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Perspectives On Digitization And Economic Growth In India

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Abstract

This study examines digitization and its effect on various sectors of the Indian economy. India's digital transformation has been remarkable in recent years, with the rapid adoption of smartphones, increased internet connectivity, and the government's push towards a digital economy. It has opened tremendous opportunities for economic growth across various sectors of the economy. The fast-paced digitization has significantly impacted the country's economic growth, with tremendous opportunities for continued growth in the digital economy. India has witnessed a remarkable increase in internet penetration, primarily driven by affordable smartphones and data plans. The number of internet users in India surpassed 600 million by the end of 2020, and this number is expected to continue to grow rapidly. With the government's continued focus on digital transformation and investments in digital technologies, India is well-positioned to continue to drive economic growth. Digital technologies such as data pooling, artificial intelligence, and others are now widely used to track and diagnose issues in agriculture; health; environment; logistics; jobs; skills market; e-governance; performing daily tasks such as navigating traffic, paying bills; and financial transactions, among others. The study employs secondary data extracted from various literature sources to analyze the impact of digitization on India's economic growth. It also involves a systematic review of the literature on the digital economy and economic reforms issues to address the objective. The research is particularly important for researchers and policymakers and offers opportunities for future studies.

Keywords: Digital economy; digitisation; economic reforms; economic growth; India.

Introduction

Background

In recent years, the rise of digitization has radically transformed how business is conducted in the global market, indicating that the world is on the brink of the Fifth Industrial Revolution (Parida et al. 2019; Rojko 2017). The accelerated development of the internet enforced by the digitization processes has already led to the emergence of a digital economy. This consequence has opened global access to unprecedented services; transformed the traditional concepts of economic growth and competitiveness; and changed the economy and society as a whole (Heimerl & Raza 2018; Watanabe et al. 2018). The digital economy continues to evolve rapidly, transforming industries, creating new business models, and offering opportunities for innovation and economic growth. It has become an integral part of the global economy, impacting various aspects of the economy and business environment. Beier et al. (2017) argued that digital transformation may affect not only the environmental aspect (resource efficiency, renewable energy sources), but also social transformations and economic growth. However, the study focuses on how digitalization influences economic growth in India.

The rapid emergence of the information and communication technology (ICT) sector of which digitization is a part, has placed India on the global stage during the last two decades. The free flow of information and ideas has brought knowledge and its myriad applications, creating new choices and opportunities in the development process in different sections of the globe. Khan (2015) revealed that the digital India initiative offers a great chance to rethink India's service sector paradigms using the most cutting-edge technologies. It also made note of the fact that many projects may need to undergo some type of transformational process, reengineering, or filtering to meet their targeted service level goals (Khan 2015). As stated by Bukht and Heeks (2017), the digital economy stimulates economic growth, increases capital and labour productivity, reduces operating costs, and promotes access to global markets. In view of this, the impact of

digitalization on the economy has attracted the attention of many researchers in recent years.

The Indian digital economy transformed in recent years due to government initiatives such as Digital India to bridge the gap between digital haves and have-nots by using technology for the citizens. However, India faced quite a few roadblocks prior to digitization characterized by a cash-dependent society, deficiency of trust in digital payments, lack of participation by start-ups, and inadequate technological infrastructure. Since the inception of the Digital India initiative, the key enabler of this growth includes enhancements in the payments infrastructure, developments in information and communications technology, and the introduction of a responsive regulatory framework, among others. Being a global concept, digitization has a prominent impact on the economic growth of any nation. To support this claim, Katz, Koutroumpis and Callorda (2014) argued that the digitization index has been linked to higher growth and employment with increasing returns to scale. As such, India's transition from demonetization to digitization illustrates the transformative power of policy measures and government initiatives in driving the adoption of digital payments. Relatedly, the digital economy in India is witnessing rapid growth, driven by technology adoption, entrepreneurship, and government support. The sector holds immense potential for job creation (direct job of 1.7 Crore and an indirect job of at least 8.5 Crore) (Kishnani, 2020) and economic development. The report by the World Bank (2022) argued that a 10% increase in mobile and broadband penetration increases the per capita GDP by 0.81% and 1.38% respectively. With the advent of digital transformation, India has become the 2nd largest telecom market in the world with 915 million wireless subscribers, and the world’s 3rd largest Internet market with almost 259 million broadband users (Kaur & Mir, 2022).

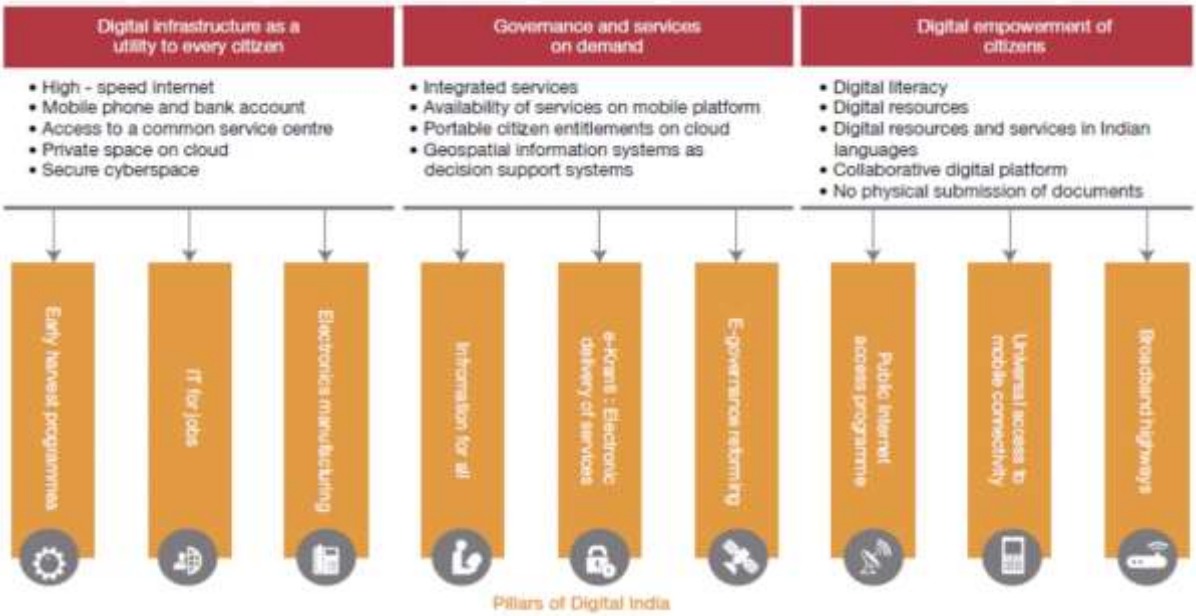
Digital India initiative

The Indian government introduced the 'Digital India' initiative in July 2015 with the goal of improving the country's online infrastructure and increasing internet accessibility among citizens. The government's main initiative under Prime Minister Modi enabled the nation to become more technologically advanced. The goal of the program is to increase service delivery efficiency and enhance the standard of living for persons from all socioeconomic backgrounds by

making government services available to them via electronic channels. By leveraging IT, this initiative aims to revolutionize the entire public service delivery system. The services are delivered to the public via various electronic media, including but not limited to mobile phones, desktop computers, laptops, tablets, TVs, radios, and the Internet. India's goal is to become a fully digitalized and knowledge-based society and economy (McKinsey Global Institute, 2017). It aims to make government services more easily accessible to all citizens by streamlining administrative processes and minimizing paper use. This program bridges the gap between rural and urban people with a plan to connect rural areas with high-speed internet networks. The Digital India program extends to the agricultural, industrial, and service sectors which constitute the growth of the economy (Vijayan, 2019). Named as the nine pillars of Digital India, the project connects the 2.5 lakh villages across India through broadband highways, public internet access, universal access to mobile connectivity, e-governance, e-kranti, information services for all, a sturdy electronic manufacturing regime, early harvest programs, and IT for jobs.

This huge project resulted in massive investments in the technology sector of Rs 1.13 lakh crore, which aided in the development of a more open, accountable, and receptive administration. It encourages the use of technology to link and empower individuals in fields like health, education, labour and employment, and commerce. As such, the initiative raises GDP per capita income, and people's standard of living by making more jobs available in the country. Another important attribute of Digital India is Digital Inclusion with technology that is transformative, affordable, and sustainable. Since its launch, Digital India has attracted more than 4 lakh crore investments and generated more than 18 lakh job opportunities. The Digital India program brought a promising development with a rise in mobile data consumption from 20 crores of GB per month to nearly 370 crore GB per month. Figure 1 illustrates the nine pillars that capture the Digital India vision areas of digital infrastructure; governance and services; and digital improvement of citizens.

Figure 1: Vision Areas of Digital India



Source: Adapted from http://meity.gov.in/divisions/national-e-governance-plan (2016)

The Government of India has a vision to make India a digitally empowered society and knowledge economy through its Digital India initiative. There are three main focuses:

• **Digital Infrastructure as a Utility to Every Citizen:** The government has made it a priority to bring high-speed internet to 250,000 Gram Panchayats, making it an essential resource for achieving digital inclusion. Citizens are issued a digital identity that is both permanent and accessible online. This will ensure easy access to Common Service Centers and a shareable private space for every citizen on a public cloud.

