Impact of Cross-border Data Flow Restrictions on Bangladesh Economy

RAPID
Research and Policy Integration for Development (RAPID)

CUTS International

#2210

Table of Contents

1 Acknowledgments

The study has been jointly undertaken by Research and Policy Integration for Development (RAPID), and CUTS International. The team include Dr. Abdur Razzaque (Chairman, RAPID & Research Director, Policy Research Institute), Dr. Shagufta Gupta (Senior Fellow, CUTS International), Jillur Rahman (Assistant Professor of Economics, Jagannath University & Associate Director, RAPID), Amol Kulkarni (Research Director, CUTS International), and Kapil Gupta (Assistant Policy Analyst, CUTS International).

The report benefitted from valuable inputs and comments from a stakeholder consultation. The authors are grateful to Syed Almas Kabir (Former President, BASIS), Dr Mahfuz Kabir (Research Director, Bangladesh Institute of International and Strategic Studies (BIISS)), Tawhidur Rahman (Senior Technical Specialist (Digital Security and Digital Diplomacy), Bangladesh Computer Council), Enamul Hafiz Latifee (Joint Secretary (Research Fellow), BASIS), Mahfuz Rahman (General Secretary, Bangladesh Freelancer Development Society), Md Akhtaruzzaman Adnan (Assistant Professor, University of Asia Pacific), AKM Ahmedul Islam (Founder, TechKnowGram Limited), Raisul Kabir (Co-founder and CEO, Brainstation-23), Raihan Sikder (Activation Ltd.), Asif Khan Shakir (Daffodil International University), Doulot Akter Mala (Senior Correspondent, The Financial Express) for their valuable inputs. The study team expresses sincere gratitude to all the key informants and stakeholders interviewed as part of the study.

Any views expressed and/or shortcomings associated with this publication are those of the authors and in no way should be attributed to the individuals and institutions named above.

2 Introduction

Bangladesh's Information and Communication Technology (ICT) sector has shown phenomenal annual growth after the launch of the Digital Bangladesh initiative in 2010. The ICT, marked as a thrust sector with high growth opportunities, job creation, and positive spill-over effects on other sectors, has become instrumental for robust economic growth. Therefore, the Digital Bangladesh initiative has now been extended further under Vision 2041, with the enhancement of the ICT sector and effective technology for socio-economic development being at its core.

In the era of the fourth industrial revolution, digital trade has taken a central role around the world, facilitated by the free flow of cross-border data and digitalisation. With 6 out of 10 people worldwide utilising the internet, today's world is more connected than ever, resulting in enormous data flows. This link is expected to expand further — increased internet penetration and the emergence of IT-enabled services (IT-es) are dramatically changing how people live, work, trade, communicate, and practically do everything else, eventually boosting cross-border data flows (CBDF).

Such flows generate the potential for capturing new markets without the need to physically enter them, enabling small companies to reach out to potential clients worldwide by using internet platforms.

The mobility of data across borders is critical to the global economy. According to a McKinsey analysis, data flows produce greater economic value than traditional flows of traded goods. While some governments allow data to move freely throughout the world, acknowledging that legal safeguards can follow the data, many others have erected additional obstacles to data transfers, making it more expensive and time-consuming, if not illegal, to transmit data internationally.

The four years since the Information Technology and Innovation Foundation's (ITIF) last major study on data flows and localisation, forced local data-residency regulations that limit data within a country's boundaries, known as "data localisation," have grown and increased. It has been observed that the Bangladesh government, like other countries throughout the world, including India, has been steadily indicating a shift toward data protection, including localization. Bangladesh still does not have a broad policy framework to prohibit cross-border data flows or mandate data localisation. However, certain existing and proposed rules imply a legislative framework prescribing control over data management, resulting in restrictions on cross-border data flows.

A Data Protection Act (DPA) has been drafted and might be published in the official gazette. The Act aims to protect personal data regarding life, property, freedom of opinion, speech, and conscience and their right to privacy, secrecy, and personal identification. This law will serve as a formal basis for the country's data protection and privacy.

Sections 42 and 43 of the draft DPA include data localisation and cross-border data flow restrictions. Section 42 directs that the sensitive data, user-generated data and classified data shall be stored only in Bangladesh. It shall be outside the jurisdiction of the courts, law enforcement agencies or authorities are of any other state other than the courts and law enforcement agencies or authorities of Bangladesh. Section 43 advised that any data, including sensitive and user-generated data, may be transferred outside Bangladesh with the data subjects' prior consent (Box 1).

Such restrictions may negatively affect the ICT sector's trade, productivity, and growth prospects, which would affect other activities that heavily rely on data. It is imperative to assess the potential and issues posed by CBDF regulations.

Box 1: Data Protection Act (DPA) provisions regarding data localisation and cross border data flows

Section 42: Storage of sensitive data, user-generated data and classified data –
(1) Sensitive data, user-generated, and classified data shall be stored only in Bangladesh. It shall be outside the jurisdiction of the courts, law enforcement agencies, or authorities of any other state other than Bangladesh's courts and law enforcement agencies or authorities.
(2) If the Government, from time to time, by general or special order, designates any data as classified data, such data shall not be transferred to any place or system without the government's prior approval.

Section 43: Provisions relating to the transfer of data as referred to in section 42 –
(1) Notwithstanding anything contained in any other provisions of this Act, if necessary for the data subject, any data, including any of his sensitive and user-generated data, may be transferred outside Bangladesh with his consent. (2) If any data is transferred outside Bangladesh under sub-section (1), the Director-General shall be informed thereof, in the manner prescribed by the Rules.

3 Objective and Methodology of the Study

The broad objective of this study is to assess the impact of cross-border data flow restrictions on the economy of Bangladesh. More specifically, there are two specific objectives for understanding and analysing the impact of restrictions on CBDF on:

i) the digital services exports of Bangladesh; and
ii) the economy of Bangladesh.

This objective also entails understanding the importance of the IT/ITeS sector to the economy of Bangladesh. Report one of the study provided an empirical understanding of the impact of policy measures that restrict the cross-border flow of data on the digital services exports of Bangladesh. This report addresses objective two. It first gives a comprehensive understanding of the role of IT/ITeS sector and CBDF in the economy and growth of Bangladesh.

It then provides empirical evidence and estimates of the impact of CBDF restrictions, via digital services exports, on the GDP of Bangladesh. Finally, the report discusses the stakeholders' views on the possible impact of such restrictions on business, employment, innovations and human capital developments.

To attain the objectives, the study uses a mixed-methods approach and relies on qualitative and quantitative methods for analysis. The research methods used were:

(i) Secondary literature review: Literature from multilateral organizations such as WTO, UNCTAD, World Bank, etc., research and policy papers, academic research and media discourse was thoroughly reviewed and analysed.
(ii) Statistical Analysis: Various statistical techniques such as mean, trend, growth rate and correlation analysis were used on secondary data about FDI, employment, GDP etc.
(iii) Econometric and Scenario analysis: Econometric model was formulated to estimate and build possible scenarios around the impact on GDP due to the decline in digital services exports due to CBDF restrictions.
(iv) Key Informant interviews: Insightful interviews aided by a semi-structured questionnaire were conducted with government, industry, policy and academic experts.

4 Importance of IT/ITeS and cross border data flows to the economy

With six in ten people using the internet across the globe, the world has become more connected than ever, resulting in unprecedented data flows. This connectivity is projected to grow further – global internet traffic in 2022 is estimated to surpass all the Internet traffic up to 2016, as indicated by the UNCTAD Digital Economy Report 2021. The increased penetration of the internet and the rise of IT-enabled services profoundly shape how people live, work, trade, communicate, and almost everything, eventually driving cross-border data flows.

A World Bank study revealed that a 10 percent rise in internet penetration in the exporting country leads to a 1.9 percent increase in exports along the extensive margin (the number of goods). A 10 percent surge in internet penetration in the importing country causes a 0.6 percent increase in exports along the intensive margin (the average value of goods) (World Bank, 2016).

IT/ITes sector and data flows are paramount in driving today's economy. According to one estimate by McKinsey, cross-border data flows account for 3 percent of global GDP (Manyika et. al, 2016). In 2014, the free flow of data was estimated to have contributed US$2.8tn to the world economy and by 2025 this figure could stretch to about US$11ton (McKinsey&Company, 2015).

One study has revealed that some 12 percent of international trade in goods has been estimated to take place via global e-commerce platforms such as Alibaba and Amazon. Not only the e-commerce giants, but businesses across the world can also use the internet (i.e., digital platforms) to trade goods, purchase and consume services online, collect and analyse data and provide new services and add value to goods exports. Cross-border data flows underpin the global value chains and offer new opportunities for participation.

Furthermore, data flows create opportunities for entering new markets without physically stepping there. For instance, cross-border data flows open markets for the US and the European Union (EU) businesses where EU businesses have access to a market of over 300 million US consumers and US businesses have access to a market of nearly 450 million EU consumers (U.S. Chamber of Commerce, 2021).

The digital economy is no longer distinct from the general economy. In the new era of international trade, cross-border data flows play a critical role in the management and monitoring the transport of goods and services. According to McKinsey & Company (2016), 86 percent of tech companies were "born global" and used some sort of cross-border operations.

The digitisation of markets and commerce could, at its core, boost production and competitiveness (Bernard et al., 2007 and World Bank, 2016). The free data flow decreases processing costs and distance limits while increasing operational efficiencies. Increased access hastens the dissemination of innovations and allows people worldwide to take advantage of emerging research and developments, resulting in the proliferation of new businesses (Deloitte, 2016).

The internet and cross-border data flows can accelerate the participation of small businesses in international trade. This has profound implications for South and East Asia, where small businesses account for 60-99 percent of all businesses, contribute to 50-98 percent of all employment, and comprise 35-70 percent of gross domestic product (GDP). Utilising digital platforms such as eBay or Alibaba, small businesses can access their potential customers across the world.

A study indicated that eBay-based small enterprises are exporting more than offline businesses. In Indonesia, only 3 percent of offline small businesses export their items, whereas 97 percent of online businesses on eBay are engaged in exporting activities (eBay, 2016).

New technologies are now gaining momentum and making access to digital inputs such as cloud computing easier for any business to provide them accessible computing power and software services that only large companies could afford previously. These advancements in digital services can help reduce fixed information technology costs and enhance business competitiveness (Meltzer & Lovelock, 2018).

Technologies such as cloud computing, Internet of Things (IoT), Artificial Intelligence (AI), Machine Learning (ML), Blockchain are gaining momentum across the world with the developed countries being the early adopters of these new frontiers (Box). These technologies have the potential to unleash new services and enhance lives and livelihoods. However, such technologies and their operation rely on the movement of data. To benefit from these advanced technologies, a country must have the necessary regulatory framework to facilitate data movement.

