ADBI Working Paper Series

PROMOTING SUSTAINABLE DEVELOPMENT THROUGH REALIZING THE DEMOGRAPHIC DIVIDEND OPPORTUNITY IN THE DIGITAL ECONOMY: A CASE STUDY OF NEPAL

Tapan Sarker, Shristi Tandukar,
and Sima Rani Dey

No. 1225
March 2021

Asian Development Bank Institute

Tapan Sarker is an associate professor at the Department of Business Strategy and Innovation, Griffith University, Australia. Shristi Tandukar is finance operations manager at World Renew, Kathmandu, Nepal. Sima Rani Dey is an assistant professor at the Bangladesh Institute of Governance and Management, Dhaka, Bangladesh.

The views expressed in this paper are the views of the author and do not necessarily reflect the views or policies of ADBI, ADB, its Board of Directors, or the governments they represent. ADBI does not guarantee the accuracy of the data included in this paper and accepts no responsibility for any consequences of their use. Terminology used may not necessarily be consistent with ADB official terms.

Working papers are subject to formal revision and correction before they are finalized and considered published.

The Working Paper series is a continuation of the formerly named Discussion Paper series; the numbering of the papers continued without interruption or change. ADBI's working papers reflect initial ideas on a topic and are posted online for discussion. Some working papers may develop into other forms of publication.

Suggested citation:

Sarker, T., S. Tandukar, and S. R. Dey. 2021. Promoting Sustainable Development through Realizing the Demographic Dividend Opportunity in the Digital Economy: A Case Study of Nepal. ADBI Working Paper 1225. Tokyo: Asian Development Bank Institute. Available: https://www.adb.org/publications/promoting-sustainable-development-digital-economy-nepal

Please contact the authors for information about this paper.

Email: tapan.sarker@griffith.edu.au

Asian Development Bank Institute
Kasumigaseki Building, 8th Floor
3-2-5 Kasumigaseki, Chiyoda-ku
Tokyo 100-6008, Japan

Tel: +81-3-3593-5500
Fax: +81-3-3593-5571
URL: www.adbi.org
E-mail: info@adbi.org

© 2021 Asian Development Bank Institute

Abstract

This paper reports the links between demographic dividend, digital economy, and sustainable development in the context of Nepal. Nepal is one of the countries that has been undergoing a remarkable demographic transition in South Asia in the last few decades, which provides it with the "window of opportunity" for sustainable development. In this regard, an appropriate study in this sector is indispensable to capture the optimum advantage of demographic dividend with the emerging techno-economic paradigm administering the dimensions of sustainability. By using multiple regressions, we analyze the economic variables of demographic dividend as the dependent variable, with the indicators of the digital economy being telecommunication and internet access as independent variables, and for the environment-related issues, greenhouse gas emissions and urbanization as explanatory variables, to understand the convoluted relationship of the influence of demographic dividend on the digital economy. The study provides a decisive rationale for the prospective policy implications necessary to grasp the advantage of demographic dividend by examining the potentials of the digital economy, exploring the environmental dimension that is currently regarded as one of the global issues in the economy. Policy implications and the impact of COVID-19 have also been discussed. The outcome of the research provides a road map for attaining the Sustainable Development Goals for Nepal. The findings and lessons learned will also assist policymakers and future researchers with similar scopes that can strengthen the economy of countries, but not limited to the least developed countries.

Keywords: demographic dividend, digitalization, environment sustainability, economy, Nepal

JEL Classification: J11, O32, Q56

Contents

1. INTRODUCTION

Nepal, being among the 48 least developed countries (LDCs) with a robust economic growth of 7.1% in the fiscal year of 2018–2019, is rigorously striving to fulfill its criteria to be upgraded as a developing country in the coming years. For the last few decades, Nepal has not only undergone remarkable demographic changes in South Asia but has entered into a demographic transition that provides it with a "window of opportunity." For Nepal, the demographic dividend became available in the 1980s and is expected to last until 2030, i.e., for 50 years (Kannan and Dharmalingam 2012). While the proportion of the young-age population has been shrinking, the working-age population (between 15 and 64 years of age) is escalating in Nepal. However, limited opportunities have impelled the working population to migrate to other countries for better living and employment opportunities. Therefore, as the period of this demographic dividend is temporary, it is necessary for Nepal to act smartly within the time frame and systematically utilize its human resources for future prosperous economic development.

The rise of the new techno-economic paradigm has been a triumph for the world economy, influencing almost every sector of business, trade, and services via the digitalization process. The increasing sophistication of connectivity and networking tools used in digital technologies has enhanced modes of communication significantly. In the case of Nepal, during the last few decades, the trend of the advancement of technology has built an innovative pathway to the digital economy for sustainable development. For instance, according to the Global Information Technology Report 2016 prepared by Baller, Dutta, and Lanvin (2016), Nepal is ranked 118 in the Network Readiness Index out of 139 among low-income group countries. This can be considered a gradual improvement in terms of growth as compared to previous years, as it ranked 123 and 126 in 2014 and 2013, respectively. However, Nepal is struggling to cope with the rapid pace of technological change, which remains insufficient compared to the pace of global digitalization. This digital transformation across the nation starts with simple digitization initiatives, planning the social architecture to cater for inclusiveness from the perspectives of digital, social, economic, professional, and personal development without compromising the needs of the future in a sustainable approach (Kar et al. 2019).

E-business permits physical spaces and flows to be reconfigured and reconstituted, with new forms of environmental problems emerging through the dispersal of land uses and complementing conventional modes of travels rather than substituting them. Further, digital technology is capable of creating environmental damage and diminishing environmental sustainability at various levels. These include increasing electronic waste streams; improved energy efficiency of production; and the product-to-service shift in consumption or rebound effects in transport (Hilty et al. 2006). Reducing environmental impacts emphasize the importance of defining a new business paradigm considering collaborative consumption to support environmental policy and encourage sustainable behavior (Toni, Renzi, and Mattia, 2018).

This study is an attempt to identify and assess the opportunities, interlinkages, and complexities associated with the demographic dividend in Nepal. More specifically, this research aims to explore the influence of the emerging digital economy on the demographic dividend with a focus on administering environmental sustainability. An appropriate study in this sector is indispensable to capture the optimum advantage of demographic dividend with the nascent stage of the digital economy. Also, to date,

studies in the area of environmental sustainability have been insufficient to provide deeper insights, investigating the extent to which digital sharing could help to reduce the material and energy needs in the period of demographic dividend. Against this backdrop, this study will provide useful insights into the interlinkages and relationships between the demographic dividend, the digital economy, and the environment. The existing regulatory frameworks tend to evolve more slowly than the digital revolution blooms. On this note, this paper will further assist in identifying policy interest and government implications to grasp the maximum advantage of the demographic dividend for a sustainable digital economy.

The remainder of the paper is structured as follows. Section 2 presents a review of the literature on the topic including a conceptual framework underpinning the measurements of variables of interest for the study. The third section introduces the data and methodology of the study. Section 4 presents the results and discussion of the study. Section 5 briefly discusses the policy implications and economic impacts of COVID-19 in the demographic transition. The final section concludes this study.

2. LITERATURE REVIEW

Lee and Mason, in their National Transfer Accounts (NTA) website, have identified average life cycle income and consumption patterns from data provided by NTA teams. They use an economic "life cycle method" to determine when age structures are most preferable, which gives an absolute predictive result that the actual pattern of the result varies among countries (Lee and Mason 2011). Politics seems to function most smoothly during the demographic dividend (Cincotta 2015). Demographic dividend, however, does not last forever and it has a limited window of opportunity. Consequently, achieving a demographic dividend requires each country to understand the size and distribution of its population, its current and projected age structure, and the pace of population growth (Ross 2004). The pace and timing of demographic transition differ among countries. As for regions, the demographic transitions in Africa, Asia, and Latin America began after the transition started in the developed world and are still underway (Bongaarts 2009). Sub-Saharan Africa experienced high fertility rates with slow adjustments to lower levels, high population growth, and a low life expectancy (Attanasio, Kitao, and Violante 2006). Labor supply, savings, and human capital were considered three mechanisms that delivered the demographic dividend. According to Bloom, Canning, and Sevilla 2003, 41–42), "the demographic transition has significant effects on investments in human capital, effects of which are the least tangible, but maybe significant and far-reaching and the mechanisms are heavily dependent on the policy environment."