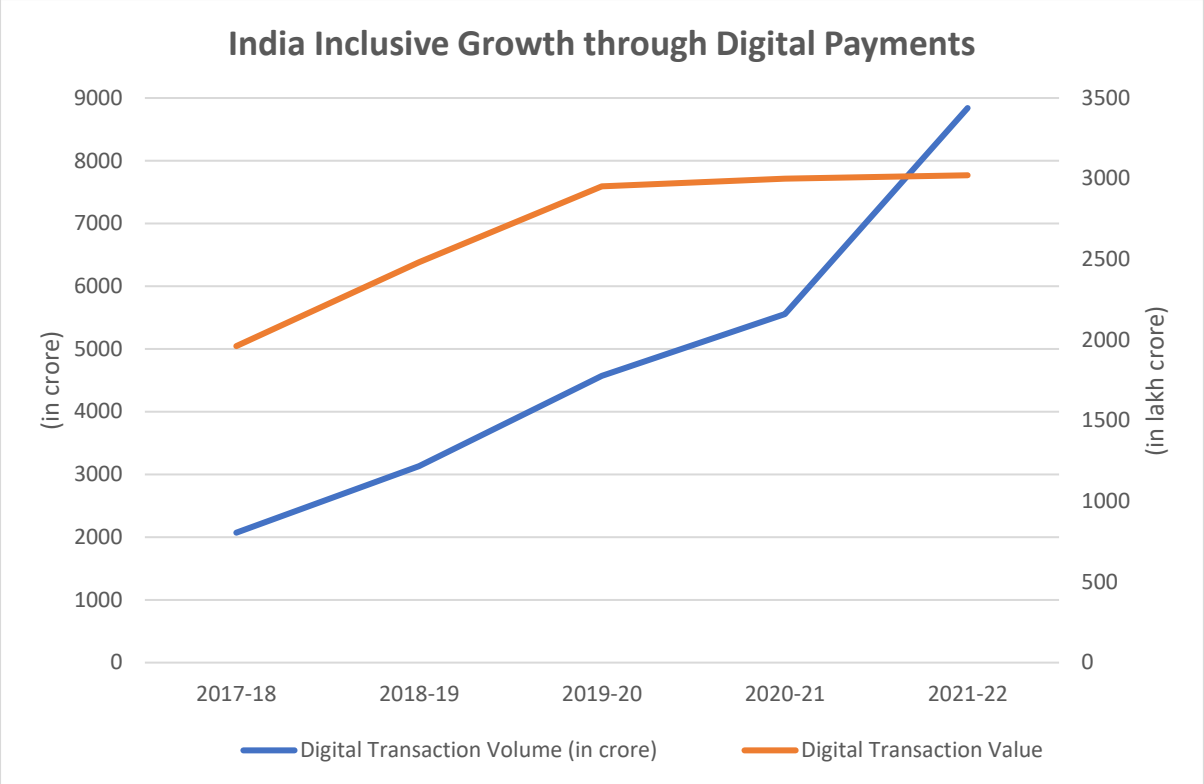
• **Governance and Services on Demand:** Under this vision, high-speed optical fiber is deployed across the whole government, facilitating better communication between agencies, and paving the way for instantaneous service delivery via digital and mobile channels. Apart from this, the government is planning to digitally change services to improve the ease of doing business in India and to make all citizen entitlements transferable through the cloud for convenient and country-wide access.

• **Digital Empowerment of Citizens:** This vision is to empower citizens through digital literacy and universal access to digital resources. e.g., all documents/certificates to be available on the cloud and in Indian languages. The government also wants

to provide collaborative digital platforms for participatory governance. e.g., the MyGov website for crowdsourcing ideas.

Digital payments in India have grown multi-fold over the past few years in terms of both value and volume. Numerous factors have shaped this trend in the country including improvements in payments infrastructure, disruptions in information and communication technology, a responsive regulatory framework, a conducive policy environment, and a greater focus on customer-centricity. This has accelerated the digital revolution with India having more than 761 million mobile internet users as of March 2022. While the number of mobile internet users in rural India has risen to 345 million, urban India continues to lead in usage with approximately 416 million mobile internet users. In addition, increased adoption of smartphones, greater access to the internet, people's growing comfort with using technology, and improved financial capabilities have also aided this growth. The increased adoption of smartphones, greater access to the internet, and growing comfort in using technology have enabled financial service providers to design innovative solutions (such as Unified Payments Interface (UPI), Immediate Payment Services (IMPS), Bharat Interface for Money (BHIM) Aadhaar Pay and Debit Cards, etc.) for the unserved and underserved segments. As of April 2022, India had more than 1.14 billion wireless telecom subscriptions. Further, the penetration of smartphones among the Indian population has increased from 26% in 2014 to 61% in 2022. India's total smartphone users will likely rise to 1 billion by 2026, which will help accelerate the uptake of digital payments. Coordinated efforts of the Government with all stakeholders have led to significant growth in digital payments, as illustrated in Figure 2.

Figure 2: Digital payments in volume and value



Source: Adapted from RBI, DigiDhan Dashboard (2022)

Steady year-on-year growth in India's digital market can be expected, given the favourable drivers - a young population, rising per capita income, and increasing urbanization. Beyond steady growth among existing customers, India has witnessed rapid and discontinuous growth in the number of new users, due to competitive market dynamics and determined government action. The government's decision in November 2016 to withdraw 500- and 1,000-rupee currency notes encouraged the acceptance of digital payments around the country. The government also offered incentives such as discounts for using digital products to pay for fuel purchases and seasonal or monthly rail tickets, as well as zero transaction fees on digital payments to government departments and public-sector undertakings, capping of monthly point-of-sale equipment rentals paid by merchants at $1.50, and withdrawal of customer charges on low-value cashless payments.

Benefits of digitization

Technological revolutions are marked by innovations that shape industrial production and drive long-term economic growth. These revolutions signify historic periods when their effects cut across all 'common sense' criteria for social interactions and business behavior (Landes, 1969; Freeman & Perez, 1988; Nye, 1990). Digitization, per se, is the process of

converting analog information to a digital format. Digitization, as a social process, refers to the transformation of the techno-economic environment and socio-institutional operations through digital communications and applications. Unlike other technological innovations, digitization builds on the evolution of network access (mobile or fixed broadband networks such as the Broadband Highways and universal access to mobile connections in India) and semi-conductor technologies (computers/laptops, wireless devices/tablets through the CSCs present multimedia content related to various fields, namely education, e-governance, health, telemedicine, entertainment and other government and private services). It also offers software, and computational engineering (increased functionality of operating systems) and the spill-over effects resulting from their use (common platforms for application development, electronic delivery of government services, electronic commerce, social networks, and availability of online information in blogs, and portals). In India, these platforms brought about Digital Point of Sale (Digital POS), Unified Payments Interface (UPI), mobile wallets, Mobile Point of Sale (mPOS), etc.

Digitization transforms the traditional concepts of economic growth and competitiveness. The study by Castellacci and Tveito (2018) documents that new technologies contribute greatly to fostering economic performance (economic growth and competitiveness). Consequently, they were defined to have a favourable effect on the well-being of the population. According to a study by Parviainen et al. (2017), digitalization implies gradual economic growth. In view of this, countries at the most advanced stage of digitalization derive 20% more economic benefits than those at the initial stage. Scholars reported digitalization to be effective in reducing unemployment, improving quality of life, and boosting citizen access to public services (Castellacci and Tveito, 2018). They stated that it allows governments to operate with greater transparency and efficiency, which also positively impacts the country's economic growth. Beier et al. (2017) examined the changes that digitalization is expected to bring about in the industrial sector by comparing highly industrialized and major emerging industrial economies. Their findings reveal that digital transformation may affect not only the environmental aspect (resource efficiency, renewable energy sources) but also social transformations and economic growth.

Mićić (2017) argued that high-tech solutions and digital transformation are among the key areas of investment for the world's leading economies. He recognized increasing financing in digital transformation through the development of the private and public ICT sector to be advantageous for economic growth and such decisive indicators as GDP, productivity, and employment. Besides, by means of the so-called technological map of Europe, he demonstrated that countries with high ICT investment levels have equally high GDP per capita (Mićić, 2017). Additionally, Bongomin et al. (2019) investigated aspects of introducing digital financial innovations, such as mobile money services, and their impact on economic advancement. For example, in India, these have facilitated online transactions and have helped bring more people into the formal banking sector, improving financial inclusion and driving economic growth. The survey of 379 Ugandan micro, small, and medium enterprises unveiled that the adoption and use of mobile money services can result in greater access to financial markets, which will subsequently increase the use of financial services and reduce risks for achieving stable and inclusive growth in developing states (Bongomin et al. 2019). Relatedly, Marinković et al. (2018) emphasized that ICT is among the key tools for ensuring the development of the economy. They argued that the increasing significance of ICT is confirmed by the rapid growth in employment in this area.

