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DEMOGRAPHIC DIVIDEND, DIGITAL INNOVATION, AND ECONOMIC GROWTH: BANGLADESH EXPERIENCE

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Abstract

This study aims to understand the linkages between demographic dividends, digital innovation, and economic growth, using Bangladesh as a case study. It adopts a three-stage least squares (3SLS) model to explore how and to what extent the digitization and demographic transition lead towards faster economic growth in Bangladesh. Results imply that economic growth is significantly influenced both by digitization and the demographic transition. Estimation reveals that with an increase of 1 percentage point in the number of internet users, the GDP would increase by 0.11%, *ceteris paribus*, while a 10-basis point decrease in the dependency ratio would increase the GDP by 7.2%, on average. The key driving factors for digitization are the labor participation rate, workers' productivity, and mobile penetration. The urbanization rate, however, adversely impacts the rise in internet users. Estimations imply that the Human Development Index (HDI) score and urbanization rate have significant negative impacts on the dependency ratio, while female participation in the labor force has a positive impact on it. The study provides insights to assist the government and policymakers in framing a roadmap on how Bangladesh could utilize demographic transition to achieve faster economic growth while fostering digitization and technological innovation. Lessons learned could also be used in other developing countries in the Asia and Pacific region.

Keywords: demographic dividend, digital innovation, e-commerce, economic growth, Bangladesh

JEL Classification: J11, J24, L81, L86, O32

Contents

1. INTRODUCTION

1.1 Background of the Study

Bangladesh is one of the most densely populated countries in the world with a total population of 165 million and about 3,000 people living per square mile (World Development Indicators 2020). Despite the population pressure, the country has been growing its economy rapidly in recent years and is expected to grow its GDP by 6.8% in 2021 (ADB 2020). While Bangladesh is experiencing rapid demographic changes accompanied by age-structural transitions, it is also creating a window of opportunity for potential demographic dividends over the next three to four decades (Navaneetham and Dharmalingam 2012; CRI 2017). Currently, about 45% of its population is aged below 24 years and 70% is aged below 40 (UNDESA 2019). The economic and social implications of such demographic transition are widely analyzed in the literature both theoretically and empirically. The earlier literature refers to the grander process of economic and social transformation, and modernization resulted from the demographic dividends enjoyed by Europe and the West throughout the middle of the twentieth century (Willekens 2016; Van de Kaa 2010). Theories imply that such a change in age structure would eventually induce higher living standards and educational levels while the society becomes increasingly urban with the industrial and services sectors of the economy used to surpass agriculture both in production and in social relevance (Reher 2011). Consequently, a larger consumer society begins to emerge, and women start to enter the labor market in more numbers. Cutler et al. (1990) explain that a lower dependency ratio owing to demographic transition would enable countries to invest more resources, which would lead to economic growth. Many scholars recognize human capital development as the core factor in reaping the benefit of demographic transition (Striessnig 2019; Ahmad and Khan 2019; Mason, Lee, and Jiang 2016). Bloom, Canning, and Fink (2007) emphasize the institutional and infrastructural improvement in the forms of healthcare, schooling, roads, and transport to facilitate the human development process, in which a productive young labor force could be employed to maintain higher economic growth. Olaniyan, Soyibo, and Lawanson (2012) argue that the education system in the country must emphasize the right relevance of entrepreneurship and private sector employment.

Consequently, scholars argue that demographic transition is evidenced to be a powerful stimulus for migration, especially from the underdeveloped regions to the developed ones (Goldscheider 2019; Bruni 2019). However, with technological advancement, specifically with the massive digitization in many developing countries, the pattern of migration in the international job market has been evolving with a newer dimension. More online jobs are now globally offered than ever before and the colossal pool of the technologically skilled young population of the developing countries is getting access to those jobs. Digitalization not only drives the technological innovation and process re-engineering to support the country's industrial and service sector to fuel economic growth but it also acts as a driver for large-scale employment generation using digital platforms (Bukht and Heeks 2017). Having benefited from the advantages of lower cost, fewer risks, and less time, many large organizations from developed economies such as the US, the UK, Japan, and Australia have been providing IT outsourcing jobs to developing and emerging digital economies like Bangladesh (Zaman 2019). Despite the huge untapped potential, there have been very few attempts to explore the economic impact resulting from the demographic composition and adoption of digitization and technological advancement in the context of developing countries like Bangladesh.

Bangladesh set aspirational goals in 2008 through its *Vision 2021* to lift the country from a low-income to a resourceful and modern middle-income economy by 2021 through massive socioeconomic progress, infrastructural setups, technological innovation, and the development of human resources (Government of Bangladesh 2012). The government at that time incorporated "digitization" as the core effectual driving force for this ambitious attainment. The "Digital Bangladesh" concept was espoused to facilitate *Vision 2021* through efficient and colossal use of information and communication technologies. The national ICT Policy 2009 was adopted to facilitate the emergence of a knowledge-driven economy that would compete within the context of future global challenges. The demographic dividend remains one of the key factors that encourage the government to set the targets to implement *Digital Bangladesh*. There are still a few hurdles that need to be overcome to reap the benefits of such digitization in a larger context. For instance, ensuring equitable inclusion of ICT in all economic sectors (Basher 2014), adopting robust ICT physical infrastructures and e-governance (Sarker et al. 2018), establishing secure uninterrupted high-speed connectivity (Islam et al. 2019), providing mass-scale e-literacy, and increasing the supply of institutional skilled and trained ICT manpower (Bhuiyan et al. 2020) are some of the key areas to improve. Nevertheless, the current tech-savvy generation and young labor force have to play a pivotal role in reinforcing the digitization process and inclusion to position Bangladesh as one of the world's leading digital economies in the coming years. Therefore, understanding the links between the demographic dividend, digital innovation, and economic growth of Bangladesh is of utmost importance, and hence it is considered central to this study.

1.2 Research Objectives

The Global Connectivity Index (GCI) 2019 reveals that Bangladesh, along with Ukraine, South Africa, and Algeria, were the top four economies with remarkable improvement and the fastest growth in the adoption of the digital economy between 2015 and 2019 (Huawei 2019). Despite this noteworthy success and advancement, the digital economy of Bangladesh still lacks formal institutional, legal, and policy support in a few key areas. For instance, overseas payment system infrastructure, internet connectivity and speed, the price of using the internet, and proper institutional training, etc. are a few issues that need adequate attention from the policymakers to sustain the growth of this sector. The government's commitment is visible; however, the potential of digitization is still untapped by some margin. Other than a few reports in newspapers, no in-depth research work has been found in this field. The digital economy is a relatively new concept and its implications in terms of reaping the demographic dividend are not comprehensively addressed in the literature. So, there is larger scope to explore this arena with some meticulous and scholarly economic analysis. This study, therefore, attempts to fill the gap in the literature and may potentially find some useful recommendations in designing future policies to support strengthening digital economies (primarily Bangladesh, which could also be replicated in other developing countries with similar demographic contexts) through using the long-lasting demographic dividends.

In considering the challenges and prospects, this study specifically attempts to explore the impact of the adoption of digitization and technological innovation in enhancing economic growth in Bangladesh, and especially to assess the role of the young labor force. For this analysis, the labor force aged between 20 and 39 is considered the young labor force. The research questions are, therefore, set as: i) how the demographic transitions are fostering the digitization process in Bangladesh; ii) whether the adoption of digitization and technological innovation makes the young

labor force more productive than the older-age working groups; and iii) how the digitization and demographic transition leads towards faster economic growth in Bangladesh. To examine these research questions, the study investigates all relevant determinants and externalities of the digital economic growth of Bangladesh from the perspective of utilizing the advantage of the demographic dividend.

2. DEMOGRAPHIC DIVIDEND, DIGITIZATION, AND ECONOMIC GROWTH: CONCEPTUAL FRAMEWORK

No demographic transition results automatically in dividends, i.e., economic benefits for the country. It largely depends on the government producing appropriate policies aimed at providing the abundant young population with proper education, the right healthcare, good governance, and other economic factors that may increase their productivity and job opportunities. Under the current context, digitization could be a significant economic factor that would drive this transformation.

The conceptual framework and nexus between demographic dividend, digitization, and economic growth can be analyzed by using endogenous growth models. Unlike the neoclassical growth models (which consider savings and capital accumulation as the drivers of economic growth, leaving the technology as an exogenous growth factor), endogenous growth theories advocate technological progress as the core determinant of sustained long-term growth, which is an endogenous factor of the models. Endogenous growth theories imply that investment in human capital, innovation, and knowledge have positive externalities and spillover effects of a technology-based economy, which would lead to economic development (Romer 1990).

Using a simplified Cobb-Douglas production function, the output is defined as

$$Y = AL^{\alpha}K^{\beta} \tag{1}$$

where *Y*, *L*, and *K* refer to the output, labor, and capital of an economy. *A* indicates the total factor productivity while *α* and *β* are the output elasticities of labor and capital, respectively.

For a constant return to scale, $(\alpha + \beta) = 1$, which would make Equation (1) as

$$Y = A\left(\frac{K}{L}\right)^{1-\alpha}.L \tag{2}$$

Output per capita can then be decomposed with three factors as shown in Equation (3).

$$\frac{Y}{P} = A\left(\frac{K}{L}\right)^{1-\alpha}.\frac{L}{P} \tag{3}$$

Now, as the demographic dividend gets dominant, the $\frac{L}{P}$ factor increases. Considering the *ceteris paribus* condition, it would increase the per capita income, i.e., $\frac{Y}{P}$ of the economy.

It may seem that in the demographic dividend phase, more labor in the workforce would result in lower capital per labor (i.e., $\frac{K}{L}$). However, as the per capita income increased, it would have a positive spillover effect on the savings as well as the investment, which would accumulate more capital in the economy. Eventually, it could

be the case that $\frac{K}{L}$ would not decline due to the demographic dividend state of the economy; rather, it would also create the opportunity to invest more in human capital, which would add future dividends from a skillful workforce generation.

Moreover, under the demographic advantage situation, there would be a huge number of young entrants entering the labor market. To survive within such a competitive environment and with the scarcities of capital and financial endowments, the role of technology remains pivotal. To make use of the viable, affordable, and low-cost technologies, the digitization process would be of utmost significance. It would then push the technology frontier (measured by the total factor productivity *A*) upward.

