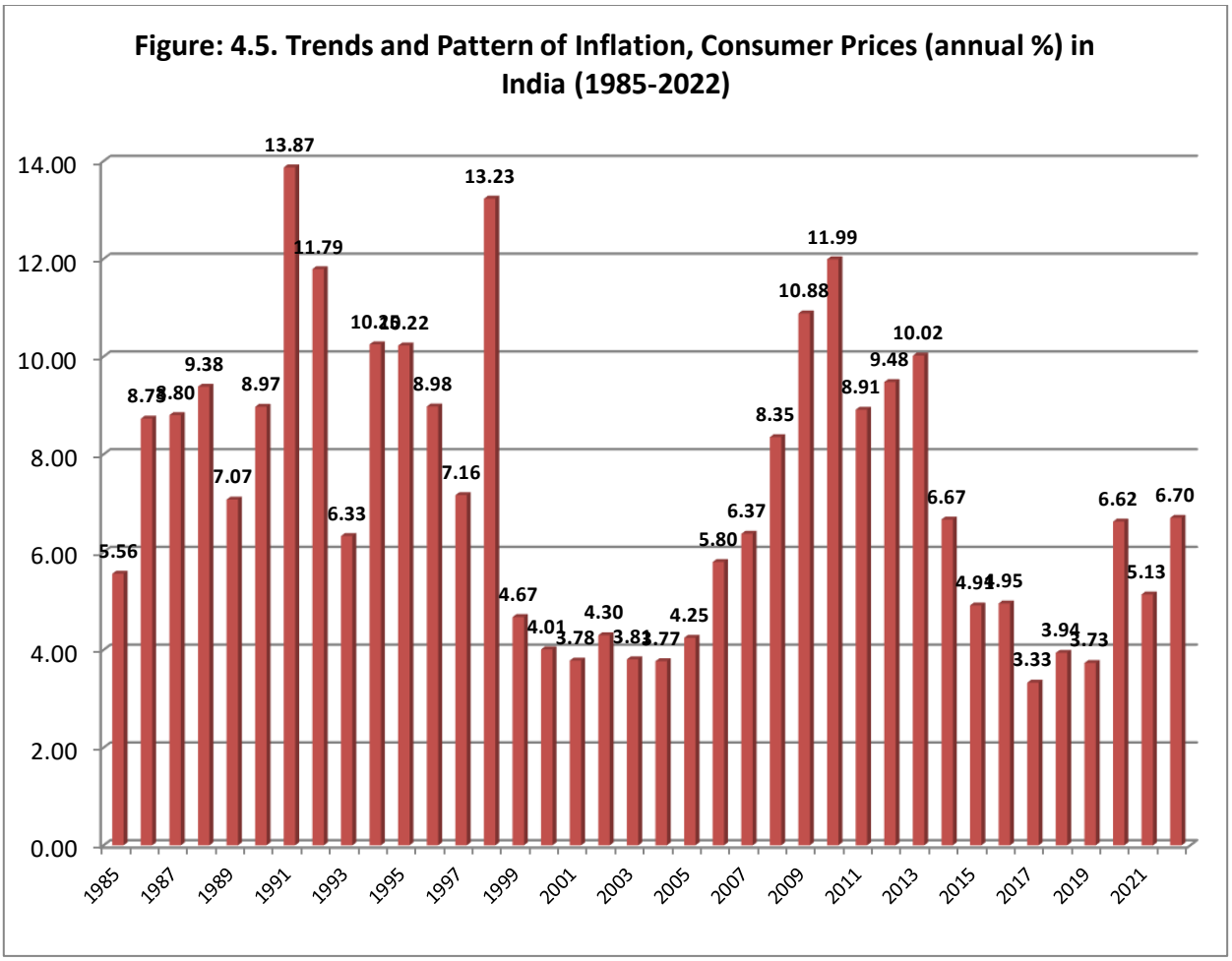
4.4. Trend and Patterns of Gross Fiscal Deficit in Indian Economy:

A fiscal deficit where government spending exceeds revenue exerts a dual and nuanced influence on economic growth. Form a Keynesian perspective, deficit spending can catalyse expansion by financing infrastructure and stimulating aggregate demand; however, the Neo-classical view warns that persisting high deficits may fuel inflationary pressures, crowd out private investment, elevate the public debt burden, and undermine macroeconomic confidence. Ultimately, the growth impact hinges on the composition and quality of expenditure: productive investments in infrastructure, human capital, and capacity building generate durable economic returns, while unproductive outlays heighten the risk of fiscal liability, making farsighted deficit management essential for sustaining long-term fiscal and economic stability (Priyaranjan & Pratap, 2020). In India, the government plans to reduce the deficit from 4.8% in 2025 to 4.4% in financial year 2026 through stronger revenues and disciplined spending, maintaining this balance is crucial, as deficits typically widen during crisis but have trended downward with improved tax collection and controlled expenditure, reinforcing sustained economic expansion.

The **Figure 4.4** reveals the trend of India's combined fiscal deficit % of GDP over 1985-2022. The chart describes consistently high fiscal deficits during the late 1980s and early 1990s, peaking above 9% around 1986-1999, coinciding with India's pre liberalization economic strains. Following the 1991 economic reforms, deficits declined gradually through the 199s and early 2000s, reaching a low of around 4 % in 2007, reflecting improved fiscal discipline. However, the global financial crisis led to a sharp rise in 2008 to 2009, after which there was a moderate decline and stabilization. The most dramatic spike is observed in 2020, where the deficit soared above 13% of GDP due to pandemic related spending and revenue collapse. Since then, there has been a gradual reduction, with the deficit easing back towards pre-pandemic by upcoming year. The chart underscores the cyclical nature of fiscal management in India, shaped by both domestic reforms and global economic shocks.