Further, Kasimova et al. (2020) indicated that the digital transformation of the world economy is followed by a systemic digital transition to new forms of relations in the production sector. They concentrated on the impact of digitalization on GDP as the main indicator of economic growth by analyzing the dependence of Russia's GDP on capital costs, labor costs, and the costs of ICT and their forecasting. For instance, the adoption of digital technologies such as automation and robotics has helped increase manufacturing efficiency and productivity, enabling Indian manufacturers to compete more effectively in global markets. Aleksandrova, Truntsevsky, and Polutova (2022) argued that digitalization transforms the traditional concepts of economic growth and competitiveness. The study showed that the state of the macroenvironment and the readiness of the population for digital transformation do not allow digital technologies to affect the economic growth rate seriously. The research outcomes confirmed that digitalization alone is not enough for economic growth (Truntsevsky and Polutova, 2022). Digitalization processes give

rise to opening borders; facilitating the spread of business transparency and publicity principles; and contributing to the ability to resist cyber threats. An influential factor affecting the efficiency of digitalization processes is the willingness of businesses and the population to accept new technologies.

Impact of digital initiatives in India

India's digital story is one of digital empowerment and digital inclusion for digital transformation based on technology that is affordable, inclusive, and equitable. The Digital India Program is generating pathways to a future powered by technology and achieving high growth of the Digital Economy to reach a level of Trillion Dollars by 2025. Some of the significant impacts of the digital initiatives by the Indian government are summarized in Table 1. The spread of digital technologies in agriculture, education, energy efficiency, employment, labour market regulation, etc. is essential for the country and has significant potential.

Table 1: Impact of digital initiatives in India

Key area	Initiative	Description	Impact
eGovernance	Common Services Centre	▪ Access points for delivery of electronic services to villages	▪ 290,000 functional CSCs with 72% of all gram panchayats covered ▪ 54,800 women entrepreneurs
	Digital land	▪ Development of a modern, comprehensive, and transparent land records management system	▪ 31 states and UTs with complete computerization of land records, as of Nov 2017 ▪ 30 states and UTs with complete computerization of property

			registration, as of Nov 2017
	DigiLocker	▪ Cloud-based platform for issuing and sharing key identity documents	▪ 15.3 million registered users ▪ 20.5 million documents uploaded
	Direct Benefit Transfer	▪ Subsidy and benefits disbursements directly to bank accounts	▪ $70 billion disbursed through DBT ▪ 433 schemes from 56 ministries covered
	Government e-Marketplace	▪ Online marketplace for procurement of goods and services by various government departments	▪ 27,978 buyer organisations and 143,751 sellers ▪ 823,283 orders
Agriculture	eNAM	▪ Pan-Indian electronic trading portal for agricultural commodities	▪ $4.8 billion value traded, as of August 2018 ▪ 96,118 buyers and 5,076,501 sellers, as of November 2017
	Soil Health Card	▪ Crop-wise recommendations of nutrients and fertilisers required for individual farms	▪ 158.7 million Soil Health Cards dispatched in cycles 1 and 2

	MKisan	▪ Crucial information, services advisories on farming through SMS	▪ 22 billion text SMSs sent since May 2013 ▪ Kisan call centres answer farmers' queries in 22 languages
Health	Rashtriya Swasthya Bima Yojna	▪ Health insurance coverage for families living below the poverty line	▪ Over 36.3 million families enrolled ▪ 8,697 public and private hospitals in 278 districts
	E-hospitals	▪ Workflow-based hospital management ICT system	▪ 47 million transactions made at indoor patient department, labs, or during registrations since 2015 ▪ Transactions implemented at 319 hospitals
Education	SWAYAM	▪ Web portal for accessing open online courses	▪ 1,031 MOOCs (massive open online courses) ▪ Courses prepared by over 1,000 faculty and teachers

			from across the country
	National Digital Library	▪ Integration of national digital libraries into one single web portal	▪ 700,000 books by 300,000 authors in 70 languages ▪ Over 18,000 video lectures
	National Knowledge Network	▪ High-speed internet backbone for educational institutes	▪ Over 1,668 institutes connected through National Knowledge Network
Manufacturing	Phased Manufacturing Programme	▪ Phase-wise increase in tariffs on mobile components to promote domestic manufacturing	▪ 118 mobile handsets and components manufacturing units set up since 2014 ▪ Imports reduced by 37% for mobile phones and 43% for TV set-top boxes from FY 2016 to FY 2017
Finance	Pradhan Mantri JanDhan Yojana	▪ National mission for financial inclusion to ensure access to financial services	▪ 327.5 million beneficiaries with 60% of beneficiaries at rural/semi-urban centre bank branches

			▪ $12.5 billion deposited in bank accounts
Power	UJALA	▪ Replacement of incandescent bulbs, tube lights with LED bulbs	▪ 307 million LEDs distributed ▪ 39 billion kWh of electricity saved per year
Skills	PMGDISHA	▪ Digital literacy program for rural citizens	▪ 13.8 million candidates trained in basic digital skills through partnering with 619 training partners
Digital infrastructure	Sectoral CERT	▪ Computer emergency response teams for every sector	▪ 4 sectoral CERTS setup for power transmission, thermal, hydro, and distribution ▪ Dedicated CERTs for finance sector under way
	MeghRaj	▪ National Informatics Centre (NIC) cloud offering services like platform; infrastructure; software as a service	Over 750 NIC applications hosted on MeghRaj ▪ 14,000 virtual servers operational

Source: Ministry of Electronics & Information Technology, Government of India (2019)

The key areas of Digital Initiatives in India

E-governance

Under this vision, all government departments are seamlessly integrated with high-speed optical fiber, which will improve the interoperability of these organizations and will result in real-time service delivery from online or mobile platforms. Apart from this, the government is planning to make all citizen entitlements portable through the cloud for easy and country-wide access and to digitally transform the services for improving the ease of doing business in India. The government also plans to use the power of Geographic Information Systems (GIS) for decision support systems and development. Key examples are the Government e-Marketplace adopted by all government departments/agencies, with comprehensive coverage of buyers, sellers, and service providers, and end-to-end digital enablement from tendering to payment and fulfillment. Furthermore, digital technologies improve urban e-governance for local bodies and satisfy citizens to address challenges of congestion, security, and utility management. Lastly, Comprehensive Direct Benefit Transfers eliminate losses and inefficiencies in the disbursement of benefits and subsidies across wages, food, fertilizer, cooking gas, power, and other areas.

Agriculture

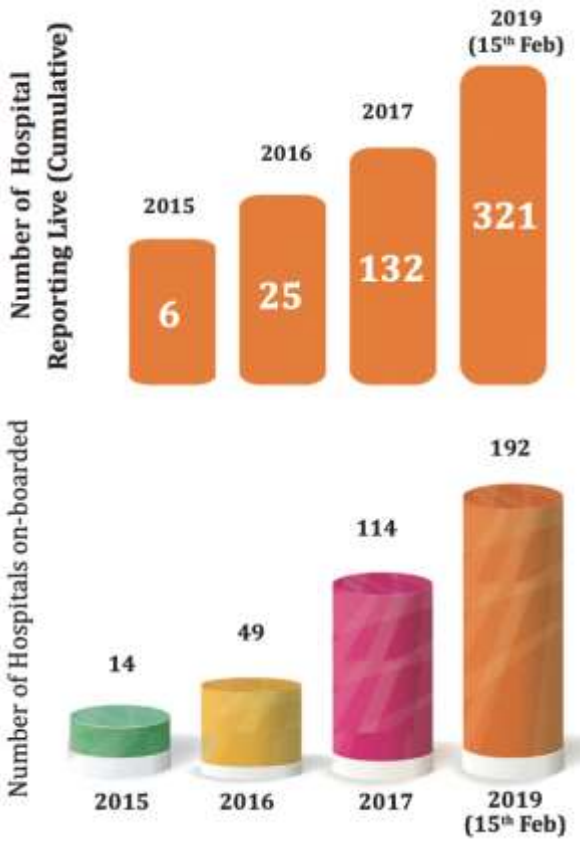
This was launched to capture the Pan-Indian electronic trading portal for agricultural commodities using eNAM. National Agriculture Market (NAM) is a pan-India electronic trading portal that networks the existing Agricultural Produce Marketing Committee (APMC) mandis to create a unified national market for agricultural commodities over 585 markets in 16 States have already been integrated. It has around 93 lakh farmers
and 84,000 traders registered. In addition, the Soil Health Card offers crop-wise recommendations of nutrients and fertilizers required for individual farms and provides crucial information, and services advisories on farming through SMS. Furthermore, the National Soil Health Card scheme was launched in 2015 to provide information on soil health digitally. So far, 13 crore cards have been issued.

Health

Under this initiative, e-Hospital and Online registration services were launched to ensure that patients can get easy access to

doctors. It has been implemented in 318 hospitals with about 5.6 Crore e-Hospital transactions since Sept 2015. The e-Hospital program enables patients to register, book appointments, pay fees, avail diagnostic reports, and seek the availability of blood types online in premier medical government institutes. The overall Indian healthcare market is valued at approximately $100 billion and is expected to grow to $280 billion by 2020 exhibiting a CAGR of close to 23%, being boosted by the increased adoption of digital technologies in healthcare. The e-Hospital service has a key role in the growth of the industry by providing wider accessibility to citizens to any government hospital through a click of a button. It also helps eliminate queues and time-consuming registration processes enabling people to access healthcare and facilities in an efficient manner. Figure 3 illustrates the number of e-Hospital services in India.

