

Chapter 16

Digital Movement, Implications on Sustainable Development in Post Pandemic Time: An Introspection with Special Reference to India



Debashis Mazumdar and Mainak Bhattacharjee

16.1 Introduction

During the last few years, particularly during the Covid-afflicted years, our country has experienced a massive expansion in digital movement starting from online transactions to online education. Now, the onset of this pandemic has pressed mankind into the virtual world of work from the actual work and thereof has gone a long way in aiding the digital revolution find deeper penetration and this transition is seemingly self-reinforcing and perpetuating in nature, for a myriad of socio-economic and political reasons. However, such transition process will wade through entailing cost, implicit but poignant in nature, as against the obvious benefit, so far, the less-developed and underdeveloped countries are concerned. To put this in a more specific way, the less-developed and the underdeveloped nations are conspicuously marked by gross inequality in income and wealth, so much so that the access to technologies supporting this very virtual world of work becomes largely unequal among people across different socio-economic strata. In this paper, an attempt has been made to give an overview of this digitization process in different fields of economic and social activities as well as an estimation of digital absorption based on some basic indicators. Besides, in this current wave of technological transition, the radical revamping of production methods is vividly emergent, which has potentially risk of rampant job loss, to be suffered by semi-skilled and unskilled at large without any alternative; notwithstanding that such revamping can indeed foster a condition for the

D. Mazumdar

Department of Economics, The Heritage College, Kolkata, India

e-mail: debashis.mazumdar@thc.edu.in

M. Bhattacharjee (✉)

Economics, Loreto College, Kolkata, India

e-mail: mainakbh4@gmail.com

laying emphasis on skill-imparting education largely at deficit along with triggering sustained growth in innovation and growth. This poses a dichotomous state of being where the present-day technological revolution will inevitably enhance the growth capacity of the less developed countries, but at the cost of growing socio-economic inequality, at least in the short run or during the immediately following period, so to say and thus in turn will be antithetical to the goal sustainable development. Thus it is this very backdrop reiterating the popular growth-development trade-off, the study shows that though the growth rate of digital absorption has been commendable onwards 2014–17, there are clear signs of a digital divide which can ultimately intensify the inequalities in the access to such digital services and, hence, can put some obstacle to the creation of ‘capabilities’ among the common people.

16.2 Objective of the Study

The principal objectives of this study are: (i) to indicate the growth trajectory of digital payments in India during 2017–21, (ii) to indicate the growth trend in internet-using people in India during 2000–2019, (iii) to evaluate the position of India in terms of digital absorption based on the indicators like digital foundation, digital reach and digital value, (iv) to show the extent of digital divide in India and (v) to suggest some policies so as to overcome these obstacles in the process of ‘digital India’ movement. As against the backdrop of these, the study goes on to developing a theoretical model based on Jones [1, 2], Baladi and Marjit [3] to illuminate on political economic implication of digital movement in the direction of distributive justice.

16.3 Data Source and Methodology

This study is primarily based on secondary data sources like the reports and data bank of World Bank, Statista (USA), R.B.I, Ministry of Electronics & IT, Government of India, NSSO data on Social Consumption of Education [4], etc. Simple statistical methods (like charts and tables) have been used to analyse the secondary data. In addition, a simple microeconomic analysis has been made to show the impact of digital divide.

16.4 Literature Survey

The Ministry of Electronics & Information Technology (MeitY), Government of India, in its report entitled ‘India’s Trillion-Dollar Digital Opportunity’ [5], which is a research collaboration with McKinsey & Company, shows that India is among the top three global economies in terms of the number of digital consumers. In 2013,

India had 238.71 million internet subscriptions and this figure went up to 560 million in 2018 making India as the second-largest internet subscriptions market in the world.

Further, the study (viz. ICUBE [6]) made by the Kantar Group, a data analytics and brand consulting company, based in London, UK, has shown that the number of active internet users in India has been growing at a steady pace in spite of challenging years during 2019–20 [6]. The ICUBE is an annual syndicated study of Kantar, which was launched in 1998, to measure the reach and frequency of Internet users in India. As per ICUBE [6] estimates, out of a population of 1433 million individuals in India, 622 million individuals are active internet users. This translates to about 43% of the total population across urban and rural India who have used internet at least once in the last one month from the date of the survey. The ICUBE [6] covered about 75,000 respondents across 390+ cities and urban locations and about 1300+ villages.

There is no doubt that digital technology will reduce office costs, cut down travel expenses (and time), besides avoiding the geographical restrictions for hiring employees with lower salary expectations, but our societies will likely shift towards more individualistic entities with less human interactions in the labour market [7].

Based on a primary survey on the teachers of urban and rural areas, another study has shown that access to critical preconditions for conducting online classes, such as power, good internet connection, internet data pack and computing devices like laptops, was limited to a small proportion of the teachers surveyed [8].

Massive online education without addressing the huge access gap and disparities in digital infrastructure would not only exclude a vast majority of students from learning opportunities but also exacerbate the existing socio-economic disparities in educational opportunities [9].