Box 1: Global Projections of New Frontier Technologies

- The global cloud computing market is projected to grow from US$445bn in 2021 to about US$950bn by 2026, at a Compound Annual Growth Rate (CAGR) of around 16 percent.
- IoT connections are estimated to reach about 25 billion in 2025 from nearly 11 billion in 2019, growing at a CAGR of 15 percent, according to Ericsson Mobility Report 2019.
- The global cellular IoT market is projected to reach over US$18,000mn by 2027 from about US$5,000mn in 2021, registering a compound annual growth rate (CAGR) of 22.6 percent during 2021–2027, as estimated by a study by The Insight Partners.
- The Blockchain market is expected to grow from roughly US$5bn in 2021 to over US$67bn by 2026, clocking a CAGR of 68.4 percent.

Source: Author's compilation from various sources (Markets and Markets, Ericsson Mobility Report 2019, The Insight Partners, Reportlinker.com)

Adopting these technologies would require enhanced cross-border data flow, potentially empowering innovation to improve consumer welfare. This can apply to a range of areas, including healthcare, finance, education, and social well-being, among others (Mok, 2020).

Consider the case of a student in Bangladesh who logs into a US-based e-learning platform to join a lecture delivered by a leading academic from Singapore; or a doctor utilising an AI platform that processes clinical trial data across the globe to determine the best intervention for her patient; a cybersecurity expert based in the US who is trying to resolve a security breach that happened in Zambia - one thing common to all these examples is the reliance on the smooth flow of data across international borders. However, new frontier technologies are at a nascent stage in Bangladesh and are perceived to gain momentum in the future, as experts suggest.

For instance, some government organisations are using IoT-enabled water and air quality monitoring systems. Organisations like the Bangladesh Water Development Board (BWDB), Bangladesh Agriculture Development Corporation (BADC), and the Department of Environment (DoE) are utilising IoT-connected devices to strengthen their monitoring mechanism (BGD e-GOV CIRT, n.d.). IoT-powered smart farming, smart metering, smart city applications, among others, are now at the early stage of application. How these applications (and more novel ones) would shape the future of Bangladesh's economy and cross-border data movement would be determined by the type of data required and underlying technology usage.

Industry experts believe that Bangladesh is expected to experience a rise in its cross-border data flows due to the increased adoption of ITeS and the proliferation of e-commerce trade within the country. In the wake of the COVID-19 crisis, Bangladesh's e-commerce boomed when the physical marketplaces had restricted access.

Before the COVID-19 crisis, consumers were largely skeptical about online shopping and would instead visit the marketplaces. But COVID-19 has forced people to try online shopping, albeit only a few categories such as groceries, health essentials, and food items have registered

increased online sales. Industry insiders suggest that this may help shape the future of cross-border e-commerce between Bangladesh and the rest of the world. Conducive policies must be in place to drive the growth of ITeS and benefit from the data movement across the borders.

Restricting data flow can adversely impact the economy (Castro, 2013) and hamper the ITeS sector, eventually hurting consumer welfare. In terms of both economic growth and social progress, the harm of restricting cross-border data flows significantly outweighs any marginal benefits from data protectionism (Meltzer and Lovelock, 2018). Data protectionism builds trade barriers and has a negative impact on business models, lowering efficiency, competition, and competitiveness (Deloitte, 2016).

According to the same study, data localisation criteria restrict customers and companies' access to digital commerce networks, digital services, and opportunities in the affected country. Due to limited data flows, companies are forced to invest in facilities of poor quality. Which limits overall productivity and increases the costs of doing business for the industries that local data suppliers represent, stifling the growth of local small and medium-sized businesses. Business's ability to synthesise massive data sets is hampered by limited access to unrestricted data flow. This deprives small retailers and customers of better goods and services that might be less expensive (Deloitte, 2016).

Several studies have been conducted to quantify the economic costs of data localization requirements. A recent report estimates that data localization measures would result in a 1.7 percent decrease in GDP for India and 0.5 percent and 0.1 percent for Indonesia and Vietnam respectively (UNDP, 2021).

The European Centre for International Political Economy (ECIPE, 2013) investigated the effects of planned and implemented data localisation policies in Brazil, China, the European Union, India, Indonesia, South Korea, and Vietnam, stating that proposed or enacted data constraints would limit GDP in India (-0.1 percent), Indonesia (-0.5 percent), and Vietnam (-1.7 percent).

The study further suggested that if data localisation criteria were implemented across all sectors of the economy, GDP losses in India and Indonesia could be as high as -0.8 percent and -0.7 percent, respectively. These regulations are approximately costing US$193bn annually to residents of the European Union, owing in part to higher inflation.

According to the Information Technology Industry Council (ITI), if international data flows were severely interrupted or halted, it would reduce EU GDP by 0.8–1.3 percent (Meltzer and Lovelock, 2018). Data localisation criteria have a negative effect on investment as well. Data localisation is expected to reduce investment in Vietnam by 3.1 percent, Indonesia by 2.3 percent and India by 1.4 percent. Also, because of the direct lack of competition, China and Indonesia's exports will fall by 1.7 percent (Castro and McQuinn, 2015).

Cross-border data transfer controls affect both the competitiveness of the government enacting the laws and other jurisdictions in the global economy.

Stricter data protection policies could have a detrimental effect on the productivity of the sectors and industries that relies on data. Ferracane et al. (2018) found that restrictive data policies result in a substantial productivity loss for local companies in industries and services sectors more reliant on data. It is estimated that lifting restrictions on data flows would generate a TFP increase of around 4.5 percent, with stronger benefits in data-intensive sectors such as retail and information services Ferracane et al. (2018).

Restrictive data regulations could suppress innovation, economic growth and international trade. Although a comprehensive impact of restricting cross-border data flow remains to be seen, experts believe that the free flow of data is necessary to support businesses, boost competitiveness, and promote overall welfare.

Literature suggests that digital services exports are closely correlated to employment and indicators of innovations such as the number of start-ups and the number of patents filed. Utilising the Global Trade Analysis Project (GTAP) model, Lee-Makiyama and Lacey (2021) found that the data localisation requirements for the Internet of Things (IoT) technologies could suppress economic activity, which will have a considerable negative impact on jobs causing 205,000 lost jobs in Brazil, 372,000 in Indonesia and 182,000 in South Africa. The loss on investment could be as high as US$5bn in Brazil and Indonesia and US$4bn in South Africa.

Data localisation can create a competitive advantage for domestic companies at the cost of foreign companies in the short run. However, such a barrier might be detrimental as innovation would be thwarted in the long run and the market will become less competitive (Kathuria, Kedia, Varma and Bagchi, 2019).

5 Infrastructure, FDI and exports of ICT/ITeS in Bangladesh

Before undertaking the impact assessment of CBDF restrictions on the economy, it is important to understand the state of ICT infrastructure, investment, and employment. This section provides an overview of the current infrastructure, foreign direct investment, employment opportunities and compensation structure. It also provides an assessment on the possible correlations between digital services exports and GDP.

ICT infrastructure in Bangladesh

Bangladesh is a relative newcomer to the information and communication technology (ICT) industry, but is doing fairly well since adopting the Digital Bangladesh Vision in 2010. While the Digital Bangladesh vision was initially crafted, with the modern philosophy of effective technology use in terms of implementing the government's commitment to development in areas such as education, health, job placement, and poverty reduction, for up to the year 2021, the initiative has now been extended further under Vision 2041. Increasing ICT use and effective technology use for socio-economic development is at the core of Digital Bangladesh.

According to the ITU's ICT Development Index 2017 – the index assesses the state of ICT development – Bangladesh ranked 147th out of 176 countries in an annual study that assesses the state of ICT development. While there are numerous long-term challenges in developing the ICT sector, particularly spending on research and development and infrastructure , the country has achieved significant progress.

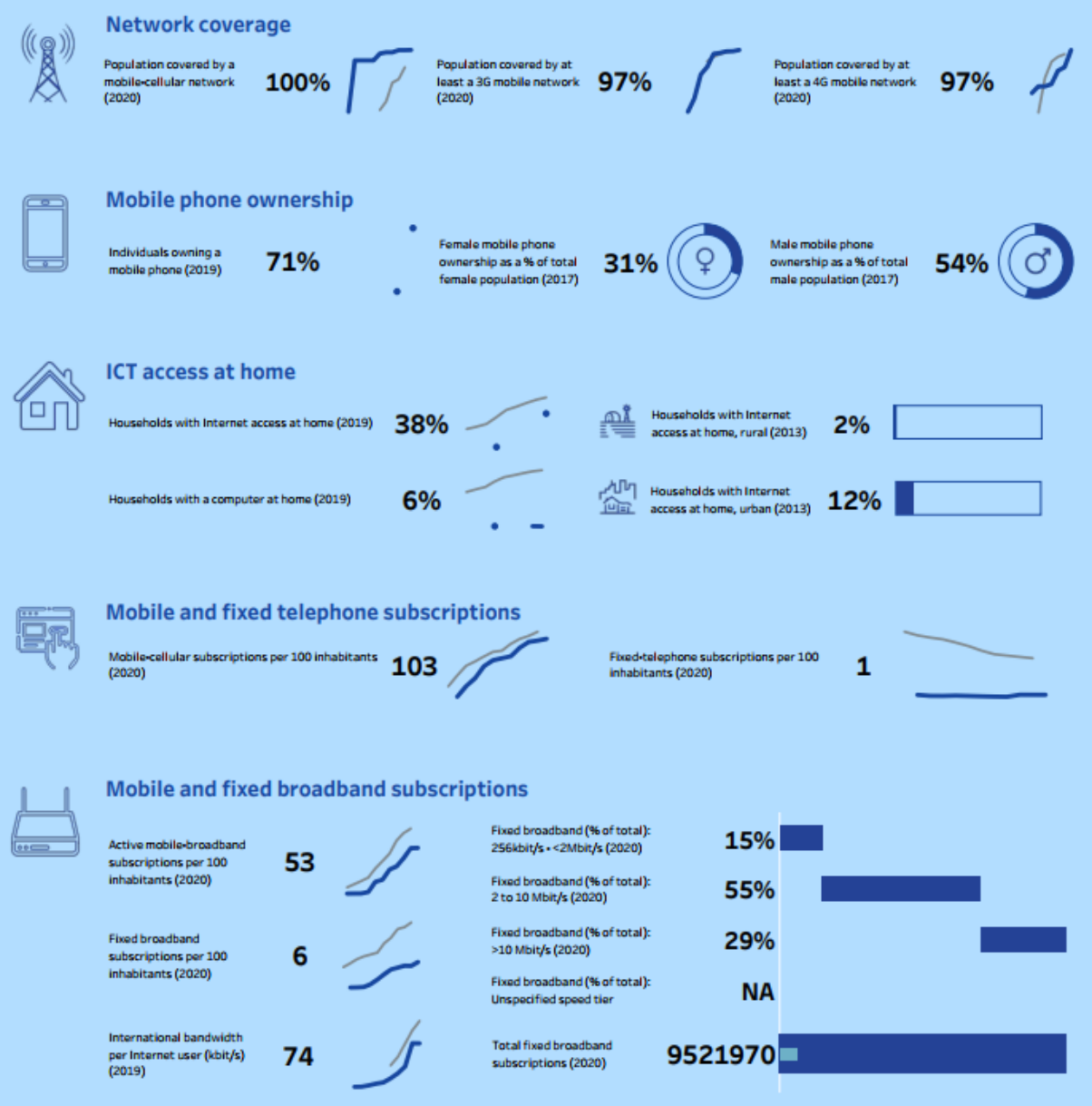
Bangladesh had just 16,000 kilometers of fiber network in 2009, which has grown approximately seven times to 110,000 kilometers in 2020 (8th Five Year Plan).[1] According to the International Telecommunication Union (ITU), the number of internet users increased from just 3.7 to 28 percent of the population during 2010-2017. In 2020, 100 percent of population was covered by mobile-cellular network.[2] Of them, 97 percent had access to 4G network (Figure 1).