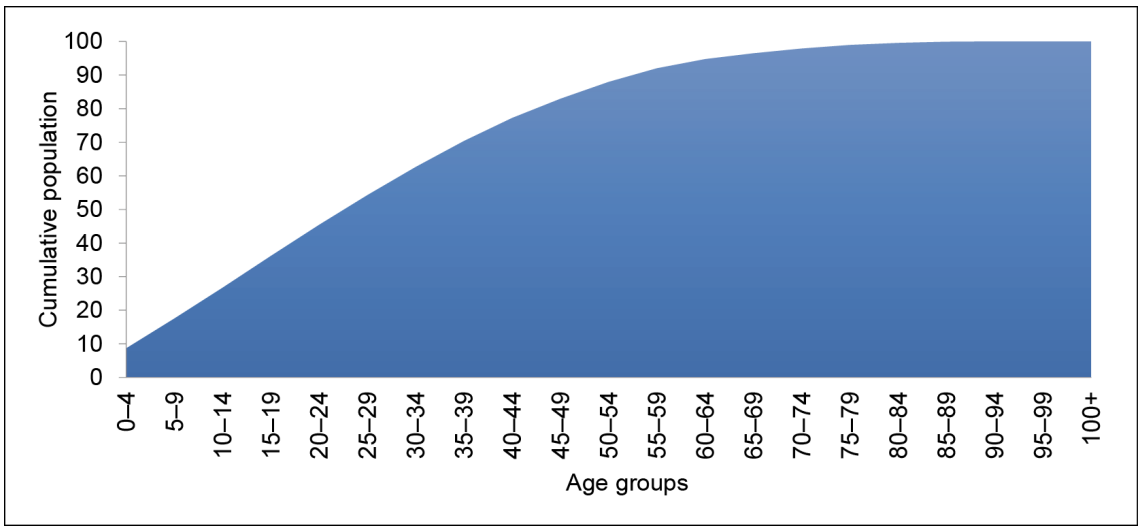
Therefore, it is implied that a demographic dividend scenario would instigate the rise of all three factors, *A*, $\frac{K}{L}$, and $\frac{L}{P}$, which eventually would increase the economic output per capita.

3. DEMOGRAPHIC DIVIDEND AND DIGITIZATION IN BANGLADESH

3.1 Age Structure and Demographic Dividend in Bangladesh: Trends and Potentials

The detailed age structure of the population depicted in Figure 1 indicates that at the moment the population of Bangladesh is largely dominated by the young. In 2019, 36.2% of the total 164.7 million population was aged below 20, 54.3% below 30, and 70.4% below 40. It also implies that 96.43 million people (58.5%) belonged to the working-age groups of 20–64 years.

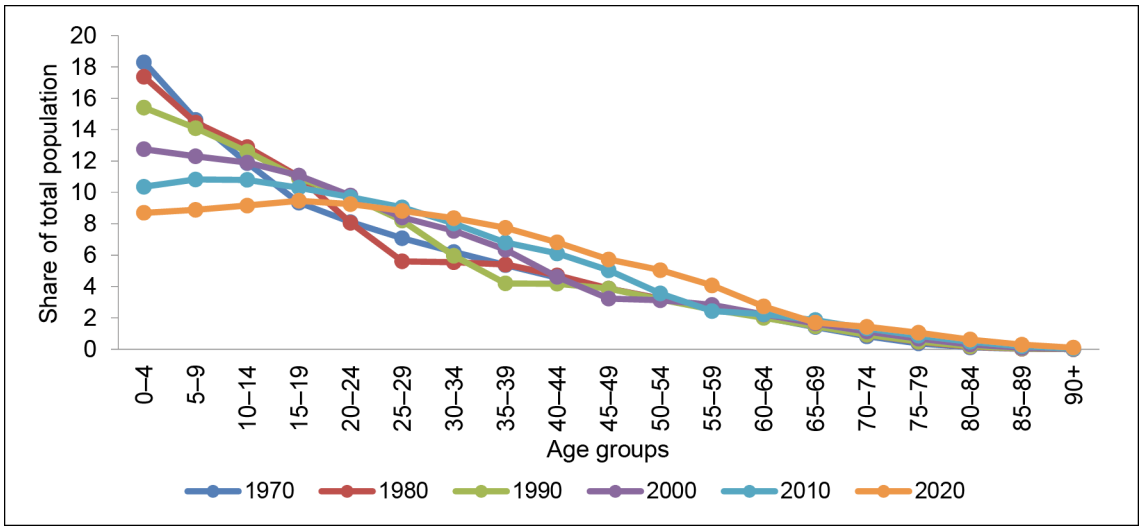
Figure 1: Age Structure of the Population in Bangladesh, 2019 (%)



Source: UNDESA (2019); Authors' compilation.

Figure 2 illustrates the transitions of different age groups since 1970. Over time the curve has become more flattened and skewed towards the working-age groups. This would indicate that the demographic transitions are intensifying and the likelihood of demographic dividends is increasing.

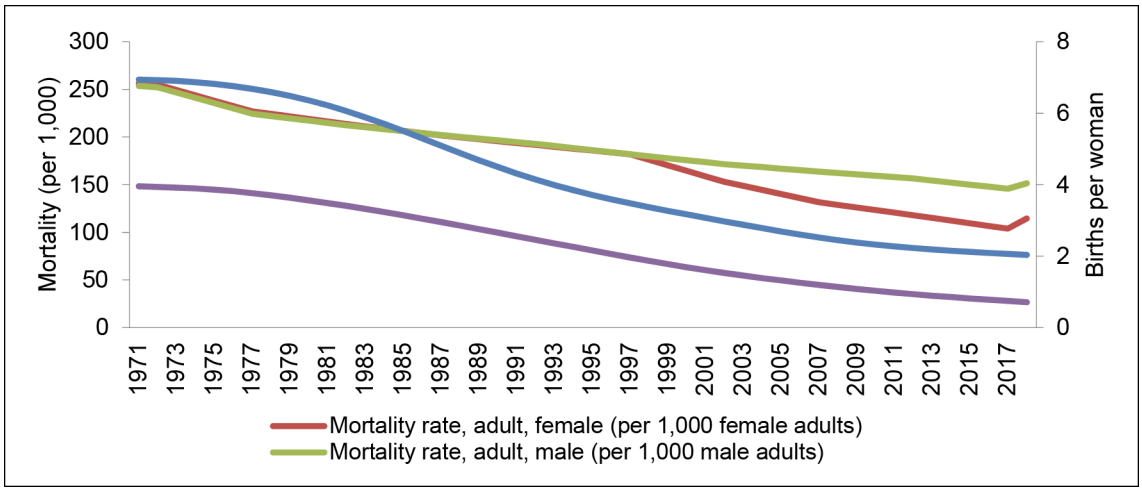
Figure 2: Chronological Transition of Different Age Groups (1970–2020)



Source: UNDESA (2019); Authors' compilation.

One key indication for moving towards demographic dividend is the declining fertility and mortality rates. As Figure 3 illustrates, the fertility rate was 6.9 births per woman at the time of independence in 1971, which dropped to 5.3 in 1985, and then fell sharply to 2.04 in 2018. Moreover, infant mortality decreased remarkably from 148.2 (per 1,000) in 1971 to 26.7 in 2018. Adult male and female mortality rates also declined markedly over this period. This all indicates that Bangladesh is well in line for attaining its demographic dividends now.

Figure 3: Trends of Fertility and Mortality Rates (1971–2018)



Source: World Development Indicators, World Bank (2020); Authors' compilation.

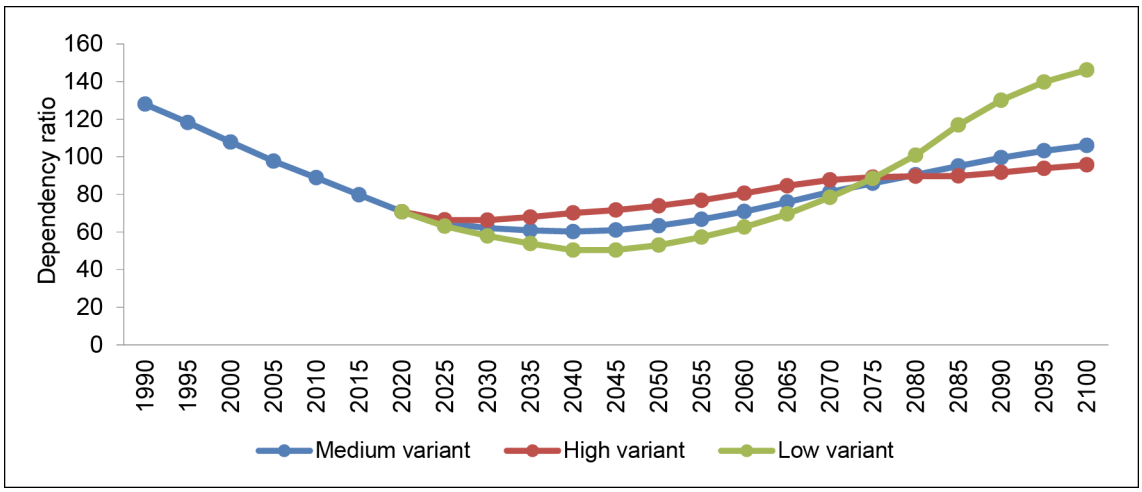
One global standard measure of demographic transition is the *dependency ratio*, which refers to the ratio of the non-working age population to the working-age population. According to the Population Division of the Department of Economic and Social Affairs of the United Nations, the nonworking-age population is considered to refer to age groups below 20 years along with the age group of above 65 years. Therefore, the age group of 20 to 65 years is considered the working population.

$$Dependency\ Ratio = \frac{Population\ aged\ 0{-}19\ and\ 65+}{Population\ aged\ 20{-}65}$$

The lower the value of the dependency ratio, the higher the dividends be the economy is assumed to gain out of it as proportionately a greater number of people are expected to be involved in economic activities than in the non-working population. Figure 4 depicts the trends of the dependency ratio in Bangladesh under three different scenarios (i.e., high-, low-, and medium-fertility variants) between 1990 and 2100 as projected by UNDESA in its World Population Prospects 2019. The medium-fertility variant refers to the historical long-term fertility trend while the high- and low-fertility variants refer to upper and lower values of 95& prediction intervals. UNDESA's projection is the most comprehensive one globally acknowledged that encompasses all historical data from the respective country's official censuses and surveys and follows the consequential trends in fertility, mortality, and international migrations. Though there is no specific threshold of this dependency ratio, anything less than 100 can be considered a good indication for an economy. Bangladesh, in this connection, seems to enter the demographic dividend phase from the early 2000s. A notable decline in the dependency ratio is observed between the 1990s and 2000s, which is largely attributed to a marked drop in the fertility rate (as illustrated in Figure 3) supported by a massive birth-control campaign from the government and non-government organizations. It was complemented by the infant mortality rates over this period.