Figure 3: Number of e-Hospitals services in India



Source: Ministry of Electronics & Information Technology, Government of India (2019)

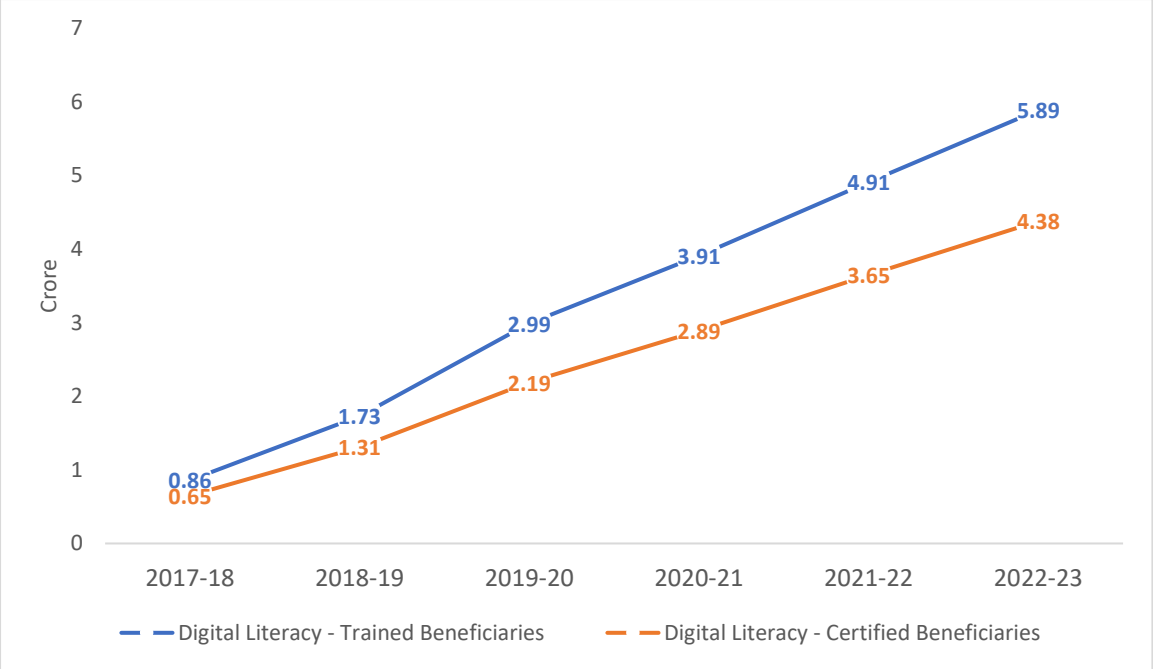
Education

The Digital India project initiated Massive open online courses (MOOCs) to provide real-time education. This is expected to address the challenge of the lack of teachers in the education system through smart and virtual classrooms. It also has the potential to make education accessible in rural areas and to weaker sections of society through mobile devices. It aims to provide entrepreneurship, education, and training in 2,200 colleges, 500 government industrial training institutes, 300 schools, and 50 vocational training centers via MOOCs. MOOCs make education accessible since the poor literacy rate in India is due to the unavailability of physical infrastructure in rural and remote areas. This shortcoming was addressed by MOOCs which are undertaken online and on mobile platforms. The increasing smartphone penetration especially in lower-tier towns and rural areas, has enabled a large section of the population to access quality education through MOOCs.

Skills

For the success of the Digital India program, capacity building is crucial. In addition to infrastructure development, digital literacy, skill building, and higher adoption of digital solutions are key to program success. Despite rising smartphone penetration and internet user base, digital literacy in India has been slow. For the benefits of the Digital India program to reach all sections of the population, improving digital literacy is imperative. Launched in July 2015, the Skill India initiative aims to impart training in different areas to 400 million people in India by the year 2022. This is essential for the success of the Digital India program, one of the major challenges of which is a lack of skilled workforce. However, the program has trained more than 50,000 youth in 100 job roles across 25 sectors at special centres (Srivastava, 2023). The trend of digital literacy in India is illustrated in Figure 4 below.

Figure 4: Digital Literacy in India



Source: https://meity.dashboard.nic.in (2022)

Digital infrastructure

To utilize and harness the benefits of Cloud Computing, the Government embarked upon an ambitious initiative - GI Cloud, which has been named as MeghRaj. The focus of this initiative is to improve broadband connectivity in rural and urban areas. The aim is to provide broadband connectivity by connecting 250,000-gram panchayats with optical-fiber cables. About 2,90,162 kilometers of optical fibre has been laid, connecting 1,15,643 gram panchayats. However, limited private-sector participation in building infrastructure is a huge challenge. The National Information Infrastructure helped integrate the country's digital infrastructure to provide high-speed connectivity and cloud platform services to the government departments up to the panchayat level, besides the social sector services like e-education, e-health, e-agriculture, financial inclusion, etc.

Materials and Methods

Achievement of the ultimate goal of the study requires not only identifying the digitalization of the country's economy and assessing its impact on economic growth but also analyzing the risks that may neutralize the positive effect of digital transformation. The research study uses reliable information extracted from numerous reputable sources and authentic websites of articles, journals, documents, printed literature, published reports, and other online databases. The study

focuses on relevant literature that allows us to capture the trends of digitization and its impact on the Indian economy.

Economic growth indicators, reflecting the level of development of the economic environment include:

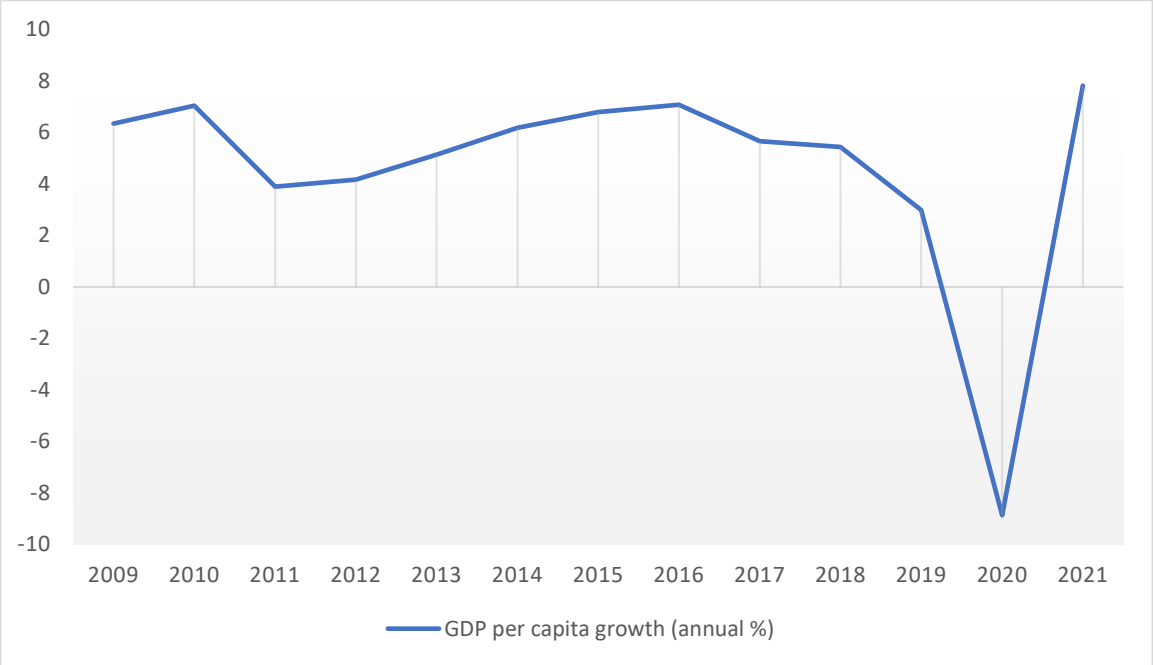
- GDP per capita – a general measure of the state of the economy (for 2009-2021) (The World Bank 2021);
- Global Competitiveness Index 4.0 – assesses the factors that collectively determine the level of a country's productivity. Thus far, it is the central driving force of long-term improvements in living standards. The Index provides evaluations in 12 areas (pillars): institutions, infrastructure, ICT adoption, macroeconomic stability, health, skills, product market, labor market, financial system, market size, business dynamism, and innovation capability (World Economic Forum 2019);
- Digitalization indicators, reflecting all aspects of digital transformation in the country: Digital Adoption Index – assists in evaluating countries' digital and technological maturity. The Index measures countries' digital adoption capabilities across three dimensions: people, government, and business (The World Bank 2016).