Figure: 4.4 Gross fiscal deficit in % of GDP (centre-state government) in India 1985-2022

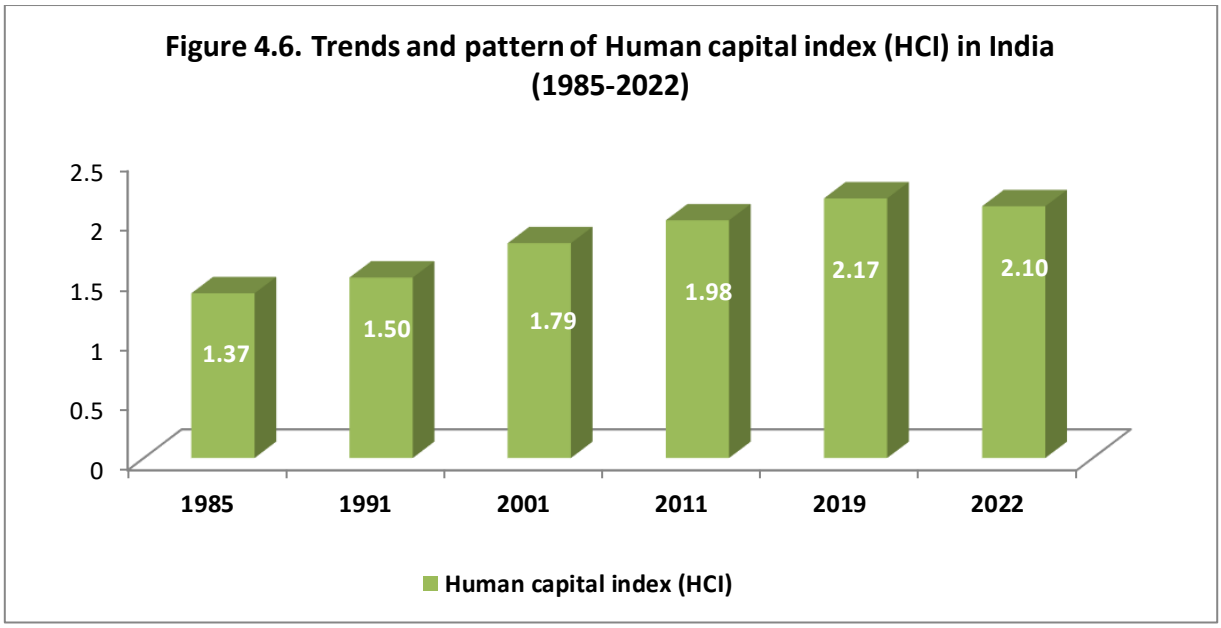




4.5 Trend and Patterns of Inflation rate in Indian Economy:

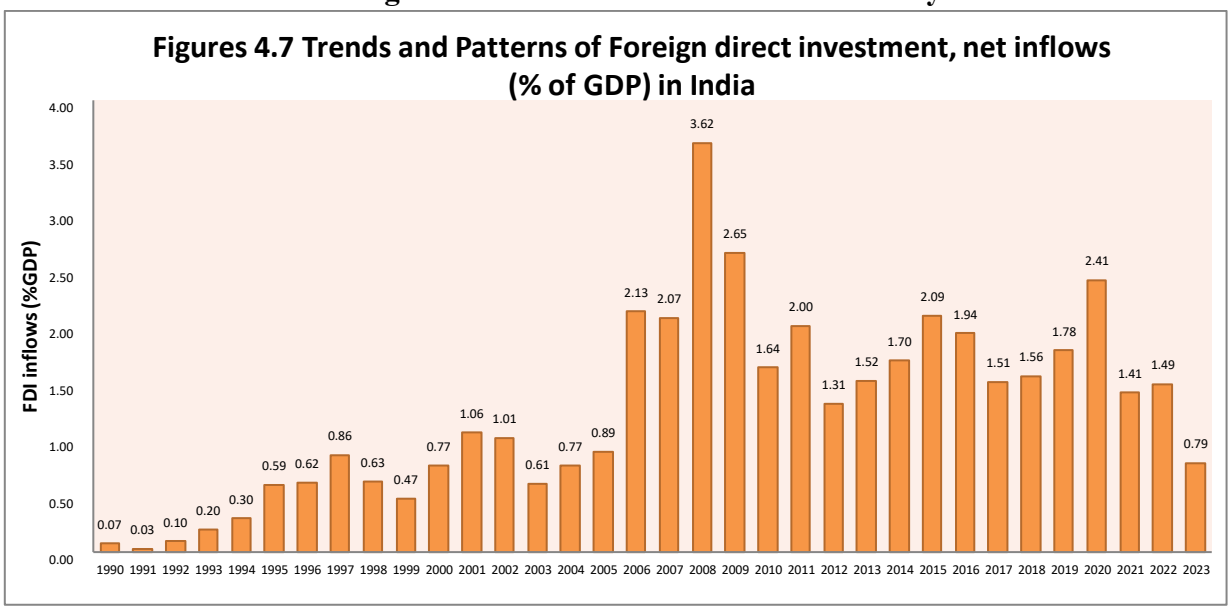
The **Figure 4.5** illustrates the fluctuating pattern of inflation over the period from 1985-2022. It shows high volatility during the late 1980s and early 199s, with inflation peaking at 13.87% in 1991 due to the balance of payments crisis and subsequent economic liberalization. A relatively stable and low inflation period followed from the late 19990s to the mid-2000s, signifying fiscal discipline and monetary tightening. Inflation surged again during the global financial crisis, reaching 11.99% in 2010, driven by rising commodity price and domestic supply constraints. From 2014 to 2019, inflation declined steadily, aided by structural reforms and the adoption of inflation targeting, with a low of 3.33% in 2017. However, post pandemic years saw a renewed rise in inflation, reaching 6.70% in 2022 due to supply chain disruptions and global price pressures. Overall, the trend underscores the evolving nature of inflation in India, shaped by macroeconomic policy shifts, global influences and structural factors.

4.6. Trend and Patterns of Human capital formation in Indian Economy:



The above **Figure 4.6** demonstrates a consistent and notable improvement in India's human capital development over the examined period 1985-2022, reflecting sustained investment in education, health, and skill enhancement. Starting from an index value slightly below 1.5 in 1985, the HCI has shown a steady upward trajectory, crossing 1.6 in 1991, and reaching approximately 2.0 by 2001, which coincides with the post liberalized period that emphasized human resource development alongside economic reforms. The HCI index further strengthened to around 2.2 in 2011 and peaked at approximately 2.4 in 2019, indicating robust improvements in life expectancy, literacy and schooling outcomes. Although the value in 2022 shows a marginal decline compared to 2019, it remains significantly higher than earlier decades, suggesting resilience in human capital formation despite possible disruptions from external shocks like the COVID-19 pandemic. In conclusion, the figure underscores India's long-term commitment to enhancing its human capital base, a critical drive of innovation, productivity and inclusive growth in a knowledge based economy.

