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The Impact of Digital Public Infrastructure (DPI) Interventions on Socioeconomic and Development Outcomes in Bangladesh

Selim Raihan, Lubaba Mahjabin Prima, Takrem Ferdous Surid, Eshrat Sharmin

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Summary

DPI refers to the foundational digital systems—such as digital ID, digital payments, and data exchange platforms—that support public service delivery and governance. The study aims to assess the current state of DPI in Bangladesh, evaluate its data ecosystem, analyse its socioeconomic impacts, identify associated risks, and provide strategic policy recommendations.

Using a mixed-methods approach, the study combines econometric analysis with expert insights from government agencies and stakeholders. Propensity Score Matching (PSM) analysis reveals those individuals with access to DPI score significantly higher on a socioeconomic status index, confirming a positive causal relationship. A separate analysis using satellite nightlight data further supports this, showing higher economic activity in regions with greater DPI access. On the global scale, the study finds that DPI contributes significantly to GDP growth across countries, including Bangladesh.

Bangladesh has made significant strides in DPI through initiatives such as the National ID system and over 9,000 Digital Centres that integrate physical and digital access points. These "phygital" infrastructures have saved citizens time and money, improved transparency, and enhanced access to services—particularly for marginalized groups like rural women. However, there are still critical challenges, including fragmented and inaccessible data systems, low digital literacy, cybersecurity threats, and the risk of exacerbating existing inequalities if DPI is not implemented inclusively.

To address these issues, the report recommends strengthening the supporting infrastructure, enhancing data governance with comprehensive legal frameworks, developing unified digital service portals, improving digital financial systems, and expanding digital literacy programs. Furthermore, it stresses the importance of safeguarding citizen data through robust cybersecurity systems and encouraging innovation via public-private partnerships. The report concludes that, with careful planning and inclusive policy frameworks, Bangladesh can harness DPI to foster equitable development, efficient governance, and sustainable economic growth.

1. Introduction

Digital transformation has emerged as a robust enabler of inclusive development in recent decades. Governments have increasingly adopted Digital Public Infrastructure (DPI) to deliver essential services as well as research marginalized population more effectively. DPI refers to the technological and institutional framework that supports the delivery of e-government services to citizens, businesses, and other stakeholders. As the world progresses, the dynamics of digital transformation have been rapid, and Information and Communication Technology (ICT) has become even more complex and advanced, with structures of data and information influencing the public and private spheres. Similarly, Digital Public Infrastructure (DPI) has evolved, working to seamlessly develop public service delivery and enhance good governance and growth. Despite the lack of consensus surrounding the sphere of DPI, the concept incorporates comprehensive digital systems and platforms. The benefits pertain to facilitating digital identity, data exchange, and financial inclusion, with enormous consequences on developing the inclusivity and growth of a country. The interconnectedness and interoperability of DPI ensure its impact in terms of efficiency and productivity. In a developing nation like Bangladesh, DPI has the potential to bridge socio-economic disparities and foster sustainable development.

Over the last few decades, Bangladesh has witnessed remarkable economic growth. This has also reached the realm of ICT. Simultaneously, policy reforms and demographic dividends have accelerated digital transformation and DPI progress. However, the span of DPI is much broader, and establishing the full potential of DPI is much more complicated, requiring a coherent understanding of the present state, challenges, and opportunities. This requires a critical evaluation of the data infrastructure and governance of Bangladesh and its consequences in the socioeconomic arena. Tackling the potential risks in terms of security and inequality is essential to ensure inclusive and sustainable digital development.