Discussion

GDP per capita: Economic impact of digitization

The first research stage required considering how India ranks in terms of GDP per capita. The generally accepted way of measuring economic growth lies in determining changes in the production volumes or in the real income of residents. Data retrieved from the World Bank's official reports indicate that in 2020, global economic growth weakened significantly (World Bank 2021). Figure 5 presents a graph of India's GDP per capita growth rates for 2009-2021 (World Bank 2021). The diagram below indicates that, in 2021, India's real GDP increased by about 7.8% compared to the previous year. With the exception of 2011, its rate was relatively stable, and only in 2020 showed a significant downward trend due to the Covid-19 pandemic which affected even the most developed economies across the world. In view of this, it can be assumed that, in general, the country has positive GDP growth dynamics, which allows considering the position on this indicator as satisfactory.

Figure 5: GDP per capita growth in India for 2009-2021



Source: Adapted from World Bank (2021)

India is underpinning its growth strategy by focusing on digitization, connectivity, a cashless/paperless economy, and an innovative start-up ecosystem. According to a report by economic analysts, the Digital India initiative could improve the GDP by around $1 trillion by 2025 (Lazanyuk & Modi, 2021). It could also be detrimental to play a major role in macroeconomic factors such as job creation, labor productivity, business development, and income generation. Currently, India is the 2nd largest telecommunications market and 3rd largest Internet market in the world with nearly 259 million broadband users (Kaur & Mir, 2022). This shows that there is a huge economic opportunity in India as the phone penetration rate in rural India is only 45%, while more than 65% of the population lives in villages, as mentioned in the newspaper report of the World Bank (Kaur & Mir, 2022). According to data provided by the European Commission, the pace of digitization in India was the fastest among most major economies in the world from 2011 to 2019 (Srivastava, 2023). Its growth in India ran neck to neck with China at 11%. The industries that contribute to GDP per capita growth with the highest forward linkages in India from the aggregate core digital economy in 2019 were construction, renting of machinery and equipment, food beverages, tobacco, textiles and textile products, and electrical and optical equipment (Table 2).

Table 2: Digitally enabled economic sectors.

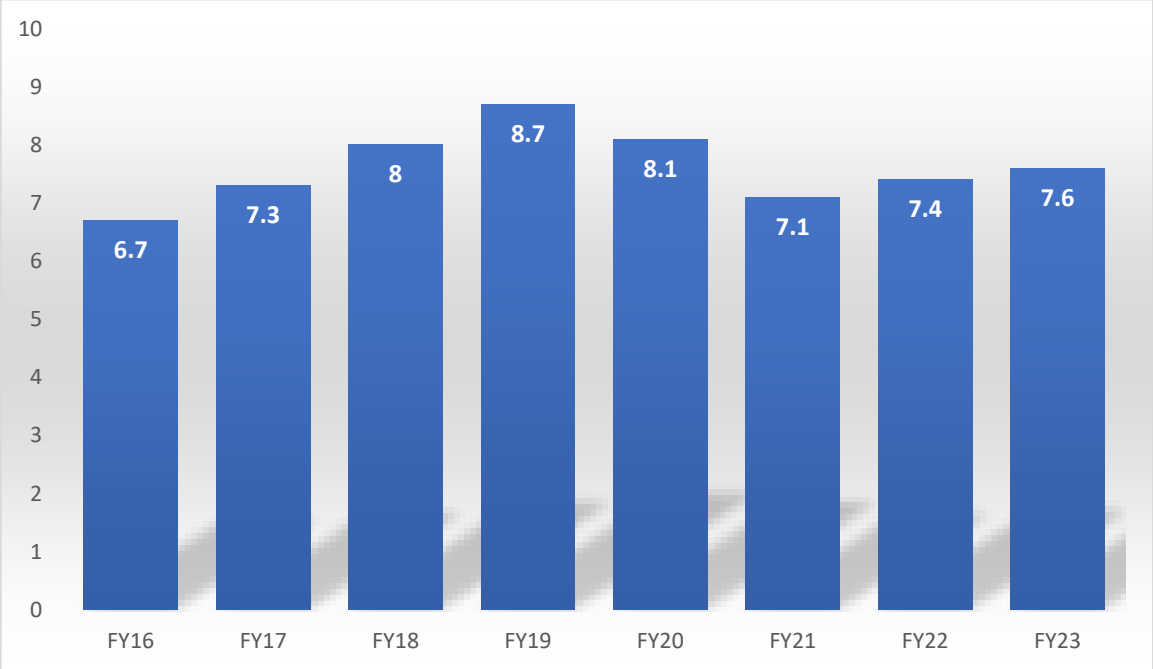
Sector	**2014**	**2019**
Construction	5.4	6.1
Renting of Machinery and Equipment and other business activities	2.2	4.2
Food, beverages, and tobacco	3.2	3.8
Textiles and textile products	3.3	3.6
Electrical and optical equipment	3.6	3.5
Transport equipment	3.5	2.9
Financial intermediation	1.3	2.6
Retail trade, except of motor vehicles and motorcycles; repair of household goods	1.3	2.2
Other community, social, and personal services	1.2	2.2
Education	0.5	2.0
Machinery, not elsewhere classified (n. e. c.)	2.0	1.9
Manufacturing, n. e. c.; recycling	2.9	1.8
Real estate activities	1.0	1.7
Chemicals and chemical products	1.3	1.7
Air transport	0.2	1.5
Wholesale trade and commission trade, except of motor vehicles and motorcycles	0.8	1.4
Other supporting and auxiliary transport activities; activities of travel agencies	0.4	1.3
Basic metals and fabricated metals	1.7	1.2
Health and social work	0.8	1.2
Inland transport	4.7	1.0
Agriculture, hunting, forestry, and fishing	0.7	0.9
Coke, refined petroleum, and nuclear fuel	0.5	0.9
Rubber and plastics	0.5	0.5
Pulp, paper, paper products, printing, and publishing	0.5	0.4
Hotels and restaurants	0.8	0.4
Electricity, gas and water supply	0.3	0.4
Mining and quarrying	0.1	0.3
Leather, leather products and footwear	0.3	0.3
Other non-metallic minerals	0.2	0.2

Sale, maintenance, and repair of motor vehicles and motorcycles; retail sale of fuel	0.1	0.2
Wood and products of wood	0.2	0.2
Water transport	0.1	0.2
Postal and Courier	0.0	0.1

Source: Adapted from RBI (December 2022)

The contribution of digitization vis-à-vis digital payments to India's economic growth has been notable in recent years. Both the value and volume of digital payments in India have grown at a fast pace including the COVID-19 affected months covering the period November 2019 to January 2023 as shown in Figure 2. The number of digital transactions increased more than three times from 300 crores in November 2019 to 1,052 crores by January 2023. Figure 6 shows the value of total digital payments relative to nominal GDP. It was 8.7 times the nominal GDP in 2019. Although it fell during the COVID-19 year, this multiple is rising again. This figure shows that the value of total digital payments is a multiple of nominal GDP indicative of the velocity of digital transactions.

Figure 6: Value of total digital payments relative to nominal GDP



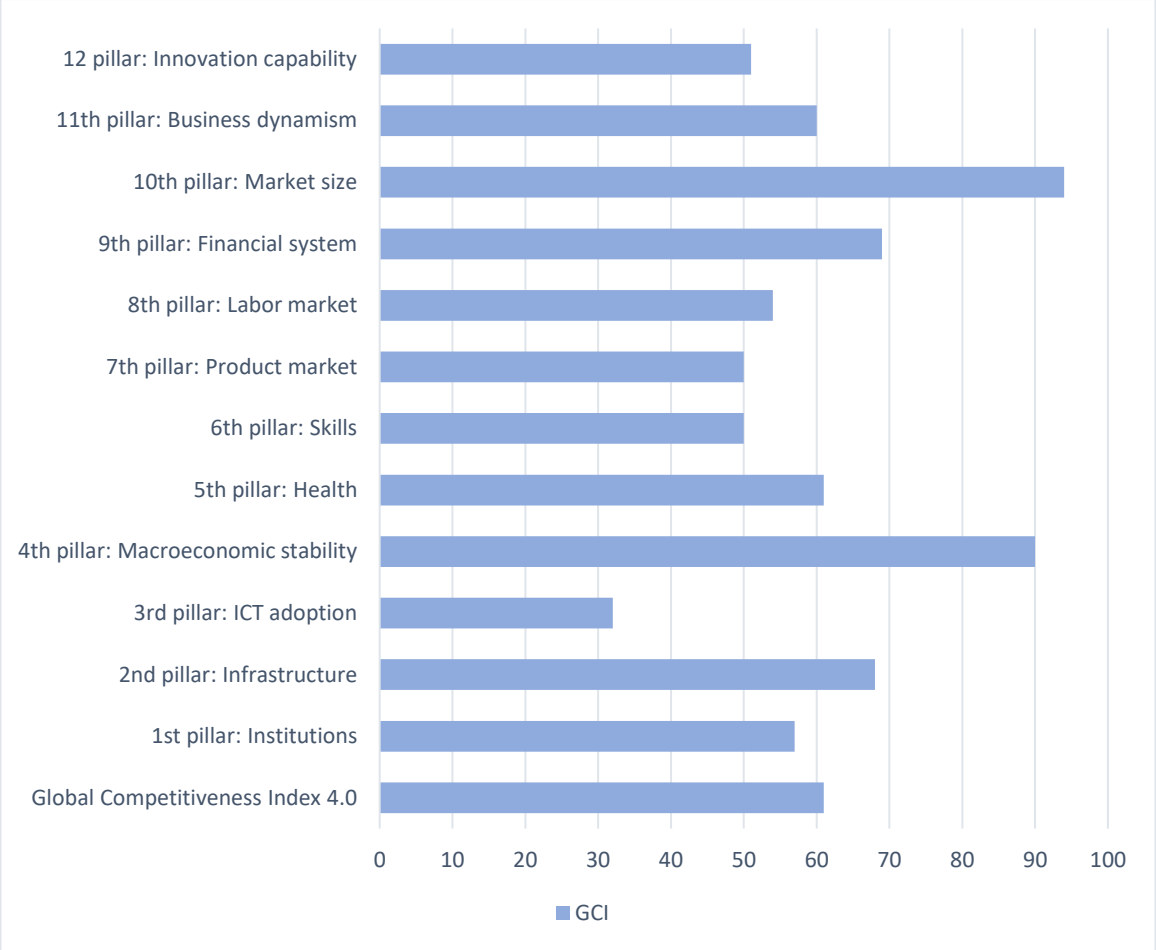
Source: Adapted from RBI, DigiDhan Dashboard (2023)