Suitability of online teaching as a surrogate has also been questioned in many studies. Researchers are of the opinion that the classroom in physical form by itself is a radical and transformatory space for many. It creates an alternative sociality; it is often a space for lasting friendship; it has the potential to break the bonds of the social givens, particularly if nurtured consciously in that direction by the teachers. Thus online classes cannot suitably substitute the offline classes [10].

Some studies have indicated the impact of digital divide upon the healthcare system. Disparities in health outcomes are a well-documented and worrisome part of the health care system in India. These disparities persist and are occasionally exacerbated by new technologies that are intended to improve health care system. This results in a digital divide in which populations that have poorer health outcomes continue to have poorer health outcomes despite technological improvements [11].

Use of tele-health/ tele-medicine platforms has been on the rise over the past several years. Tele-health has been lauded as a means to close the healthcare gap to rural populations. Taken within the context of several social determinants of health, we can see how the digital divide occurs and can perpetuate inequity based on various social factors [12].

This problem of digital divide was present even in some of the developed countries of the world. This becomes evident from some research studies [13] which indicate negative correlation between rurality and internet speed at the county level of USA during the COVID pandemic, highlighting the struggle for rural areas. The

schools in those areas tackled the challenges of providing equitable educational access by attempting to provide internet access for students, while even households with internet service struggled to maintain sufficient internet speed and its affordability. Essential activities moved online, yet sufficient Internet was an essential public service that remained unattainable for many US households.

16.5 Indications of Silver Lining

Digital India, a flagship program of Ministry of Electronics & Information Technology (MeitY), Government of India launched in July 2015, has been implemented with a vision to transform India into a knowledge economy and digitally empowered society by realizing the full potential of fast-paced technological advancement. Digital services like e-Hospital, BHIM-UPI, online scholarships, DigiLocker, Umanagapp, e-Courts, Tele Law, e-Way Bills, etc. have improved ease of living for citizens. The Government e-Marketplace (GeM) has not only made government procurement transparent but has also enabled small businesses and even Start-Ups to sell their products and services to government organizations (Annual Report, MeitY, 2020–21).

Resurgence of electronic manufacturing has made India the manufacturing location for the second largest number of mobile phones in the world. The production of mobile phones has gone up from about 6 crore in 2014–15 to about 33 crore in 2019–20. The domestic production of electronic items has increased substantially, from INR 1,90,366 Crores (USD 29 billion) in 2014–15 to INR 5,33,550 Crores (USD 75.7 billion) in 2019–20 at a compound annual growth rate (CAGR) of 23%. India's share in global electronics manufacturing has grown from 1.3% in 2012 to 3.6% in 2019 (Annual Report, MeitY, 2020–21).

On one hand, the world's largest digital literacy program Pradhan Mantri Grameen Digital Saksharta Abhiyan (PMG DISHA) is working to boost digital inclusion by making 6 Crore rural adults digitally literate, and on the other hand, 233 BPO units have been set up under BPO Promotion Schemes to create new job opportunities for young men and women. A total of 7300 crore online transactions on e-Gov applications in 2020 reveal the volume of the impact of Digital India in transforming India. In fact, emerging technologies like 5G, internet of things, advanced data analytics, artificial intelligence, cloud computing, augmented and virtual reality, 3D printing, robotics and blockchain, etc., will redefine the future of technology-led transformation in India.

If we review the growth of digital payments in India in the recent past (2017–21), we find that the volume of this payment increased from USD 83,730 million in 2017 to USD 1,39,262 million in 2021 (Table 16.1 and Fig. 16.1) showing a slight downward trend during pandemic period, viz. in 2020. Table-1 shows that while the share of digital commerce in these payment was maximum among all the reasons or modes of digital payments (like digital commerce, digital remittance and mobile POS payment) it also increased by about 45% during that period. The growth of

mobile POS payments indicates a spectacular growth of 1216% during that period (from USD 1,477 million in 2017 to USD 19,441 million in 2021). The World Bank data regarding the percentage of population using internet in India also shows a tremendous hike during 2017–19 (Fig. 16.2). The figure reveals that only about 1% of India's total population used internet service during 2000–01 and this figure went up to 20% in 2017, and in 2019 it increased to about 40%.

India has also experienced the second-fastest rate of growth of digital adoption in comparison with seventeen mature and emerging digital economies such as Brazil, China, Indonesia, Russia, South Korea, Sweden, and the United States (Table 16.2). India's digital index score has moved from 17 in 2014 to 32 in 2017 (on a scale of 0 to 100), which shows a second-fastest rise after Indonesia [5]. India has also performed well on e-governance and digital identity and in terms of the uptake of digital media by online consumers. For instance, India's monthly mobile data consumption per user, at 8.3 gigabytes (GB) per month in 2017, is found to be over 54 times the figure in mid-2016 and higher than countries like China at 5.5 GB per user, and it was comparable to digital leaders like South Korea at 8–8.5 GB per user.