[1] https://www.thedailystar.net/business/news/ict-infrastructure-shaping-sync-economic-boom-2023145

[2] Mobile-cellular telephone subscriptions refers to the number of subscriptions to a public mobile-telephone service that provide 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. It excludes subscriptions via data cards or USB modems; subscriptions to public mobile data services; private trunked mobile radio; telepoint; radio paging and telemetry services.

Mobile-cellular subscriptions per 100 inhabitants stood at 103 – higher than India (83.6) and Pakistan (79.5). According to the ITU data, active mobile-broadband subscription was 53 per 100 inhabitants, while the figure for fixed-broadband connection stood at just 6. Figure 18 provides a snapshot of the mobile and internet infrastructure and access in Bangladesh.

Figure 1: Mobile and Internet Infrastructure and Access in Bangladesh



Source: ITU, World Telecommunication/ICT Indicators Database.

The Government of Bangladesh is also taking initiatives to develop ICT infrastructure. The government is in the process of developing 28 government High-tech Parks (HTP), Software Technology Parks (STP), High-tech cities and High-tech villages. Additionally, there are 8 private Software Technology Parks (8th FYP). The National Data Center (NDC) of Bangladesh is being operated and managed by the Bangladesh Computer Council. Infrastructure as a

Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS) are the three primary kinds of services provided by NDC.[3]

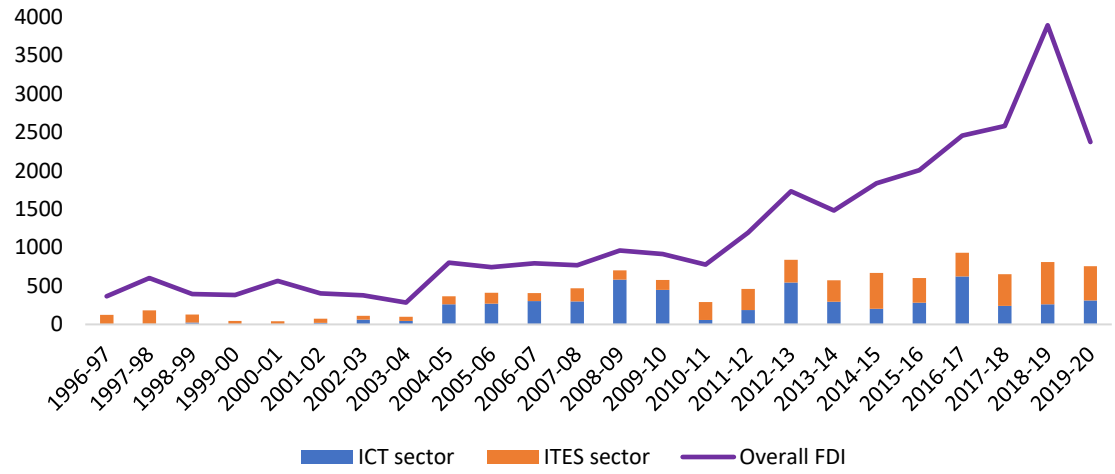
Currently there are 6 Data Centers in Bangladesh.[4] To develop storage infrastructure, government is setting up Tier-3 and Tier-4 National Data Centres in different parts of the country, and developed Tier-4 Data Disaster Recovery Center in Jessore. Improvements in all these areas will help accelerate growth in agriculture, manufacturing, education, health, human resource development, social security, environmental and disaster management, etc. It will also facilitate exports of digital goods and services.

Foreign Direct Investment in the IT/ITeS Sector

In 2019-20, the net foreign direct investment (FDI) in Bangladesh was US$2.37bn, of which US$758mn was invested in the ICT/ITeS industry (Figure 2).[5] During the same year, the ICT sector attracted US$311mn.[6] A major part of the ICT investment was due to telecommunication. This is accountable to the huge infrastructural upgradation to adapt with technological advancement in the telecommunication sector and mobile internet technology.

The share of ICT/ITeS in total FDI was more than 30 percent in 2019-20. The total accumulated FDI stock in the IT/ITeS sector stood at US$4.6bn – about a quarter of total stock (Figure 3). 26.5 percent of FDI in ICT/ITeS sector was due to U.K. investors followed by Malaysia (16.4 percent), the United States (11.3 percent), India (7.7 percent), Norway (7 percent), Saudi Arabia (5.6 percent), and Sri Lanka (4.3 percent) (Figure 4).

Figure 2: Net FDI Inflow in Bangladesh



Source: Authors' analysis using Bangladesh Bank data.

[3] https://ndc.bcc.gov.bd/?page_id=106
[4] https://discover.cloudscene.com/market/data-centers-in-bangladesh/all
[5] Overall FDI inflow in 2019-20 declined significantly due to the covid-19 induced economic shock worldwide.
[6] ICT include telecommunication, and Computer software and IT.

Figure 3: FDI Stock in Bangladesh at end-June, 2000-2020, (in US$mn)

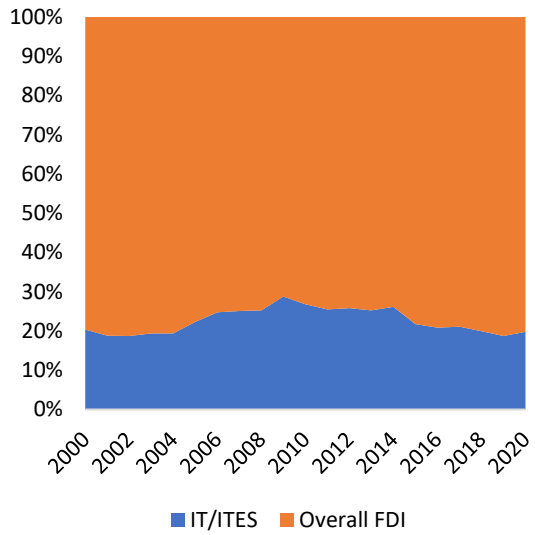
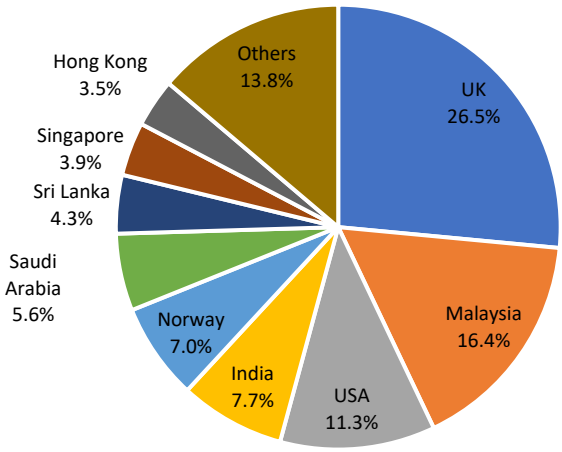


Figure 4: FDI Stock n IT/ITES sector by source country, June 2020



Source: Authors' analysis using Bangladesh Bank data.

Box 2: 8th FYP Strategic Areas and Investment Priorities for the Development of ICT Sector

Eighth Five-Year Plan Strategic areas for the ICT sector

- Leveraging Line Ministry Centric Digital Economy Opportunities
- Adopting the Five Helix Approach
- Establishing cooperation between Industry, Academia, and Government
- Intellectual Asset and Local and Global Market Centric Start-up Success Creation and Youth Empowerment while leveraging on local opportunities
- Leveraging of Redesign Capability for Creating Success in High-tech Devices and Innovation
- Turning high-tech Parks into Nucleus of Digital, Knowledge and Innovation Economy
- 4IR Productive Knowledge Acquisition
- Digital Economy for Leveraging Fourth Industrial Revolution
- ICT for Greater Transparency, Good Governance, and Service Delivery
- Ensuring Equitable and Fair Share of Bangladesh in Global Digital Value Chain
- Leveraging Digital Economy for Attaining Sustainable Development Goals
- Intensifying Effectiveness and Efficiency, and Encouraging Private Investment
- Developing the Culture and National Innovation System for Leveraging Knowledge Economy
- Harnessing the power of ICT for revival from the effect of COVID 19 and for adaptability to shocks arising from health crisis, natural disaster, climate change, or global shift in competitive landscape

Eighth Plan investment priorities for the development of ICT sector

- Ensure rapid and satisfactory completion of all ongoing ICT projects.
- Upgrade ICT infrastructure to provide space for projected growth of ICT services in adequate speed and reliability.
- Provide funding for R&D in ICT & Science and Technology
- Provide funding for ICT capacity building in public institutions
- Support ICT initiatives to expand services in the rural areas (cloud- based service, National helpline, BPO, Incubation Centre, ICT Research & Development centre, Broadband connectivity etc.)
- Develop and implement an e-government master plan

- Support product innovation & creation ecosystem
- Provide physical incentives & Institutional reform to create appropriate investment climate
- Establish Virtual University, Multimedia University
- Support in promotion of Bangladesh ICT Industry in the global market to brand Bangladesh as a destination for software, hardware, BPO, freelancing and ICT Innovation.

Employment in the ICT/ITeS sector

In Bangladesh, there is no precise information about employment in the ICT/ITeS sector. According to the IT-ITES Industry Statistics of Bangladesh 2019, the industry's expected full-time employment was 64,067. (Table 1).

With 62,524 part-time workers included, total employment in registered enterprises was 126,591 (in 2018). Employment in the sector has expanded reportedly at a compound annual growth rate (CAGR) of 22.3 percent. This stated employment is merely a stated picture. Many small businesses in the sector are not registered members of any of the organisations that participated in the study. Aside from that, a large number of people work independently. When all of this is taken into account, BASIS estimates that there might be 400,000 people directly working in his field, with 15-20 percent of them being women (USAID, 2019).