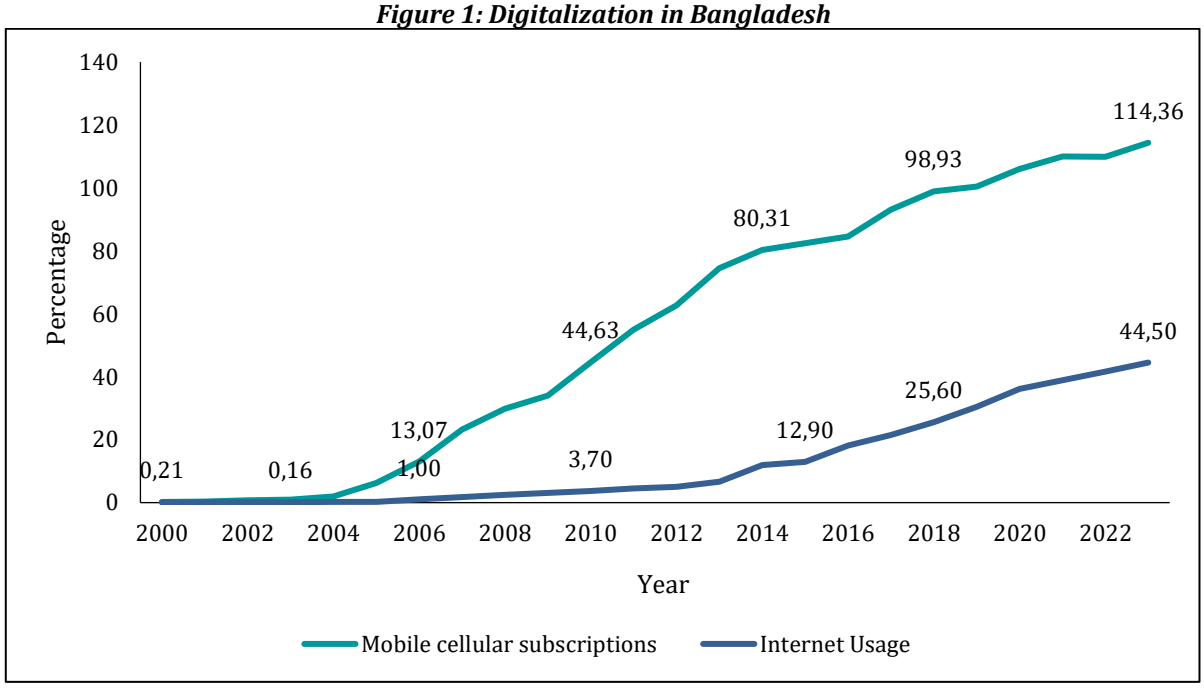
Despite DPI's rising global prominence, there is limited empirical research evaluating its impact in emerging economics such as Bangladesh. As DPI becomes a cornerstone of digital transformation, examining the progress, gaps and outcomes from the context of Bangladesh will offer valuable insights for local and global stakeholders. The study adopts a mixed-method approach. It applies Propensity Score Matching (PSM) and linear regression models to measure the causal impacts of DPI interventions on socioeconomic outcomes. It deploys nationally representative surveys and calibrated nighttime light intensity data to establish the causal mechanisms. In addition, the study conducts a cross-country econometric analysis to examine the macroeconomic impact of DPI on GDP growth. Moreover, it deploys insights from Key Informant Interviews (KIIs) to understand the ideal trajectory for Bangladesh.

Section 1 provides the introduction. Section 2 outlines the trend of digitalization in Bangladesh. Section 3 evaluates the available literature on DPI. Section 4 examines the current understanding of DPI. Section 5 dives into the scenario of DPI in Bangladesh. Section 6, 7 and 8 describe the econometric techniques and findings of PSM model, linear regression using nighttime light intensity data, and cross-country analysis respectively. Section 9 analyses insights from KIIs. Section 10 delves into the recommended ways forward. Section 11 concludes the report.

2. The Trend of Digitalization in Bangladesh

The trend of digitalization of Bangladesh is highlighted in Figure 1. Mobile cellular telephone subscription includes 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. 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. The trends in both of these usages show a positive rise in Bangladesh over the span of the last 24 years. In 2000, only 0.07% of the population used the internet, which rose to 44.5% in 2023. Mobile phone subscriptions, on the other hand, rose from only 0.21% to 114.36% in 2023.