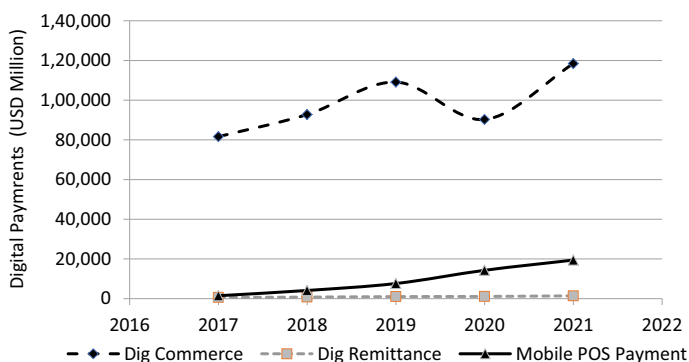


Fig. 16.1 Digital payments in India during 2017–21 (in USD Mill). *Source* Based on Table 16.1

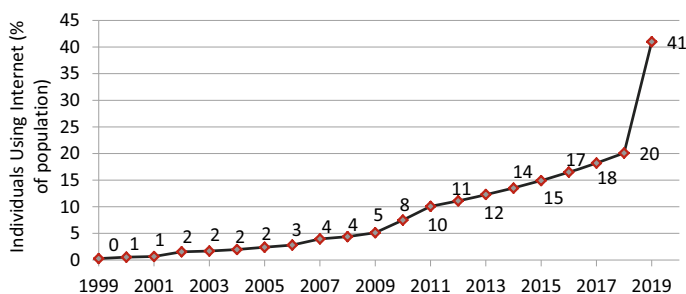


Fig. 16.2 Individuals using the Internet (% of population) in India during 2000–2019. *Source* Compiled by the authors using the database of World Bank (www.worldbank.org)

Table 16.1 Trend of digital payments in India during 2017–21

Year	Digital payment in India (in USD million)			
	Dig commerce	Dig remittance	Mobile POS payment	Total payments
2017	81,638	615	1,477	83,730
2018	92,769	783	4,132	97,684
2019	1,09,119	1,031	7,629	117,779
2020	90,281	1,128	14,291	105,700
2021	1,18,405	1,416	19,441	139,262

Source Statista (www.statista.com), USA

Table 16.2 Digital adoption index: a comparison across nations

Country	DAI in 2017	Country	Growth in DAI during 2014–17
South Korea	75	Indonesia	91
Sweden	73	India	90
UK	67	China	45
Singapore	67	Russia	44
USA	66	Germany	44
Australia	66	Japan	43
Canada	65	Italy	36
Russia	64	South Africa	35
Japan	64	France	35
Germany	61	South Korea	31
France	58	UK	30
Italy	57	Brazil	30
Brazil	50	USA	30
China	46	Sweden	27
Indonesia	40	Canada	25
South Africa	40	Australia	25
India	32	Singapore	24

Source Compiled by the authors using the database of India's Trillion-Dollar Digital Opportunity [5], Ministry of Electronics & IT, GOI; [DAI: Digital Adoption Index]

Sometimes the government of any country deliberately puts restrictions upon the use of internet service to restrict the spread of political unrest or to restrict the insurgency in any region. Interestingly in the year 2020 this type of internet shutdown cost India almost USD 2.8 billion in 2020. The high cost is a combination of the long hours (the highest among eight countries as shown in Table 16.3) and the number of people (about 10.3 million) who were affected by such internet shutdowns [14]. Table 16.3 shows that the hours of internet shutdowns in India and Myanmar remain almost the same in 2020 but the higher economic costs for India signify how it

Table 16.3 Economic Cost of major Internet shutdowns across nations in 2020

Country	Internet shut-downs in 2020 (hours)	Economic cost of major internet shut-downs (in USD million)
India	8,927	2,779
Belarus	218	336
Yemen	912	237
Myanmar	8,808	189
Azerbaijan	1,128	123
Ethiopia	1,536	111
Sudan	36	69
Turkey	18	51

Source Compiled by the authors using the database of the cost of Internet shutdowns, Statista

has affected greater number of people involved in economic activities using internet service.

16.5.1 *Flipside of this Process*

So far, our discussion has revealed the growth aspect of ‘digital movement’ in India. According to Warschauser [15], ‘What is most important about ICT is not so much the availability of a computing device or the Internet line, but rather the people’s ability to make use of that device and line to engage in meaningful social practices’.

Let us first look into the factors which determine the Digital Adoption Index (DAI). The DAI is prepared on the basis of three broad pillars, viz. digital foundation of a country, digital reach of the people and the digital value generated through the usage of digital technology. This DAI is measured on the basis of 30 metrics divided between those three pillars. Principal component analysis is conducted to estimate the relative importance of the three pillars: 0.37 for digital foundation, 0.33 for digital reach and 0.30 for digital value [5]. Within each pillar, each element is assigned equal value, with indicators normalized into a standard scale of 0–100 (0 indicating lowest possible value). A simple average of the normalized values was then used to calculate the index [5].