Table 1: Total Employment of IT-ITES Industry (2013-18)

Year	2013	2014	2015	2016	2017	2018	CAGR
Full-time Employment of the IT/ ITES Industry	23,392	28,615	35,003	42,817	52,375	64,067	**22.32%**
Part-time Employment of the IT/ ITES Industry	22,829	27,925	34,159	41,785	51,113	62,524	**22.32%**
Total Employment of the IT-ITES Industry	46,221	56,540	69,162	84,602	103,488	126,591	**22.32%**

Note: Estimades are based on the revenue generated by 1755 members of BASIS, BACCO and E-cab. Revenue of nonmembers and others subsectors such as internet service providers, IT hardware companies, gig economy, IT workers in as manufacturing, finance, healthcare, government, etc. are not included.
Source: IT-ITES Industry Statistics of Bangladesh 2019.

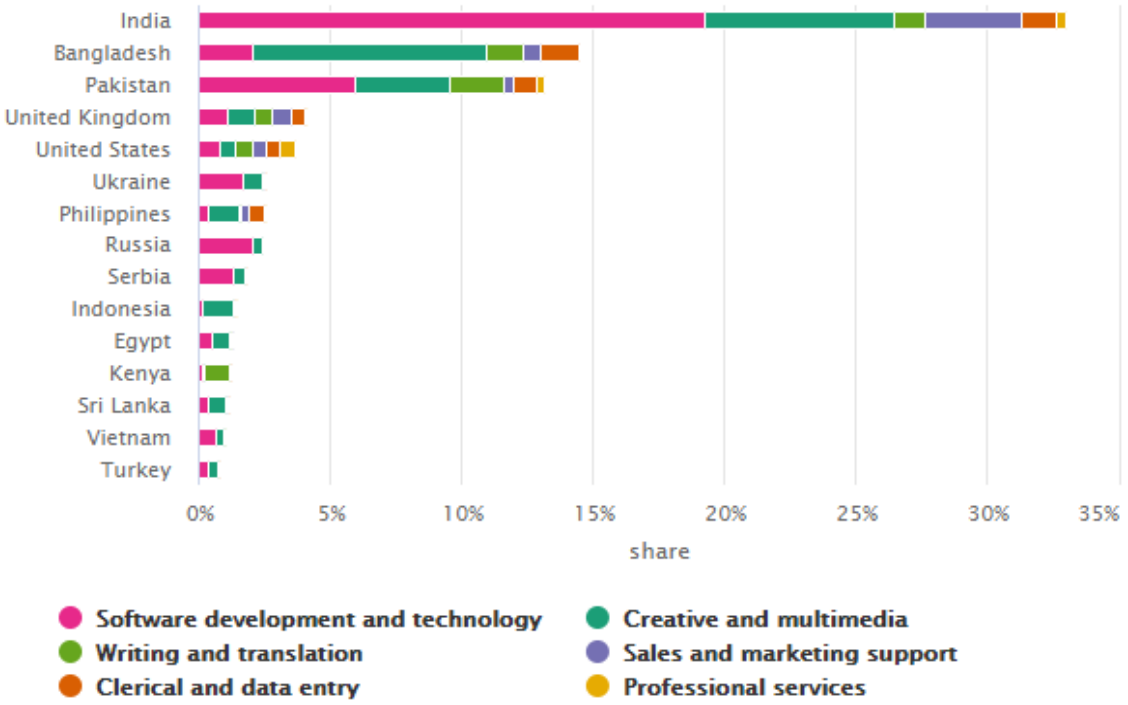
Along with formal and informal employment in the ICT/ITeS industry, a significant number of people work as freelancers. The government's digitalisation of Bangladesh initiative, as well as the ongoing development of ICT infrastructure, such as easy internet access in both urban and rural areas, and several public and private initiatives to promote freelancing, among other, are facilitating the country's rapidly growing freelancers. Over 650,000 freelancers are registered in the country, with 500,000 actively participating in the global gig economy. According to the ICT Minister, online workers earn around US$500mn every year.

According to the Oxford Internet Institute's (OII) Online Labour Index 2020, Bangladesh is the world's second-largest source of online labor (after India). Bangladesh accounts for about 15

percent of global internet labor, while India accounts for 33 percent (Figure 5). In Bangladesh, female workers made up roughly 17 percent of all online gig workers (Stephany et al., 2021).[7]

According to the latest time series estimates of OLI 2020 data, Bangladesh's proportion of the global online worker population has climbed by 5 percentage points in the last five years. Bangladeshi internet gig workers mostly work in creative and multimedia fields, as well as software development and technology (Figure 5).

Figure 5: Major Suppliers of Global Online Labour



Note: Clerical and data entry - customer service, data entry, transcription etc; creative and multimedia – animation, graphic design, photography; professional services – accounting, legal, project management; sales and marketing support – lead generation, posting ads, search engine optimisation; software development and technoogy – data science, game development, mobile application development etc.; writing and translation – article writing, copywriting, translation
Source: Online Labour Index 2020, Oxford Internet Institute (OII)

Compared to other skill intensive sectors, the ICT sector in Bangladesh offeres well paid employment for the workers with required skills. The average monthly earnings of entry level workers in the ICT/ITeS sector varies in the range of BDT 30,000-40,000, according to the IT-ITES Industry Statistics of Bangladesh 2019. The earnings for the top level employees in the management track progessionals is BDT 1,27,243 and for technical track professionals is BDT 80,382 (Table 2).

[7] Stephany, F., Kässi, O., Rani, U., Lehdonvirta, V. (2021). Online Labour Index 2020: New ways to measure the world's remote freelancing market.

There are clear differences in the earnings of management and technical track professionals. According to the labour force survey of Banfladesh 2016-17, the average montly income of Information and communication technology professionals was 23,810. Apparently, the average earnings of IT/ITeS professionals seems to be relatively higher than some other professionals (Table 3).

Table 2: Average Monthly Earnings of IT/ITES Professionals (taka)

Professionals	Top level	Mid-level	Entry level
Management track professionals	127,243.09	86,058.06	37,473.40
Technical track professionals	80,382.61	63,307.19	31,866.56

Source: IT-ITES Industry Statistics of Bangladesh 2019.

Table 3: Average Monthly Income from Employment (wage/salary), by Occupation and Sex

Industry/sector	Male	Female	Total
Agriculture, forestry and fishing	8,915	7,460	8,712
Mining and quarrying	9,767	11,636	9,818
Manufacturing	12,983	10,132	12,068
Electricity, gas, steam and air conditioner	28,503	17,289	27,489
Water supply, sewerage, waste management	18,955	10,610	16,584
Construction	9,951	8,900	9,864
Wholesale and retail trade, repair of motor vehicle	12,819	11,419	12,620
Transportation and storage	11,918	12,613	11,981
Accommodation and food service activities	12,904	10,145	12,314
Information and communication	24,158	20,749	23,810
Financial and insurance activities	33,576	26,418	32,278
Real estate activities	27,215	31,669	27,529
Professional, scientific and technical	24,754	17,809	23,931
Administrative and support service activities	16,229	18,563	16,581
Public administration and defense	24,518	21,795	24,125
Education	24,426	22,701	23,730
Human health and social work activities	24,630	22,224	23,414
Arts, entertainment and recreation	15,005	15,949	15,148
Other service activities	14,811	12,724	14,291
Activities of households as employers	9,441	7,644	8,041
Activities of extraterritorial organization	23,251	13,368	21,967
Total	13,583	12,254	13,258

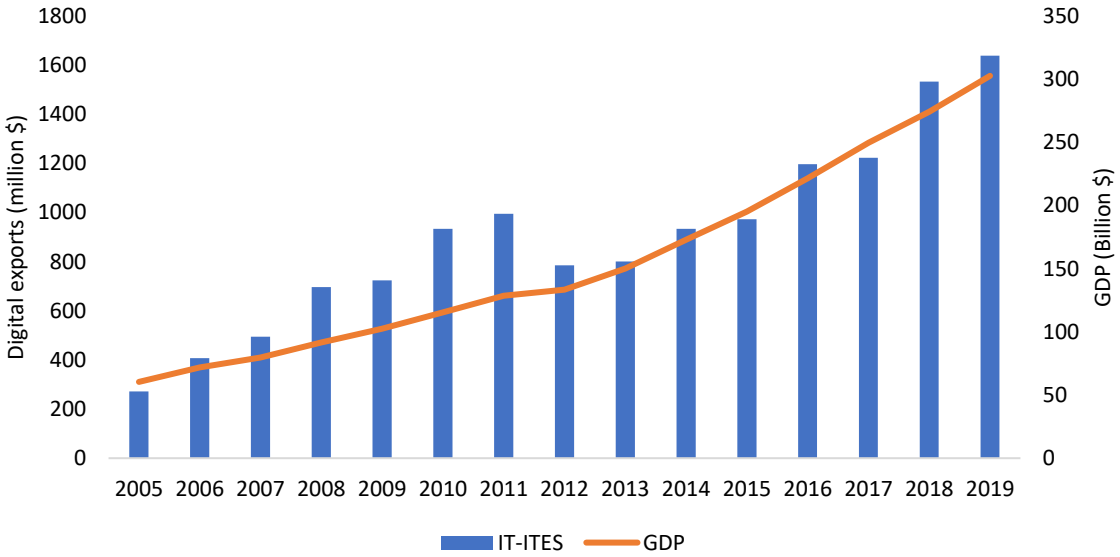
Source: Labour Force Survey (LFS) 2016-17, Bangladesh Bureau of Statistics (BBS).

Digital Exports and the Bangladesh Economy

Digital services exports are strongly correlated with GDP (Figure 6). Over the past 15 years, average annual growth rate of IT-ITES services exports was more than 15 percent against 13.6 percent growth in nominal GDP. A simple correlation analysis between IT-ITES services exports and GDP shows the correlation coefficient of 0.97 – a strong positive correlation. A cross-country analysis also shows that per capita GDP and the share of IT-ITES services in total services exports are also positively related (Figure 7).