As Figure 4 shows, the dependency ratio with medium- and low-fertility variants has been falling and the trend will continue until 2040 when the ratio will come to its lowest at 60.2 (for the medium-fertility variant) and 50.4 (for the low-fertility variant). It will go up thereafter as the projection reveals. Under the medium-fertility variant, the ratio is expected to cross 70 in 2060, 80 in 2070, and 90 in 2080. Therefore, with intense scrutiny, it is implicit that Bangladesh has got the prodigious opportunity to optimize the gain of demographic dividends at least for the next four to five decades, which would be a crucial factor in the country attaining high-income status by 2041 as it has targeted. Of course, it should only be attainable with a proper strategic framework that would plan and facilitate the deployment of its human and other resources optimally and efficiently.

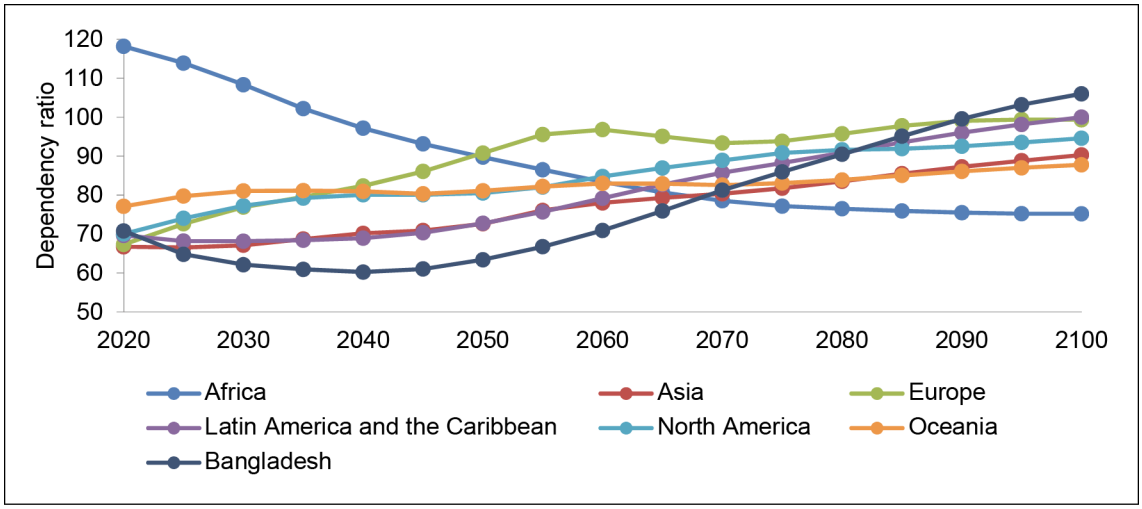
Figure 4: Dependency Ratio Trends in Bangladesh (1990–2100)



Source: UNDESA (2019); Authors' compilation.

Now, under a global context, the countries, having the potential of extracting the demographic dividend gains, use to compete with each other in this connection. Despite some challenges from other regions of the world, Bangladesh would still enjoy the highest potential benefits compared to the rest of the regions until 2070 as Figure 5 illustrates. Africa, Oceania, and other parts of Asia will take over the benefits after that.

Figure 5: Dependency Ratio in Different Regions, Medium-Fertility Variant (2020–2100)



Source: UNDESA (2019); Authors' compilation.

3.2 Digitization in Bangladesh: Trends and Potentials

3.2.1 Digital Infrastructures and Ecosystem

Fostering economic activities through digitization requires the establishment of the digital infrastructure for businesses and operations, the e-money transactions, a digital payment system, and online-based platforms for providing and facilitating services for the businesses.

Throughout the last decade, Bangladesh has experienced rapid growth in internet connectivity and mobile phone penetration. Furthermore, the country has also fostered the development of a support system for digital entrepreneurs that would attract the huge young population towards attaining the advantages of digitization and technologies.

Table 1 compares the trends of fixed-broadband usages in Bangladesh with its 12 neighboring countries including eight SAARC countries. It reveals that despite the lower number of broadband subscriptions per 100 inhabitants, the growth rate of broadband users has been the fastest among all the aforementioned countries. Bangladesh stood third among the SAARC countries after the Maldives and Sri Lanka in terms of fixed-broadband subscriptions in 2018, at 6.34 per 100 people. Among the top user countries, Viet Nam has the highest proportion of subscriptions of 13.6%, followed by Thailand with 13.2% and the Maldives with 10.4%. During the 2010–2018 period, Bangladesh experienced the highest (22.6 times) growth in fixed-broadband subscriptions among all peer countries, followed by Nepal with 12.8 times and Sri Lanka with 6.4 times.

Table 1: Fixed-Broadband Subscriptions per 100 Inhabitants

Country	2010	2011	2012	2013	2014	2015	2016	2017	2018
Afghanistan	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.05	0.04
Bangladesh	0.28	0.31	0.40	1.00	2.00	3.13	4.17	4.57	6.34
Bhutan	1.27	1.91	2.39	2.88	3.47	3.83	2.24	2.24	1.43
Cambodia	0.25	0.15	0.20	0.22	0.43	0.54	0.62	0.83	1.02
India	0.89	1.07	1.18	1.17	1.22	1.29	1.41	1.33	1.34
Malaysia	7.44	8.75	10.05	9.97	10.25	10.12	8.86	8.64	8.55
Maldives	4.25	4.64	4.55	4.90	4.56	5.09	6.16	7.36	10.37
Myanmar	0.05	0.04	0.04	0.05	0.05	0.06	0.17	0.21	0.24
Nepal	0.22	0.35	0.85	1.16	0.93	1.12	0.82	1.82	2.82
Pakistan	0.44	0.64	0.81	0.85	1.03	0.90	0.81	0.88	0.85
Sri Lanka	1.13	1.76	1.72	2.05	2.73	2.99	4.24	5.78	7.27
Thailand	4.84	5.77	6.66	7.62	7.95	9.07	10.47	11.86	13.24
Viet Nam	4.17	4.32	5.32	5.68	6.54	8.26	9.72	11.91	13.60

Source: International Telecommunication Union (2020); Authors' compilation.

Table 2 shows that Bangladesh attained 100% mobile/cellular telephone subscriptions in 2018. Though it lags behind most of its peer countries in terms of subscriptions, the rate of growth in mobile subscriptions in Bangladesh was remarkable at 118% during the 2010–2018 period. Among these peer countries, only Myanmar and Nepal had higher growth than Bangladesh over this period.

Table 2: Mobile/Cellular Telephone Subscriptions per 100 Inhabitants

Country	2010	2011	2012	2013	2014	2015	2016	2017	2018
Afghanistan	35.00	45.81	49.23	52.08	55.16	57.27	61.05	65.93	59.12
Bangladesh	46.03	56.52	64.36	76.30	82.10	84.08	86.08	94.53	100.24
Bhutan	57.52	69.84	79.95	76.64	86.86	92.84	94.80	98.00	93.26
Cambodia	56.95	94.61	129.26	134.86	133.90	134.33	126.32	116.01	119.49
India	60.94	71.49	68.32	69.20	72.86	76.41	85.15	87.32	86.94
Malaysia	120.03	127.96	142.16	145.93	150.43	145.70	141.65	136.12	134.53
Maldives	135.17	139.41	141.11	150.43	153.06	162.62	170.79	181.33	166.36
Myanmar	1.17	2.44	7.25	13.18	55.53	77.82	95.36	89.82	113.84
Nepal	34.04	49.39	61.54	79.36	85.56	101.85	117.81	130.63	139.45
Pakistan	55.28	59.39	64.16	66.79	69.51	63.13	67.03	69.51	72.56
Sri Lanka	85.68	89.81	94.16	98.32	106.42	114.31	122.72	133.47	142.65
Thailand	106.74	114.71	125.32	137.72	141.87	149.81	173.51	175.60	180.18
Viet Nam	126.83	143.26	146.63	136.34	148.45	129.83	128.79	126.87	147.20

Source: International Telecommunication Union (2020); Authors' compilation.

Along with fixed-broadband and mobile subscriptions, the advancement towards digitization is fostered by the mass-scale use of the internet in Bangladesh. According to Internet World Stats, Bangladesh is positioned ninth in the world in terms of internet users. The latest data reveal that 94.2 million people in Bangladesh used the internet in 2020. Though the penetration (i.e., the percentage of the population using the internet) remained lower at 57.2%, the annual average growth rate among internet users was very high at 49.5% per annum during the 2000–2020 period.

Table 3: Top 20 Internet User Countries (2020)

	Country	Total Users (in millions) in 2020	Percentage of Population Use of Internet	Annual Average Growth in Internet Users (2000–2020)
1	People's Rep. of China (PRC)	854.0	59.3	1.9
2	India	560.0	40.9	5.8
3	United States	313.3	94.7	0.1
4	Indonesia	171.3	62.6	4.5
5	Brazil	149.1	70.2	1.5
6	Nigeria	126.1	61.2	33.1
7	Japan	118.6	93.5	0.1
8	Russian Federation	116.4	79.7	1.9
9	**Bangladesh**	**94.2**	**57.2**	**49.5**
10	Mexico	88.0	66.5	1.7
11	Germany	79.1	94.4	0.1
12	Philippines	79.0	72.1	2.0
13	Turkey	69.1	81.9	1.8
14	Viet Nam	68.5	70.4	18.0
15	United Kingdom	63.5	93.6	0.2
16	Iran	67.6	80.5	14.2
17	France	60.4	92.6	0.3
18	Thailand	57.0	81.7	1.3
19	Italy	54.8	90.6	0.2
20	Egypt	49.2	48.1	5.7
TOP 20 Countries		**3,241.3**	**61.9**	**0.6**
Rest of the World		**1,332.9**	**52.0**	**0.6**
Total World		**4,574.2**	**58.7**	**0.6**

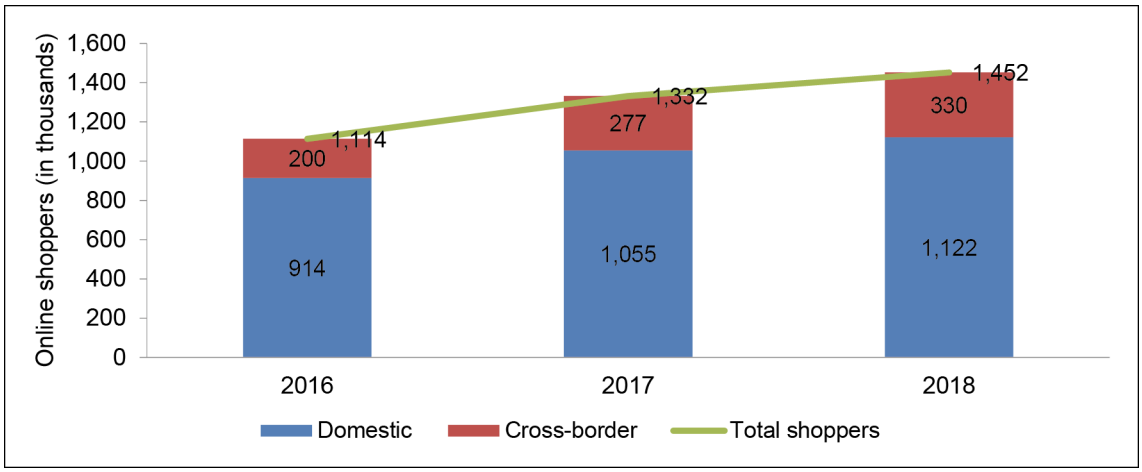
Source: Internet World Stats at https://www.internetworldstats.com/top20.htm. The source compiles data from the respective country's agencies, surveys, and also from standard global data sources like the International Telecommunication Union (ITU); Authors' compilation.