4.7. Trend and Patterns of Foreign Direct Investment in Indian Economy:



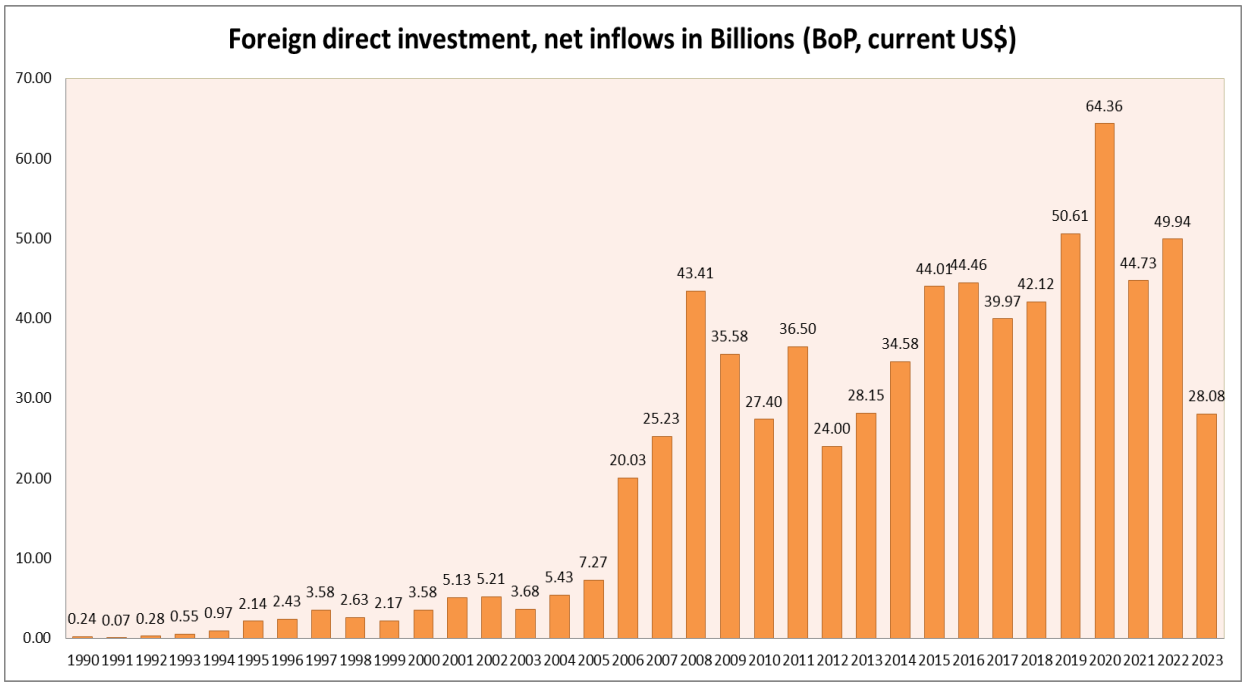
Source: Author's Plotting Using World bank database

The above chart 4.7 illustrates India's foreign direct investment performance inflows from 1990 to 2023, expressed as a percentage of Gross Domestic Product (GDP). This chart offers valuable insights the trends, and fluctuations in India inflow with the economic reforms and global investment dynamics during study period. Initially in 1990 and 1991 FDI as percentage of GDP was negligible 0.07% and 0.03%, reflecting India's pre-liberalization closed economy but began to raise modesty post 1991, coinciding with India's economic liberalization and easier regulations of license raj. This reflection can be seen in the raise of foreign direct investment in percent of GDP during 1992 (0.10%). The share increased gradually from 1993 to 1996, reflecting the early investor response to policy liberalization and opening of key sectors. Further, the FDI in percentage of GDP increased from 0.20% to 0.62% during 1993 to 1996. The FDI inflows rose to around 0.86% of GDP, as foreign participation in key sectors increased during 1997, result of early gains from economic liberalization and development of IT Hubs in India. Despite that during 1998 to 2000, India's FDI inflows exhibited relatively stagnation, depicting the 0.63% in 1998 and 0.47 % in 1999 FDI inflows in percent of GDP, resulting of spillover effect from **Asian financial crisis (1997)** and internal political uncertainties. During 2000 and 2001, the FDI inflows in India % of GDP again showing recovery and it saw a sustained upward trajectory, with net FDI inflows crossing 1 % of India's GDP by 2001. During 2002, FDI inflows in % of GDP is showing stagnant little decline. During 2003, the FDI inflow % of GDP again decline and reached to 0.61% from 1.01% in 2002. After declining in 2003, it is showing again gradually rising trend and FDI inflows became 0.77% in 2004, 0.89% in 2005 of India's GDP. In the year 2006, it surpasses the 2 % and become 2.07% of GDP and further maintained this momentum with 2.07% in 2007, indicating strong investor's confidence. Further, in 2008 it reaches its peak, where FDI inflows approached 3.6% of GDP, marks the highest point in the series, driven by booming global capital flows, India's high growth momentum and regulatory easing in key sectors. Following the 2008 global financial crisis and because of its spillover effect, FDI inflows dropped sharply up-to 2.65% of GDP in 2009 and continuously declined in 2010 also, FDI Inflows become 1.64% of India's GDP but recovered partially in subsequent year, the recovery remained moderate volatile, reflecting global risk aversion and emerging markets uncertainties. Further after one year recovery in 2011, during 2012 FDI inflows in % of GDP sharply declined again, result of Middle-East geopolitical instability such as Syria and Libya war. India is one of the oil importing countries and that time depended on the Syria for its oil imports. Again from 2013 FDI inflows started recovery and gradually increasing and again crossed the 2% of GDP in 2015. After 2015, FDI inflows gradually decreasing form 2016 to 2018. The FDI inflows illustrate some recovery in further years underpinned the flagship policy initiatives like make in India, FDI liberalization and ease of doing business reforms and FDI Inflows reached up-to 20.41% of GDP during 2020, Further, during 2021 FDI inflows showing sharp declined, reflecting during pandemic COVID capital inflows in Medicare and online tech of Indian economy attracts Foreign investment. However, 2022 and 2012 show a pronounced decline, with FDI net inflows falling below 1% of GDP in 2023, the lowest on over decades, result of Russia & Ukraine war, and USA Federal bank and other central banks hike in interest rates.