Global Competitiveness Index

Based on the data from the Global Competitiveness Index (GCI), Figure 7 exhibits a its values for India in the context of the 12 pillars. India ranks 68th on Global Competitiveness Index (GCI), down 10 places in 2019. The drop is only partly the consequence of a relatively small decline in score (61.4, –0.7 points), but also, and more significantly, the progress made by several countries ranked close to India: Colombia (62.7, +1.1 points, 57th), Azerbaijan (62.7, +2.7, 58th), South Africa (62.4, +1.7, 60th) and Turkey (62.1, +0.5, 61st). India trails China (28th, 73.9) by 40 places and 14 points. Along with Brazil (71st, 60.9), it is among the low-performing BRICS, although the competitiveness profiles of the two economies are quite different. India ranks beyond 100th on five pillars and features in the top 50 of just four pillars. However, it does rank high on macroeconomic stability (90, 43rd) and market size (93.7, 3rd); and its financial sector (69.5, 40th) is relatively deep and stable, despite the high delinquency rate (10% of the loan portfolio, 106th), which contributes to weakening the soundness of its banking system (60.4, 89th). India performs well when it comes to innovation (50.9, 35th), well ahead of most emerging economies and on par with several advanced economies.

This contrasts with major shortcomings in some of the basic enablers of competitiveness. ICT adoption is limited (31.1, 120th), but has improved sharply (+8 since the 2017 edition). India achieves mixed results on the various aspects of governance (56.8, 59th). Transport (66.4, 28th) and electricity (86.6, 103rd) infrastructures have improved significantly over the past two years, although from a low base. The electrification rate was almost 90% in 2017, up 7 percentage points from 2015. At the same time, health conditions remain poor, as reflected in low healthy life expectancy (59.4 years, 109th), which is one of the shortest outside Africa and significantly below the South Asian average. India must also grow its skills base (50.5, 107th). Product market efficiency (50.4, 101st) is undermined by a lack of trade openness (43.9, 131st) and the labour market is characterized by a lack of worker rights' protections, insufficiently developed active labour market policies, and critically low participation of women (ratio of female workers to male workers of 0.26, 128th).

Figure 7: Global Competitiveness Index 4.0



Source: Adapted from the World Economic Forum (2019)

Table 3 presents the values of the descriptive statistics for the 12 composite indicators or pillars that make up the 2018 and 2019 GCI for India. The descriptive statistical values of Global Competitiveness Index India have the following descriptive statistical values: Average = 61.5, Standard Deviation = 0,707. The average 2018 and 2019 GCI indicates a medium level of competitiveness. From this brief characterization, it became evident that the latent variable with the highest average value corresponds to the Market size pillar (93.50), Macroeconomic stability pillar (90.00), followed by Financial system (69.50), Infrastructure (68.50), Business dynamism (60.50) and Health (60) pillars. While the pillars Institutions (57.50), Labor market (56), Innovation capability (52.50), Skills (52), Product market (50.50), and ICT adoption (30.00) present not only values below the average value of the 2019 GCI but are the pillars with low performance in terms of competitiveness for India.

Table 3. Descriptive statistics of the 12 indicators of the GCI

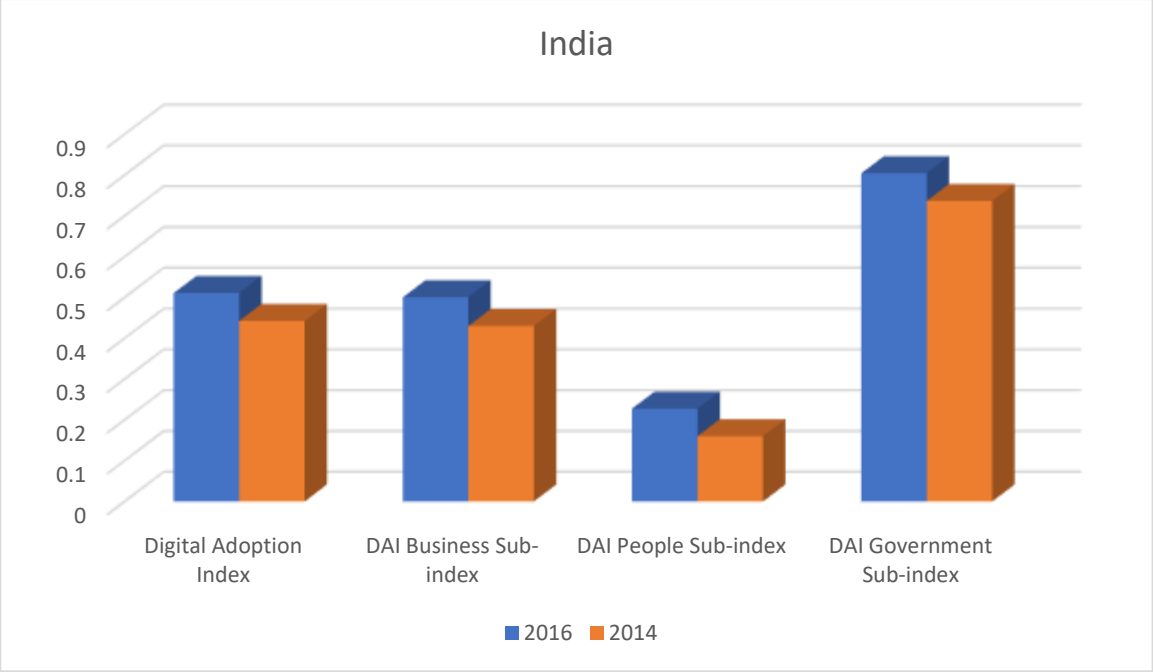
GCI Indicators	Mean	Min.	Max.	Std. Deviation
Global Competitiveness Index	61.5	61	62	0.707
1. Institutions	57.50	57	58	.707
2. Infrastructure	68.50	68	69	.707
3. ICT adoption	30.00	28	32	2.828
4. Macroeconomic stability	90.00	90	90	.000
5. Health	60.00	59	61	1.414
6. Skills	52.00	50	54	2.828
7. Product market	50.50	50	51	.707
8. Labor market	56.00	54	58	2.828
9. Financial system	69.50	69	70	.707
10. Market size	93.50	93	94	.707
11. Business dynamism	60.50	60	61	.707
12. Innovation capability	52.50	51	54	2.121

Source: Self-generated by researchers

Digitalization indicators

The set of digitalization indicators adopted by the researchers reflects India's level of digitalization. The results for India's Digital Adoption Index (DAI) sub-indexes in Figure 8 shows that there is a substantial range of values. The overall value of the Digital Adoption Index (DAI) is 0.51, which is consistent with estimates for internet access and reflects the true degree of ICT penetration and use (World Bank, 2016). A more detailed examination of DAI's components explicates the scores of DAI Business (0.50) and DAI Population sub-indexes (0.22) and the digitalization of government (0.80). In the meantime, the estimates of leading countries for these sub-indexes are (Iceland) 0.97 for DAI Business, (Hong Kong SAR, China) 0.91 for DAI Population, and (Korea, Rep.) 0.98 for DAI Government. This circumstance explicates the difficulties connected not only with the adoption of ICT but also with people's readiness to change the ways in which they conduct business and the nature of the work they undertake. Figure 8 illustrates the digital adoption index in India.