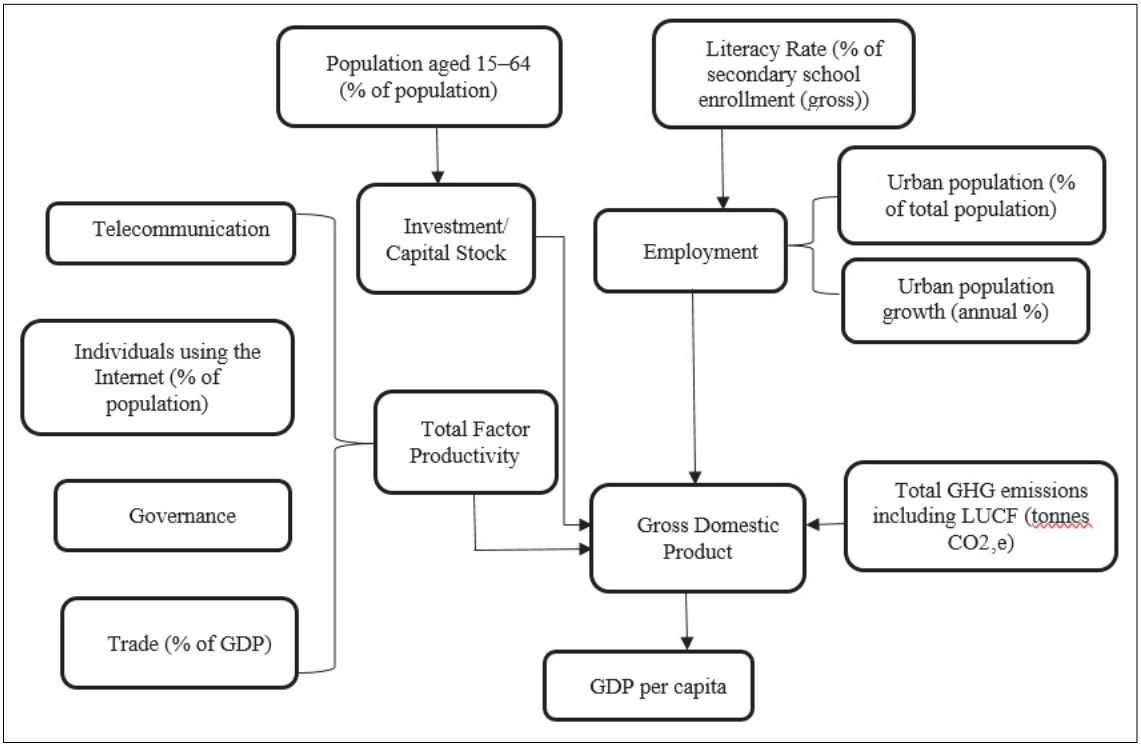
A nation necessitates a national transformation across diverse institutions, including the urban and rural areas of a society, which entails a great deal of innovation in planning, process re-engineering, and execution to be considered a digital nation. The higher the population growth, the greater the need to bridge the economic, social, and digital divide with a focus on sustainability (Dwivedi, Weerakkody, and Janssen 2012). At a very basic level, a digital nation is more of a connected nation that can share information and intelligence dynamically, in real time, to deliver services and improve the quality of life, requiring an integrated infrastructure in which data sources and software functionality are shared (Kar et al. 2019). However, these technologies can be used, but also misused, in various ways and need to be secured to avoid adverse impacts on society (Chatfield and Reddick 2018). Digitalization increasingly enhances the likelihood of social and environmental sustainability challenges and threats, including the carbon footprint associated with increased electricity generation demand,

cybersecurity vulnerabilities, and social discrepancies depicted by the yawning gap regarding access to information and communications technology (ICT), commonly referred as the "digital divide" between individuals who have benefited from a digital economy and those whose scope of jobs, economic resources, and other social benefits is limited (OECD 2017). Looking back into shorter history, the study observed that the energy efficiency of ICT doubled every 1.57 years and the overall energy used for ICT increased as the demand for ICT grew even faster than the improvements in ICT energy efficiency; nevertheless, the study concluded that it would be too early to project well-founded scenarios to describe the sustainability status of digital sharing (Aebischer and Hilty 2015).

Among the four dimensions of sustainable development, 33% of the research has to do with social-related problems; 28% with institution-related problems; 20% with economy-related problems; and 19% with environment-related problems, and the recycling of waste was not always beneficial from a sustainability perspective (Janowski 2015). Demography can highly influence these dimensions of sustainable development, including economic development. The emergence of consumers who are intrigued by sharing, affordability, and environmentally friendly options is a key success factor for sharing business models and sustainable economic model (Hasan and Birgach 2016). A few scholars give paradoxical implication, such as, on the one hand, a study of demography can potentially promote sustainable practices by influencing patterns of consumption and production; on the other hand, it may reinforce the prevailing unsustainable economic paradigms by creating unregulated markets. Further, studying population size, density, and age mix can create a dynamic potential of digital assessment transforming conventional sustainability analyses from purely technical activities to effective strategies of corporate social responsibility. The adoption of the circular economy paradigm requires a rigorous management approach, technical skills, and effective tools for redefining the business model with the use of efficient and digitized production units aimed at new market segments, such as green consumers, architects, and designers, who are more sensitive to the socially responsible behavior of the industry, while also using innovative digital distribution channels to lower production costs and create an improved reputation among stakeholders and offsetting the high cost of internalizing environmental and social externalities (Garcia-Muiña et al. 2019).

Drawing on the above literature, we propose a conceptual framework underpinning the study. Figure 1 shows the various channels through which the demographic dividend, digitalization, and sustainable environment in an economy are interrelated. The represented variables of digitalization increase the total factor productivity, demographic dividend variables play a significant role in stimulating the economic growth through capital accumulation and employment generation, and environmental indicators also contribute to boosting the economic productivity. Therefore, maintaining a balanced ratio among these three indicators is essential to ensure sustainable growth.

Figure 1: Demographic Dividend-Digitalization-Sustainable Environment Nexus



Sources: Authors' depiction.

3. DATA AND METHODOLOGY

3.1 Data Description and Properties

This study aims to analyze the demographic dividend, digital economy, and sustainable environment nexus of Nepal using a range of indicators. The percentage of the working population and the literacy rate represent the demographic indicators that depict the dependency ratio and human capital status to represent the demographic dividend. Further, the use of mobile and internet technology reflects the extent of digitalization of Nepal's economy. Broadly, urbanization and greenhouse gas emissions represent the environmental indicator. As well as the above-listed variables, other variables could have a substantial impact on the studied nexus and economic growth in general. From this point, we have included trade openness, Human Development Index, and governance indicator to avoid bias (omitted variable bias and simultaneity bias) in our results estimation. Most of the studied variables were attained through the World Bank's Development Indicators (WDI) (World Bank Group 2019).

The study is an attempt to analyze the economic variables of the demographic dividend as the dependent variable, with the indicators of the digital economy being telecommunication and internet access as independent variables, and for the environment, greenhouse gas (GHG) emissions and urbanization as explanatory variables, to understand the convoluted relationship between the demographic dividend and the digital and sustainable economy. Multiple linear regression analysis is employed to explore the sustainability of the digital economy in the demographic transition period in the country, while also exploring the environment issue. Further, this research will be one of the few researches conducted in this sector to associate

the digital economy with the demographic dividend and grasp the optimum advantage from the demographic dividend phase in Nepal, alongside the practice and role of environmental sustainability in the digital economy in the socioeconomic dimension of the country.