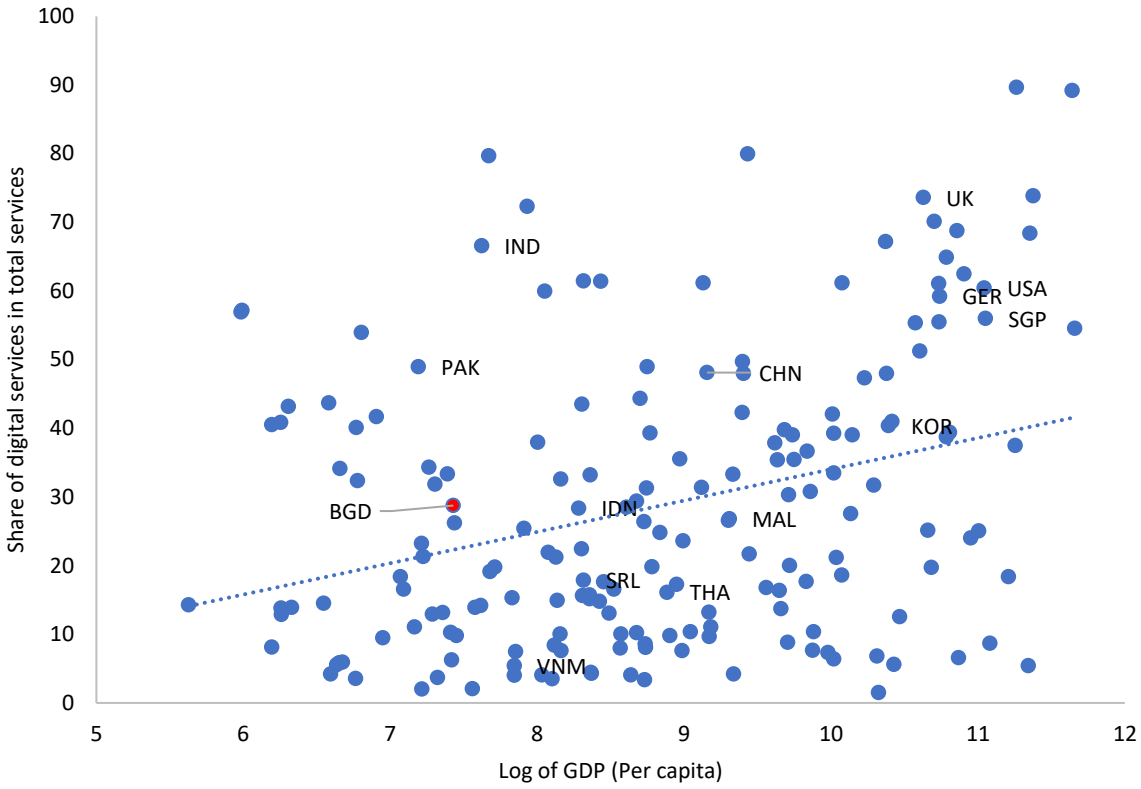
Given the per capita GDP, Bangladesh stands above the predicted value of the share of IT-ITES services exports in total services. This is accountable to the lower share of other services and the overall low volume of services exports.

Figure 6: Trend in GDP & ICT/ITeS Exports



Source: Authors' analysis using data from the BBS and UNCTADStat.

Figure 7: Relationship between Share of IT/ITES Services in Total Services Exports and GDP per capita



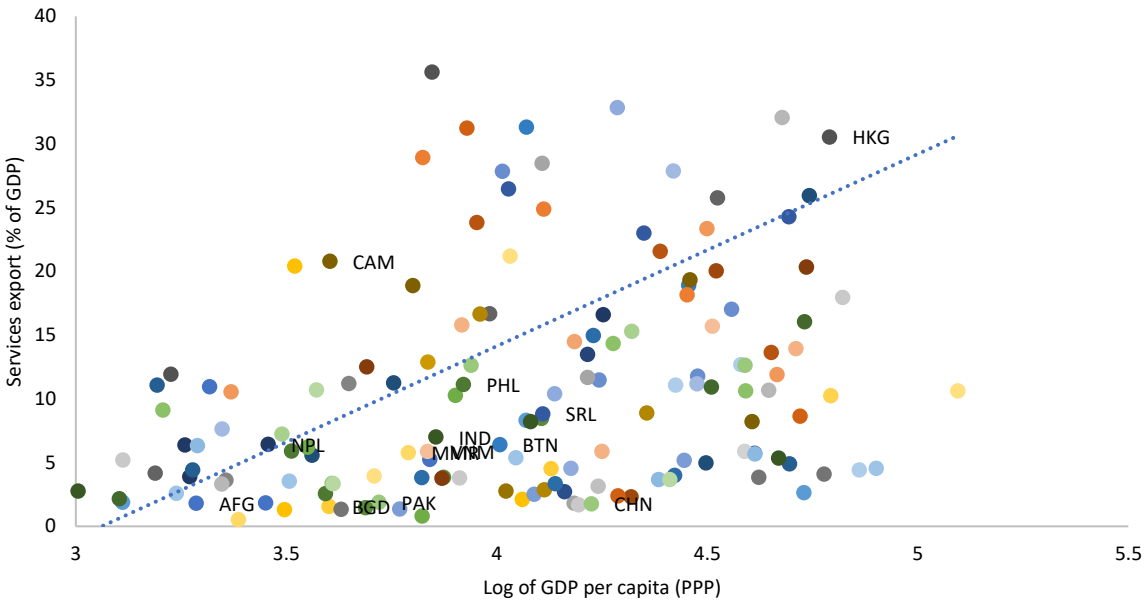
Note: Countries are indicated as BGD – Bangladesh, BTN – Bhutan, CAM – Cambodia, CHN – China, GER – Germany, IDN – Indonesia, IND – India, KOR – Republic of Korea, MAL – Malaysia, PAK – Pakistan, SRI – Sri Lanka, THA – Thailand, UK – United Kingdom, USA – United States, and VNM – Vietnam.
Source: Author's presentation using UNCTADstat data.

A similar positive correlation has been observed from the cross-country analysis between services exports and GDP per capita (Figure 8). However, given the per capita income, measured in purchasing power parity terms, Bangladesh has the lowest services trade to GDP ratios. The situation is even worse when only the services export is considered. For Bangladesh, the services exports-GDP ratio is just 1.5 percent.

In line with the international experience, Bangladesh's services export-GDP ratio should have been at least three times higher. While for such comparator countries as India, the Philippines and Sri Lanka, services exports are around 40 percent of their respective total exports, the corresponding figure for Bangladesh is just 13.8 percent (Figure 9).

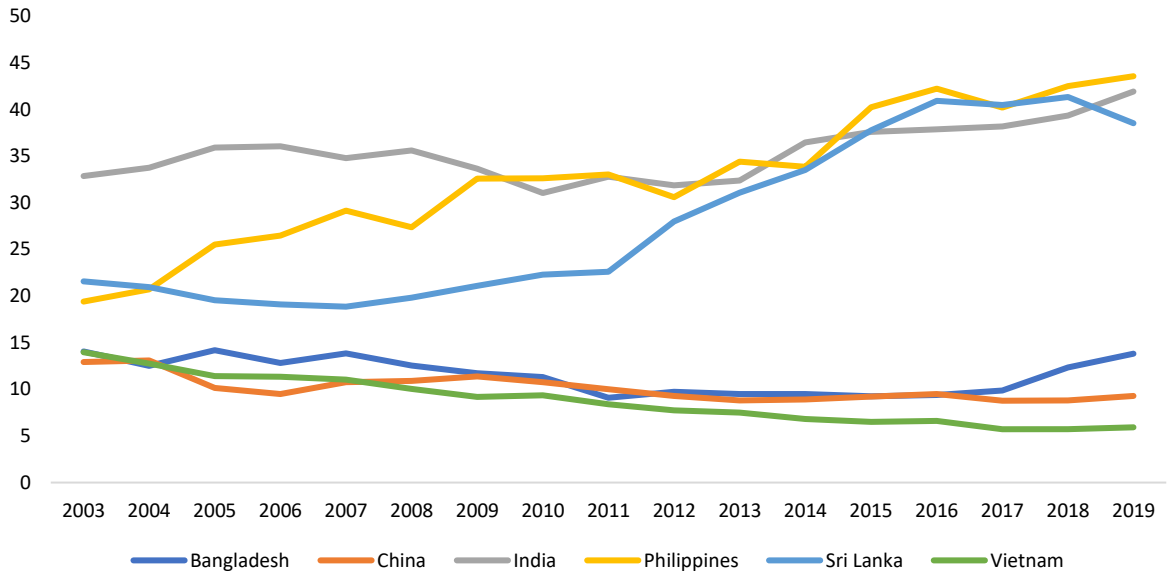
During 2005-17, the relative significance of services exports has declined from 13 percent in 2005 to 9.8 percent in 2017. It then started increasing to stand at 13.8 percent in 2019. China and Vietnam have comparable services share in exports. However, these two countries are as amongst the most successful merchandise goods exporting countries in the world. Bangladesh can leverage the growth of overall services exports by increasing the digital services exports.

Figure 8: Services Export Openness



Note: Countries are indicated as AFG – Afghanistan, BGD – Bangladesh, BTN – Bhutan, CAM – Cambodia, HKG – Hong Kong, IND – India, MMR – Myanmar, NPL – Nepal, PAK – Pakistan, and PHL –Philippines.
Source: Razzaque et al. (2020) using World Development Indicator (WDI) data.

Figure 9: Services Export as Share of Total Exports in Selected Developing Countries (%)



Source: Authors' presentation using WDI Data.

6 How might restrictions on cross border flow of data impact Bangladesh's digital services exports and GDP

The discussion so far has established the importance of IT/ITeS sector and cross border data flows in the economic growth of a country and Bangladesh in particular. In the subsequent discussion the report explores this issue further through econometric modelling and scenario analysis.

Econometric Analysis Findings

This report estimates a log-log regression model that helps in understanding the impact of digital services exports on the GDP. It uses panel data comprising of a hundred countries from 2000 to 2017. The model estimates a positive and statistically significant relation between digital services exports and the GDP. This means that digital services exports make an important contribution to the economy. It is estimated that if digital services exports increase by 1 percent, the GDP of the country would increase by 0.02 percent and vice versa.[8]

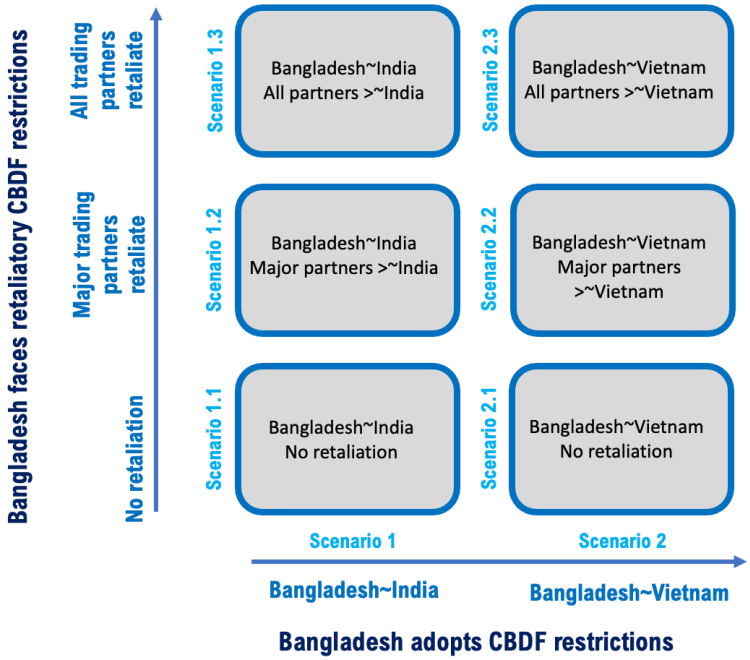
The report further uses the results to estimate various scenarios to better understand the implications for GDP. However, this analysis is restricted to the change in GDP due to change in digital services exports, it should be noted that cross border data flows contribute to the economy in many other ways and hence the impact would be larger and spread across productivity, innovation, wage levels, employment, investment and even traditional sectors.