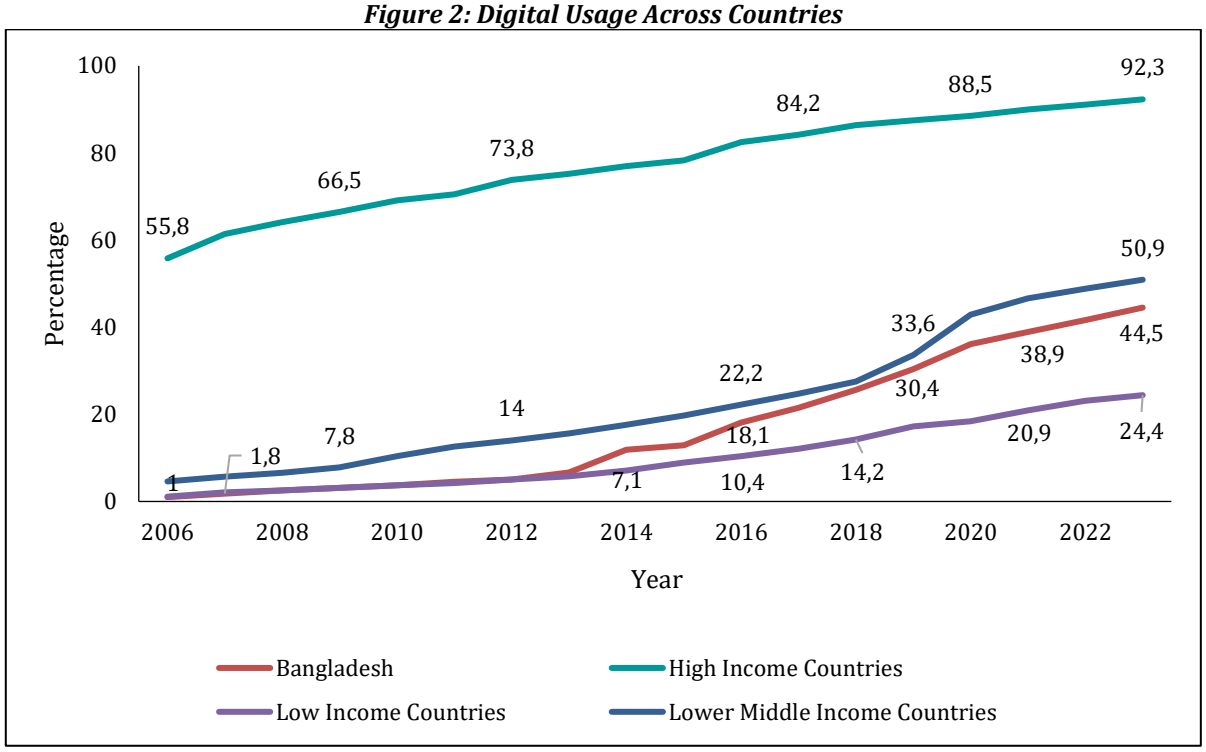
Figure 1: Digitalization in Bangladesh



Data Source: World Development Indicators

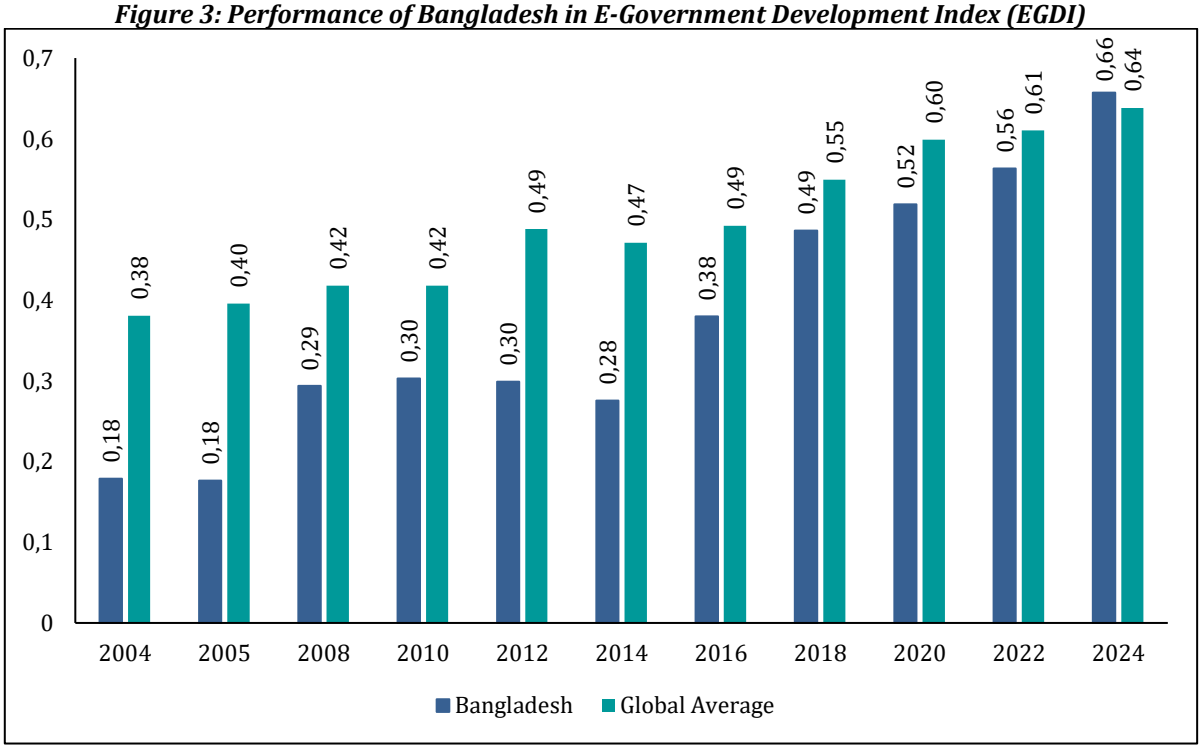
From Figure 2, in pertinence to global standards over the years from 2006 to 2023, the level of adaptation of the internet in Bangladesh has been significantly low, especially when compared to the average values of countries with high levels of national income. The level has also always been lower than the average of lower-middle income countries and lower than low-income countries till 2007. Since 2008, the adaptation levels have been equal to those of the low-income countries till 2010. Bangladesh surpassed this average only in 2011, gradually rising to reach 44.5% in 2023.

Figure 2: Digital Usage Across Countries



Data Source: World Development Indicators

Figure 3: Performance of Bangladesh in E-Government Development Index (EGDI)