Data are available for the majority of the variables incorporated into the model from 1999 to 2019 and the detailed scenario of the key indicators used for analytical purposes can be found in Appendix 1. Few data are extrapolated for the later periods of the inspected time to tackle the issues of missing data, and particularly the governance and emissions data. The important details of variable definitions and sources are presented in Table 1.

Table 1: Variable Definitions and Sources

Variables	Definitions	Sources
Population aged 15–64 (% of the total population)	Total population between the ages of 15 and 64 as a percentage of the total population. The population is based on the de facto definition of population, which includes all residents regardless of legal status or citizenship.	World Development Indicators (WDI)
School enrollment, secondary (% gross)	Gross enrollment ratio is the ratio of total enrollment, regardless of age, to the population of the age group that officially corresponds to the level of education shown.	World Development Indicators (WDI)
Urban population (% of the total population)	Urban population refers to people living in urban areas as defined by national statistical offices.	World Development Indicators (WDI)
Urban population growth (annual %)	Urban population refers to people living in urban areas as defined by national statistical offices.	World Development Indicators (WDI)
Mobile cellular subscriptions (per 100 people)	Mobile cellular telephone subscriptions are subscriptions to a public mobile telephone service that provides access to the PSTN using cellular technology. The indicator includes (and is split into) the number of postpaid subscriptions, and the number of active prepaid accounts (i.e., that have been used during the last three months). The indicator applies to all mobile cellular subscriptions that offer voice communications.	World Development Indicators (WDI)
Individuals using the internet (% of the population)	Internet users are individuals who have used the internet (from any location) in the last 3 months. The internet can be used via a computer, mobile phone, personal digital assistant, games machine, digital TV, etc.	World Development Indicators (WDI)
Human Development Index	The Human Development Index (HDI) is a summary measure of average achievement in key dimensions of human development: a long and healthy life, being knowledgeable, and having a decent standard of living. The HDI is the geometric mean of normalized indices for each of the three dimensions.	UNDESA
Governance	A simple average of aggregate indicators of three broad dimensions of governance, and the dimensions are: Regulatory Quality, Rule of Law, and Control of Corruption.	Kaufmann, Kraay, and Mastruzzi (2010)
Trade openness	Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product.	World Development Indicators (WDI)
Total GHG emissions including LUCF (tonnes CO_2,e)	Total greenhouse gas emissions – measured in tonnes of “carbon dioxide-equivalents.”	Climate Watch (2020)

Source: Authors’ compilation.

3.2 Data Limitations

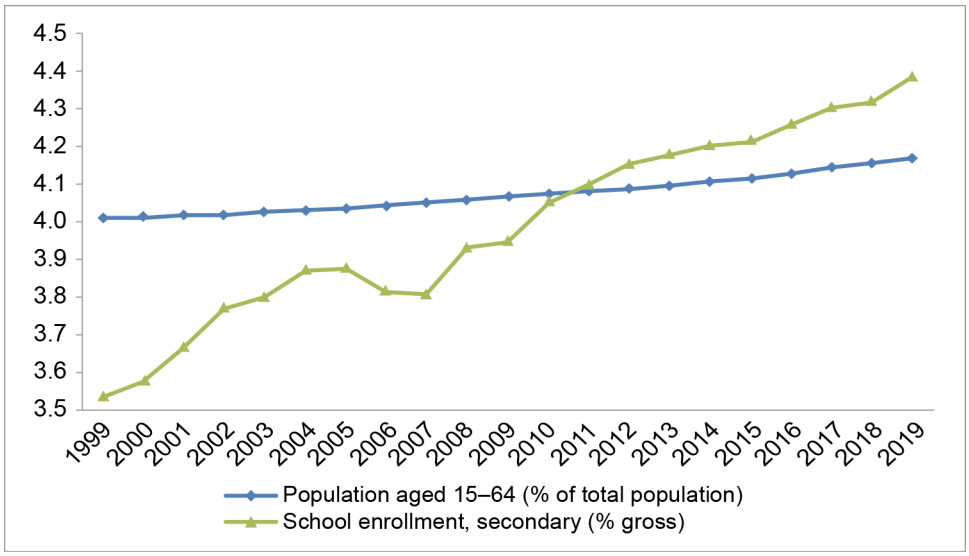
While there are limited data available on studied variables, the study includes the empirical estimation with the short span of 1999–2019.

4. RESULTS AND DISCUSSION

4.1 Nepal in the Nexus of Population Aging and Demographic Transition

Traditional demographic transition theory suggests that demographic changes occur in a certain sequence and distinct phases. However, due to the nontraditional transition, different aspects of Nepal's demographic changes have occurred simultaneously and outside of traditional transition theory parameters, experiencing these rapid demographic changes at relatively much lower levels of development (National Planning Commission and UNICEF 2017). Although Nepal's fertility and mortality declines have reached levels comparable to many middle-income countries, Nepal continues to rank among the least developed countries in the world in contemporary development classifications.

Figure 2: The Demographic Dividend of Nepal



Sources: Authors' depiction using WDI data Figure 2 exhibits the experience of the demographic dividend of Nepal in the last two decades using logarithmic transformations. Both the dividend indicators show an upwards pattern, and specifically the literacy rate experiences a sharp increase, which indicates the positive investments of the Nepalese in human capital. Nepal, being a least developed country, has consistent and remarkable growth in the literacy rate, which indicates that these demographic indicators can positively influence the Nepalese economy.

The report published in a collaboration between the National Planning Commission of Nepal and UNICEF in 2017 gives prominent examples of economies that were able to take advantage of their demographic windows of opportunity to reap significant economic and societal benefits in East Asia with patterns of social sector investments combined with a favorable sequence of fertility and mortality decline in the 1970s and 1980s. Early examples include Taipei,China; Hong Kong, China; and Singapore, along with Thailand and Malaysia, which are also counted among economies that invested

strategically in education, health, and labor market opportunities for women, which led to dramatic economic growth. However, demographic transitions in the contemporary developing world seem considerably shorter. The analysis presented in this study represents a critical first step in paving the way for demographic analysis and the importance of strategic early investments for a smart economy in Nepal to strengthen the ability to contextualize and tailor policy and programmatic interventions and act within the limited window of time. In Nepal, poverty, political instability, and the lack of a right policy environment were considered the main reasons for youth migration to Middle East countries as labor from the beginning of a demographic window of opportunity (Chalise 2018).

4.2 Nepal to Enter in Stages III of the Demographic Dividend

There is universal primary education but poor educational quality and a high level of school dropout due to the prevalence of early marriage and low productive opportunities for girls and women. Some of these characteristics are associated with migration patterns which have profound implications for dependency ratios, productivity, and savings and the importance of regionally disaggregated analysis of demographic trends. Migration to and from regions will have important implications for regional disaggregation within the country, and also the patterns of international migration. In 2018, the working-age population was 63.86% of the total population with 66.57% of the female population and 60.65% of the male population. Currently, Nepal is at the lower end of Stage II, characterized by a low birth rate and low death rate, while attempting to approach Stage III of a demographic transition with fertility prevailing slightly higher than mortality. With fewer people in need of support, the country has a window of opportunity for rapid economic growth if the right social and economic policies are developed and investments made, including in digitization, to take advantage of the demographic dividend (UNFPA 2017).