3.2.2 E-commerce and Digital Entrepreneurship

E-commerce is one of the core embedded parts of a digital economy. It refers to the economic activities of goods and services using online platforms. Over time, new avenues of e-commerce are opened to provide various products and innovative online services that connect mass consumers and suppliers in a virtual marketplace. Hence, in a way, it facilitates large-scale digital entrepreneurship, especially among the young population.

Globally, e-commerce and cross-border online businesses have been rising at a good pace. According to UNCTAD (2018), over 1.45 billion people shopped online in 2018, which was 9% higher than in 2017 and 30.3% higher than in 2016, as shown in Figure 6. The global value of e-commerce transactions increased to US$25.6 trillion in 2018, an 8% rise from 2017. The US, Japan, and the PRC have the highest e-commerce sales and share 55.4% of global sales. Category-wise, B2B (business-to-business) comprises around 83% of all e-commerce sales while B2C (business-to-consumer) makes up the rest.

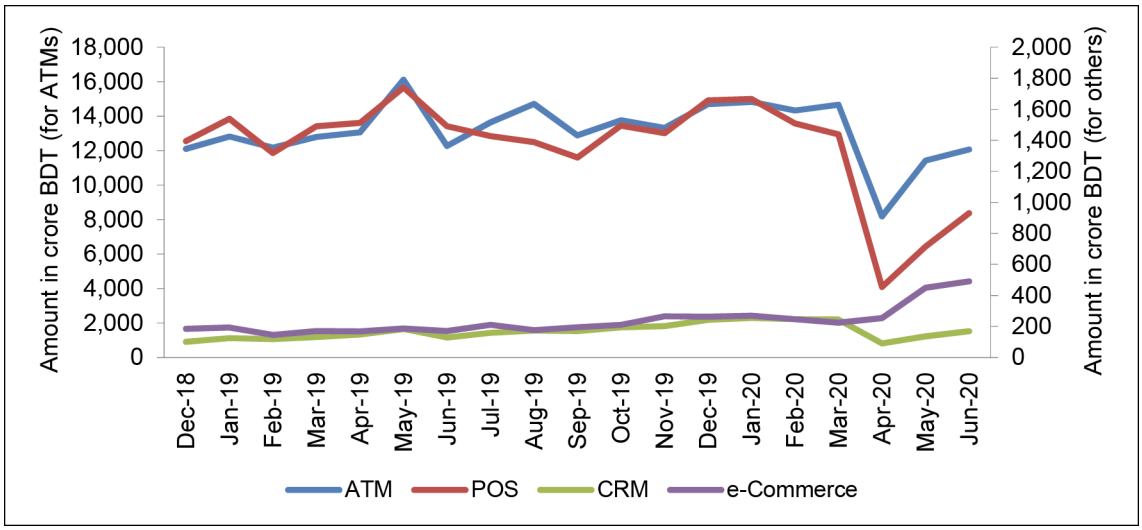
Figure 6: Global Online Shoppers (2016–2018)



Source: UNCTAD (2018); Authors' compilation.

In Bangladesh, e-commerce is in its early stage; however, the sales have been increasing and are yet to tap the fullest potential. Only 8% of internet users are internet shoppers, according to 2017 data (UNCTAD 2019). However, as the digitization process is shaping up, more infrastructural and regulatory support is being provided by the government and concerned organizations. E-commerce has thus been facilitated on a wider scale and people are getting more accustomed to online purchasing rather than the conventional physical visits to shops. As people are becoming financially educated to handle smart devices and digital payment systems, the prospect of e-commerce seems to be immense.

Figure 7: ATM, PoS, CRM, and e-Commerce Transaction Statistics by Cards



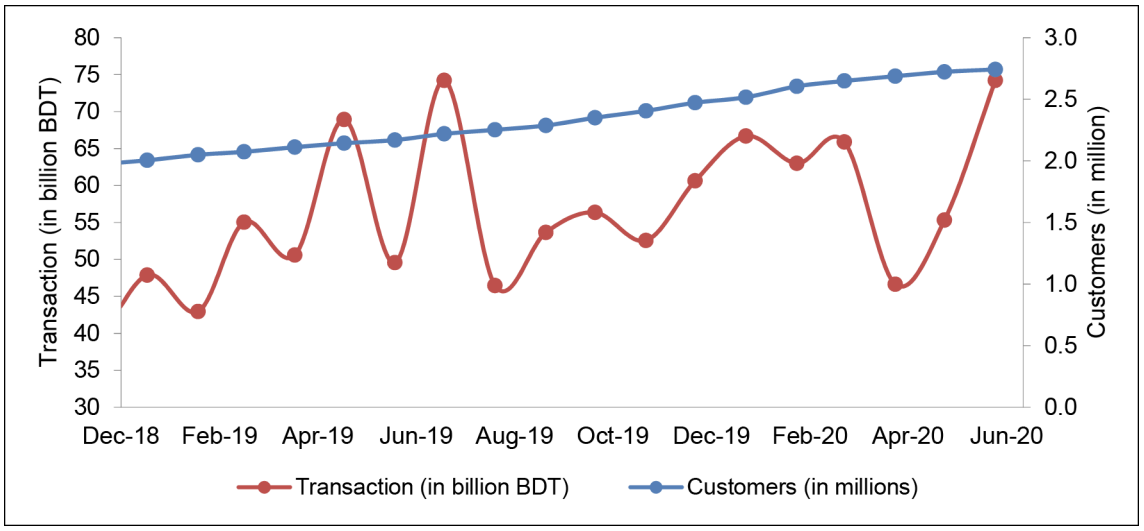
Note: ATM – Automated Teller Machine, POS – Point of Sale, CRM – Cash Recycling Machine.
Source: Bangladesh Bank (2020); Authors' compilation.

As Figure 7 depicts, the volume of e-commerce sales in Bangladesh using credit or debit cards has been gradually increasing, and in particular, the rate has risen remarkably during the lockdown era of COVID-19. As of June 2020, the total volume of e-commerce sales using cards had reached BDT491.4 crore equivalent to

US$58 million. Though the use of cards in ATMs, PoSs, and CRMs seemed to be an increasing trend up to December 2019, COVID-19 seems to have impacted the usage in the earlier phase until April 2020; after that, the usage increased again.

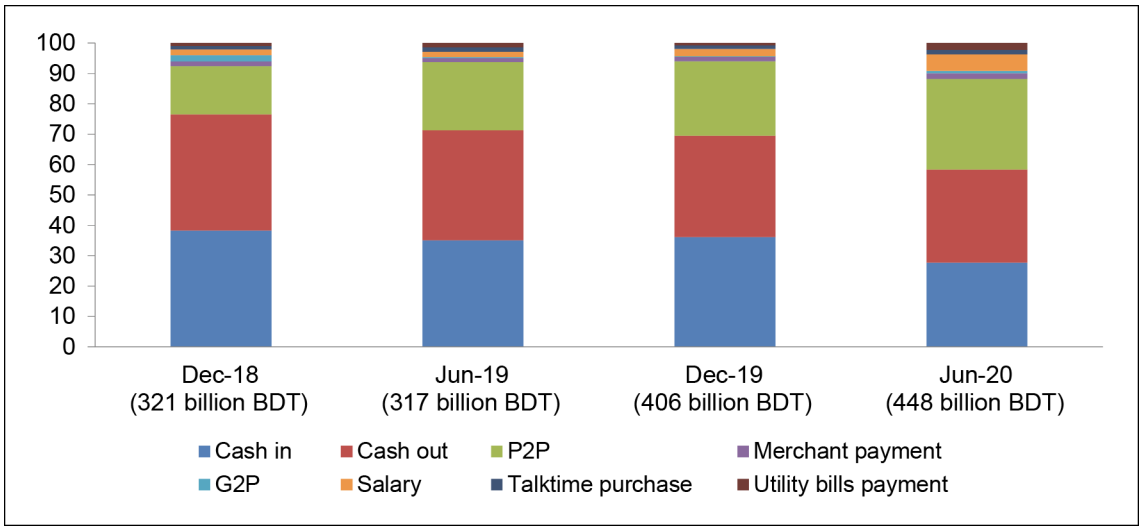
Banking plays a significant role in supporting digitization through an online payment system along with internet banking. The process of internet banking is experiencing a rising trend, as shown in Figure 8. Transactions through internet banking amounted to BDT38.0 billion in December 2018, which gradually increased and hit BDT74.2 billion in June 2020. During this period, the number of online banking customers also increased from 1.97 million to 2.74 million.

Figure 8: Internet Banking Trend in Bangladesh



Source: Bangladesh Bank (2020); Authors' compilation.

Figure 9: Transaction Shares of MFS Activities



Source: Bangladesh Bank (2020); Authors' compilation.

Besides the banks, mobile financial services (MFSs) play a major role in transforming the digital payment system. There is still a kind of oligopolistic market of MFSs but the market is under constant regulation and overseen by the central bank. As a result, the MFS activities have been growing faster than the digitization process has accelerated to the next level. According to the Bangladesh Bank's statistics, MFSs support an array of financial activities: cash in, cash out, merchant payments, person-to-person (P2P), government-to-person (G2P), salary disbursement, talktime purchase, and utility bills payment. Total transactions through MFSs increased from BDT321 billion in December 2018 to BDT448 billion in June 2020, an increase of around 40%. Figure 9 illustrates that over time, shares of P2P, salary disbursements, utility payments, merchant payments, and talktime purchases increased while the shares of cash in, cash out, and G2P decreased. In June 2020, cash out, P2P, and cash in hand the highest shares with 30.0%, 29.3%, and 27.2%, respectively. In contrast, G2P, talktime purchase, and merchant payments had the lowest shares with 0.8%, 1.4%, and 1.8%, respectively.