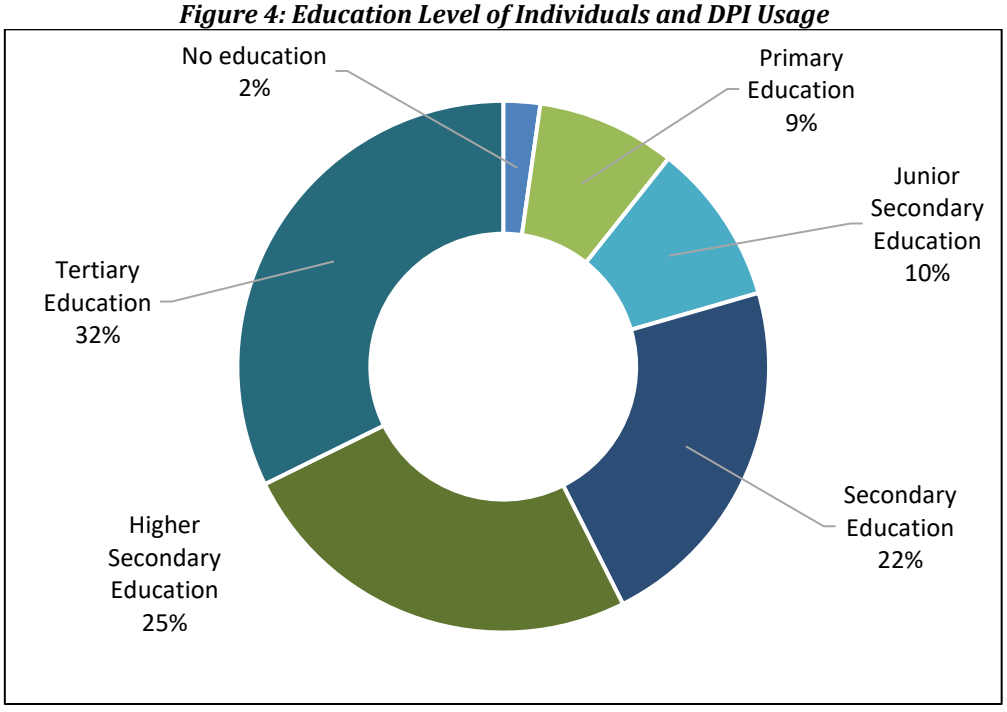
Data Source: United Nations E-Government Knowledgebase

This rise in digital access has been paralleled by an improvement in digital governance performance. With the increase in digital use, the tendency of utilising e-governance is also improving. Figure 3 represents the performance of Bangladesh in the E-Government Development Index (EGDI) of the United Nations and global ranking from 2004 to 2024. The index evaluates the performance of the countries with a value ranging from 0 to 1.

From a 0.18 value among the countries in 2004, the index value showed an increasing trend over the last two decades. In 2024, the index value of Bangladesh was 0.66. which was higher than the global average. Moreover, the figure highlights Bangladesh's significant progress in enhancing its digital governance and infrastructure.

In addition to macro-level indicators, access to DPI is also influenced by individual characteristics such as education. The frequency of using DPI also increases with educational attainment in the case of Bangladesh. According to the Survey on ICT use and access by individuals and households 2023, among the people who have used DPI, 2% have no formal education, 9% have completed primary education, 10% have attained junior secondary, and 22% have reached the secondary education level. Furthermore, 25% individuals have higher secondary and 32% hold a tertiary level qualification. These ratios clearly indicate that individuals with higher levels of education are more likely to access digital public services, representing a strong relationship between educational attainment and DPI usage (Figure 4).

Figure 4: Education Level of Individuals and DPI Usage



Data Source: Survey on ICT Use and Access by Individuals and Households 2023

The primary objective of this study is to investigate the condition and potential of the DPI in Bangladesh. The research aims to achieve the following objectives:

a. Assessing the state of DPI in Bangladesh
b. Evaluating the Availability of Data
c. Tracing the Possible Impacts of DPI
d. Identifying the Probable Risks
e. Outlining the Desired DPI Pathway

With these objectives, the study aims to build a comprehensive report on the current status of DPI in Bangladesh, providing evidence-based perspectives on its potential and practical pathways to eradicate the risks associated with this intervention and implement inclusive and sustainable development.

3. Review of Literature

DPI refers to the digital system, such as digital identity, digital payment, data exchange, etc. The international policy community has increasingly recognized DPI's significance. The G20 adopted the Global DPI Framework in its 2023 declaration for emphasizing interoperability, security, and open standards as guiding principles (G20 Digital Economy Working Group, 2023).

Gelb and Metz (2018) argued that robust digital ID systems enhance efficiency, reduce fraud, and expand financial access. The OECD (2024) also underscored DPI's role in establishing trustworthy digital governance, calling for interoperable and inclusive systems that balance innovation with regulatory oversight. For instance, India's Aadhaar and UPI, Estonia's X-Road, and Brazil's Pix have become global benchmarks, which illustrate the transformative potential of DPI when aligned with inclusive governance and secure architecture.