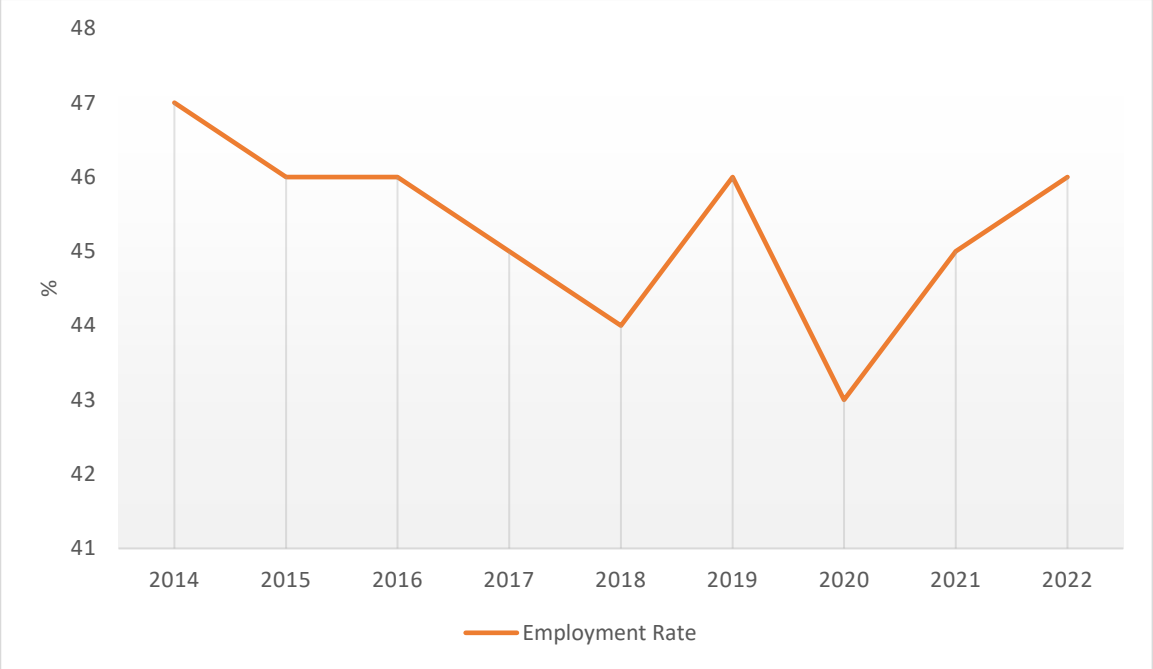
Figure 8: Digital Adoption Index



Source: Adapted from the World Bank (2016)

Furthermore, there is a widespread belief that the introduction of new technologies leads to a decrease in employment (Lazanyuk & Modi, 2021). There are claims that the introduction of technology may adversely influence jobs, with more reliance on digital and information technology. However, the trend of the employment rate in India as shown in Figure 9 does not support the hypothesis that digitization leads to a decrease in employment. Instead, it leads to a redistribution of work due to, for example, an increase in employment in large infrastructure projects, among others.

Figure 9: Employment Rate in India (2014-2022)



Source: Adapted from the World Bank (2022)

The Reserve Bank of India (RBI) report points out that employment in the digital sectors of the Indian economy is still quite limited. Based on India's current population (2022) and the worker population ratio in 2019-20 as per PLFS (at 38.2%), the total employed workers in the core digital economy were estimated at 4.9 million. Table 4 gives the relative share of employment in the digital sectors. The highest share at 59.8% pertains to computer programming consultancy and related activities followed by telecommunication services at 15.2%.

Table 4: Sector-wise employment distribution in the digital sector (%)

Sector	**Share**
Computer programming consultancy and related activities	59.8
Telecommunications	15.2
Manufacturing, nec; recycling	9.8
Data processing, hosting and related activities	7.6
Software publishing	2.2
Motion pictures, videos, TV	2.2
Computer manufacturing	1.1
Web portals	1.1
Tapes, CDs	1.1
Total	100

Source: Adapted from Reserve Bank of India (RBI) (December 2022)

The rapid expansion of India's digital economy has been a key factor in the country's economic growth. As compared to developed countries, India's pace of digitalization has been very high in recent years, particularly over the period from 2011 to 2019 (Table 5). The pace of digitalization as measured by the compound annual growth rate (CAGR) in the ICT sector during this period has been as high as 10.6%, with only China exceeding India's growth marginally. With the advent of 5G and the setting up of semiconductor industries in the country, India is expected to accelerate further its pace of digitalization in the next few decades. Digitalization is a critical and distinguishing feature of India's unfolding growth story in the 21st century.

Table 5: Pace of digitalization: A cross-country perspective (% CAGR in the ICT sector)

Countries	CAGR (2001 to 2011)	CAGR (2011 to 2019)	CAGR (2001 to 2019)
China	17.8	11.0	14.7
India	11.0	10.6	10.8
South Korea	6.4	2.5	4.7
Taiwan	5.3	3.3	4.4
Brazil	9.8	-2.1	4.3
Germany	2.3	4.1	3.1
EU	2.4	3.2	2.8
France	1.7	3.0	2.2
United States	-3.0	6.8	1.2
United Kingdom	-0.9	3.9	1.2
Japan	-0.5	-0.3	-0.4

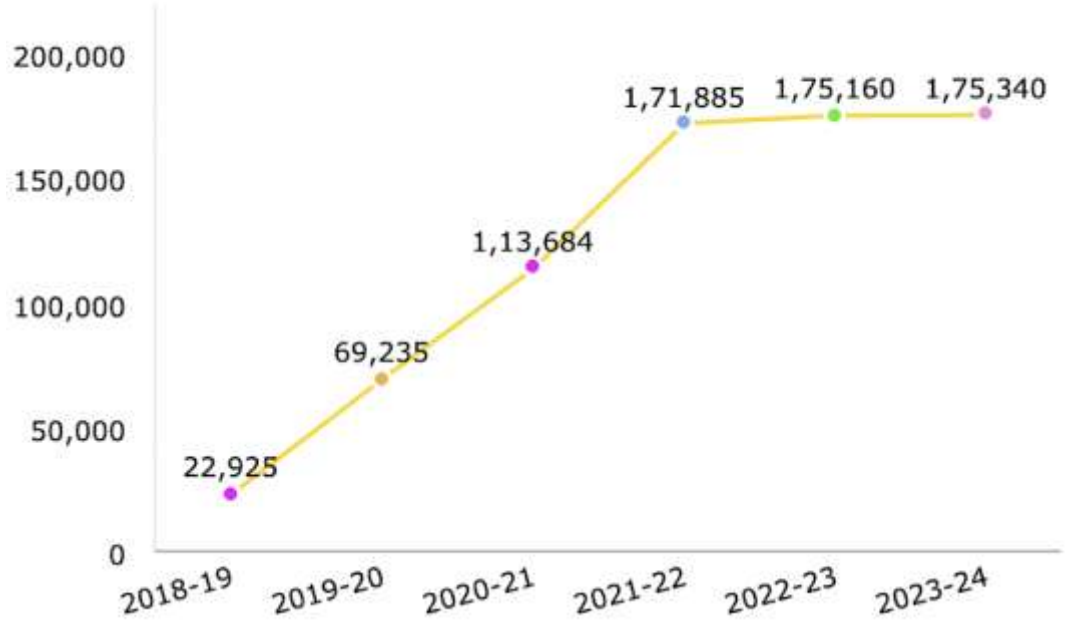
Source: Adapted from Reserve Bank of India (RBI) (December 2022)

Impact on society

The Digital India program has had a significant impact on social and societal issues; and has grown phenomenally over the past decade. The COVID-19 pandemic bolstered this further and introduced several first-time users to digital financial services in the past two years. The shift to a "new normal" presented significant opportunities for institutions to make digital payments more accessible and affordable for the one billion people who comprise the country's low- and middle-income segments. Digital payments in India are no longer an urban phenomenon. Stakeholders in the ecosystem increasingly

perceive that the next set of low-income users will drive the future growth of digital payments in the country. The rise in smartphone and internet penetration in rural markets is expected to take digital payments to the last mile. In addition, the m-Education service platform has been crucial in expanding educational opportunities to underserved communities. In India, only 6.5% of the population can read and write digitally, while barely 20% of the population use the internet. On the one hand, the Digital India project has especially been helpful in providing real-time education and partly solving the challenge of teacher shortages in the education system through virtual and smart classrooms. On the other hand, it has been a huge task to connect every village, town, and city via national fibre optic cable. The biggest challenge, however, is the inadequate digital infrastructure due to the rapid and increasing rise of digitisation (Katakam, 2018). The digital village is illustrated in Figure 10.

Figure 10: Digital village - Candidates registered for digital education.