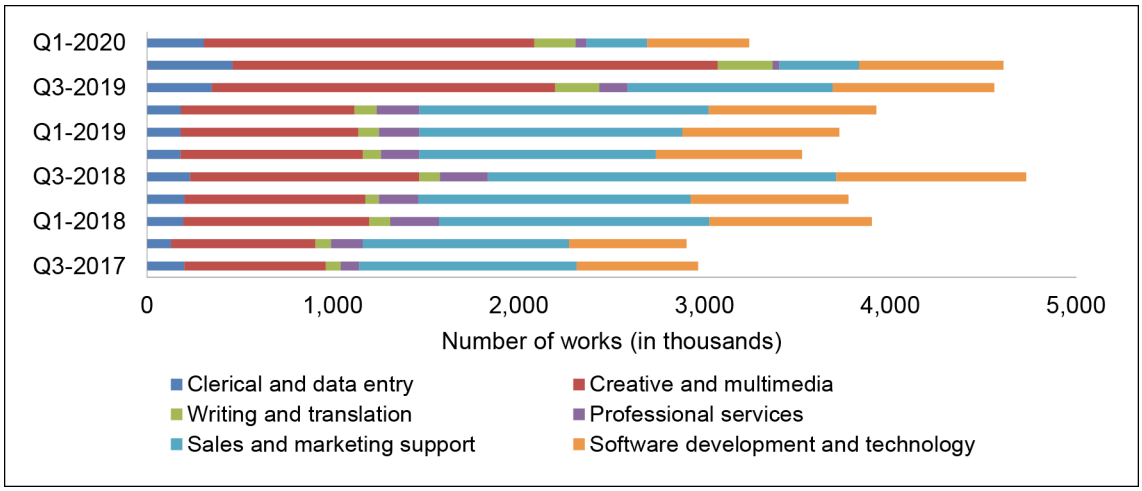
3.2.3 Professional Settings (Freelancing and IT-skilled Jobs)

Digitization not only energizes entrepreneurship and extends business opportunities in an economy, but also opens up the colossal horizon of the online job market for the technologically skilled labor force both at home and abroad. This is exclusively crucial for countries like Bangladesh that have a large number of young people entering the labor market each year.

The global online outsourcing market has been expanding and countries with higher labor costs are hiring low-cost laborers from developing countries to do several sets of jobs online. The jobs comprise software development, creative and multimedia work, sales and marketing support, especially in the health and education sectors, data entry, tax preparation, search engine optimization, and so on (Chakravorti, Tunnard, and Chaturvedi 2015; Van Ark 2016). As a result, online freelancing jobs are becoming popular, especially among the tech-savvy young generation, students, females, and the unemployed. Thus, freelancing has become a major solution to the unemployment problem of the country with such a large labor force. The fast-track digitization comprising of mass-scale internet access (both in urban and rural areas) accompanied by the government and non-government's initiatives have promoted freelancing jobs and facilitated the expansion of the online job markets. As an outcome, Bangladesh has already emerged as the second-largest supplier of online labor after India with a global share of 16% of freelance workers (Oxford Internet Institute 2020). According to the ICT Division of the Ministry of Posts, Telecommunications, and Information Technology of the government of Bangladesh, there are around 650,000 registered freelancers in the country, of whom about 500,000 are actively delivering on a regular basis. Though the number of freelancers is a small share of the total labor force in Bangladesh, the untapped potential in the global market may encourage more young laborers to enter these online jobs. On average, they earn US$100 million per annum, which is expected to rise at a good rate in the near future. The government has already taken various measures, including the establishment of tech cities, to support these freelancing jobs on a large scale.

Figure 10 reveals the IT outsourcing works along with their different areas accomplished by Bangladeshi freelancers over the period 2017Q3 to 2020Q1. It indicates a seemingly growing trend of outsourcing works (by Bangladeshi freelancers) until the end of 2019. COVID-19 may be having an adverse impact as the work volume decreased in the first quarter of 2020.

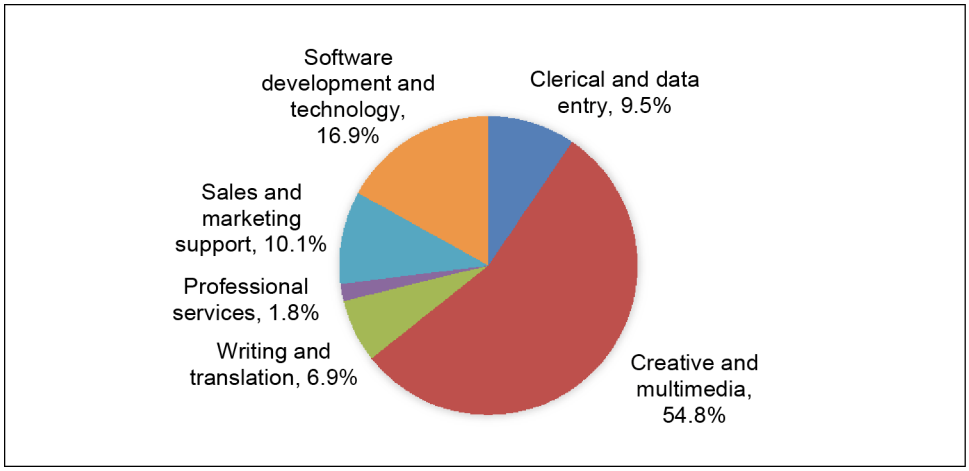
Figure 10: Data of IT Outsourcing by Bangladesh



Source: Oxford Internet Institute (2020); Authors' compilation.

In terms of job category, it is evident that over time, Bangladeshi freelancers are deployed more in *creative and multimedia* jobs while the share of *sales and marketing support* jobs has declined. According to the latest available quarter's data (i.e., 2020Q1), freelancing jobs in *creative and multimedia* comprise 54.8% of all freelancing outsourcing jobs. As shown in Figure 11, it is followed by *software development and technology* with 16.9%, *sales and marketing support* with 10.1%, and *clerical and data entry* with 9.5%.

Figure 11: Share of Various Freelancing jobs by Bangladeshi workers (in 2020Q1)



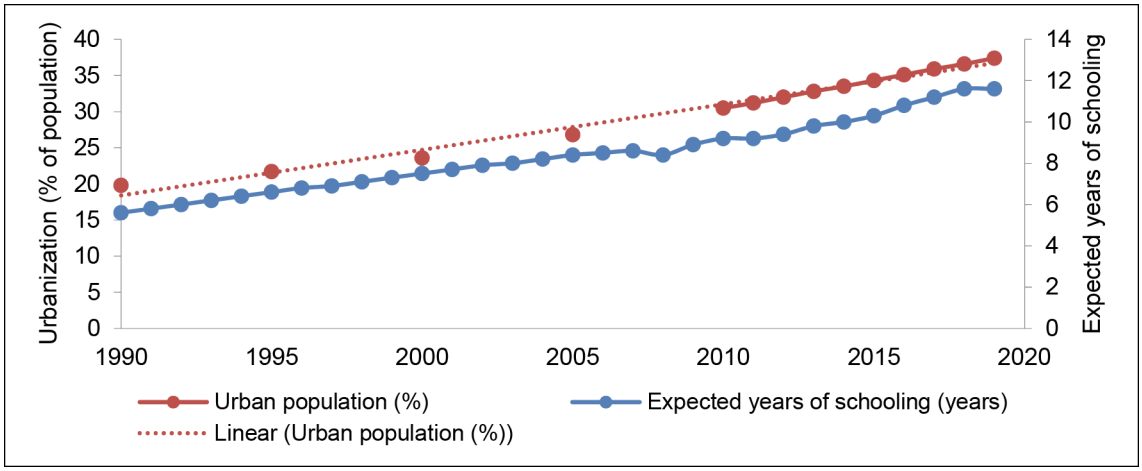
Source: Oxford Internet Institute (2020).

3.3 Key Factors Facilitating Demographic Transitions and Digitization

Some key factors are pivotal in facilitating both the demographic transition and digitization, such as faster urbanization, education, and structural transformation (i.e., moving away from agriculture towards industry and service sectors). Figure 12

shows that the urbanization rate almost doubled from 19.8% in 1990 to 37.4% in 2019. Moreover, the expected years of schooling (i.e., the total years of schooling a child can expect to receive throughout his/her life under the prevailing context when he/she enters into the school) also rose from 5.6 years in 1990 to 11.6 years in 2019, revealing that an educated young population is getting prepared to attain the demographic advantages.

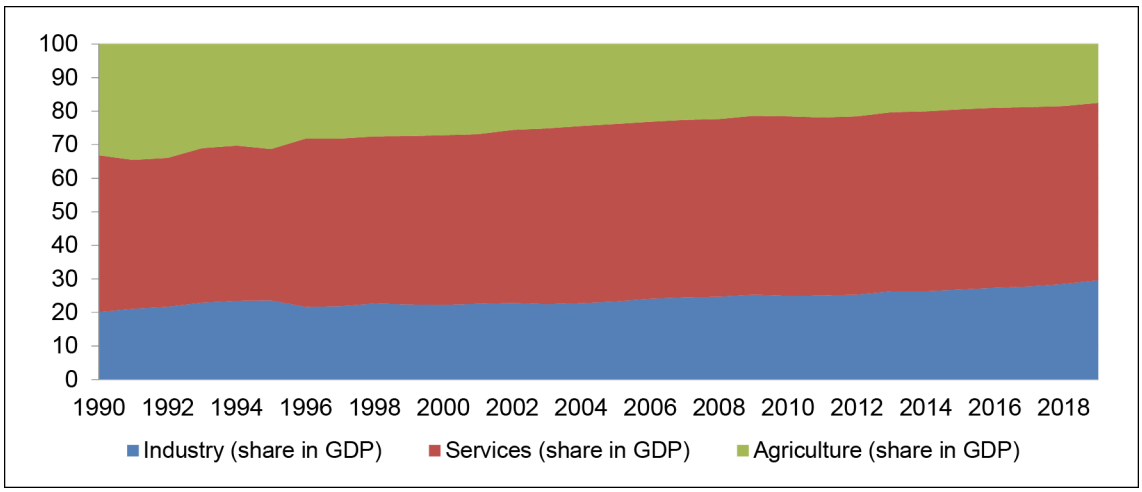
Figure 12: Urbanization and Expected Years of Schooling Trends (1990–2019)



Source: UNESCO (2020); UNDESA (2019).

Figure 13 depicts a significant structural change in Bangladesh's economy over the 1990–2019 period. During this time, the share of agriculture declined from 33.1% to 17.5% while the industry sector's share increased from 20.2% to 29.6%, and the service sector's share from 46.7% to 52.9%.