Scenario Analysis

The first report in this two-part study delved into the impact of CBDF restrictions on digital services exports of Bangladesh. The report analysed various scenarios that also accounted for possibility of retaliation from trading partners. The results discussed in this section build further on the scenarios analysed in report one. Based on the results of an econometric model that explains GDP as a function of digital services exports, in addition to other control variables, this report estimates the resultant impact on GDP due to decline in digital services exports of Bangladesh upon the imposition of CBDF restrictions. Figure 10 provides details on the scenarios.

[8] Refer to Appendix for details on the econometric model, data sources and results.

Figure 10: Scenarios Analysed to understand the Impact on GDP



1. Scenario 1: Impact on GDP when Bangladesh adopts CBDF restrictions similar to India.
   1.1 Impact on GDP due to change in Bangladesh's digital services exports when Bangladesh's data policy rank is similar to India.
   1.2 Impact on GDP due to change in Bangladesh's digital services exports when major export destinations that account for 50 percent of digital services exports from Bangladesh retaliate and impose restrictions similar to India.
   1.3 Impact on GDP due to change in Bangladesh's digital services exports when all export destinations retaliate and impose restrictions similar to India.

2. Scenario 2: Impact on GDP when Bangladesh adopts CBDF restrictions similar to Vietnam.
   2.1 Impact on GDP due to change in Bangladesh's digital services exports when Bangladesh's data policy rank is similar to Vietnam.
   2.2 Impact on GDP due to change in Bangladesh's digital services exports when major export destinations that account for 50 percent of digital services exports from Bangladesh retaliate and impose restrictions similar to Vietnam.
   2.3 Impact on GDP due to change in Bangladesh's digital services exports when all export destinations retaliate and impose restrictions similar to Vietnam.

Scenario Analysis Results

As shown in figure 11, the first report in this study estimated a decline ranging from 29 percent to 44 percent in digital services exports of Bangladesh due to CBDF restrictions, depending on the severity of restrictions and retaliatory measures from trading partners.

Figure 11: Results of Scenario Analysis- Impact on Digital Services Exports[9]

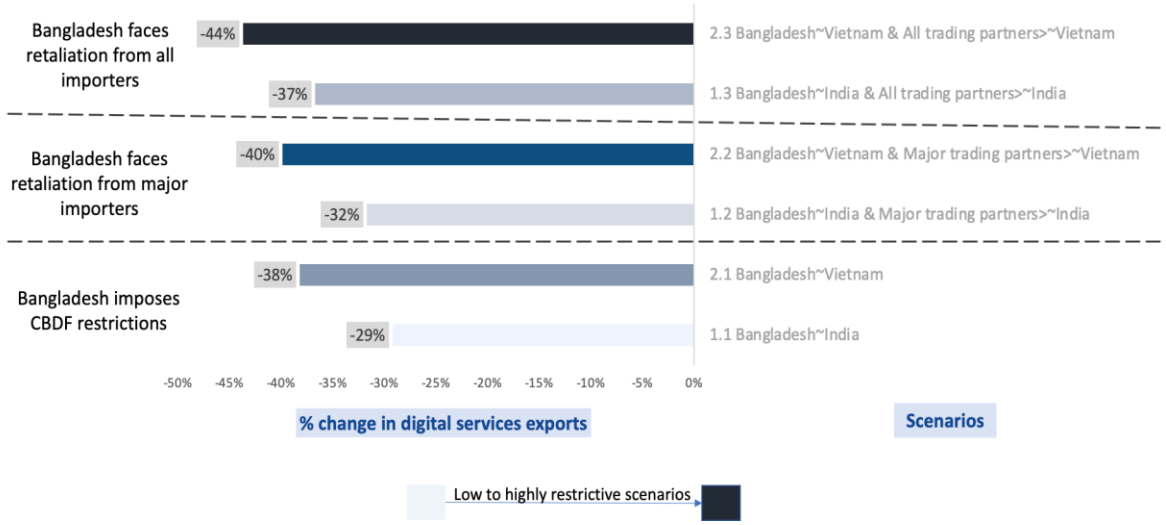
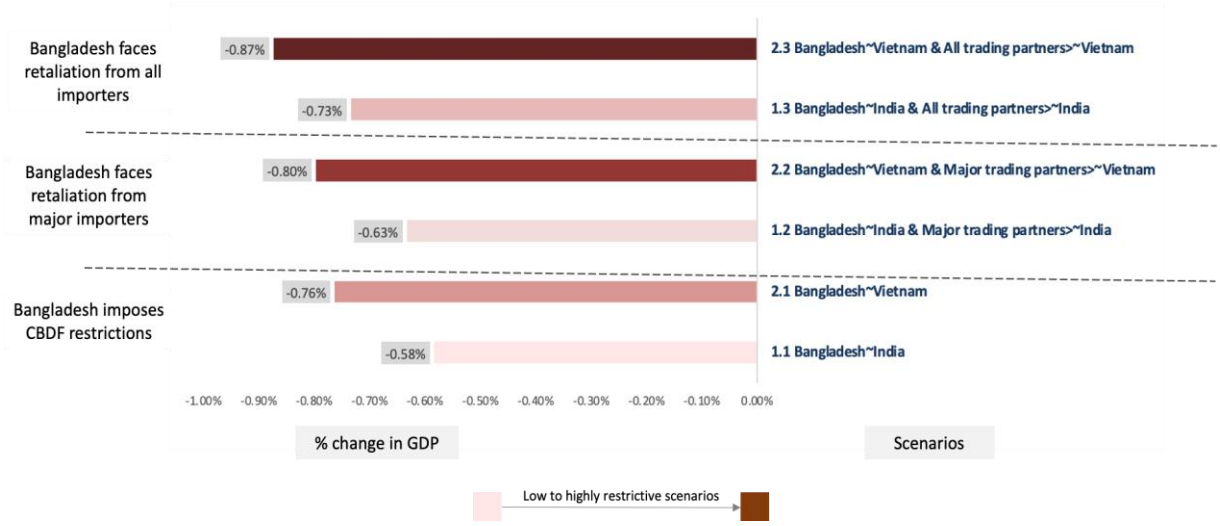


Figure 12 presents the scenario analysis results for impact on GDP as a consequence of the results presented in Table 3. Extending the scenarios further the report estimates a decline in GDP by 0.6 percent to 0.9 percent due to decline in digital services exports as a consequence of CBDF restrictions.

Figure 12: Results of Scenario Analysis- Impact on GDP



Impact on GDP Bangladesh Imposes CBDF Restrictions Equivalent to India

Bangladesh's GDP may see a 0.58 percent decline, as a result of 29 percent decline in digital services exports, if it adopts restrictions similar to India. Retaliation by major trading partners and all importers may lead to a GDP decline of 0.63 percent and 0.73 percent respectively, this is because digital services exports are estimated to decline by 32 percent and 37 percent in these scenarios.

9 Refer to report 1 for detailed results and methodology.

Impact on GDP Bangladesh Imposes CBDF Restrictions Equivalent to Vietnam

A more restrictive policy approach by Bangladesh, such as CBDF restrictions similar to Vietnam, could reduce exports by as much as 38 percent which would lead to a 0.76 percent decline in GDP. If major trading partners also retaliate with similar restrictions Bangladesh will face 40 percent decline in digital services export and GDP would decline by 0.8 percent. Lastly if all the trading partners retaliate then Bangladesh GDP would decline by 0.9 percent due to a 44 percent decline in digital services exports.

Given the 3.8 percent growth rate of Bangladesh's economy in 2020 and the need to recover from COVID induced deceleration, these probable scenarios could mean a setback to growth and recovery efforts.

Data Localisation and Economy- Industry Experience and Perspective

This study explores the perspectives of the industry stakeholders through consultations and key informant interviews. The general view of the industry stakeholders is that, as Bangladesh aspires to embrace increased digitalisation, enforcement of data localisation provisions should not be done in a matter so that it hampers the current business environment. Rather, attention should be paid to preserving data security.

Several factors would dictate how CBDF regulations will affect the economy that include the availability of skilled human resources, necessary infrastructure, enforceability of regulations, and perceptions of investors and future business clients, among others. According to some stakeholders, data flow restrictions could negatively affect trade and productivity and growth.

Many stakeholders have a view that any lop-sided regulatory position with CBDF would be damaging to Bangladesh's ICT sector as the present infrastructure and human capital are not aligned with the requirements of data localisation.

Most of the stakeholders believe that the current landscape in Bangladesh is not properly suited for the growth of the local data centre ecosystem mainly due to such reasons as: high operating cost, lack of skilled professionals, and inadequate ICT infrastructure. There is a consensus among industry experts that an acute shortage of experienced professionals who can deal with the associated technological know-how of CBDF is currently a significant challenge.

One key informant who noted that the current academic curriculum is not well suited to train the students on CBDF matters. Without specific training and practical exposure, it would be quite difficult to develop a pool of skilled workforce who can handle the technical aspects of CBDF. This observation resonates with the view of employers in the ICT industry who believe that under the ambit of current academic training, the country would hardly develop the required skilled professionals who can navigate the CBDF matters. One key informant underscored the importance of the intellectual property. He mentioned that:

"In this age of cross-border data flows, protecting intellectual property can become a matter of concern. Hence, skill-building initiatives should also consider equipping professionals with proper training of intellectual property."

However, industry experts have the views that restricting cross border data flows would generate demand for specific skill sets to operate and maintain the digital platforms and data centres, which in turn will help demand-driven skill development. It will help grow the ancillary industries like artificial intelligence (AI), and machine learning, in medium to long run. The data protections restrictions and regulations would create employment opportunities to operate data centres. However, such regulations from other countries may hamper employment of freelancers and BPO service holders whose operations heavily rely on data.

Industry representatives also noted that the current ICT infrastructure needs to be significantly upgraded to comply with the CBDF regulations. As pointed out in the earlier section, the government has taken the initiative to establish new data centers. However, maintaining an uninterrupted power supply is critical to operating the Tier III and Tier IV data centers that demand constant and reliable electricity connections. One industry expert mentioned that:

"The development of necessary infrastructure and skilled human resources go hand-in-hand. Across the world, technology is evolving every day and the country's infrastructure and associated human resources should be constantly updated to match the emerging needs of this digital age."

Industry experts also noted that current data center infrastructure is at nascent stage and adopting any restrictive policy could backfire on the business enterprises. One key informant reported that:

"We are heavily reliant on services offered by AWS, Microsoft Azure, Google Cloud service, and their counterparts. They have established their presence in the market. If we are to build such services, we both need the right mix of infrastructure and skilled human resources. Any adoption of such domestic services should be built upon the experiences of the market leaders."