The digital foundation, in turn, takes into consideration four important factors, viz. fixed-line or land-line infrastructure of telecommunication, mobile telephone infrastructure, e-governance platforms and the affordability of the people in using these services. A close introspection of the relative position of India to 16 other countries (as already indicated in Table 16.2) in terms of the matrices used for showing the position of India regarding digital foundation during 2014–17 clearly shows that (i) average price of using internet was much higher in India, (ii) international internet bandwidth per user was much lower and (iii) the download speed on internet data

was also lower in India (Table 16.4). Thus, digital foundation was not very strong in India during 2014–17.

Similarly, the digital reach in a country is determined by (i) the number of devices (say, smart phones per 100 people), (ii) data usage by the people and (iii) Number of Apps and content. In this case also, we find that the number of smartphones per 100 people, mobile broadband subscription per 100 people, fixed broadband subscriptions per 100 people, etc., remained at a low level in India during 2014–17 (Table 16.5).

The third pillar of DAI, viz. the digital value consists of the factors such as (i) digital payments, (ii) e-commerce transactions as percentage of total retail transactions, (iii) Average data usage for entertainment, etc. Table 16.6 clearly shows that the position of India in many of these dimensions (say, number of cashless consumer transaction per person, e-commerce transactions as percentage of total retail transactions) remained at a low level compared to 16 other nations under study [5].

Table 16.4 India's position in relation to 16 other countries in digital foundation during 2014–17

Parameters	Best performing country	India's position
Allocated Spectrum <1 GB per Km ² , 2014 and 2017	58.3	0.3
Allocated Spectrum >1 GB per Km ² , 2014 and 2017	221.3	0.9
4G availability, 2015–2017	100%	86.%
Average mobile download speed, 2014 and 2017	26.0 Mbps	4.9 Mbps
International Internet Bandwidth per internet user, 2013 and 2016	960 Kbps	16
Average fixed line download speed, 2014 and 2017	28.6 Mbps	6.5 Mbps
No. of public Wifi hotspots per 1 lac people, 2014 and 2017	614.4	21.5
Average price per GB of mobile data, 2013 and 2017	0.07% GNI per capita	0.37% GNI per capita
Average fixed broadband subscription charge, 2014–2017	0.1% GNI per capita	0.45% GNI per capita
Government Online Service Index, 2013–2017	100%	100%
Digital identity program assesment	100%	100%

Source India's Trillion-Dollar Digital Opportunity [5], Ministry of Electronics & IT, Government of India

Table 16.5 India's position in relation to 16 other countries in digital reach during 2014–17

Parameters	Best performing country	India's position
No. of smart phone user per 100 people, 2013 and 2017	95.8	22.2
No. of basic phone user per 100 people, 2013 and 2017	49.9	34.8
Mobile phone subscription per 100 people, 2016 and 2016	1617	87
Mobile internet subscription (2G, 3G, 4G or 5G) per 100 people, 2016 and 2016	178.6	80.9
Mobile broadband subscription (2G, 3G, 4G or 5G) per 100 people, 2016 and 2016	144.4	38.7
Average mobile data consumption per user per month, 2013 and 2017	86 GB	1 GB
Fixed broadband subscription per 100 people, 2014 and 2016	42.4	1.4
Average fixed-line consumption per user per month 2014 and 2017	153.6 GB	18.3 GB
No. of app downloading, 2014 and 2017	81.7	45.7

Source Same as Table 16.4

Table 16.6 India's position in relation to 16 other countries in digital value during 2014–17

Parameters	Best performing country	India's position
E-participation Index, 2014 and 2017	100%	76%
% of people using WhatsApp, Wechat & other popular instant messaging app, 2014 and 2017	73%	28%
Average time spent on social media sites per user per week, 2014 and 2017	25.6 h	17 h
% of people engaged in one purchase/e-commerce, 2014 and 2017	78%	26%
% of people engaged in social media, 2014 and 2017	85%	19%
E-commerce as a % total retail, 2015 and 2017	20%	5%
% of users searching for product information online before online purchase, 2014 and 2017	85%	19%
Average data usage for music per user per month	1.3 GB	27.5 MB
Average data usage for video per user per month, 2013 and 2016	59.2 GB	335.4 MB
No. of cashless consumer transactions per person, 2013 and 2016	802.7	767.6

Source Same as Table 16.5

16.6 Extent of Digital Divide

When different segments of the society fail to avail the benefits of digital movements, it shows a sign of digital divide, say, the access to digital infrastructure may be higher for urban people compared to rural people. In this regard, we shall particularly focus our attention to the problem of digital divide with respect to online education during the pandemic period. It is true that online education can benefit students to access digital libraries, to complete short-term internship programmes and enhance their knowledge domain at lower opportunity cost (since they can save their time which would have been required to pay regular visits to libraries or training centres). However, the success of online education is critically contingent upon the availability of digital infrastructure. A student may have a smartphone but may not have adequate access to internet (with the required speed. Thus, access to internet service along with the possession of a proper digital device (say, in the form of a desktop computer, laptop computer, notebook, palmtop, tablet or similar handheld devices) can be considered as the ideal combination for availing online education.