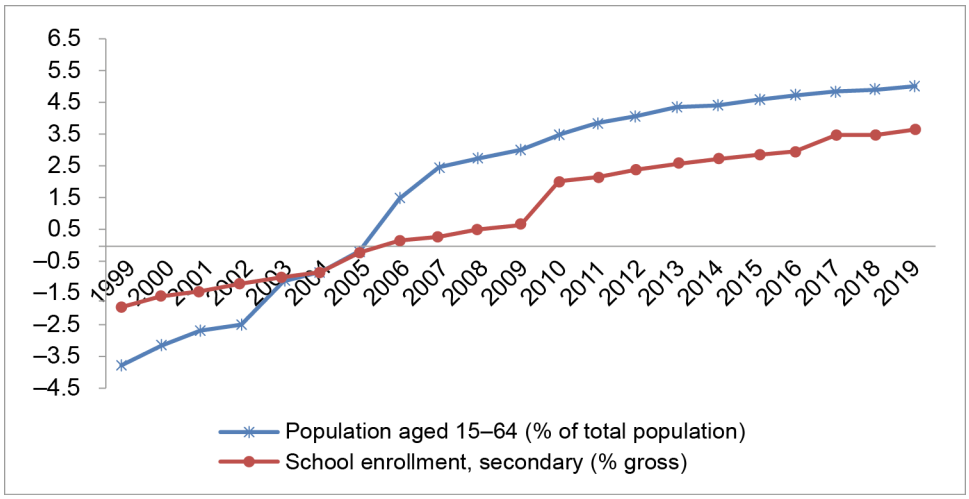
Nepal's demographic window of opportunity is similar to that experienced by Japan; Malaysia; Indonesia; and Taipei,China for around 50 years (Amin et al. 2017). In terms of an aging transition, Nepal's duration is projected to be closer to that of Japan's, which at 26 years is among the fastest-aging transitions in the world (Oizumi 2013). According to the report by UNFPA in 2017, Nepal's demographic dividend seems to end in 2047 having started in 1992. As more children survive and parents have fewer children, parents are motivated to invest in high-quality education and health through infrastructural support and effective policy. Also, the investments in the productivity of the future workforce can help reduce dependency burdens by making the dependent (elderly) population more self-sufficient in the future. The experience of the Republic of Korea; Taipei,China; Indonesia; Malaysia; Viet Nam; Thailand; and the PRC, economies that established productive engagement in the workforce, are relevant for ensuring faster uptake of technology. On close analysis of these developed and developing economies, Nepal, despite being a least developed country, represents a unique case where the demographic dividend can prove to be advantageous via policy prescriptions for sustainable development. First, the demographic transition is occurring at a relatively low stage of development; second, a fertility decline is well underway, with the average fertility rate being 2.3 births per woman compared to 6.3 in 1976. With the declining fertility rate, Nepal's dependent population has started shrinking. This is freeing more people to work and contribute to economic development. A demographic dividend generally results in rapid economic growth because of a decline in the country's birth rate (UNFPA 2017).

4.3 Digital Economy in the Period of "Window of Opportunity"

Information technology in the economy has accelerated the substantial transformation from public to private businesses, creating the virtualized existence of versatile business relationships and partnerships with improved market access, and revamping the value chain in production and distribution processes, enabling faster results and less costly product designs. According to the Digital Economic Report 2019, currently the world is characterized by a yawning gap between the underconnected and the hyperdigitalized countries. In the LDCs, only one in every five people uses the internet as compared to four out of five in developed countries. In the last decade, global exports of ICT, including digital services, grew considerably faster, constantly reshaping the existing market, reflecting the acceptance of digitalization by the world economy. It is envisioned that the proliferation of digital economy firms and platforms will eventually become an inevitable and crucial part of the global economy (Yaraghi and Ravi 2017). In LDCs, these frontier technologies are estimated to represent 16% of all service exports, which more than tripled from 2005 to 2018 (Korovkin 2019). However, the enhancement of the digital world not only has a broader scope in developed countries but has also proved to be a boon to developing and least developed countries.

E-commerce is still a new concept but is growing rapidly, and as of May 2017, there were more than 56,286 registered websites in Nepal, including 40,000 commercial websites among the total number of 166,781 companies registered. Nepalese investors are very limited, so firstly, to break this monopolistic business, and secondly, to shift the country towards industrialization, Nepal encourages FDI (foreign direct investment) in the limited arena of necessity. The total number of companies registered under the Department of Industry in 2017/18 was 497 followed by 439 in 2018/19 and about half of that in 2019/2020 with 277 due to COVID-19, with a total industry number of 8,247 in 2019/2020. In spite of the fact that COVID-19 can adversely affect business and investments, many businesses and organizations in Nepal have started leveraging digital marketing to upgrade their business globally through virtualization. The growth of e-commerce in Nepal is inhibited due to the lack of a supporting ecosystem, such as limited digital payment options. However, this is changing slowly with the emergence of FinTech startups such as eSewa and Khalti, which are expected to disrupt the payments landscape (Ministry of Communication and Information Technology 2019. According to the data, agriculture represents 24.26% of GDP and ICT services like the smart irrigation project, digitization of land records, and e-Haat Bazar assist in the development of agriculture. Similarly, since COVID-19, smart classrooms, online learning platforms, mobile learning apps, and biometric and e-attendance systems have brought a remarkable reform to our traditional education system. However, because of the lack of connectivity and the absence of a high-quality internet service in rural parts of the country, people are deprived of the advantages that connectivity brings to them. Similarly, in urban areas and cities, the fluctuating internet connection is another challenge that needs to be resolved in the near future.

Figure 3: The Digitization Scenario of Nepal



Source: Authors' depiction using WDI data.

Figure 3 highlights the digitalization scenario of Nepal using logarithmic transformations. Both the dividend indicators show an upwards pattern at an increasing rate, which is the representation of Nepal's adaptability to information and communications technology. The subscriptions of mobiles per 100 people enables to determine the overall percentage of individuals using the internet.

The Global Information Technology Report 2016 ranked Nepal in 118th position out of 139 low-income group countries in the Network Readiness Index, which represents a gradual growth compared to its previous positions of 118th out of 143 in 2015, 123rd out of 148 in 2014, and 126th out of 144 in 2016. The position is based on the Environment subindex (political and regulatory environment, business and innovation environment), the Readiness subindex (infrastructure, affordability, and skills), the Usage subindex (individuals, business, and government), and the Impact subindex (economic and social impact). According to a World Bank report, every 10% increase in broadband penetration has an impact of 1.21% on high-income economies and 1.38% on low- and middle-income economies, which depicts the high significance of the impact of ICT on the economy of the country.

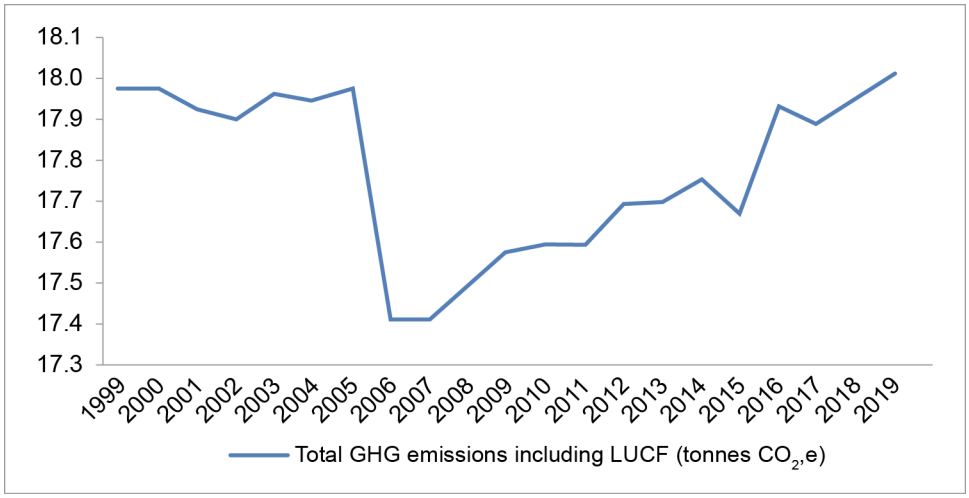
The digital economy, being a broad concept, also brings a complex paradigm with it enhancing the scope for research. Also, there is neither a widely accepted definition of the digital economy nor the exact tools to measure it. Another challenge for national digital strategizing, especially in the context of developing economies, is the "digital gap," observed due to the inability of LDCs to compete for speedy digitization with developed countries. A simple example is the unavailability of a proper international payment gateway, which hinders access to global trade and markets. Besides the development of infrastructures, it is also necessary to increase digital literacy to reap the benefits from digitization and reduce the prevailing digital divide in the country.