Figure 13: Economic Structural Changes (1990–2019)



Source: World Development Indicators, World Bank (2020).

4. METHODOLOGY

This study uses two distinct methodologies to examine three research questions. To understand how the demographic transitions (reflected through the higher labor participation over time) are fostering the digitization process in Bangladesh, and how the digitization, in aggregate, leads towards faster economic growth, a three-stage least squares (3SLS) simultaneous equation model is adopted, while to identify whether young people's adoption of digitization and technological innovation makes them more productive than the older age groups, this study applies *labor elasticities of productivity* measures as explained in Section 4.2.

4.1 The Three-Stage Least Squares (3SLS) Model

In establishing the causal linkage to estimate the impact of demographic dividend on the economic growth of Bangladesh through using the digitization channels, a system of equations using the simultaneous equation estimation modeling approach seems to be most appropriate. As the demographic dividends and digitization are found as the endogenous variables to economic growth, to comprise the cross-equation error correlation owing to the unobserved characteristics normally encountered among the dependent variables, a three-stage least squares (3SLS) approach can be used.

In this connection, an ordinary least squares estimation (OLS), two-stage least squares (2SLS), or seemingly unrelated regression (SURE) would most likely generate biased and inconsistent estimations of parameters because of the unaccounted for correlation among the endogenous dependent variables along with the error terms of these equations. A 3SLS model overcomes these limitations as its estimates are calculated by assessing a set of linear (or nonlinear) equations with the cross-equation constraints but considering a diagonal covariance matrix of the error terms across these equations (Zellner and Theil 1962). Hence, a 3SLS model would result in more efficient parameter estimates than other simultaneous equation estimation models like the SURE and 2SLS.

The 3SLS estimation approach comprises three consecutive stages:

1. Initially, the 2SLS estimates are obtained by regressing each endogenous variable (i.e., demographic dividends, and digitization in this study) on all exogenous variables. The regression-predicted values are used as instruments to estimate the 2SLS parameter estimates using the OLS.
2. In the second stage, the optimal instrument, or weighting matrix, is computed by using the estimated residuals. The contemporaneous (cross-equation) variance-covariance matrix of the error terms is determined by using the 2SLS parameter estimates to compute residuals.
3. In the last stage, the contemporaneous (cross-equation) variance-covariance matrix of the disturbances obtained from the previous stage is used to obtain the transformation of the original variables; and the generalized least squares (GLS) method is applied to estimate the 3SLS model parameters.

For this study, structural equation and system equations are considered as follows:

$$lnGDP_t = \gamma_0 + \gamma_1 lnCapital_t + \gamma_2 lnProductivity_t + \gamma_3 Internet_t + \gamma_4 Dep\_ratio_t + \epsilon_t \quad (4)$$

$$Internet_t = \alpha_0 + \alpha_1 labor\_rate_t + \alpha_2 urban\_rate_t + \alpha_3 lnProductivity_t + \alpha_4 Mobile\_penet_t + \alpha_5 Rural\_electricity_t + \varepsilon_{1t} \quad (7)$$

$$Dep\_ratio_t = \beta_0 + \beta_1 HDI_t + \beta_2 urban\_rate_t + \beta_2 labor\_female_t + \varepsilon_{2t} \quad (6)$$

where GDP_t : GDP at constant 2010 US$ at time t

$Capital_t$: Gross Capital formation at constant 2010 US$ at time t

$Productivity_t$: Labor productivity measured in income per worker at time t

$Internet_t$: Internet users per 100 people at time t

Dep_ratio_t : Dependency ratio (i.e., population aged below 19 and above 65/ population aged 20–64) at time t

$labor\_rate_t$: Labor participation rate at time t

$urban\_rate_t$: Urban population to total population at time t

$Mobile\_penet_t$: Mobile penetration (per 100 people) rate at time t

$Rural\_electricity_t$: Percentage of rural population having access to electricity at time t

HDI_t : Human Development Index score (developed by the UNDP) at time t

$labor\_female_t$: Rate of female participation in the labor force at time t

α, β, and γ are the parameters of estimates

ε, and ϵ are error terms

Here, the demographic dividends (presented by the dependency ratio) and digitization (presented by the internet user population) are found as the endogenous variables to the economic growth (presented by the GDP). The rest of the variables are exogenous to the model.

Hence, the estimation process follows the following stages:

1. OLS is applied to Equations (5) and (6) and obtains the predicted values of $\widehat{Internet_t}$ and $\widehat{Dep\_ratio_t}$.
2. The values of $\widehat{Internet_t}$ and $\widehat{Dep\_ratio_t}$ are substituted into the right-hand side of the structural equation (i.e., Equation (1)), and OLS is applied to this transformed equation. Structural parameters of the models (i.e., α and β values) are estimated using 2SLS, and are subsequently used for the estimations of the error terms of Equations (5) and (6). If the sample size is *n*, then the variance-covariance of the estimated error terms is calculated as follows:

$$\widehat{\sigma_{\varepsilon_1}}^2 = \frac{\sum_{i=1}^{n} {\varepsilon_{1i}}^2}{n}$$

$$\widehat{\sigma_{\varepsilon_2}}^2 = \frac{\sum_{i=1}^{n} {\varepsilon_{2i}}^2}{n}$$

$$\widehat{\sigma_{\varepsilon_1\varepsilon_2}} = \widehat{\sigma_{\varepsilon_2\varepsilon_1}} = \frac{\sum_{i=1}^{n} \varepsilon_{i1}\varepsilon_{i2}}{n}$$

Hence, the variance-covariance matrix of the error terms is as follows:

$$\begin{vmatrix} \widehat{\sigma_{\varepsilon_1}}^2 & \widehat{\sigma_{\varepsilon_1\varepsilon_2}} \\ \widehat{\sigma_{\varepsilon_2\varepsilon_1}} & \widehat{\sigma_{\varepsilon_2}}^2 \end{vmatrix} = \begin{vmatrix} \frac{\sum_{i=1}^{n} \varepsilon_{1i}{}^2}{n} & \frac{\sum_{i=1}^{n} \varepsilon_{i1}\varepsilon_{i2}}{n} \\ \frac{\sum_{i=1}^{n} \varepsilon_{i1}\varepsilon_{i2}}{n} & \frac{\sum_{i=1}^{n} \varepsilon_{2i}{}^2}{n} \end{vmatrix}$$

3. Finally, the GLS method is applied to get the final estimations of all equations using the transformed value resulting from the above variance-covariance of the error terms.

4.2 Labor Elasticities of Productivity

To estimate whether or not the adoption of digitization results into higher productivity for the young labor force as compared to the others, this study adopts the productivity sharing approach to calculate the labor elasticities of productivity separately for these two working groups (i.e., millennials aged 20–39 and others aged 40–65).

Labor elasticity of the young laborers' productivity at time *t* is calculated as,

$$\in_{y,t} = \frac{\%\ change\ in \frac{Y}{L}\ between\ time\ t\ and\ (t-1)}{\%\ change\ in\ the\ number\ of\ laborers\ aged\ (20-39)\ between\ time\ t\ and\ (t-1)} \quad (7)$$

Similarly, the labor elasticity of the others' productivity at time *t* is calculated as,

$$\in_{o,t} = \frac{\%\ change\ in \frac{Y}{L}\ between\ time\ t\ and\ (t-1)}{\%\ change\ in\ the\ number\ of\ laborers\ aged\ (40-65)\ between\ time\ t\ and\ (t-1)} \quad (8)$$

5. DESCRIPTION OF DATA

For empirical analysis, data on required variables are collected from various sources for the 1990–2019 period. Data on GDP in constant 2010 US$, gross fixed capital formation (in constant 2010 US$), labor force participation rate (i.e., number of laborers as % of total population aged 15–64), labor force participation rate of females (i.e., number of female laborers as % of total females aged 15–64), urbanization rate (i.e., the urban population as % of the total population), mobile/cellular subscriptions, and access to electricity of the rural population (% of rural population) are extracted from the World Bank's World Development Indicators data set. Human Development Index score data are collected from the United Nations Development Program's website. Data on productivity (measured in 2010 constant US$ per worker) and population and labor under different age groups are extracted from the ILO modeled estimates of the United Nations Department of Economics and Social Affairs (UNDESA). For the data on internet users, two data sets are used: World Development Indicators and Internet World Stats.

6. RESULTS AND FINDINGS

6.1 Summary Statistics

Table 4 shows the summary statistics of the variables used for modeling. The phenomenal economic growth has been evident from the data as Bangladesh experienced fivefold growth (i.e., from US$42.4 billion to US$210.0 billion) over the three decades between 1990 and 2019. Notably, the pace of growth increased over time. In the first decade of the period referred to, 150% growth was achieved, while in the second and third decades, the growths were 163% and 182%, respectively. This has significant implications in this study in perceiving the plausible nexus between the faster digitization and growth in recent years.

The capital accumulation also experienced a remarkable tenfold increase from US$6.3 billion to US$65.3 billion during the 1990–2019 period. The share of capital in GDP also increased over this time from around 15% to 31%. The higher standard deviation refers to the higher variability among the capital's data during this period.

Table 4: Summary Statistics of the Variables (1990–2019)

Variable	Mean	Std. Dev.	Min	Max
GDP (in billion US$)	98.00	48.30	42.40	210.00
Capital (in billion US$)	24.80	17.20	6.31	65.30
Labor force participation rate (in %)	59.01	0.80	58.53	61.41
Labor force participation rate, female (in %)	29.88	3.83	25.41	38.39
Productivity (in US$)	1,946.90	609.50	1,262.69	3,301.06
Urban population (% of total population)	27.32	5.51	19.81	37.41
Access to electricity in rural areas (% population)	32.64	25.11	2.50	85.00
HDI score	0.50	0.07	0.39	0.62
Dependency ratio	1.00	0.17	0.72	1.28
Internet users (% population)	6.52	13.58	0.00	57.75
Mobile penetration (in %)	30.42	38.18	0.00	107.47

Source: Authors' compilation.

The labor force participation rate was relatively stable at around 60% during the reference period with a very small standard deviation. Despite this steady participation rate, the proportion of the labor force aged 15–64 increased quite rapidly from 33.2 million in 1990 to 67.7 million in 2019, reflecting the faster demographic transition. Interestingly, the female participation rate increased from 25.4% to 38.3% during the 1990–2019 period. Workers' productivity steadily increased from US$1263 per worker to US$3301 per worker. The variability of productivity data is also relatively lower.