However, NSSO data on social consumption of education (2017–18) in India clearly reveals that only about 9% of the students who were enrolled in any course had access to essential digital infrastructure, viz. a computer with internet access (Fig. 16.3). In urban areas, this percentage was much higher (21%) compared to the rural areas (4%). This divide between rural and urban areas was also prominent in respect of access to internet service and availability of computers.

Therefore, the online education system which was being followed during the pandemic period cannot be considered as inclusive when 75% of the enrolled students did not have access to internet and 91% of the enrolled students did not have computer with internet. Hence, the extent of exclusion seemed to have surpassed the benefit of inclusion in this regard. This divide was also clear in respect students across social groups (viz. SC, ST, OBC and General category students).

Figure 16.4 clearly reveals that students belonging to SC, ST and OBC groups remained far behind the students belonging to general category in terms of the possession of a computer along with internet access. The NSSO Report on the social consumption of education (2017–18) indicated that such measly access to digital infrastructure is enmeshed with huge socio-economic and spatial disparities. Thus,

Fig. 16.3 Percentage of enrolled students in india with access to digital infrastructure in 2017–18. *Source* Compiled by the authors using the database of NSSO on social consumption on education (2017–18)

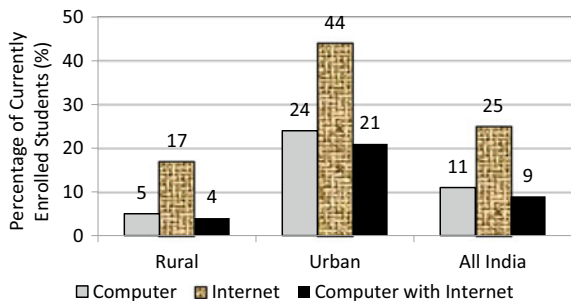


Fig. 16.4 Digital divide among the students across social groups in India in 2017–18. *Source* Same as Fig. 16.3

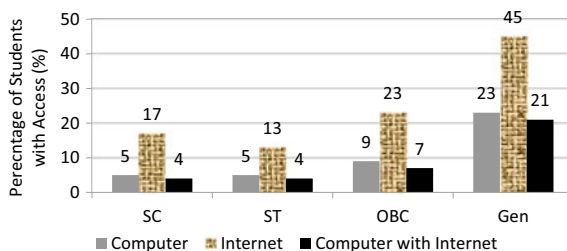
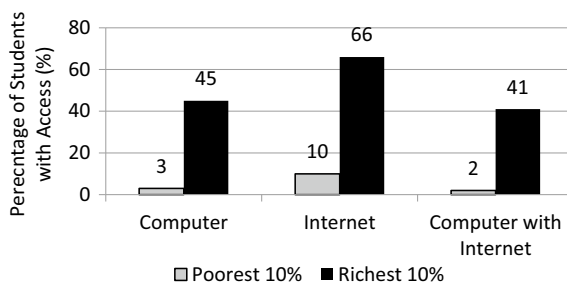


Fig. 16.5 Digital divide among the students across income groups in India in 2017–18. *Source* Same as Fig. 16.4



this digital divide was also acute among students across the income groups. It has been observed that about 41% of the students belonging to the richest 10% households had possessed computer with access to internet service but only 2% of the students belonging to the poorest 10% households enjoyed this opportunity (Fig. 16.5).

There were also inter-state variations with regard to that digital divide. Across the states, Goa emerges as the best performer with 30% of the enrolled students having access to computer with internet. The states such as Uttarakhand, Maharashtra, Haryana, Himachal Pradesh, Tamil Nadu, Punjab, Sikkim, Kerala, Mizoram and Nagaland remained above the All-India average in this regard whereas the states like Odisha, Bihar, Madhya Pradesh and Tripura remained below the All-India average (Fig. 16.6).

In this connection, we can refer to a real-life story published in the Times of India on 5 July, 2021. It is all about the financial difficulty faced by a poor family in Chhattisgarh. The report states that Lakshmi Sahu and her husband Purushottam Sahu together used earn Rs 5,400 a month and during June 2021 they had to spent Rs 14,000 on a smartphone for their 12-year-old son to facilitate his online learning. This poor family, already burdened with debt, found it difficult to afford the monthly data recharge and on some days they did not have money to buy groceries. Thus, this might have happened to many other poor families in India.

This apart, a student does not only need a gadget and internet connectivity for attending online classes, a congenial physical space around them is also very crucial. It should be ideally a quiet and isolated space where the student is not disturbed by the presence of others. But in many cases, particularly in urban areas, getting such a physical space is also very difficult. Even in rural areas, economically and socially