While India has made significant strides in attracting FDI since the 1991, the fluctuating trends, particularly the downturn in recent years warrants a re-examination of both external factors such as global polices, crisis and geopolitics scenario of countries and internal factor or bottlenecks. By enhancing the absorptive capacity of the manufacturing and tech sectors while fostering investor friendly environment, remains crucial for leveraging FDI as driver growth and structural transformation. This

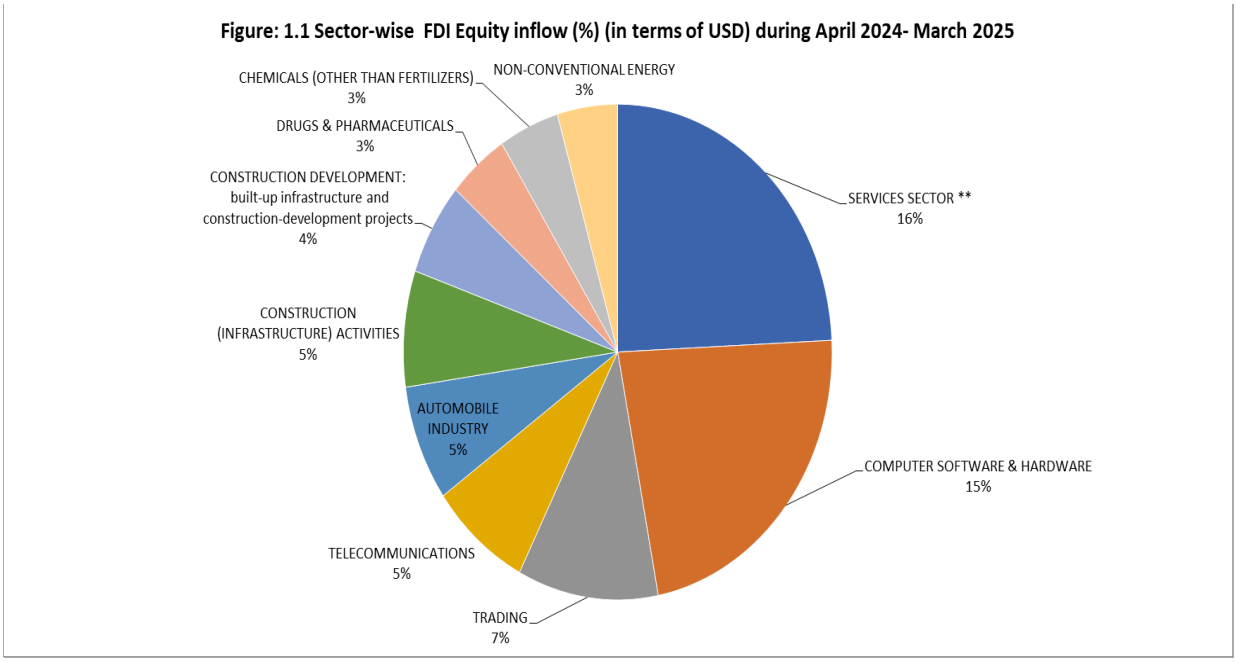
study seeks to investigate the impact of FDI in manufacturing sector's productivity and also determine the role of absorptive capacity in it.

Figure 4.7.1 Foreign Direct Investment, Net inflows (Bop, current US$)



The above **Figure 4.7.1** illustrates the foreign direct investment, net inflows in billions (BOP, current USD) and provides a longitudinal view of India's FDI trends from 1990 to 2023. It reflects a significant structural shift in India's external investment landscape, which correlates closely with trends observed in the earlier chart depicting FDI inflows as a percentage of GDP. Together, these two depicts offer both relative and absolute perspectives on FDI performance. The trajectory of financial direct investment inflows in India illustrates a strong upward trends from the early 1990s thorough 2020, followed by a notable decline in subsequent years. FDI inflows, which stood at merely 0.24 billion USD in 1990, surged significantly to 43.41 billion USD in 2008, reflecting India's growing integration into the global economy and investor confidence post-reforms. Another sharp peak was recorded in 2020 at 64.36 billion, driven by the expansion of digital services, favourable government policies, and supply chain shifts during the pandemic. However, this momentum weakened, with inflows declining to 49.94 billion USD in 2022 and further to 28.08 billion USD in 2023. This contraction corresponds with declining FDI as percentage of GDP, indicating rising global economic uncertainties, post COVID corrections and hike in interest rates at global level. The sharp fall in absolute inflows is mirrored in the declining percentage of GDP, underscoring both volume and efficiency losses. Therefore, this divergence between FDI volume and GDP share underscores the need for structural reforms in infrastructure, regulatory clarity, and skill enhancement to maximise FDI's impact on productivity and industrial competitiveness.

Figure 4.7.2. Sector-wise Foreign Direct investment, net inflows (%) in terms of USD during April 2024-March 2025



Source: Author's Plotting Using DIPP database

The above **Figure 4.7.2** is providing a detailed breakdown of the composition of foreign direct investment across various sectors in India in terms during April 2024-March 2025. It offers valuable insights into the distribution and sectorial attractiveness of FDI in current fiscal landscape. This chart describes that service sector continues to lead as the most attractive destination for FDI, accounting for 16 % of total equity inflows. This reflects sustained investors' confidence in this area, including financial services, business process outsourcing and IT-enabled services that reinforce India's role as a global service hub. Further, second highest position is shared by the computer software and hardware sector with the 15% inflows of total inflow of FDI in Indian economy. This high share underscores India's position as a global digital innovation hub and highlights the increasing its aspiration for investment digital infrastructure and technology. Further chart illustrates that trading sector captures 7% while telecommunications attracted 5 % of total FDI inflows in India during this period, signifying continued interest in India's consumption driven economy and the expansion of digital connectivity, particularly in the context of e-commerce growth. After that chart illustrates that key industrial sectors such as automobile industry, construction activities (infrastructure) and other construction development (other build-up activities) collectively drew a significant portion of FDI, each with 5%, 5%, and 4% respectively, indicting investors' interest in India's physical infrastructure and automobile sector, crucial for long-term economic growth and employment generation. Further other industries such as drugs & pharmaceuticals, chemicals (excluding fertilizers), and non-conventional energy illustrates 3%, 3% and 3% share in the total FDI inflows of Indian economy, pointing to a growing intersect in strategic sectors aligned with sustainable development, healthcare resilience and green energy transitions. The overall conclusion of this chart describes that the distribution suggests a balanced mix of FDI across traditional and emerging sectors with technology and services continuing to drive inflows, while core infrastructure and manufacturing's sector maintain a steady share. The relatively lower but significant share of drugs &