4.4 Environmental Sustainability and Digital Economy in the Transition

A smart ecosystem needs to address both technological and management perspectives (Janssen and Helbig 2018), and researchers focus on issues related to governance and the implementation of technology-enabled transformation initiatives in achieving environmental sustainability (Chatterjee et al. 2018). Although the potential

of the information age to save material and energy cannot be doubted, it might nonetheless be too early to assume an optimistic opinion on the environmental impacts of the emerging digital economy like moving business online to reduce waste such as print, retail space, and transportation requirements, as it necessitates more energy-intensive computers (Sui and Rejeski 2002).

Figure 4: The Emissions Pattern of Nepal



Sources: Authors' depiction using Climate Watch data.

Figure 4 shows the emission patterns of greenhouse gases of Nepal and the graphed variable is transformed into natural log. GHG emissions reveal an upwards pattern, though the GHG emissions were reduced from 2006 to 2015. One of the primary reasons for this downward trend in 2006 was the political stability in the country after the royal massacre and the civil war, which hampered the overall economy.

Even though limited industrialization seems to have a minimal impact on the environment, a lack of proactive measures might lead to serious environmental issues. The increasing scope of a digital economy in the country should be envisioned with a sustainable environment. The arguments about the welfare, employment, and income aspects of the development in the context of the sharing digital economy propose the platforms that present three-dimensional (3D) printed goods which can promise new forms of sustainable, resource-efficient, and optimized production in the sharing economy (Cohen and Munoz 2016). Three-dimensional printing technology lowers manufacturing inputs and outputs through low-volume, customized, and high-value production processes at a low cost, saving energy by only consuming the quantity of materials that will end up in final products without producing too much process-related waste and reducing CO2 emissions over the entire life cycle of its products and per unit of gross domestic product (GDP), and can be a potentially effective catalyst for environmental sustainability and sustainable development (Gebler, Uiterkamp, and Visser 2014). The current environmental problems are the consequence of production and consumption patterns, so the environmental dimension of the digital economy deserves special attention for its sustainability (Sui and Rejeski 2002).

Table 2 presents the summary statistics of the modeled variables separately. The means of dividend variables of Nepal are 58.71, 1.03, and 55.64, respectively. The means of mobile subscriptions and internet use are 48.14 and 10.03, respectively. The mean of level emission variables is too small to report and the means of the percentage of urban population and population growth are 16.51 and 3.36, respectively.

Table 2: Summary Statistics

	N	Mean	SD	Min	Max	Variance
Population aged 15–64 (% of total population)	21	58.71	2.95	55.08	64.65	8.7
School enrollment, secondary (% gross)	21	55.64	13.76	34.27	80.18	189.39
Urban population (% of total population)	21	16.51	2.15	12.86	20.15	4.63
Urban population growth (annual %)	21	3.36	1.23	1.76	6.08	1.52
Mobile cellular subscriptions (per 100 people)	21	48.14	53.99	.02	156.02	2,914.97
Individuals using the internet (% of population)	21	10.03	12.59	.15	39.96	158.44
Human Development Index	21	.51	.05	.44	.58	0
Governance	21	–.65	.13	–.8	–.37	.02
Trade openness	21	48.68	4.53	41.83	55.8	20.48
Total GHG emissions including LUCF (tonnes CO_2,e)	21	5.36e+07	1.03e+07	3.64e+07	6.64e+07	1.05e+14

Source: Author's calculation.

4.5 OLS Regression Results

This section presents the multiple regression outputs of studied variables relevant to the demographic dividend, the digital economy, and the environment. In total, representations of three models are exhibited in Tables 3–6. Trade openness, the Human Development Index, and governance indicator are also included in all models of all tables so that the issue of omitted variable bias can be taken care of.

These three models are developed assuming the interaction of dividend, digitalization, and environmental variables. The working population as a dependent variable is regressed on digitalization (mobile use and internet access) and environmental variables (environment greenhouse gas (GHG) emissions, urban growth, and urbanization) in Tables 3 and 4. School enrollment as a dependent variable is regressed on digitization (mobile use and internet access) and environmental variables (environment greenhouse gas (GHG) emissions, urban growth, and urbanization) in Tables 5 and 6.

Table 3: OLS Regression Results

	(1) Population Aged 15–64 (% of total population)	(2) Population Aged 15–64 (% of total population)	(3) Population Aged 15–64 (% of total population)
Mobile cellular subscriptions (per 100 people)	0.0548**	0.0249**	0.0253*
	(0.0137)	(0.00673)	(0.0105)
Total GHG emissions including LUCF (tonnes CO_2,e)	–2.21e-08		
	(1.76e-08)		
Urban population (% of total population)		1.073***	
		(0.225)	
Urban population growth (annual %)			0.535*
			(0.232)
Constant	58.11***	46.40***	38.27***
	(8.383)	(3.520)	(6.877)
Governance	–1.982	–0.131	–0.0600
	(1.824)	(1.134)	(1.588)
HDI	–2.300	–14.25	40.79*
	(16.53)	(9.220)	(15.41)
Trade (% of GDP)	–0.0198	0.0127	–0.0735
	(0.0336)	(0.0228)	(0.0394)
Observations	21	21	21
R^2	0.985	0.993	0.988

Standard errors in parentheses. *p < 0.05, **p < 0.01, ***p < 0.001.

Table 4: OLS Regression Results

	(1) Population Aged 15–64 (% of total population)	(2) Population Aged 15–64 (% of total population)	(3) Population Aged 15–64 (% of total population)
Individuals using the internet (% of population)	0.128***	0.0790***	0.0911***
	(0.0212)	(0.0155)	(0.0214)
Total GHG emissions including LUCF (tonnes CO_2e)	–8.21e-09		
	(1.10e-08)		
Urban population (% of total population)		0.824**	
		(0.209)	
Urban population growth (annual %)			0.346
			(0.191)
Governance	–0.650	0.127	–0.0936
	(1.231)	(0.888)	(1.153)
HDI	27.62***	4.570	42.96***
	(6.357)	(7.531)	(8.549)
Trade (% of GDP)	0.0103	0.0230	–0.0372
	(0.0243)	(0.0176)	(0.0332)
Constant	42.75***	40.92***	36.32***
	(3.132)	(1.736)	(3.535)
Observations	21	21	21
R^2	0.991	0.995	0.992

Standard errors in parentheses. *p < 0.05, **p < 0.01, ***p < 0.001.

In total, four tables are presented to express the different scenarios of these chosen variables for Nepal. In Table 3, increased working populations tend to be more technology-friendly, which is evident in all models where mobile subscriptions per 100 people are statistically significant. GHG emissions are not significant in any models. Urbanization variables representing environmental issue are also found to be significant in Models 2 and 3. In Table 4, the other indicator of digitalization, internet use, reveals a positive and significant impact on the demographic dividend in all models, which supports the notion that people from the working-age group aged 15–64 are becoming more digitalized over the years. Among the environmental variables, urbanization is only found to be significant enough in Model 2 to influence the demographic dividend.

Table 5: OLS Regression Results

	(1) **School Enrollment, Secondary** (% gross)	(2) **School Enrollment, Secondary** (% gross)	(3) **School Enrollment, Secondary** (% gross)
Mobile cellular subscriptions (per 100 people)	0.0450	0.138*	0.261***
	(0.0545)	(0.0482)	(0.0503)
Total GHG emissions including LUCF (tonnes CO_2, e)	0.000000220**		
	(6.99e-08)		
Urban population (% of total population)		2.539	
		(1.611)	
Urban population growth (annual %)			–2.752*
			(1.109)
Governance	–1.698	–8.138	–15.81
	(7.259)	(8.134)	(7.588)
HDI	232.9**	11.48	–64.17
	(65.76)	(66.13)	(73.62)
Trade (% of GDP)	–0.278	–0.262	–0.0253
	(0.134)	(0.164)	(0.188)
Constant	–65.50	8.627	76.27*
	(33.36)	(25.25)	(32.85)
Observations	21	21	21
R^2	0.989	0.985	0.987

Standard errors in parentheses. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

In Table 5, when the literacy rate is taken as the proxy of dividend, the mobile subscriptions per 100 people disclose the significant impact on the literacy rate in Models 4 and 5. The scenario for urbanization variables is more or less the same as in Table 3 and the GHG emission variable is found to be significant. The estimation outcome of Table 6 is very similar to the results of Table 4. Internet use also reveals a positive and significant impact on secondary schooling in all models and GHG emissions are also found to be significant. Urbanization growth has become significant in Model 3.