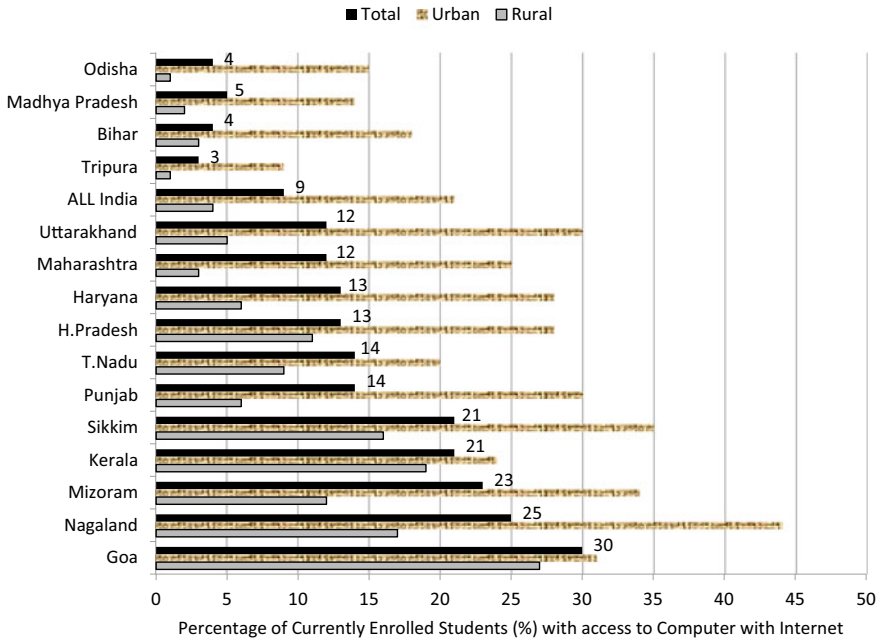


Fig. 16.6 Digital divide among the students across the states in India in 2017–18. *Source* Same as Fig. 16.5

disadvantaged students who do not have access to the privacy of well-endowed domestic spaces face similar problems.

The physical space of the schools and colleges in general and the classrooms in particular are not merely a space for the transaction of knowledge, it is often a space for lasting friendship and a means for creating a permanent social bondage. A physical classroom has the potential to break the gaps created out of our narrow social taboos particularly in cases where some dedicated teachers are engaged in inculcating value judgments among the students.

Despite all these negative aspects of online teaching, education planners in India advocated for this mode of teaching as the future of higher education. During the pandemic period, several documents and statements of the high functionaries of the Ministry of Human Resource Development (MHRD), University Grants Commission (UGC) and NITI Aayog have emphasized upon online learning [10]. The National Education Policy (NEP) [16] of the government of India calls for carefully designed and appropriately scaled pilot studies to determine how the benefits of online/digital education can be reaped while addressing or mitigating the downsides. However, this policy stresses the need for optimization and expansion of the existing digital platforms and ongoing ICT-based educational initiatives to meet the current and future challenges in providing quality education for all [16].

16.7 A Theoretical Model on Digital Movement in Context of Developing Nations

The context of digital movement has enough potential to trigger socio-economic and political commotion in developing and less-developed nation where the distributive is largely impaired due to persistent and yawning income inequality among different functional groups. Now of late, this technological wave of transition dawned a substantial amount of uncertainty and thereof attracted enough political remonstrations from the potential sufferer, particularly the groups of people who anticipate a fair amount of threat on their livelihood. To be precise, there is strong consensus on the apprehension that such technological would result in large displaced of semi-skilled and low-skilled who are in majority in less-developed countries for want of modern technical education who are the real sough after to let this new technological epoch to surface and persist. However, the interesting flipside of this dispensation is based on the contention that this technological revolution is what necessary only to suit the production needs of the current time but to aid the developing nation enhance their competitive edge in global trade and economy. Moreover, with the developing nations transiting into a phase of advancement of technical education and progressing with it, this digital movement has become indispensable for creating suitable job openings required to employ the large generation of youths equipped in modern skill sets which otherwise will find the way to expatriation in search of coveted livelihood and that in turn will amount a potential brain drain and exodus of skilled labour, slogging the process of economic growth and to that end the economic developed. Hence, the bottom line that comes from quite obviously the developing countries are required to introduce dynamism in their economic growth by having effective policy instruments that are capable of offsets the potential fallout of digital movement on distributive justice as what is the seemingly rational roadmap to sustainable development amidst this new wave of technological progress. Now the model described below is attempt to set an appropriate to this line of rumination on the disruptive aspect(s) of the digital revolution/ movement extant and the potential implication for sustainable development in developing and less-developed nations.

The structure of the model, drawing on as noted earlier in the objective, is based on a three-sector small open economy namely, X (a modern technology-intensive sector) operating with high skilled labour (S) and specific capital (K'), Y (urban sector) operating with semi-skilled and less-skilled labour (L) and traditional capital (K) and a rural sector (Z) operating with L and K. Now, it is hereby assumed that X runs with a fixed coefficient production technology, so is Y, while Z runs with flexible coefficient. In this backdrop, we allow for high-skilled labour force being partly employed for want of suitable job opportunity for want of the specific capital, whereas, L and K are fully employed. Moreover, wage rate of L-workers in Y institutionally given as \bar{W} and there is migration of L between Y and Z. Besides, all three sectors are open to foreign trade and thereof the price of the output produced by each is exogenously given. Thus, we have the following equations.

$$P_X = a_{SX}W_S + a_{K'X}r' \tag{16.1}$$

$$P_Y = a_{LY}\bar{W} + a_{KY}r \tag{16.2}$$

$$P_Z = a_{LZ}W + a_{KZ}r \tag{16.3}$$

$$\bar{W}\left(\frac{a_{LY}Y}{L - a_{LZ}Z}\right) = W \tag{16.4}$$

$$a_{SX}X < S \tag{16.5}$$

$$a_{SX}X = K' \tag{16.6}$$

$$a_{LY}Y + a_{LZ}Z = L \tag{16.7}$$

$$a_{KY}Y + a_{KZ}Z = K \tag{16.8}$$

Now, as what is quite evident, that there are seven equation seven unknown, namely, W_S, W, r', r, X, Y, Z [Note: (5) is inequation].