The transition of the rural and urban settings should have notable implications both for digitization and the economic growth of the country. The urbanization rate doubled from 19.8% to 37.4% during the 1990–2019 period. The variability of urbanization was also on the lower side, implying that the process remained steady over time. Yet, the rising urbanization does not imply that the living standard of the rural population has been degraded, rather that they are also enjoying the outcomes of the faster economic growth of the country. There have been revolutionary attainments in access to electricity in rural areas in the last three decades. In 1990, only 2.5% of the rural population had access to electricity, which increased to 85.0% in 2019. As is evident, the variability of this variable remains much higher.

Bangladesh has also achieved great success in its socio-economic context in recent times. The life expectancy, education, and standard of living have improved markedly, which is evident in the Human Development Index score. The HDI score gradually increased from 0.39 in 1990 to 0.62 in 2019. This may have been reflected in the dependency ratio as the ratio dropped from 1.28 to 0.72 during this period.

As mentioned earlier, the digitization process has also moved faster in Bangladesh, especially over the last decade. The number of internet users spiked from 3.7 million (i.e., 2.5 persons per 100 people) in 2010 to 94.2 million in 2019 (i.e., 57.8 persons per 100 people). The number of mobile subscribers also rose from 67.9 million (i.e., 46 per 100 people) in 2010 to 175.4 million (i.e., 107 per 100 people) in 2019.

6.2 Estimations of the 3SLS Model

Table 5 highlights the findings from the 3SLS model adopted for this study to link the impacts of demographic dividend and digitization on the economic growth of Bangladesh.

Table 5: Results of the 3SLS Estimations

Dependent Var.	Explanatory Var.	Coefficient	Standard Error	P-value
lnGDP				
	lnCapital	0.245***	0.070	0.00
	lnProductivity	0.579***	0.039	0.00
	Internet	0.001***	0.0002	0.00
	Dep_ratio	–0.723***	0.257	0.01
Internet				
	Labor_rate	9.029***	1.603	0.00
	urban_rate	–7.238*	4.235	0.09
	lnProductivity	128.717*	85.146	0.10
	Mobile_penet	14.867*	9.111	0.10
	Rural_electricity	0.117	0.230	0.61
Dep_ratio				
	HDI	–2.471***	0.134	0.00
	urban_rate	–0.004*	0.002	0.10
	labor_female	0.007***	0.001	0.00

Source: Authors' estimation.

6.2.1 Economic Growth Determinants

Estimations reveal that economic growth is significantly influenced by both digitization and the demographic transition. The 3SLS model results indicate that for an increase of 1 percentage point of internet users per 100 people, the GDP would increase by 0.001%, *ceteris paribus*. The coefficient is statistically significant at a 99% confidence level. This is quite evident as digitization, particularly in recent times, has played a noteworthy role in excavating new opportunities in various sectors of the economy, especially in the service sector. Moreover, the demographic structure, represented by the dependency ratio, also signifies that the higher the working-age population (i.e., lower dependency ratio), the higher the economic growth will be. The results indicate that a 10-basis point decrease in the dependency ratio, *ceteris paribus*, would increase the GDP by 7.2%, on average.

In addition, economic growth is also positively impacted by two key endowments of the growth model, i.e., accumulated capital and labor productivity. The results show that a 1% increase in capital formation would increase the GDP by 0.25%, on average, *ceteris paribus*. Estimation also depicts that a 1% increase in laborers' productivity would result in a 0.58% growth.

The model also explains the key driving forces of two endogenous variables, i.e., digitization and dependency ratio.

6.2.2 Determinants of Digitization

Digitization, represented by internet users per 100 people, is positively influenced by the labor participation rate, workers' productivity, and mobile penetration. Presumably, more people in the labor force would prompt the usage of digitization since they remain capable of maintaining the cost of using the internet and other digital platforms. The finding implies that a 1 percentage point increase in the labor participation rate, *ceteris paribus*, would lead to an increase in internet users by 9.0 percentage points. The estimation is significant at a 99% confidence level.

Findings also reveal that a 1% increase in laborers' productivity, *ceteris paribus*, would increase the usage of the internet by 1.29 percentage points. The estimation result is significant at a 90% confidence level. This may be the case for two reasons: i) higher labor productivity is linked with greater use of technology; and ii) higher labor productivity leads to a higher income for laborers, who can then spend more on digitized services and usage of the internet.

The finding implies that a 1 percentage point increase in mobile penetration, *ceteris paribus*, would lead to an increase in internet users by 14.9 percentage points. The estimation is significant at a 90% confidence level. A mobile is the most convenient pivotal instrument for using the internet. The penetration of mobiles has already been on the higher side with 107 mobiles subscribed for every 100 people. Now, the usage of the internet may experience an increasing trend and may gradually smooth out in the future.

Rural people's access to electricity is used as a proxy for rural development. Findings show that it is also estimated to have a positive association with digitization, though the coefficient has not been statistically significant.

The results imply that the urbanization rate has negatively impacted the use of the internet, i.e., the more people migrate from rural to urban areas, the more the internet usage rate goes down. Estimation reveals that a 1 percentage point increase in the urbanization rate, *ceteris paribus*, would lead to a decrease in internet users by 7.2 percentage points. The estimation is significant at a 90% confidence level. It may be plausible as the migration to a new environment costs a lot and urban life is usually competitive and expensive. To cut down the cost, low-income migrants may not be encouraged to use the internet, which remains costlier in this SAARC region. The average cost for a 1 Gigabyte internet package in Bangladesh is around US$0.70, higher than that in neighboring India, Sri Lanka, and Pakistan as shown in Table 6.

Table 6: Average Cost of 1 GB Internet in 2020

Global Rank	Country	Average Price of 1GB (in USD)
1	India	0.09
8	Sri Lanka	0.51
10	Viet Nam	0.57
12	PRC	0.61
17	Pakistan	0.69
19	Bangladesh	0.70
28	Myanmar	0.78
31	Nepal	0.86
47	Malaysia	1.12
49	Bhutan	1.16
51	Thailand	1.23
66	Cambodia	1.50
67	Afghanistan	1.55
134	Maldives	3.88

Source: https://www.cable.co.uk/mobiles/worldwide-data-pricing/; Authors' compilation.

6.2.3 Determinants of Dependency Ratio

Three exogenous variables are tested as the determinants of the dependency ratio, which proxies the demographic transition in this 3SLS model.

The Human Development Index is found to have a significant impact on the dependency ratio. The result implies that a 10-basis point increase in HDI score, *ceteris paribus*, would decrease the dependency ratio by 0.24 percentage points. The estimation is significant at a 99% confidence level. It would be rational to believe that with the progress in life expectancy, education level, and social indicators, people usually focus on maintaining their standard of living. As a consequence, the birth rate drops in one time frame, and eventually, the dependency ratio drops for the next time frame.

Urbanization is found to have a negative effect on the dependency ratio, implying that as more people move from rural to urban areas, the share of the working population should increase. Life in urban areas is more competitive and expensive. Hence, to support livelihoods, a greater proportion of people join the workforce, and the dependency ratio comes down. The impact is, however, minimal according to the estimation shown in Table 6. It shows that an increase of 1 percentage point in urbanization, *ceteris paribus*, would result in a 0.4-basis point decline in the dependency ratio. The estimation is significant at a 90% confidence level.

The female participation rate in the labor force, however, is found to have a positive association with the dependency ratio. This is an interesting aspect of this demographic transition. On the one hand, if a female member joins the labor force, the probability of having children usually goes down as creating a good balance between the family (i.e., children's grooming) and employment becomes difficult. On the flip side, a female member taking a job also indicates that the family is sufficiently well-off in terms of income to support a greater number of children. Hence, there is a probable implication of seeing the dependency ratio rise as female participation in the labor market increases. The estimation presented in Table 6 implies that an increase of 1 percentage point of the female participation rate in the labor force, *ceteris paribus*, would result in a 0.7-basis point increase in the dependency ratio. The estimation is significant at a 99% confidence level.

6.2.4 Model's Robustness

The model's robustness is also tested, and the findings are presented in Table 7. It shows that all three equations have very high R-square values, which indicates that the model is well fitted for the variables used. The values of chi-square are also high enough to affirm the robustness of the model. Root mean square error (RMSE) represents the variance of the residuals. The lower the value of RMSE, the more accurately the model can predict the responses. Bearing this in mind, the RMSE values of this model show very low values for economic growth and demographic transition equations. Hence, the model seems to fit well in every aspect.

Table 7: Robustness of the Model

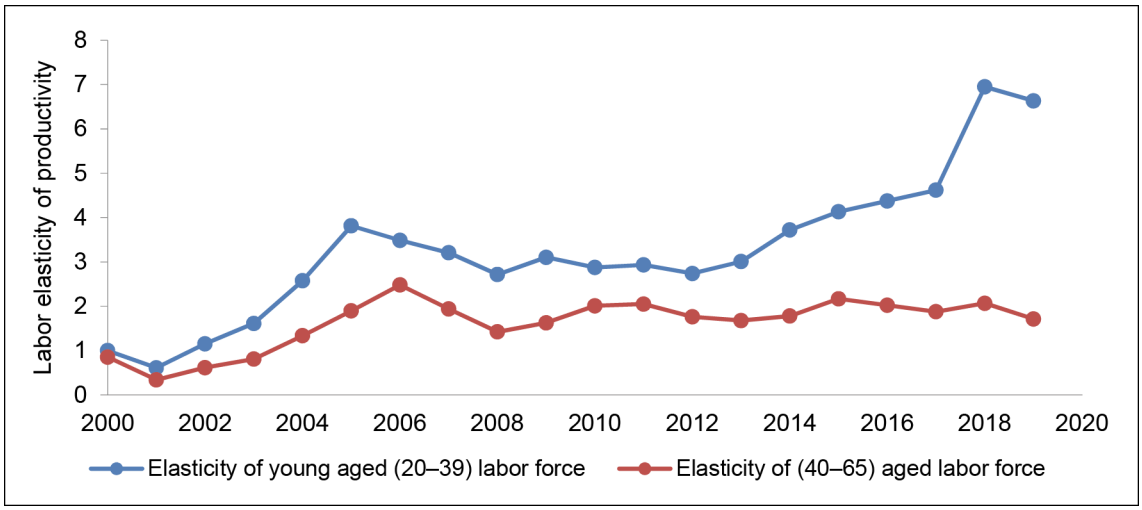
Equation	Observations	Parms	RMSE	R-sq	chi2
lnGDP	30	4	0.006568	0.9998	155,144.3
Internet	30	5	3.673195	0.9244	369.11
Dep_ratio	30	3	0.00686	0.9983	17,786.63

Source: Authors' estimation.