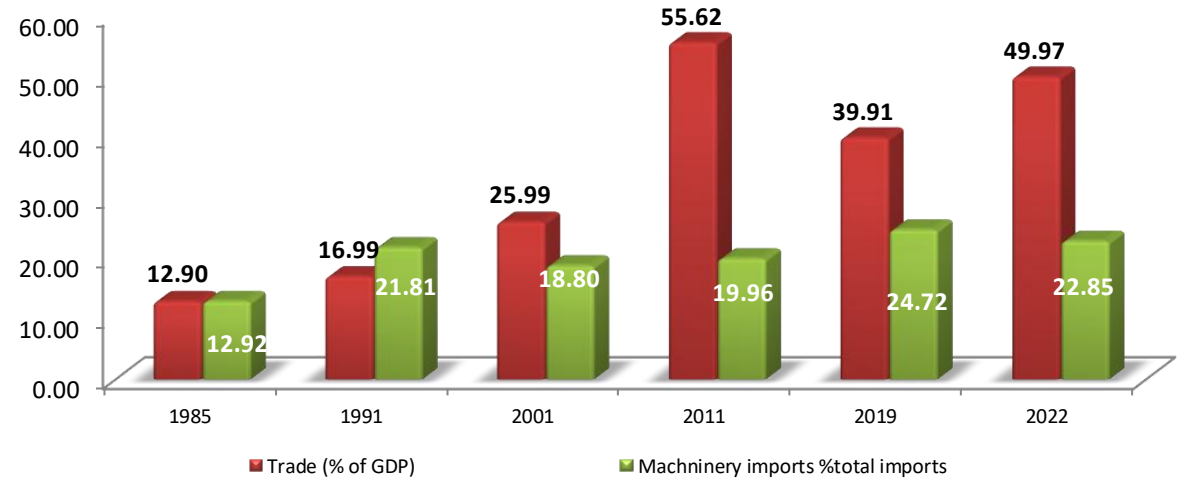
pharmaceuticals, chemical industry and renewable energy point-out India's shifting focus towards innovation and sustainability.

Overall conclusion of this section describes that India's FDI journey is marked by reform-driven booms, global cycle influences, and domestic policy responses. To sustain both the scale and impact of FDI, future efforts must focus on enhancing infrastructure, policy predictability, and sectoral diversification.

4.8. Dynamics of Trade openness and High tech machinery imports in India:

Trade dynamics encompass the shifting interplay of technology, policy frameworks, and global market demand that influences the flow of international trade. A significant feature of high-tech imports is their role as powerful drivers of domestic innovation and productivity, as they enable technology diffusion and provide access to sophisticated intermediate goods that enhance a country's economic capabilities. High-tech imports act as vital channels of technology transfer, strengthening India's innovation capacity and manufacturing competitiveness. India's growing reliance on electronics and machinery imports supports domestic industrial growth and offsets trade imbalances, even as rising high-tech exports signal improving capabilities. Despite this progress, dependence on foreign technology persists, making such imports crucial for India's economic transformation and long-term growth ambitions.

Figure: 4.8 Dynamics of Trade-openness (% GDP) and high tech-imports % of Total imports in India (1985-2022)



The above **Figure 4.8** illustrates the evolving relationship between India's trade openness and share of high tech or machinery imports in total imports over nearly four decades. Trade openness in % of GDP shows a substantial increase from 12.9% in 1985 to a peak of 55.62% in 2011, reflecting India's liberalization and deeper integration into the global economy. Although it's slightly declined to 49.97% in 2022, the overall upward trend signals a sustained openness in Trade policy. Simultaneously, the share of machinery imports (as proxy for capital imports) in total imports also fluctuates but remains relatively stable compared to trade openness. It increased from 12.92% in 1985 to 24.72% in 2019, indicating a growing emphasis on importing technologically advanced goods, though it dipped slightly to 22.85 % in 2022. Notably, the highest divergence between trade openness and capital goods imports occurred in 2011, where trade surged machinery imports did not rise proportionately, suggesting a more

diversifies import basket beyond capital goods. In conclusion the chart demonstrates that while India has become significantly more trade oriented and its capital goods import has grown moderately.

4.9. Dynamics of Research and Development Activities in Indian Economy:

Technology is widely regarded as the core driver of sustainable growth and an essential catalyst for climate-resilient. In India, the R&D landscape is undergoing a significant structural evolution, propelled by an intensified national commitment to innovation centric growth. Public and private investments in science and technology have expanded steadily, underpinned by coherent policy frameworks, targeted funding mechanisms, and substantial institutional reforms. Together, these developments signal India's aspiration to advance toward a self-reliant, knowledge based economy capable of addressing critical development and environmental challenges through scientific progress and technological innovation.

4.9.1. Patent applications and research & development expenditure in India:

Trends of Table 4.9 along-with Figure 4.9, presents a comprehensive overview of trends in patent applications and research and development expenditure in India over the period of 1985 to 2022. This longitudinal dataset disaggregates patent applications into those filed by resident and non-residents, capturing the evolution of domestic and foreign innovation activity in Indian context. The data reveals that total patent application in India began at modest level of 3475 in 1985, with resident applications constituting approximately 28% of total patents. From 1985 through the mid-1990s, growth in patents filling was gradually increasing, reflecting a nascent innovation ecosystem. By 1997, total applications had reached 10155 making a significant upturn. However, this upward trajectory experienced a notable contraction in 1998 and 1999, where applications trajectory experienced a notable contraction in 1998 and 1999, where applications declined to 8954 and further to 4826 respectively possibly influenced by macroeconomic uncertainties or transition shifts in intellectual property frameworks.