16.7.1 Advent of Digital Movement and Its Implications on Wage-Inequality

Here we shall analyse the potential consequences of the introduction digital revolution on the economy. To begin with, the eve of digital movement will create negative among the semi-skilled and low-skilled workers out of fear about displacement owing to the adoption of digital technology involving both digitization and digitalization. This will pull down the bargaining power of L-workers and thereof will cause significant fall in \bar{W} . Thus, we have the following result.

$$\widehat{W} = \left[\frac{1 + \left(\frac{L_Z^0}{L_{fY}^0}\right)\sigma_Z\theta_{KZ}\left(\frac{\theta_{LY}}{\theta_{KY}}\right)}{L_{fY}^0 - \left(\frac{L_Z^0}{L_{fY}^0}\right)\sigma_Z\theta_{KZ}} \right] \left(\frac{d\bar{W}}{\bar{W}} \right) \tag{16.9}$$

[Hints to the derivation has been cited in the appendix]

Hence, for $\left(\frac{d\bar{W}}{\bar{W}}\right) < 0$ we get, $\widehat{W} < 0$. Let us explain the rationale behind this result. Following the worsening of urban wage of L-workers, the expected wage-earning

in Y will contraction and in effect fewer workers employed in rural sector will be willing to migrate or there may happen a reverse migration owing to the extent of fall in W_Y may be too intense to afford the cost of living over there. This will increase the supply of L in Z and hence W will witness a decline. Therefore, we have the following proposition.

Proposition 16.1 *Assuming there is wage inequality between high-skilled workers on the one hand and semi-skilled and low-skilled workers on the other, being already extant, the advent digital movement would work to exacerbate such inequality and hence as its immediate impact such technological transition in production will militate against the distributive justice. Besides in the circumstance of pandemic, such negative development would add to the misery of the economically marginalized section of the nation. Moreover, if assumed further that sector Z produces the wage goods at large, fall in W and consequently, a contraction in purchasing of workers at large, demand for goods produced Z will get squeezed in resulting contraction of its output and thus a further fall in W and thereof a surge in rural -urban wage disparity.*

16.7.2 Introduction of Digital Technology in Urban Sector and Its Consequences

In this section, we shall address the potential consequences of the introduction of digital technology in urban sector as a drive towards modernization. To this end, the production function corresponding sector can re-thought as what follows.

$$Y = \text{Min}[f(L, S), K/a_{KY}] \quad (16.10)$$

Let us now try and elicit the underlying intuition of this modified production function. This is so that post the introduction digital technology in Y sector, for obvious reason, there will arise the condition for substitution of low-skilled workers by high-skilled counterpart (at least partly to begin with) as complimentary to K. Thus, makes sense to keep the overall production function in standard Leontief form, where (L, S) will operate with K as complimentary input, while retaining the substitutability of between L and S [Note: f is linearly homogenous in (l, S)]. Hence, reducing (16.10) to unit isoquant form we get,

$$1 = f(a_{LY}, a_{SY}) \quad (16.10')$$

Besides, these the zero-profit condition of Y-sector will change into:

$$P_Y = a_{LY}W_Y + a_{KY}r + a_{SY}W_S \quad (16.2')$$

Now with no change in exogenously given P_Y , and factor prices, Eq. (16.11) suggests a reduction in a_{LY} and rise in a_{SY} as sufficient for its own fulfillment. Hence, we introduce a parameter ρ signifying the degree of the usage of digital technological in Y sector, such a_{LY} is falling ρ while a_{SY} is rising in ρ , where, a_{LY} and a_{SY} are cost-minimizing in nature. Besides, it is reasonable with the onset of digital drive the unutilized skilled labour finds vent to utilization leading the situation to full employment. However, this full employment will quite reasonably come against departure from of L, particularly for the reason of wage rigidity in urban sector and not all the displaced workers will be able to find alternative employment in the rural sector. Thus, in this backdrop, the previously mentioned full employment conditions will change into what follows.

$$a_{SX}X + a_{XZ}(\rho)Z = S \quad (16.5')$$

$$a_{LY}Y + a_{LZ}Z < L \quad (16.7')$$

Now let us come to the precise dispensation of aftermath of this development on W_S , W , r and r' as what follows.

$$\widehat{W} = \varepsilon_{L\rho}^Y \widehat{\rho} < 0 \quad (16.11)$$

$$\widehat{W}_S = - \left[\frac{\{(\theta_{KY}/\theta_{KZ})\theta_{LZ} - \theta_{LY}\}\varepsilon_{L\rho}^Y + \varepsilon_{S\rho}^Y \theta_{SY}}{\theta_{SY}} \right] \widehat{\rho} \quad (16.12)$$

$$\widehat{r} = -(\theta_{LZ}/\theta_{KZ})\varepsilon_{L\rho}^Y \widehat{\rho} > 0 \quad (16.13)$$

$$\widehat{r}' = -(\theta_{LZ}/\theta_{KZ})\widehat{W}_S \quad (16.14)$$

[Note: $\varepsilon_{i\rho}^Y$ is the technological elasticity of the employment of factor $i = L, S$ and $\widehat{\rho} > 0$].