When asked about how the enforcement of CBDF regulations might affect the business operations and growth, mixed observations were found. One expert noted that the impact of CBDF regulation on businesses would be largely determined by one simple question: Are the regulations growth-accelerating or growth-restricting? Growth-accelerating regulation would aim to support the businesses to adopt the standard CBDF provisions while promoting respective business interests. In contrast, growth-restricting policies would hamper business expansion and future business prospects.

Another industry expert mentioned that ensuring policy certainty is a key concern. If the provisions are set in a manner that it promotes local investment while ensuring quality service, then there it would generate new jobs and new work opportunities. Majority of the industry representatives noted that if Bangladesh adopts a very restrictive CBDF policy, it would ultimately hamper the ease of doing business.

In contrast, according to some stakeholders, CBDF restrictions could negatively affect trade and productivity. Many stakeholders believe that any lop-sided regulatory position with CBDF would be damaging to Bangladesh's ICT sector as the present infrastructure and human capital are not aligned with the requirements of strict data localisation strategy. Such rules may also generate information asymmetry favouring domestic firms at the expense of international firms. Stringent CBDF restrictions may also deter foreign investments.

Industry representatives emphasised that ensuring a conducive business environment would be critical to build a good data center ecosystem in Bangladesh. Getting necessary approval (such as registered domain name, trade licenses, tax identification number, etc,) should be streamlined and access to finance should be eased to help establish a conducive business environment.

At least three-fourth of the respondents believe that under the existing conditions, the performance of data centres will suffer, and potential scalability of data center ecosystem would be limited. About three-fourth of the respondents noted that return on investment would be poor or adversely affected under the existing infrastructure in the face of fact-changing ICT world.

The free flow of data fueled the online economy. Consumers can access the same services in Bangladesh as one who lives in California of the United States. Global tech companies such as Amazon, Apple, Meta, Google, and Microsoft argue that if they are required to store data locally, they would not be able to offer the same services around the world.[10]

Overall, the industry perspective could be summarised in the following sentence:

> *"Localisation strategy can be finetuned to harness growth opportunities and make the most of cross-border data flows. Fully restricting or fully liberalising data sharing policies may not bode well. Right mix of skilled human resources and infrastructure has the potential to spur growth and attract investment."*

[10] For details, see https://bdnews24.com/technology/2022/05/24/the-era-of-borderless-data-is-ending

7 Conclusion

With the increased use of ICT, the world is becoming more linked through data sharing. To boost and sustain information-driven economic development and stimulate innovation, free flow of data across borders would be essential. This will facilitate the exchange of ideas and information as well as the dissemination of knowledge, insightful analysis of the data available for informed decision making, along with cooperation and cross-pollination between individuals and businesses. Information innovation needs an environment that encourages people to experiment with new internet uses. People are less willing to experiment, and, as a result, innovation is less likely to arise in places with severe restrictions that restrict digital cooperation (World Economic Forum).

Restricting data flows can significantly influence a country's economy, stifling trade performance, diminishing productivity, and rising costs for downstream businesses that increasingly rely on data.

The findings of the empirical exercise undertaken as part of the study seems to suggest that CBDF restrictions would likely to have an adverse impact on Bangladesh's digital service exports, leading to similar implications for overall output (GDP). If Bangladesh imposes controls similar to India, the adverse output impact could be 0.58 percent as a result of a 29 percent drop in digital service exports.

A more restrictive policy approach by Bangladesh, such as CBDF limits comparable to Vietnam's, could cut digital service exports by up to 38 percent, resulting in a 0.76 percent fall in GDP. Retaliation by key trading partners and all importers by imposing similar restrictions would result in a bigger impact on GDP.

The free flow of data facilitates innovation as it builds upon sharing and disseminating ideas and collaboration between individuals and companies. Restricting the flow of data for a country like Bangladesh, which has to do a lot of catching up with advanced-capacity countries, could be a hindrance in taking full advantage of the rapidly evolving data analytics and techniques, machine learning systems, and fraud prevention mechanisms given that data localization can obstruct the very fuel for their development. Restricted flow could result in limited or slow utilisation of cutting-edge global techniques available to analyse to information to find appropriate solutions to various problems.

Traditional sectors also stand to benefit from innovation and digitisation, which is already happening via smart factories, online ordering, etc. Such innovation, for instance, can help Bangladesh's garment manufacturing sector reinforce its world-leading position.

Data flows are essential to digitisation as well. Alignment with good practices in cross-border data flows are important for established companies and newer tech start-ups to participate in the global digital trade and markets and thus help develop Bangladesh's digital economy.

The argument of national security by protecting citizens' data also lies under the scanner since security is more a function of protocols and systems than its physical location. In fact, data localisation potentially jeopardises real time security of data, such as in the financial sector, where data flow is essential for global fraud detection and anti-money laundering protocols. Also, an inward approach to data security can actually make it more vulnerable when the local-level capacity in protecting data from unauthorized access and data corruption is weaker than the global standard.

Extensive global research shows data localization typically increases compliance costs for companies, disrupts global supply chains, acts as a non-tariff barrier, and poses roadblocks to the path of digitally enabled growth. While the intent behind data localisation is understandable, its objectives can be achieved without putting high costs on industry and trade.

Bangladesh needs to develop and upgrade ICT infrastructure before implementing restrictions of cross-border data flows. The current infrastructure in data centers and internet speed is far from the requirement. Uninterrupted and high-speed internet services across the country need to be ensured. The local data centres provide fewer services than Google and Amazon located in Singapore or California. The services and security system of local data centres should be upgraded up to the mark. Global tech companies should be provided the opportunity to establish data centre in Bangladesh.

Any policy in favor of data localisation and its restrictiveness needs a comprehensive cost-benefit analysis. The rationale of economic and employment growth through the emerging data centres needs more empirical backing, given that long term impact on employment is likely to be minimal. In fact, only 5 to 30 permanent jobs are created by a typical data centre.

A research-based pragmatic policy towards data regulation must be the way forward for Bangladesh, so that it maintains the potential of the industry to grow, bolsters its position as an attractive destination for ICT/ITES sector, and most importantly, achieves the full potential of Digital Bangladesh and Vision 2041.

To sum it up, policymakers in Bangladesh can update legislation to address valid data-related concerns, but they must also guarantee that individuals, businesses, and governments can reap the immense societal and economic advantages of data and digital technology.

8 References

Castro, D. and McQuinn, A., 2015. Cross-border data flows enable growth in all industries. Information Technology and Innovation Foundation, 2, pp.1-21.

Castro, D., 2013. The false promise of data nationalism. ITIF, December.

Deloitte. 2016. Advancing the ASEAN Economic Community: The Digital Economy and the Free Flow of Data. https://www2.deloitte.com/content/dam/Deloitte/sg/Documents/about-deloitte/ sea-about-aec-digital-economy-free-flow-ofdata-2016.pdf.

ECIPE (European Centre for International Political Economy). 2013. The Economic Importance of Getting Data Protection Right: Protecting Privacy, Transmitting Data, Moving Commerce. In Castro and McQuinn 2015, 10.

eBay (2016). Small Online Business Growth Report: Towards an Inclusive Global Economy.

Ferracane, M.F. and Marel, E.V. (2018). The Cost of Data Protectionism. https://ecipe.org/blog/the-cost-of-data-protectionism/

Bangladesh e-GOV CIRT. (n.d.) IoT Possibility and Challenges in Bangladesh context. Accessed from https://www.cirt.gov.bd/iot-possibility-and-challenges-in-bangladesh-context/

Kathuria, R., Kedia, M, Varma, G., and Bagchi K. (2019). Economic Implications of Cross-Border Data Flows. Economic Implications of Cross-Border Data Flows. © Indian Council for Research on International Economic Relations.

Lee-Makiyama, H., Narayanan, B., and Lacey, S. (2021). Cross-Border Data Flows: The Impact of Data Localisation on IoT. Retrieved from: https://www.gsma.com/publicpolicy/resources/cross-border-data-flows-the-impact-of-data-localisation-on-iot

Mok, B. P. (2020). Cross-Border Data Flow as a Business Growth Enabler https://www.salesforce.com/ap/blog/2020/05/cross-border-data-flow-business-growth-enabler.html

Mattoo, A., & Meltzer, J. P. (2018). International data flows and privacy: The conflict and its resolution. Journal of International Economic Law, 21(4), 769-789.

Manyika, James, Susan Lund, Jacques Bughin, Jonathan Woetzel, Kalin Stamenov, and Dhruv Dhingra. (2016). Digital globalization: The New Era of Global Flows. McKinsey & Company. http://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/digital-globalization-thenew-era-of-global-flows.

McKinsey & Company. (2015). By 2025, Internet of things applications could have US$11 trillion impact. http://www.mckinsey.com/mgi/overview/in-the-news/by-2025-internet-of-things-applications-could-have-11-trillion-impact.

Meltzer, J.P. and Lovelock, P., 2018. Regulating for a digital economy: Understanding the importance of cross-border data flows in Asia. Global Economy and Development Working Paper, 113.

Stephany, F., Kässi, O., Rani, U., Lehdonvirta, V. (2021). Online Labour Index 2020: New ways to measure the world's remote freelancing market.

UNCTAD. (2016). Data protection regulations and international data flows: Implications for trade and development. https://unctad.org/system/files/official-document/dtlstict2016d1_en.pdf

US Chamber of Commerce.2021. Transatlantic Data Flows: Moving Data with Confidence. https://www.uschamber.com/technology/data-privacy/transatlantic-dataflows

UNDP. (2021). Enabling Cross Border Data Flow: ASEAN And Beyond. https://sgtechcentre.undp.org/content/sgtechcentre/en/home/blogs/cross-border-data-flow.html

World Bank. (2016). "World Bank Development Report 2016: Digital Dividends." Overview booklet. World Bank, Washington D.C.

9 APPENDIX

ECONOMETRIC MODEL

$$GDP_{it} = \propto + \beta_1 GFCF_{it} + \beta_2 emp\_people_{it} + \beta_3 ICTgoods\_imp_{it} + \beta_4 ICTgoods\_exp_{it} + \beta_5 NonICTgoods\_imp_{it} + \beta_6 NonICTgoods\_exp_{it} + \beta_7 ICTservices\_imp_{it} + \beta_8 ICTservices\_exp_{it} + \beta_9 NonICTservices\_imp_{it} + \beta_{10} NonICTservices\_exp_{it} + \mu_{it}$$

Where,
i equals 1 to 100, top digital services exporting countries t is time period from 2000 to 2017

GDP_{it} is the dependent variable, Gross Domestic Product of country i at time t.