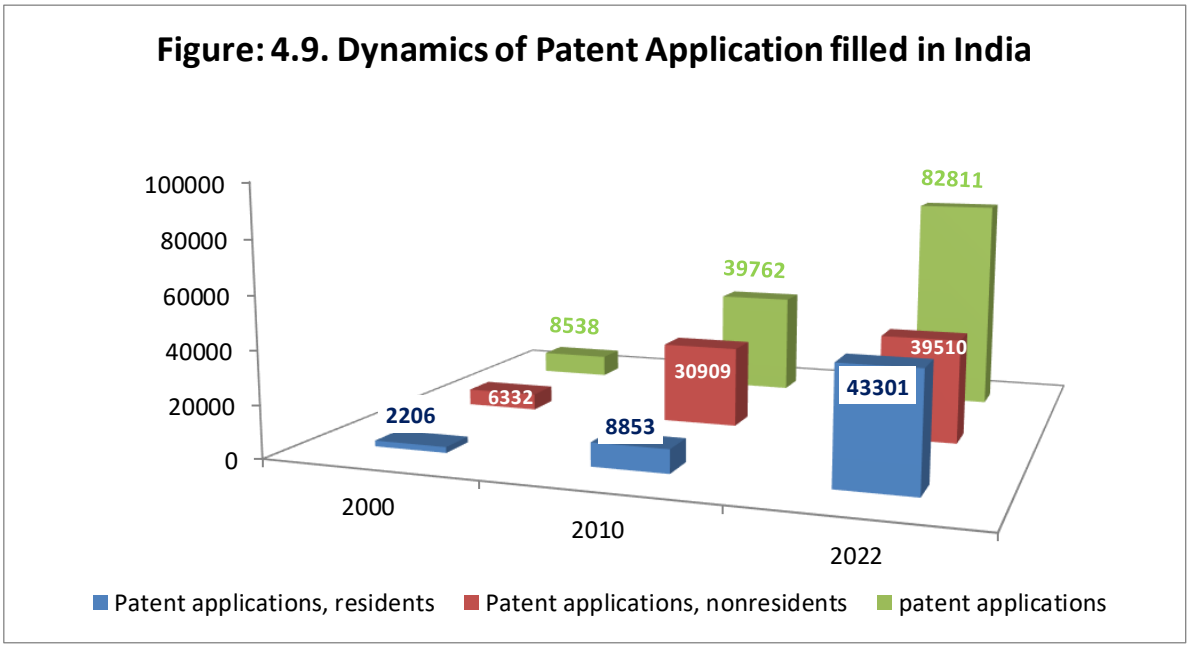
Table: 4.9. Dynamics of Research and Development Activities in India (1985-2022)

Year	Patent applications, residents		Patent applications, non-residents	Total Patent Applications	R&D Expenditure
1985	982		2493	3475	
986	999		2497	3496	
1987	988		2520	3508	
1988	1033		2504	3537	
1989	1048		2600	3648	
1990	1147		2673	3820	
1991	1267		2328	3595	
1992	1248		2176	3424	
1993	1209		2511	3720	
1994	1588		3212	4800	
1995	1545		5021	6566	
1996	1661		6901	8562	0.639050007
1997	1926		8229	10155	0.686689973
1998	2247		6707	8954	0.703790009
1999	2206		2620	4826	0.724129975

2000	2206		6332	8538	0.756990016
2001	2379		8213	10592	0.735909998
2002	2693		8772	11465	0.72566998
2003	3425		9188	12613	0.719290018
2004	4014		13452	17466	0.756900012
2005	4721		19661	24382	0.824109972
2006	5686		23242	28928	0.804729998
2007	6296		28922	35218	0.805069983
2008	6425		30387	36812	0.858759999
2009	7262		27025	34287	0.833140016
2010	8853		30909	39762	0.788489997
2011	8841		33450	42291	0.755020022
2012	9553		34402	43955	0.743990004
2013	10669		32362	43031	0.706420004
2014	12040		30814	42854	0.701590002
2015	12579		33079	45658	0.693099976
2016	13199		31858	45057	0.669839978
2017	14961		31621	46582	0.66602999
2018	16289		33766	50055	0.66000998
2019	19454		34173	53627	0.659420013
2020	23141		33630	56771	0.645579994
2021	26267		35306	61573	
2022	43301		39510	82811	

Source: World Development Indicators, 2024

Figure: 4.9. Dynamics of Patent Application filled in India



The recovery is observed post 2000, with patent fillings registered substantial growth, driven largely by non-resident filings. Further, during 2000-2008, total applications nearly expanded, peaking at 36812. Although a brief dip occurred in 2009 (34287 applications) possibly due to the global financial crisis, after which the trend resumed an upward climb. During 2012, applications surpass 43000, and although some volatility followed in subsequent years, the overall trend remained positive. Significantly, the year 2022 marks a historical high, with total factor patent filings reaching 82811 more than twentyfold increase from 1985. Notably, the contribution of resident fillings surged to 43301, indicating strengthening domestic innovation capabilities, policy reforms in intellectual property right (IPRs), and institutional support for indigenous research and development activities.

On the Parallel to these innovation indictors, the table also documents trends in research and development expenditure as percent of GDP in India has maintained a relatively stable R&D intensity, ranging between 0.64% and 0.86% of GDP, reflect a need for deeper public and private sector investment to match the innovation intensities of global peers. The comprehensive assessment of this table underscores a progressive, although uneven, growth in India's innovation landscape, driven by structural reforms, global integration, and a rising emphasis on knowledge based industrial development. The increasing share of resident patent applications post 2016, in particular, may be interpreted as evidence of evolving domestic capabilities in science and technology, which hold significant implications for productivity dynamics in Indian manufacturing.

4.10. Performance of Financial Sector in India:

The **Table 4.10** and **Figure 4.10** illustrates the evolution of Indian financial system and provide a comprehensive view of key inductors of financial development in India; broad money in percent of GDP, Bank deposit to GDP ratio, domestic credit to the private sector, and market capitalization over the period 1985-2022. These indicators collectively provide a robust overview of India's monetary expansion, financial intermediation capacity, and capital market maturity over nearly four decades.

From the late 1990s and particularly post 2000, all financial indicators show a consistent upward trajectory with notable surges in broad money and bank deposits, indicating increase liquidity and saving mobilization. The analysis revealed that broad money as a percentage of GDP exhibited notable fluctuations in India through-out the study period. The analysis indicates a generally upward trajectory in India's broad money to GDP ratio from 1985 to 2009, despite intermittent declines in few years namely in 1988, 1990, and 1995. Starting at 42.63% in 1987, it peaked near 79.8% by 2009, reflecting monetary deepening aligned with expanding economic activity and financial liberalization. Although fluctuations occurred, particularly post 2010, the trend remained largely positive. Although fluctuations occurred, particularly post-2010, the trend remained largely positive. A slight increase was recorded in 2011, followed by a decline in 2012. By 2013, it rose again to 78.18%, and drifted around similar values in subsequent years, 77.89% in 2014 and 78.01% in 2015. However, 2016 and 2017 saw a marginal decline, with figures stabilizing around the same level through 2018.