Let us explain these results. It is well that the introduction of digital technology in Y-sector will drive out L from being replaced by S as what is a necessity quite obviously. This will cause downward adjustment in W in rural as what is required for the rural sector to absorb the displaced workers, but such an adjustment would not be enough to keep with full employment since, in anticipation of such an abject fall in wage many displaced to may refuse to migrate to the rural sector and instead, will find alternative livelihood through self-employment or settle with relatively less low paying informal jobs. Now to absorb a part of these displaced workers the demand for capital would rise, notwithstanding the internal substitution of labour by scale or the rising demand for capital may come on the back of the need for increasing scale of production in Z-sector. Now let us assume that the rate displacement of L in Y-sector brought about introduction of digital technological is substantially higher

than that of the absorption of S then, the term in the numerator in negative, provided that (a) Y-sector is more K-intensive relative to Z and (b) Z-sector is more L-intensive relative to Y-sector. Consequently, we have $\widehat{W}_S > 0$ and thereof, $r' < 0$. While the flip side, although a trivial one, so to say, is that $\widehat{W}_S < 0$ and henceforth, $r' > 0$. Now in this case one interesting point that arises quietly logically, that the rate of fall in W_S is higher relative to that in W , what is evident from the following.

$$\widehat{W}_S - \widehat{W} = - \left[\left[\left[\frac{(\theta_{KY}/\theta_{KZ})\theta_{LZ} - \theta_{LY}}{\theta_{SY}} \right] + 1 \right] \varepsilon_{L\rho}^Y + \varepsilon_{S\rho}^Y \right] \widehat{\rho} > 0 \quad (16.15)$$

Thus, we have the following proposition.

Proposition 16.2 *Introduction of digital technology in the urban sector comes with two distinct dichotomous ramifications as on the overall income inequality. One end is that, if the high skilled rises in the aftermath of such technological transition, given that wage earning low skilled and poorly skilled workers will witness an inevitable decline, the wage disparity will shoot. Moreover, this extends to the similar income disparity between the tradition capital and specific capital. Thus, the income inequality problem will get furthered within the functional groups. The other end is that, if high skilled wage falls (although a trivial possibility) then the within the group income inequality can potentially down, however the between group inequality will rise. Hence, overall status income inequality remains a little ambiguous in this case.*

16.8 Conclusion

The present study brings out the potential aftermath of digital movement for developing nations in general and India in particular, as on the distributive justice notwithstanding its role in enhancing the overall factor productivity of the economy and at the same time mitigating unemployment and underemployment of skilled labour as what can be considered as the product modern technical education. Now in this study, it well vivid that the inception of digital revolution or movement as big shot technological transition is a significant threat to distributive justice, a what seems to be true, particularly true, for a developing country or less developed one with preponderance of semi-skilled or low skilled workers in labour force, so far labour is displacing character is concerned. There, the advent of digital technology and a additionally drive towards enabling its faster penetration across different sectors in a less developed country will bring about a severe loss of employment and an sharp in unemployment in the immediate term or even during the considerable period-of-time offing, which in turn will amount to a marked increase socio-economic inequality and thus jeopardization of distributive justice. This will create a ripe condition for the dichotomous of society led by the decimation of the middle class (or low middle class or) and consequently, the marginalization of common people, as what resembles ‘missing middle phenomenon’ [17]. To this end the current chapter can be seen

as caveat for developing and less developed nations which have not only embarked on this digital movement but have gone into the task of enabling its furtherance in order they can cope with the new global economic order.

Appendix

The result indicated by Eq. (16.9) [vide: Proposition 16.1] has been derived using the standard hat-algebra [1] as illustrated below.

$$\theta_{SX}\hat{W}_S + \theta_{K'X}\hat{r}' = 0 \quad (16.16)$$

$$\theta_{LY}\left(\frac{d\bar{W}}{\bar{W}}\right) + \theta_{KY}\hat{r} = 0 \quad (16.17)$$

$$\theta_{LY}\hat{W} + \theta_{KY}\hat{r} = 0 \quad (16.18)$$

$$\hat{W} = \left(\frac{d\bar{W}}{\bar{W}}\right) - \left(\frac{\sigma_Z\theta_{LZ}\theta_{KZ}}{L_{fY}^0/\bar{L}}\right)(\hat{W} - \hat{r}) \quad (16.19)$$

Similarly, can be derived, Eq. (16.15) [vide: Proposition 16.2].

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