6.3 Calculation of the Elasticities

Labor elasticities of productivity are calculated to understand if the adoption of digitization leads to higher productivity among the young than the other working population. Using Equations (7) and (8), the elasticities of the two groups are calculated. The results depicted in Figure 14 show that between 2000 and 2019, the labor elasticity of productivity of the young saw a rising trend as against the seemingly constant elasticity of the 40- to 65-year-old labor group. After 2012, the elasticity of the young gained marked momentum and rose from 2.93 to 6.63 over the 2012–2019 period. During the same period, the elasticity of the other group hovered between 1.76 and 1.71.

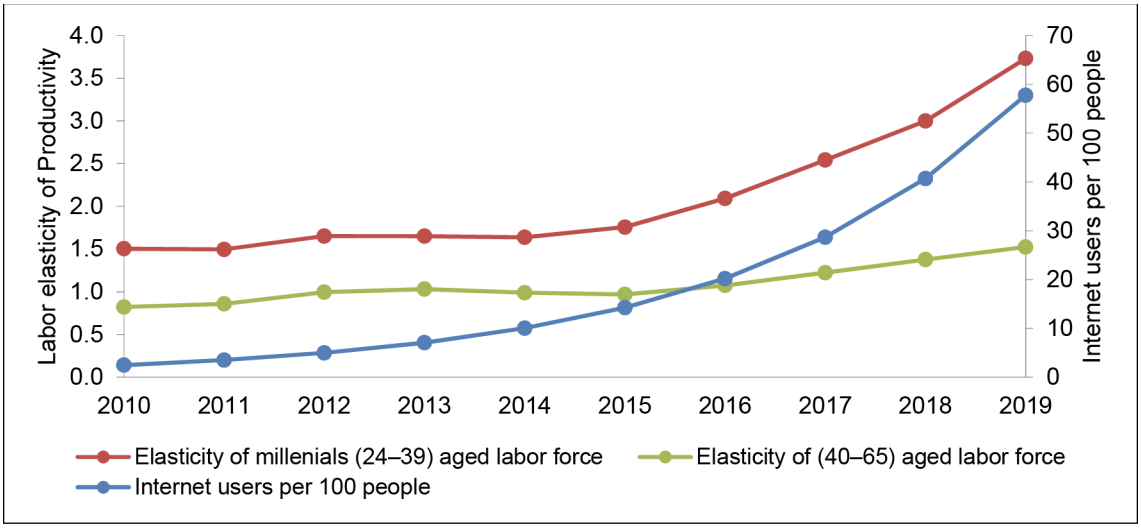
Figure 14: Labor Elasticities of Young (20–39) and Other -Aged Working Groups



Source: World Development Indicators (2020); UNDESA (2019).

Nevertheless, the question comes about as to how the different usages of the internet can be distinguished based on the age groups and how the pattern could be linked with the level of labor productivity. It might be easily analyzed if the data on age-based productivities were available. Since such data are not explicitly available, this study takes an indirect approach to establish the link. The correlations between the aggregated internet penetration and the labor elasticity of productivity are calculated for two age groups of the labor force. The higher the correlation, the greater the impact of digitization on productivity that is assumed for that segment of the labor force. From earlier analyses, it is evident that the digitization process has seen a momentous acceleration in Bangladesh, largely in very recent years. The number of internet users per 100 people increased from 10.0 to 57.8 just over the five years from 2014 to 2019. The elasticity also rose sharply for the 20- to 39-year-old labor force at the same time, as illustrated in Figure 15. The correlation between the labor elasticity of productivity and internet users per 100 people throughout 2000–2019 is also found to be higher (with a correlation coefficient of 84.8) for the 20- to 39-year-old labor force than for the others (with a correlation coefficient of 74.8), indicating that a close association exists between digitization and the productivity of millennials.

Figure 15: Digitization and Labor Elasticities of Productivity (Young and Other Groups)



Source: Authors' calculation.

7. SUMMARY, POLICY SUGGESTIONS, AND CONCLUSION

This study has been comprehensive in its approach to understanding the links between the demographic dividends, digital innovation, and economic growth of Bangladesh, which has been attaining reasonable success in all these factors (i.e., digitization, demographic transition, and economic growth). With the conceptual framework and empirical evidence, it explains how the digitization process can be accelerated with the involvement of the young labor force and the government's support in developing digital infrastructures and regulations. Furthermore, this study reveals the marked improvement in the younger labor force's productivity owing to the rapid adoption of digitization. Finally, it uses the 3SLS simultaneous equation estimation model to

explore how and to what extent the digitization and demographic transition lead towards faster economic growth in Bangladesh.

Bangladesh entered the demographic dividend phase in the early 2000s. The dependency ratio started falling after that and the trend, according to the UNDP, will continue until 2040 when the ratio will come to its lowest. Data reveal that despite some challenges from other regions of the world, Bangladesh will still be able to extract higher probable gains from the demographic transition than the rest of the regions until 2070 provided that a proper strategic framework is planned and human and other resources are deployed and facilitated optimally and efficiently.

Moreover, the digitization process in Bangladesh has moved at an outstanding pace in recent times, encompassing mass-scale digital infrastructure for businesses and operations, the e-money transaction, a digital payment system, and online-based platforms for providing and facilitating services for businesses. Despite the lower number of broadband subscriptions per 100 inhabitants, the growth rate of broadband users has been the fastest among all peer nations. The progression towards digitization is fostered by the accelerated use of the internet in Bangladesh as the country was ranked ninth in the world in terms of internet users in 2020. Yet, there is still enormous untapped potential since the internet penetration is only about 57%.

E-commerce has been getting popular and people are accustoming themselves to this new digitalized business ecosystem. Usage of ATMs and PoSs has been gradually increasing. Increased transactions through internet banking and MFSs also play a crucial role in taking the digital payment system to the next level of comfort.

Digitization not only instigates the entrepreneurship and extended business opportunities of an economy but also creates the massive openings of the online job market for the technologically skilled labor force. Online freelancing jobs are becoming popular, especially among the tech-savvy young generation, students, females, and the unemployed. Thus, freelancing has become a big solution to the unemployment problem of the country with such a large labor force. Bangladesh has already been ranked as the second-largest supplier of online labor after India with a global share of 16% of freelance workers.

Application of the 3SLS model estimates that economic growth is significantly influenced by both digitization and the demographic transition. Results reveal that with an increase of 1 percentage point of internet users (per 100 people), the GDP would increase by 0.001%, *ceteris paribus*, while a 10-basis point decrease in the dependency ratio would increase the GDP by 7.2%, on average. The key driving factors for digitization are the labor participation rate, workers' productivity, and mobile penetration. The urbanization rate, however, appears to be an adverse factor to the rise in internet users. Presumably, the low-income migrants (i.e., from rural to urban areas) usually find it challenging to cope with the new competitive and expensive environment and hence may not be encouraged to use the costlier internet. Rural development is also found to have a positive impact on digitization.

Estimations imply that the Human Development Index score and urbanization rate have significant negative impacts on the dependency ratio, while female participation in the labor force has a positive impact on it.

Based on the findings, the study identifies several policy areas that need to focus on overcoming the challenges of digitization and maximizing the untapped potentials of digitization and demographic dividends in attaining higher economic growth.

i. **Infrastructure:** Local governments have been playing a pivotal role in expanding the necessary public services through Union Digital Centers (i.e., the smallest tier of local government) and thereby strengthening the e-government policies (Government of Bangladesh, ICT Division 2019). To reinforce the process, more community digital centers, telecenters, and hubs at the rural grass-roots level could be established to provide constant multifaceted support through skilled manpower. Post offices can be renovated with state-of-the-art technologies to ease the monetary and financial transactions and to provide courier services that may be crucial for e-commerce development as well.

ii. **Payment system modernization:** Cashless transactions are a prime precondition of a modern digitized payment system. Encouraging people to use cards instead of cash in their daily transactions may need substantial incentives for the users. Lowering the costs of operation on debit and credit cards is of utmost importance in this regard. More MFSs should be allowed to enter the market so that the current oligopolistic market turns into a competitive one that would be able to reduce the transaction costs and extend the market-based products and services. The establishment of more ATMs, PoSs, CRMs, and CDMs should be allowed taking into consideration efficient distribution at different locations. Modernization of a payment system will not only bring benefits to the common people but can also be used to facilitate government strategies such as online tax collection, to improve the financial management of projects, and to promote a conducive investment environment. Recently, the National Board of Revenue commenced online filing of tax returns amid the COVID-19 pandemic (bdnews24.com 2020), which can be eased further in the future.

iii. **Ease of regulations:** Rather than being too strict, regulatory frameworks, legislation, and policies on e-commerce, digital payments, freelancing jobs, and inward remittances should be eased to attract more people and investments towards digitization. For instance, the limits on transactions with cards, MFS accounts, and internet banking should be meticulously extended over time. Because of the lower limits and procedural constraints, sometimes a certain level of transactions is hampered.

iv. **Security and safety measures:** Alongside the easing of regulation, proper security and safety measures should also be ensured, otherwise people may not put their trust in the digital system. Banks and MFSs should incorporate proper safekeeping measures in debit and credit card transactions, internet banking, e-wallets, etc. The Bangladesh Bank (i.e., the central bank of the country) may also intervene with conducive regulations.

v. **e-commerce support:** To sustain the vibe and progress of e-commerce, adequate logistics and transportation supply chains are required. A comprehensive government policy in this regard may be framed so that more young entrepreneurs and laborers can create their jobs in these sectors. To expand the network of businesses, including e-commerce, express roads and highways and faster rail lines need to be developed throughout the country.

vi. **Entrepreneurship development:** The government should provide adequate financial support at concessional rates in the form of venture capital or SME loans to meet the capital requirements for the new ventures and e-commerce businesses. The Bangladesh Bank may also facilitate large refinance schemes for the ICT-based new entrepreneurs. The government may also allow tax rebates and provide other forms of fiscal support to develop the base of digital commerce and businesses.

vii. **Education and skill-based training:** Digital financial education has a big role to play in influencing the behavioral patterns of people towards digitization. The potential benefits of digitization are only attainable through proper guidelines and edification. The government has already positioned ICT as a core subject at the school level. However, more skill-based training and knowledge-sharing sessions can be arranged for the young population to groom them up for becoming self-employed entrepreneurs or to work as expert freelancers. More ICT city and hi-tech parks should be established in all districts of Bangladesh to support both the knowledge and the employment of young people.

This study has significant implications in identifying the determinants as well as the potentials of digitization and the demographic transition towards the economic progress of Bangladesh. It empirically reveals that both digitization and the demographic transition can play a momentous role not only in creating enormous employment opportunities for the young and educated labor force but also in sustaining the existing high economic growth trajectory of Bangladesh. Furthermore, the study provides adequate economic analysis as input for the government and policymakers. The outcome could be linked to the roadmap to attain sustainable development targets for the developing countries by using the channel of millennials' adoption of digitization and technological innovation.

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