Table 4.10 Dynamics of Financial Sector in India (1985-2022)

Year	Broad Money (BM) (%GDP)	Ratio of Bank Deposit (BD) to GDP	Domestic credit to private sector (% of GDP)	Market Capitalization (MC) in % of GDP
1985	39.53	**31.01**	24.56	2.72
1986	41.66	**33.15**	25.80	3.36

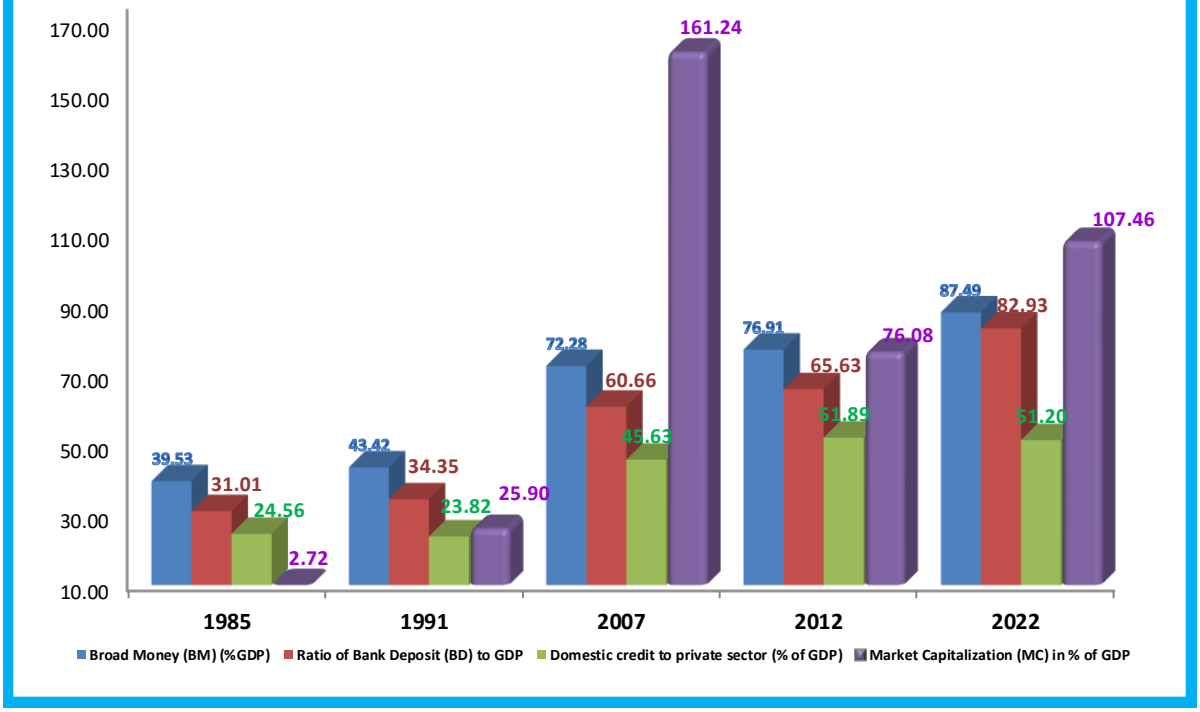
1987	42.63	33.82	25.38	4.69
1988	42.50	34.12	25.28	5.56
1989	42.82	33.90	26.59	5.51
1990	42.18	33.23	24.92	8.18
1991	43.42	34.35	23.82	25.90
1992	44.14	35.55	24.70	15.88
1993	44.88	35.75	23.83	26.28
1994	46.02	36.44	23.65	29.22
1995	43.55	33.61	22.51	32.93
1996	44.69	35.08	23.40	26.03
1997	47.46	37.84	23.56	30.14
1998	48.90	39.51	23.68	27.50
1999	51.06	41.22	25.42	30.26
2000	54.65	45.02	28.34	48.17
2001	57.74	47.71	28.62	30.65
2002	62.62	52.04	32.31	33.44
2003	63.18	52.29	31.63	50.85
2004	64.64	53.76	36.19	58.60
2005	65.55	55.35	40.07	76.15
2006	68.06	58.77	43.63	95.22
2007	72.28	60.66	45.63	161.24
2008	77.37	64.98	49.56	66.00
2009	79.08	66.04	48.12	101.89
2010	77.68	65.12	50.56	105.18
2011	78.84	65.57	51.29	68.27
2012	76.91	65.63	51.89	76.08
2013	78.18	67.12	52.39	68.13
2014	77.90	67.34	51.88	82.72
2015	78.01	67.06	51.87	82.96
2016	74.55	69.80	49.10	76.10
2017	74.14	64.65	48.79	96.40
2018	74.10	63.68	50.34	84.50
2019	76.98	67.20	50.74	80.65
2020	87.68	76.54	54.51	97.03
2021	82.10	72.09	50.14	113.61
2022	87.49	82.93	51.20	107.46

Source: Compilation Data from World Development Indictor and RBI handbook of India.

The overall conclusion depicts that broad money comprising currency in circulation and demand deposits shows a steady upward trend from 39.53% in the mid-1980s to over 87.49% of GDP by 2022, reflecting a long-term deepening of India's monetary base, driven by banking expansion, financial inclusion initiatives, and increased monetization of the economy.

The bank deposit ratio also followed a parallel trajectory, demonstrated a persistent upward trend from 31.0% in 1985 to 82.93% in 2022. This trend is consistent with rising household saving being intermediated through formal banking channels, a critical source of funding for both public and private investment. This upward dynamic is pointing to improved financial inclusion, trust in the banking system, and the expansion of deposits mobilization efforts, especially in the post liberalization era. The major growth phases include the post 2000 decade and the financial inclusion drives of the 2010s.

Figure: 4.10 Perofrmnace of Indian Financial sector (1985-2022)