Table 6: OLS Regression Results

	(1) School Enrollment, Secondary (% gross)	(2) School Enrollment, Secondary (% gross)	(3) School Enrollment, Secondary (% gross)
Individuals using the internet (% of population)	0.219*	0.365*	0.705***
	(0.0955)	(0.136)	(0.116)
Total GHG emissions including LUCF (tonnes CO_2, e)	0.000000195**		
	(4.94e-08)		
Urban population (% of total population)		1.791	
		(1.829)	
Urban population growth (annual %)			–3.271**
			(1.029)
Governance	–3.448	–4.758	–10.37
	(5.551)	(7.772)	(6.225)
HDI	226.5***	108.2	43.73
	(28.66)	(65.92)	(46.16)
Trade (% of GDP)	–0.273*	–0.173	0.217
	(0.110)	(0.154)	(0.179)
Constant	–62.32***	–27.86	19.83
	(14.12)	(15.20)	(19.09)
Observations	21	21	21
R^2	0.992	0.984	0.990

Standard errors in parentheses. *p < 0.05, **p < 0.01, ***p < 0.001.

In summary, the empirical output of the study indicates that the percentage of internet users is significant with any combinations of environmental variables in all models of the demographic dividend. This outcome indicates that a lower dependency ratio exhibits positive externalities in the form of having young generations with advanced technological knowledge and keeping emissions at a sustainable level. So, the increased population growth is increasing the number of working-age people and these literate people from the young age group have a greater tendency to use the internet and new technology to keep themselves updated with the new digitalized world. And the same scenario was evident in the case of urbanization, which implies that the pace of urbanization is quite satisfactory and also contributes to the dependency on ICT through mobile use among young people. In the case of emissions, GHG emissions are found to be significant. This may be because of the higher prevalence of GHG gas in the environment (see Figure 4).

5. REGULATORY FRAMEWORK AND IMPACT OF COVID-19

5.1 Significance of E-governance in the Digital Economy

E-governance plays a crucial role in enhancing the digital economy in the country. If a government goes digital, it gradually influences other sectors of the economy and Nepal is gradually improving its online portals. The development of e-government in various phases of digitization, transformation, engagement, and contextualization

contributes to greater government effectiveness and further to environmental sustainability as the phase develops (Janowski 2015). Regardless of a state's digital governance response and how it is shaped by political and institutional realities, adaptive governance approaches are essential to address the socioeconomic sustainability challenges posed within differing manifestations of digitalization (Linkov et al. 2018).

The Nepalese government has established a Government Integrated Data Centre, with every governmental body implementing as little paperwork as possible and going digital. The IT infrastructure needed for a National e-Payment Gateway has already been prepared. Also, the Data Recovery Center in Hetauda was constructed to keep the information safe from potential loss due to natural calamities and emergencies. The introduction of the Digital Nepal Framework is one of the efforts by the government to track the progress and plan for the coming years. With the budget announcement for the fiscal year 2020/21, the government distinctly showed interest in developing ICT infrastructures. The government has allocated Rs7.13 billion to the ICT sector for the coming fiscal year. The new budget prioritizes a cashless economy in Nepal and, as a result, focuses on enhancing cybersecurity.

The level of penetration of the government digital infrastructure scheme and e-services in Estonia suggested that the individual choice of opting for a universal digital identity is affected by socio-demographic and macro-level characteristics. The findings support the idea that the demographic is not the only reason for individuals to choose e-residency, and other country-level factors, such as professional interests, business interests, education, cultural ecosystems, and information security, also play a significant role (Tammpuu and Masso 2019). Further, the enhancement of e-government is an important intermediary variable for the environmental sustainability in small island developing countries, besides the key idea of product sustainability to gain a competitive advantage in globalizing in the online market (Lee 2017). In countries like India and Bangladesh, the governments have taken up initiatives like "Digital India" and "Digital Bangladesh" to transform the government and governance using ICTs across the country; similarly, governments are also communicating with their people via social initiatives like "REACH" in Singapore, "Mann Ki Baat" in India, and "MyGov" in Australia (Kar et al. 2019). According to the World Development Report of 2016, Nepal, Rwanda, and Uganda scored highly among low-income countries on their administrative e-governance system, indicating that governments are more intensive users of information technology than firms to strengthen the state's capability and improve outcomes.

5.2 Status of Policies Regulated and its Importance for Sustainability

Policy on human behavior still plays a significant role in solving environmental problems and most environmental policies require considerations for shifting towards sustainable behavior (Toni, Renzi, and Mattia 2018). Without complementary developments, such as regulation and improved skills and institutions to help implement these regulations, the accelerated growth opportunities that digital technology may offer could be replaced by unexpected risks (World Bank Group 2016).

Environmental policies merely seem to focus on the manufacturing industry as the source of pollution rather than services and consumption, on the details of the law rather than the dynamics of the system, although production problems tend to be industrial and local consumption problems tend to be problems for everyone on an increasingly global scale. If the digital economy is a complex system and the relationship between the internet and the environment is best captured from the theory of complexity, this will have serious policy implications (Elliott and Kiel 1999). There are numerous policies relating to information technologies, including the Information and Communications Technology (ICT) policy that was revised after the country promulgated its new constitution in 2015. The government seems to show initiatives for the development of ICT through the concept of e-governance but needs a periodic policy update, data security, and skilled human resources to make it effective. As well as the ICT policy, other policies include the National Broadband Policy announced in 2016, which suggests a framework for stimulating broadband access and availability across the country. Along with National Broadcasting Act and Regulation, Radio Act, Radio Communication License Regulation and Cybersecurity Policy 2016 are critical frames for the development of the ICT sectors. Further, the handling and regulation of digital data are convoluted, as they touch upon human rights, trade, economic value creation and capture, law enforcement and national security, which indicates the need for research in this sector.

With the number of young entrepreneurs increasing, digitalization has a significant role in being blended with environmental awareness for sustainable development. However, the skewed distribution of access, affordability, and availability dimensions needs to be addressed through macro policies such that the younger generations envision competing in the international arena without any hindrance from a regulatory and governance framework, for instance, the prerequisite homework for the availability of a secure international payment gateway to provide a platform on which the global market can thrive.

5.3 Impact of COVID-19: Challenges and Opportunities

A series of lockdowns and restrictions in business operations have resulted in a colossal health and economic crisis not limited to any specific country. Governments are increasing the provision for the welfare of citizens and various concessions for businesses to offset the damage with a sequence of predictions to reach a normal scenario.

Demographic indicators like age and family structure, co-residence patterns, the population mix, and other socioeconomic aspects determine the impact of COVID-19. It is evident that older populations and people with preexisting medical conditions have a higher risk of morbidity and mortality from COVID-19. Nepal is experiencing a demographic transition, but due to the limited infrastructures and the living standard of people, this demographic dividend can turn to be a demographic burden, with a lack of proper health facilities. Recent evidence shows that people from minority ethnic groups and living in economically deprived areas have a high chance of falling seriously ill and dying from COVID-19 infections. People with different demographic and socioeconomic characteristics respond differently to COVID-19, as the ability to cope, recover, and adapt varies greatly with respect to their socioeconomic status and capability across population subgroups, including the institutional and geographical contexts.

In Nepal, manufacturing businesses depend greatly on raw materials from India and the PRC, but the travel restrictions have had a tremendous impact in terms of economic fallout, followed by service industries being shut down and banks finding it challenging to maintain liquidity, and the crisis overall has resulted in a high unemployment rate, risk of market volatility, and a massive downturn in the economy. Businesses take a holistic view of potential risk and postpone investments. However, the priority now lies in eradicating this disease as the number of cases is rising each day with the lifting of restrictions. Policy regulators, mainly the Ministry of Finance, the Central Bank, the federal government, local government, and the overall central government, are deliberately implementing numerous monetary and fiscal policies to mitigate the market risk and financial and nonfinancial risks, prioritizing the health sectors, which still seems to be inadequate in the current situation that has resulted from a novel coronavirus.