$GFCF_{it}$ is Gross Fixed Capital Formation, which represents the net increase in fixed capital. Simply put, it is the net investment. A holistic model for the economy cannot be drawn without taking GFCF as a control variable.

emp_people_{it} which is the employment to people ratio has been included as another control variable for the model as consumption and employment share a positive correlation.

$ICTgoods\_imp_{it}$ & $ICTgoods\_exp_{it}$ measure the overall trade in ICT goods.
$NonICTgoods_{imp_{it}}$ & $NonICTgoods\_exp_{it}$ represent the amount of trade in Non ICT goods. This with the above mentioned two variables cumulatively provides the entire trade scenario for goods.

$ICTservices\_imp_{it}$ & $ICTservices\_exp_{it}$ represent the overall trade in ICT services & ITeS.
$NonICTservices\_imp_{it}$ & $NonICTservices\_exp_{it}$ represent the amount of trade in Non ICT services. These four categories together sum up the entire trade for services.

Table A1: Data Sources

Variable name (as in database)	Variable name (as in the model)	Database	Original Unit	Converted unit	Definition (as in database)	Years available
GDP	GDP	World Bank national accounts data, and OECD National Accounts data files via WDI database	Current US$	PPP adjusted constant 2013 US$[11]	GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in current U.S. dollars. Dollar figures for GDP are converted from domestic currencies using single year official exchange rates. For a few countries where the official exchange rate does not reflect the rate effectively applied to actual foreign exchange transactions, an alternative conversion factor is used.	2000-2017
Gross fixed capital formation (current US$)	GFCF	World Bank national accounts data, and OECD National Accounts data files via WDI database	Current US$	PPP adjusted constant 2013 US$	Gross fixed capital formation (formerly gross domestic fixed investment) includes land improvements (fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings. According to the 1993 SNA, net acquisitions of valuables are also considered	2000-2017

[11] To convert the variable into constant 2013 US$, two step methodology has been followed:
Step I: Data has been adjusted for PPP (Purchasing Power Parity) by using the following formula: GDP (PPP adjusted current US$)it= GDP(Current US$)itPPP conversion factor, GDP (LCU per international $)it ;
Where, i indexes for country observation and t indexes for time observation. Data source of PPP conversion factor, GDP (LCU per international $) is World Bank, International Comparison Programme database via WDI database.
Step II: PPP adjusted GDP at current US$ figures at different times have been converted to constant 2013 US$ by using the following formula:
GDP constant 2013 US$it=GDP PPP adjusted current US$it?CPIUS,2013CPIUS,t ;
Where, CPI is the Consumer Price Index of all urban consumers of US.

Variable name (as in database)	Variable name (as in the model)	Database	Original Unit	Converted unit	Definition (as in database)	Years available
					capital formation. Data are in current U.S. dollars.	
Foreign direct investment, net (BoP, current US$)	FDI	International Monetary Fund, Balance of Payments Statistics Yearbook and data files via WDI database	Current US$	PPP adjusted constant 2013 US$	Foreign direct investment are the net inflows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor. It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments. This series shows total net FDI. In BPM6, financial account balances are calculated as the change in assets minus the change in liabilities. Net FDI outflows are assets and net FDI inflows are liabilities. Data are in current U.S. dollars.	2000-2017
Employment to population ratio, 15+, total (%) (modeled ILO estimate)	emp_people	International Labour Organization, ILOSTAT database via WDI database	% of population	% of population	Employment to population ratio is the proportion of a country's population that is employed. Employment is defined as persons of working age who, during a short reference period, were engaged in any activity to produce goods or provide services for pay or profit, whether at work during the reference period (i.e. who worked in a job for at least one hour) or not at work due to temporary absence from a job, or to working-time arrangements. Ages 15 and older are generally considered the working-age population.	2000-2017
Computer and Information services – exports/ import	—	UNCTAD	US Dollars at current prices and current exchange rates in millions	Constant 2013 US$ (in millions)	(1) Computer services consist of hardware and software-related services and data processing. (2) New agency services include the provision of news, photographs and feature articles to the media. (3) Other information services cover database services: database conception, data storage and dissemination of data. Direct non-bulk subscriptions to	2000-2017

Variable name (as in database)	Variable name (as in the model)	Database	Original Unit	Converted unit	Definition (as in database)	Years available
					periodicals regardless of means of information transmission also belong to this service category There are two separate sub-categories, namely, computer services and telecommunication services under UNCTAD's Services (BPM6): Exports and imports by service-category and by trade-partner, annual database. Country-wise export and import flows data with world for the available years 2005 onwards under these two categories are aggregated to get the variable: Computer and Information services-exports/imports. However, only one category computer and information services is these under UNCTAD's Services (BPM5): Exports and imports by service-category, value, shares and growth, annual, 1980-2013 (Discontinued) data series. Country-wise export and import figures of this category are taken for the year 2000 to 2004.	
Telecom muni-cationns services - exports/ import	—	UNCTAD	US Dollars at current prices and current exchange rates in millions	Constant 2013 US$ (in millions)	Covers the transmission of sound, images or other information by telephone, telex, telegram, radio and television cable and broadcasting, satellite, electronic mail, facsimile services, teleconferencing, business network services, and related support services. It further comprises cellular phone services and online (Internet) access services. It does not include the value of the information transported, nor telephone network installation services	2000-2017

Variable name (as in database)	Variable name (as in the model)	Database	Original Unit	Converted unit	Definition (as in database)	Years available
ICT enabled services exports/imports	—	UNCTAD	US Dollars at Current prices And current exchange rates in millions	Constant 2013 US$ (in millions)	These two variables indicate ICT-enable services export and import, respectively. Following sub-categories are considered as ICT-enable services.110: • Sales and marketing services, not including trade and leasing services • Insurance and financial services • Management, administration, and back office services • Licensing services • Engineering, related technical services and R&D • Education and training services After conversion of export and import figure under each of these six categories from current to constant 2013 US$ (in millions), sum of these six are computed and define as ICT-enable services export and import figures, respectively.[12]	2000-2017
—	ICTservices_exp	UNCTAD	—	Constant 2013 US$ (in millions)	This is the sum of Computer and Information Services, and Telecommunications services export and ICT enabled services exports.	2000-2017
—	ICTservices_imp	UNCTAD	—	Constant 2013 US$ (in millions)	This is the sum of Computer and Information Services, and Telecommunications services import and and ICT enabled services imports.	2000-2017
—	ICTgoods_exp	WITS	US Dollars at Current prices And current exchange rates in millions	Constant 2013 US$ (in millions)	Products under these five categories are defined according to the OECD's Guide on Measuring the Information Society 2011 as ICT goods: • computers and peripheral equipment • communication equipment • consumer electronic equipment • electronic components • miscellaneous Under these categories, total 112 HS six digit products according	
—	ICTgoods_imp					

[12] For more details about ICT-enabled services, please see the following documents UNCTAD. (2015). International Trade in ICT Services and ICT-enabled Services: Proposed Indicators from the Partnership on Measuring ICT for Development.

Variable name (as in database)	Variable name (as in the model)	Database	Original Unit	Converted unit	Definition (as in database)	Years available
					to HS 1996 product classification have been identified as ICT-good in this document.[13] One product group has been prepared on these 112 products. Country-wise aggregate on these products' export and import figures with world at different times are taken to define these two variables, respectively.	
Total Services export/ import		UNCTAD	US Dollars at Current prices And current exchange rates in millions	Constant 2013 US$ (in millions)	This is the country-wise sum of export / import flow with world of all service categories available under UNCTAD's Services (BPM5): Exports and imports by service-category, value, shares and growth, annual, 1980-2013 (Discontinued) data series for the years 2000 to 2014, and UNCTAD's Services (BPM6): Exports and imports by service-category and by trade-partner, annual database for the years 2005 to 2017.	2000-2017
—	NonICTservices_exp	UNCTAD		Constant 2013 US$ (in millions)	These two variables are computed by author using following formula: non_ict_serv_exp/imp = total_serv_exp/imp – (ict_serv_exp/ imp + ict_enabl_serv_exp/imp)	
—	NonICTservices_imp					
Total Goods exports/Imports		WITS	US Dollars at Current prices And current exchange rates in millions	Constant 2013 US$ (in millions)	These two variables contain observations of total gross export/ import figures of country and year wise.	2000-2017
—	NonICTgoods_exp	WITS	—	Constant 2013 US$ (in millions)	These two variables are computed by author using following formula: non_ict_good_exp/imp = total_good_exp/imp – ict_good_exp/ imp	2000-2017
—	NonICTgoods_imp					

[13] OECD. OECD Guide to Measuring the Information Society 2011, 2011, https://www.oecd.org/sti/ieconomy/oecdguidetomeasuringtheinformationsociety2011.htm.

Results:

Table A2: Econometric Model Results

Variables	Coefficients and P-value	
	Estimate	Pr (>z)
Intercept	0.4136100	4.986e-08
GFCF (Bn USD)	0.2197690	< 2.2e-16
Employment to people ratio	0.0817298	0.106179
ICT goods import	0.0019308	0.907830
ICT goods export	0.0022886	0.246906
Non ICT goods import	-0.0018914	0.690109
Non ICT goods export	0.0476416	< 2.2e-16
ICT services import	0.0680652	1.370e-11
ICT services export	0.0184416	0.065181
Non ICT services import	0.0697235	0.007971
Non ICT services export	0.0178615	0.473158
Total Sum of Squares	4.2465	
Residual Sum of Squares	0.6429	
R-squared[14]	0.84863	
Adj. R-squared[15]	0.84749	
P-value[16]	<2.22e-16	

The results indicate that the model is a good fit with a R-squared value of 0.85. This means that 85 percent of the variation in independent variable (GDP, in this model) can be explained by the dependent variables. Total ICT services export, which includes ICT services and IT enabled services derive a coefficient of 0.0184416 with a p value of .065. This goes on to imply that a 1 percent increase (decrease) in ICT services export will increase (decrease) the average GDP (average over time and countries taken into model) by 0.02 percent.

14 R-squared measures the proportion of the variation in your dependent variable (Y) explained by your independent variables (X) for a linear regression model.

15 Adjusted R-squared adjusts the statistic based on the number of independent variables in the model.

16 The P value, or calculated probability, is the probability of finding the observed, or more extreme, results when the null hypothesis (H0) of a study question is true – the definition of 'extreme' depends on how the hypothesis is being tested. P is also described in terms of rejecting H0 when it is actually true, however, it is not a direct probability of this state.

CUTS International

D-217, Bhaskar Marg, Bani Park, Jaipur 302 016, India
Ph: 91.141.228 2821, Fax: 91.141.228 2485
Email: cuts1@cuts.org, Website: www.cuts-international.org

Also at Delhi, Kolkata and Chittorgarh (India); Lusaka (Zambia); Nairobi (Kenya); Accra (Ghana); Hanoi (Vietnam); Geneva (Switzerland) and Washington DC (USA).