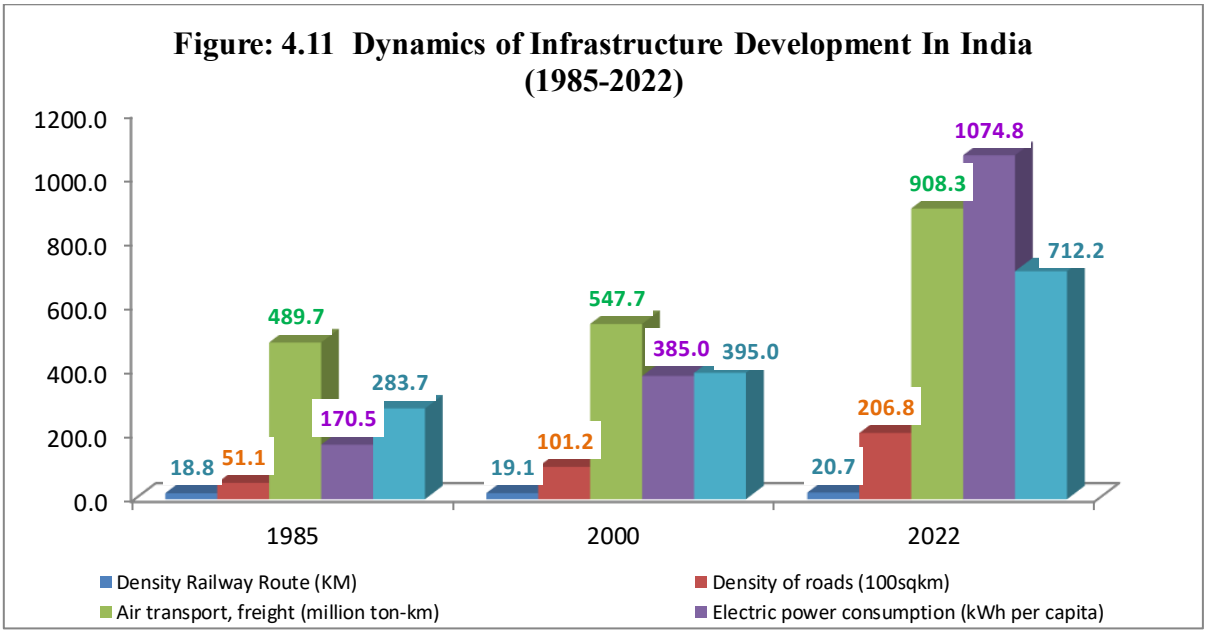
The credit to the private sector has improved but at a relatively slower pace, growing from under 24.56% in the 1985 to 51.20% by 2022, reflecting increased access to formal credit for firms and households. However, its relatively slower growth compared to deposits suggests a lag in credit deployment capacity, increased in risk aversion and inefficiencies in credit allocation in the financial system. The mod 2000 to 2010 marked a peak period of credit penetration, followed by stagnation after 2015 suggests emerging constraints in financial intermediation, possibly reflecting concerns over non-performing assets and regulatory tightening by RBI to control inflationary issues in the economy. The private credit to GDP ratio's deceleration post 2015 signals a disconnected between liquidity availability and productive investment uptake, particularly for small and medium sized manufacturing firms.

The most dynamic shifts are observed in market capitalization. Market capitalisation as a percentage of GDP shows the most volatility, yet its growth trajectory is pronounced modest until the early 2000s, after which it surged, peaking at over 160% of GDP in 2007 and again surpassing 100% in 2021-22. These peaks coincide with bullish equity markets, reforms in capital markets, and growing investor participation both domestic and foreign. This dramatic expansion, particularly after the early 2000s,

underscores the rapid evolution and globalization of India's capital markets. The sharp corrections as seen in 2008 and 2011, illustrates the market's sensitivity to global domestic macroeconomic shocks.
In overall conclusion, collectively these indicators reflects a robust deepening of India's financial sector, transitioning from a bank dominated structure to a more diversified and market integrated financial ecosystem. Despite cyclical fluctuations, the overall trend underscores enhanced financial sector resilience, rising monetary depth, and improved capital market integration. However, the divergence between deposits growth and private sector credit highlights on-going challenges in credit transmission and the need for further reforms to ensure efficient financial intermediation.

4.11. Dynamics of Infrastructure Development in India:

Figure: 4.11 Dynamics of Infrastructure Development In India (1985-2022)



Data Source: WDI and RBI handbook of India, 2025

The **Figure 4.11** provides a comprehensive view of the evolution of India's core infrastructure indictors across seven key sectors; telecommunication, railways, aviation, roads, energy and electricity. Over the period 1985-2022, India witnessed transformation infrastructure growth, marked by exponential progress in telecommunication density, which rose from merely 0.4 telephone subscriptions (fixed and mobile both) per 100 people in 1985 to over 82.5 in 2022, signaling digital proliferation and mobile penetration. The railway route length remained relatively stable, increasing modestly from 61850km to 68,143km but rail density improved from 18.81 to 20.73 per 1000 sq. km/s, reflecting slight network densification during period. The air freight volume surged dramatically from 490 million ton km in 1985 to a peak of 2704 million ton-km in 2018, underscoring the expansion of air logistic and international trade connectivity. However it showed volatility post 2019 due to pandemic related disruptions. The road infrastructure expanded significantly, with total road length quadrupling from 1.68 million km to nearly 6.8 million km, and road density increasing from 51.1 to 206 Km as per 100 sq. Km, reflecting massive investments in connectivity and rural-urban integration. The electricity consumption per capita raised steadily from 170.5 kWh in 1985 to 074.8 kWh in 2022, reflecting industrialization, electrification and rising living standards. Similarly, energy use (in oil equivalent) increased triple times from 283.7kg to 712 kg per capita, highlighting higher energy demand aligned with economic growth.

5. Conclusion and policy Implications:

The study highlights that India's economic growth and manufacturing productivity have evolved through distinct phases shaped by changes in macroeconomic conditions and structural factors. Capital formation, human capital, financial development technological advancement and, macroeconomic stability have remained important components of the country's changing productive capacity. The analysis also indicates that major events such as the 1991 economic reforms, the 1997-98 Asian financial crisis, the 2008-09 global financial crisis, the 2017 GST transition and the 2020 COVID-19 shock were associated with significant changes in the growth trajectory (Morris, 2022).. These developments suggest that India's growth process has not been uniform and that manufacturing productivity has remained sensitive to both domestic structural changes and external shocks (Bhat et al., 2018). Overall, sustained and inclusive growth requires a combination of macroeconomic stability and continued strengthening of the structural foundations of productivity.

The findings suggest that policy should focus on strengthening the structural foundations of long-term growth and manufacturing productivity while maintaining macroeconomic stability. Greater emphasis on productive capital formation, infrastructure, skill development, and human capital can enhance the productive capacity of the economy. Similarly, deeper financial development and improved access to finance can support investment and technological improvement in the manufacturing sector. Policies encouraging technology adoption, innovation, R&D and digital transformation can further improve manufacturing efficiency and competitiveness. At the same time, maintaining stable macroeconomic conditions and developing appropriate mechanism to respond to major domestic and external shocks can reduce disruptions to investment and production or market (Bhardwaj et al., 2023). A coordinated approach combining macroeconomic stability, human capital formation, productive investment, financial deepening and technology up-gradation is therefore important for strengthening manufacturing productivity and supporting sustained economic growth in India.

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