Nepal's attempt to upgrade itself from LDC countries in prospective years seems to have been postponed due to the economic crisis resulted from COVID-19. However, the trend of working from home brought by the pandemic, along with the upward trend of digitization and the significant outcome of the empirical result of regression, shows that the digital economy tends to have a wider scope. The demographic dividend contributing to enhancing the scope of the digital economy also raised the consciousness of environmental sustainability as learning initiated by developed European countries, through innovative environment-friendly concepts to pave a fresh path to control environment depletion and achieve the Sustainable Development Goals. Moreover, in adversely affecting the economy, it has taught mankind numerous lessons and forced it to think sustainably, in particular teaching emerging economies to be well prepared beforehand rather than revising their plans later.

6. CONCLUSION AND POLICY IMPLICATIONS

The pace of urbanization is observed as being satisfactory with the literacy rate increasing among working people, who have a greater tendency to mobilize the technology effectively. As developing countries are emerging markets for global digital platforms and their users contribute significantly to the generation of value and profits, firms that invest in ICTs are generally more productive, competitive, and profitable. However, small-business owners in developing countries, and especially in LDCs, lack the capabilities, skills, and awareness to leverage digital connectivity for their business operations, especially in the forestry and agriculture sectors with the significant generation gap. In this context, Nepal needs to double its pace to improve its digitized economy to become an integral part of the global market and remove the tag of being a low-income country.

Although Nepal is an agricultural country, among the emission variables used in the research, methane gas was observed to be significant that influenced the GHG emission being significant. This depicts the necessity of unconventional economic thinking and policy analysis for optimum utilization of the resource. For instance, systematic and sustainable industrialization, green bonds to evolve as a major contributor to GDP can be used as emerging tools to step on environment-friendly investments. An effective national digital strategy needs to be addressed, but not limited, to the cultural and ideological challenges of the decentralized information environment to blend the digital economy with a green economy to take the optimum advantage of the demographic dividend.

The declining dependency ratio, rising life expectancy along with gradually peaking working-age population or the youth population indicates that the country is reaching the peak point of demographic bonus to induce economic growth, provided that strategic public policy is formulated and implemented. Without a good economic and human development policy, sound institutions, proper investment and saving incentives, and systematic health facilities, a demographic opportunity might turn into a demographic burden regardless of the pandemic. So, this pandemic has warned the country to make its effort for pragmatic change in the country in its development strategies prioritizing the necessities of the country in socioeconomic and technology sectors like agriculture, education, tourism, urban infrastructure, health, energy, finance, and disaster management to create an enabling environment and allow the government and enterprises globally to unlock the potential to achieve exponential growth. Even though Nepal is still in the initial stage of digitalization, motivating improvements in the digital economy have been observed in recent years, which can assist in achieving successful digitalization with optimal utilization of the demographic window of opportunity with environmental sustainability. The impact of digitalization varies among countries and individual governments require policy space to modulate the digital economy to fulfill various legitimate public policy objectives (UNCTAD 2019). The continuously rapid pace of technological change requires sustainable and qualitative investment measures, including foreign investments and cross-border trade. Besides the size of investments, in balancing the supply chain of education, enhancing work skills, technological advancement and infrastructure development, entrepreneurship, and private-sector participation facilitate a robust financial ecosystem. Extensive use of disruptive technologies such as artificial intelligence (AI), robotics, the Internet of Things (IoT), intelligent waste management, public transport management, municipality mobile applications, electronic health records, mobile health units, national payment gateway, and structural employment for young people is essential to reap the benefit of the demographic dividend and cope with digital disruptions, given the concomitant environmental impact. Also, a proper broad-based policy gap analysis is necessary to ensure that the ICT sector is grounded on sound policy frameworks, with a public and private partner for endorsing automation and digitalization and suggesting improvements if necessary, in order to incorporate the use of emerging technology in regulation to get the best out of the ICT.

To ensure digital transformation in the least developed countries like Nepal, and to contribute to more inclusive outcomes, national efforts should be complemented by more international assistance for optimizing the demographic transition, integrating the digital dimension into their aid policies and strategies with assistance aimed at reducing the digital divides, safeguarding the environment for value addition, building capacities in the private and public sectors, and supporting the enforcement of relevant laws and regulations in order to transform into a data-driven green digital economy.

REFERENCES

Aebischer, B., and L.M. Hilty. 2015. The energy demand of ICT: A historical perspective and current methodological challenges. In *ICT Innovations for Sustainability*. Springer International Publishing: Cham. Switzerland. 71–103.

Amin, S., A. Bajracharya, AJ. Bongaarts, M. Chau, and A.J. Melnikas. 2017. Demographic Changes of Nepal: Trends and Policy Implications. Final Report. Kathmandu: Nepal Planning Commission, Government of Nepal.

Attanasio, O.P., S. Kitao, and G.L. Violante. 2006. Quantifying the effects of the demographic transition in developing economies, *Advances in Macroeconomics* 6(1): 1–44.

Baller S., S. Dutta, and B. Lanvin. Eds. 2016. The Global Information Technology Report 2016 Innovating in the Digital Economy. World Economic Forum. (accessed 16 May 2020).

Bloom, D.E., D. Canning, and J. Sevilla. 2003. *The demographic dividend: A new perspective on the economic consequences of population change.* Rand: Santa Monica.

Bongaarts, J. 2009. Human population growth and the demographic transition. *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences* 364 (1532): 2985–2990. https://doi.org/10.1098/rstb.2009.0137 (accessed 20 May 2020).

Chalise, H.N. 2018.Demographic window of opportunity in Nepal**.** *Nepal Population Journal* 18(17): 133–140.

Chatfield, A., and C. Reddick. 2018. Customer agility and responsiveness through big data analytics for public value creation: A case study of Houston 311 on-demand services. *Government Information Quarterly.* 26(2). 346–357*.*

Chatterjee, S., A. K. Kar, and M. P. Gupta. 2018. Alignment of IT authority and citizens of proposed smart cities in India: System security and privacy perspective. *Global Journal of Flexible Systems Management*, 19(1), 95–107.

Cincotta, R. 2015. Demography and early warning: Gauging future political transitions in the Age-structural time domain. *Journal of Intelligence Analysis*. 22(2). 129–148.

Climate Watch. 2020. Historical Emissions. https://www.climatewatchdata.org/data-explorer/historical-emissions (accessed 5 August 2020).

Cohen, B., and P. Munoz. 2016. Sharing cities and sustainable consumption and production: Towards an integrated framework. *Journal of Clean Production* 134: 87–97.

Dwivedi, Y. K., V. Weerakkody, and M. Janssen. 2012. Moving towards maturity: Challenges to successful e-government implementation and diffusion. *ACM SIGMIS Database.* 42(4): 11. https://doi.org/10.1145/2096140.2096142 (accessed 20 May 2020).

Elliott, E., and L.D. Kiel.1999. *Nonlinear dynamics, complexity and public policy.* Nova Science Publishers. Commack. NY.

Garcia-Muiña, F.E., R., González-Sánchez, A.M., Ferrari, L., Volpi, M., Pini, C., Siligardi, and D. Settembre-Blundo. 2019. Identifying the equilibrium point between sustainability goals and circular economy practices in an Industry 4.0 manufacturing context using eco-design. *Social Sciences MDPI.* 8(8): 241.

Gebler, M., A.J.S. Uiterkamp, and C. Visser. 2014. A global sustainability perspective on 3D printing technologies. *Energy Policy* 74: 158–167.

Hasan, R., and M. Birgach. 2016. *Critical success factors behind the sustainability of the sharing economy.* In Proceedings of the IEEE 14th International Conference on Software Engineering Research. Management and Applications (SERA). Towson. MD. USA. 287–293.