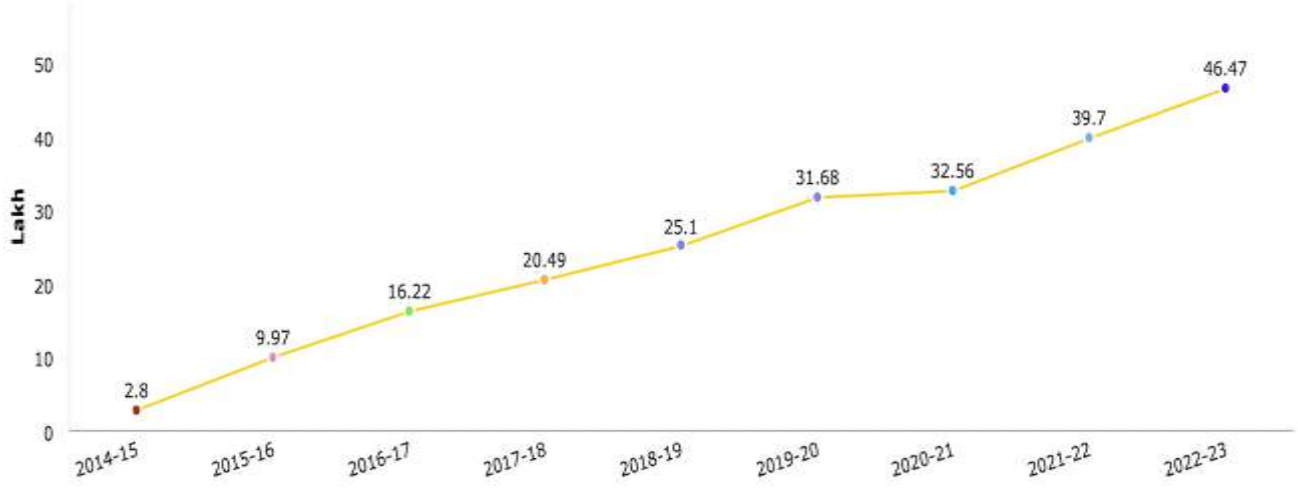
Source: Adapted from https://meity.dashboard.nic.in (2022)

Impact on services

Digital transformation not only helps to meet the requirements of customers but also provides a better avenue to capture the demands of those customers. The main objective of a digital strategy is to improve the customer experience and increase the organization's competitive advantage. In addition, digital

transformation strives to improve business processes. However, this shift does not just happen, a well-planned strategy and tools are needed to support the strategic goals. Furthermore, digitization has brought a vast network of more than 3.06 lakh of digital services delivery centres across the country. About 2.10 lakh Gram Panchayats have been created to provide access to digital services, especially in rural areas at an affordable cost. The common service centre has been growing since its inception as shown in Figure 11. These centres have also led to the empowerment of marginalized sections of society by creating jobs for 10 lakh people and by promoting rural entrepreneurs. This digital transformation has provided a better avenue to capture customer needs and also helps meet their requirements (Lazanyuk & Modi, 2021).

Figure 11: Common Services Centre



Source: Adapted from https://meity.dashboard.nic.in (2022)

Impact on manufacturing

Digitization in the manufacturing sector has a great influence on the development of the Indian Economy. The manufacturing segment has grown as one of the high-growth sectors in India after digitization. The Indian government has launched a number of programs to boost domestic electronics production, with the ultimate goal of eliminating all imports by 2020. To better support the growth of the mobile handset and component manufacturing ecosystem in India, the Phased Manufacturing Programme was initiated. India has increased the number of factories producing mobile phones and their parts from 2 units in 2014 to 120 units. In 2016-17, the import duty on mobile parts was reduced from 29 percent to 12.5 percent and domestic mobile handset manufacturing output

increased from 60 million units in 2014-15 to 225 million in 2017-18. The government's Modified Specific Incentive Package Scheme has received 245 investment proposals totalling over $8 billion; of these, the Ministry of Electronics and IT approved 142. Out of these, 74 companies have launched into full-scale commercial production. The manufacturing sector plays an important role in the evolution and has bolstered growth in productivity. This industry has a huge potential due to its vast workforce relative to other sectors which contributes to domestic revenue growth. Electronic devices and internet services are still by and large very costly for an average Indian citizen (Manikanta, 2017). This causes a barrier because spending on made-in-India products becomes impossible when many people do not have enough money for basic life necessities (Manikanta, 2017).

Key Challenges to Digital India

An initiative of this scale has never been conceived before and, apart from little availability of skilled manpower, execution has been a challenge. Hence, the vision cannot be realized without tackling such looming challenges. Some of the challenges are detailed below.

Adoption of Internet

Apart from infrastructure installation, the adoption of the Internet remains a concern. Internet penetration has remained close to 15% in India, while in China it is nearly 46%. Moreover, people in poor areas would find it difficult to afford internet through broadband or mobile. Low literacy levels, lack of content with regional relevance, and lack of appropriate access devices would also hinder the adoption.

Data Speed

Data speed is another area where India faces a big hurdle. India is ranked 20th in mobile data speed, with an average speed of 0.099 Mbps. In comparison, Canada, the top-ranked nation, has an average data speed of over 4.5 Mbps.

Security

With cybercrime on the rise, the idea of placing information about a billion citizens online seems like a risky move. Hence, highest levels of security measures and protocols would need to be taken to ensure a safe environment for the citizens.

Manpower

Skilled manpower is, perhaps, the biggest challenge of all. India has nearly 475 million people engaged in labour, out of which about 93% are engaged in unorganized labour. Skilled manpower is essential for the development and effective adoption of new technologies. Creating a system to train and provide gainful employment to so many people is an immense challenge.

Coordination and standardization

Various government departments such as DeitY, DoT, Law, Finance, etc. would be involved in creating systems and operational standards for seamless integration. Such involvement would require significant levels of coordination to ensure the proper flow of information.

Recommendations

The Digital India initiative was perceived to be a game changer from the perspective of good governance, with the coordinated engagement of the entire government. For India to reap the full benefits of digitization, the following recommendations are provided for business leaders, government officials, and individuals.

Business Leaders

Business leaders will need to determine which digital trends pose the most threat to their organization and industry, and then prioritize the implementation of those strategies. Given India's size, the rapid pace of digitization, and the comparatively low current productivity in many sectors, the country may be uniquely positioned to benefit from and be disrupted by these developments. Organizations that want to maximize the benefits of the digital revolution will need to have leaders who are willing to act swiftly and aggressively to modify their current business models and implement widespread digitization throughout their operations. In this context, four imperatives stand out. First, before adopting new, disruptive business models, organizations will need to alter their existing ones and take calculated risks. Second, digital should be at the forefront of executives' minds when formulating plans.Customers today, whether they are making an online purchase or calling to inquire about an apparent billing discrepancy, have come to expect the ease and quickness of digital interactions, yet many businesses fail to live up to these expectations. Third, businesses will have to

invest funds to build digital capabilities, especially to hire experts to help them implement and speed up digital transformation. That is especially challenging in India because many of its most talented workers emigrate and rarely return. Companies could partner with universities to recruit and develop talent, beginning with digital natives who are currently enrolled or have recently finished their studies. Finally, firms must encourage flexible, digital-first organizations. This may call for a shift to a digital-first mentality, beginning with a "test and learn" approach that promotes rapid iteration, and a high tolerance for failure and redeployment.

Government

The Indian government has been quite active in promoting digital transformation, from making regulations clearer to enhancing infrastructure to creating the Digital India initiative, a bold ambition to double the size of the digital economy. However, much work remains to be done for India to capture its full digital potential. Government can help by partnering with the private sector more extensively to drive digitization. It is imperative for the government to invest in digital infrastructure and public data, that organizations can leverage onto, even as they put in place strong privacy and security safeguards. Capturing the gains of the digital economy will require more ease in creating and scaling start-ups; as well as policies to facilitate new-economy jobs for workers. Most directly, national and state governments can foster digital growth by continuing to invest in digital infrastructure and the digitization of government operations. Government can help further in at least three ways: by creating and managing public data sources that public and private organizations can use to enhance existing products and services and develop entirely new ones; fostering a regulatory environment that supports digital adoption while also protecting citizens' privacy; and facilitating the evolution of labour markets in industries that have been disrupted by automation.

Individuals

Individuals are already reaping the benefits of digitization as consumers, but they will need to be cognizant that its disruptive powers can affect their lives and work in other fundamental ways, too. As workers in an environment impacted by digital technologies, individuals will need to be aware of how their work may change and what skills they will need to thrive in the future. Additionally, they will need to look

for opportunities to capture the benefits of a new digitally-led economy and workplace. Individuals will also need to become stewards of their personal data and skeptical consumers of information. Preparation can start with understanding how innovative and disruptive technologies may influence rival businesses and their employees. Preparing for change may involve becoming comfortable with basic digital tools such as mobile phones and the internet, acquiring additional skills in a worker's current industry, or training for a new line of work. Hence, individuals will need to be aware of how the digital economy could affect them as workers and consumers and prepare to capture its opportunities.

Conclusion

The Digital India Programme has resulted in a paradigm shift and transformed India into a knowledge-based economy and digitally empowered society. The program has ensured the digital inclusion of all by providing access to the robust digital infrastructure created under it, facilitating connection with the rest of the world. Digitization is an important vehicle for change and could dramatically expand India's role and influence in the global economy and become a powerhouse of digital innovation. Countries that have attained advanced digital transformation levels, especially the massive adoption of connected digital technologies and applications by consumers, businesses, and governments have reaped significant benefits for their economies, societies, and public sectors. ICT use has boosted economic development rates, enhanced service quality, and opened doors for business owners and customers in several countries. However, for countries to get the most out of digitalization, stricter rules are required to ensure that competition between businesses and the skills of workers are adjusted to meet the demands of the modern economy. The findings of this study suggest that the influence of digitization on economic growth is only possible if the economic environment is ready to accept such a transformation. Therefore, future studies may aim to provide extensive quantitative evidence linking digitalization to the rate of economic expansion.

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