Hilty, L.M., P. Arnfalk, L. Erdmann, J. Goodman, M. Lehmann, and P. Wäger. 2006. The relevance of information and communication technologies for environmental sustainability: A prospective simulation Study. *Environment Modelling and Software* 11: 1618–1629.

Janowski, T. 2015. Digital government evolution: From transformation to contextualization. *Government Information Quarterly* 32: 221–236.

Janssen, M., and N. Helbig. 2018. Innovating and changing the policy-cycle: Policy-makers be prepared! *Government Information Quarterly* 35(4): S99–S105.

Kannan, N., and A. Dharmalingam. 2012. A review of age structural transition and demographic dividend in South Asia: Opportunities and challenges. *Journal of Population Ageing* 5(4). 281–298.

Kar, A.K., V. Ilavarasan, M.P. Gupta, M. Janssen, and R. Kothari. 2019. Moving beyond smart cities: Digital nations for social innovation & sustainability. *Information Systems Frontiers* 21: 495–501.

Kaufmann, D., A. Kraay, and M. Mastruzzi. 2010. The worldwide governance indicators: A summary of methodology, data and analytical issues. *World Bank Policy Research, Working Paper No.* 5430.

Korovkin, V. 2019.*National digital economy strategies: A survey of Africa*. ORF Issue Brief No. 303. New Delhi. Observer Research Foundation.

Lee, R., and A. Mason. 2011. *Population aging and the generational economy: A global perspective.* Cheltenham. UK. Edward Elgar.

Lee, Y. B. 2017. Exploring the relationship between e-government development and environmental sustainability: A study of small island developing states. Sustainability. *MDBI*. 9: 732.

Linkov, I., B. Trump, K. Poinsatte-Jones, and M. Florin. 2018. Governance strategies for a sustainable digital world. *Sustainability* 10(2): 1–8.

Ministry of Communication and Information Technology. 2019. *Digital Nepal Framework.* https://mocit.gov.np/application/resources/admin/uploads/source/EConsultation/EN%20Digital%20Nepal%20Framework%20V8.4%2015%20July%20%202019.pdf (accessed 24 May 2020).

National Planning Commission and the United Nations Children's Fund (UNICEF). 2017. *Demographic Changes of Nepal: Trends and Policy Implications.* https://www.npc.gov.np/images/category/Demographic_Dividend_Report_May_2017_final_for_circulation1.pdf(accessed 20 May 2020).

Oizumi, K. 2013. Aging in Asia: When the Structure of Prosperity Changes. Tokyo: Oriental Life Insurance Cultural Development Center. http://www.olis.or.jp/pdf/Aging_in_Asia.pdf (accessed 19 May 2020).

Organization for Economic Co-operation and Development (OECD). 2017. *Key Issues for Digital Transformation in the G20.* Report Prepared for a Joint G20 German Presidency/OECD Conference 2017. https://www.oecd.org/g20/key-issues-for-digital-transformation-in-the-g20.pdf (accessed 20 May 2020).

Ross, J. 2004. *Understanding the demographic dividend*. Washington D.C. Futures Group. Policy Project.http://www.policyproject.com/pubs/generalreport/demo_div.pdf (accessed 15 May 2020).

Sui, D., and D. Rejeski. 2002. Environmental impacts of the emerging digital economy: The E-for-environment e-commerce? *Environmental Management* 29(2): 155–163.

Tammpuu, P., and A. Masso. 2019. Transnational digital identity as an instrument for global digital citizenship: The case of Estonian e-residency. *Information Systems Frontiers* 21(3). https://doi.org/10.1007/s10796-019-09908-y (accessed 20 May 2020).

Toni, M., M.F. Renzi, and G. Mattia. 2018. Understanding the link between collaborative economy and, sustainable behavior: An empirical investigation. *Journal of Cleaner Production* 172: 4467–4477.

United Nations Conference on Trade and Development (UNCTAD). 2019. Value Creation and Capture: Implications for Developing Countries. *Digital Economic Report 2019*. UN Publications. https://unctad.org/en/PublicationsLibrary/der2019_en.pdf (accessed 1 May 2020).

United Nations Population Fund (UNFPA). 2017. *Demographic dividend*. http://www.unfpa.org/demographic-dividend (accessed 20 May 2020).

World Bank. 2019. World Development Indicators (WDI). https://databank.worldbank.org/source/world-development-indicators# (accessed 5 August 2020).

World Bank Group. 2016. Digital Dividends. World Development Report. http://documents.worldbank.org/curated/en/896971468194972881/pdf/102725-PUB-Replacement-PUBLIC.pdf (accessed 20 May 2020).

Yaraghi, N., and S. Ravi. 2017. The current and future state of the sharing economy. 2017. Brookings India IMPACT Series No.032017. March 2017. http://dx.doi.org/10.2139/ssrn.3041207 (accessed 19 May 2020).

APPENDIX 1: KEY INDICATORS AND VARIABLES (1999–2019) INCORPORATED IN THE STUDY

Year	Working-Age Pop.	School Enrollment (%)	Urban Pop. (%)	Urban Pop. Growth (%)	Mobile Cellular Subscriptions (per 100 people)
1999	55.079	34.27134	12.857	6.078335	0.023394
2000	55.269	35.7619	13.397	5.93153	0.042713
2001	55.430	38.96552	13.947	5.704944	0.070998
2002	55.642	43.43044	14.24	3.62176	0.088495
2003	55.891	44.65308	14.538	3.497629	0.326412
2004	56.154	47.94606	14.841	3.403277	0.459406
2005	56.427	48.14908	15.149	3.325134	0.882969
2006	56.949	45.33157	15.462	3.28883	4.439006
2007	57.394	44.99971	15.781	3.246689	12.39035
2008	57.796	51.03944	16.105	3.103007	15.75005
2009	58.217	51.79061	16.434	2.832563	20.82271
2010	58.698	57.63132	16.768	2.493196	34.04098
2011	59.043	60.26435	17.108	2.111827	49.38563
2012	59.503	63.7488	17.458	1.834271	61.53811
2013	60.046	65.35344	17.815	1.757324	79.36417
2014	60.598	66.87903	18.182	1.998324	85.56218
2015	61.106	67.84369	18.557	2.442467	101.8546
2016	62.076	70.77675	18.942	2.960308	117.8146
2017	62.998	74.07729	19.336	3.392323	130.6294
2018	63.858	75.27547	19.74	3.721818	139.4464
2019	64.647	80.17992	20.153	3.907939	156.0244

Year	Individuals Using the Internet (%)	HDI	Governance	Trade (%)	GHG Emissions
1999	0.146669	0.439	–0.37	52.566	63,930,000
2000	0.204652	0.446	–0.47	55.710	64,270,000
2001	0.240015	0.447	–0.45	55.799	60,970,000
2002	0.312956	0.457	–0.45	46.230	59,420,000
2003	0.382811	0.462	–0.46	44.247	63,110,000
2004	0.449844	0.469	–0.72	46.147	62,300,000
2005	0.826551	0.475	–0.69	44.062	63,970,000
2006	1.141389	0.486	–0.61	44.761	36,410,000
2007	1.41	0.491	–0.65	44.579	36,470,000
2008	1.73	0.502	–0.7	46.036	39,490,000
2009	1.97	0.514	–0.76	47.079	42,970,000
2010	7.93	0.529	–0.8	45.984	43,660,000
2011	9	0.535	–0.8	41.828	43,780,000
2012	11.1493	0.548	–0.78	43.658	48,140,000
2013	13.3	0.554	–0.75	48.145	48,590,000
2014	15.44	0.56	–0.69	52.255	51,280,000
2015	17.58162	0.566	–0.68	53.095	47,230,000
2016	19.68876	0.569	–0.79	48.751	61,250,000
2017	34	0.574	–0.71	51.363	58,756,000
2018	33.69671	0.579	–0.63	55.084	62,511,800
2019	39.96096	0.583	–0.673	54.925	66,402,440