In contrast, Chowdhury (2023) and Surid and Sharmin (2024) documented major DPI initiatives such as the National ID system, Surokkha vaccination platform, and over 9,000 Union Digital Centres that bring over 300 services to citizens' doorsteps. Haque and Ferdous (2024) outlined challenges such as low digital literacy, limited infrastructure, and a rural-urban divide. Additionally, Zuckerman (2020) warned of the civic risks posed by centralised digital systems and emphasized the need for transparency, decentralization, and alternatives to profit-driven digital platforms.

The importance of DPI was underscored during the COVID-19 pandemic, when countries with strong digital infrastructures were better positioned to enforce travel restrictions and administer public health measures. Taylor et al. (2021) discovered that nations with better internet connections were more successful in minimizing work-related mobility, emphasizing the relevance of digital infrastructure in crisis management and public health compliance. This suggests that public health restrictions governing movement and person-to-person interaction are less likely to be effective in countries with lower digital infrastructure, even after controlling for variations due to GDP and pandemic severity. This could constrain poor countries' public health options in the face of future socially disruptive occurrences while also encouraging state investment in digital infrastructure. Thus, there are positive externalities associated with closing the digital gap. Improving global digital business infrastructure may lessen human exposure to future pandemic threats.

The sector of utilising DPI to benefit a country is not limited to the sphere of health and well-being. The incorporation of digital tools into public-private partnerships (PPPs) has been suggested as a strategy for attracting long-term investments in infrastructure projects. Tolstolesova et al. (2021) underline the need to combine traditional finance techniques with digital tools to maximize the implementation of PPP projects, hence improving the overall efficacy of infrastructure development. The limited usage of existing tools at various stages of PPP projects, combined with the growing demand for extra resources, necessitates the consideration of adopting digital tools to supplement traditional ones. Digitalization comprises not just financing instruments, but also the development of infrastructure, such as digital platforms, required to carry out such

operations in the digital world. As a result, each phase of project realization can be supported by a unified funding toolbox that includes both traditional and digital technologies.

The benefits of DPI are paramount in agricultural production and food security. Agriculture in developing countries suffers from extensive operational inefficiencies that could be addressed through the adoption of digital agriculture technologies. Goswami et al. (2023) show that although initial growth was more visible in downstream sectors and high-value crops, reaching smallholder farmers upstream is gradually emerging, despite significant challenges such as small fragmented holdings, insufficient data infrastructure and public policy, and unequal access to digital infrastructure. However, limited access to digital materials continues to be a substantial impediment. Despite the potential benefits, the aspect of DPI in agriculture presents numerous problems. Issues such as the digital divide, insufficient data infrastructure, and legislative barriers can all inhibit progress.

Furthermore, a strong legislative framework to enable digital projects is necessary. Sukadi et al. (2024) emphasize the need to develop a legal framework for electronic land certificates in Indonesia, highlighting that without a robust legal infrastructure, the benefits of digital transformation may not be completely realized. Increasing digital infrastructure and public awareness of land technologies are critical to the success of electronic land certificates. This idea has the potential to increase trust in legal bodies and speed up the resolution of land disputes. For long-term use, data security, technology, and public education regulations must be reinforced. The digital transformation of land administration necessitates cross-sector collaboration.

Hence, the ability of digital public infrastructure to adapt and change in response to changing societal needs is critical to its future. Policymakers must prioritize investments in digital infrastructure to close the digital divide and improve access to public services. Sirait et al. (2023) underline the need for collaborative governance in the creation of digital infrastructure. They advocate for inclusive policies that address the various requirements of all residents.

Despite these contributions, much of the global literature lacks the focus on the functioning of DPI in lower-middle-income countries with complex governance ecosystems, such as Bangladesh. Additionally, the domestic literature emphasized descriptive case studies without empirical evidence linking DPI to socioeconomic outcomes. The lack of systematic assessment is prominent in the case of DPI's impact on individuals' socioeconomic scenario, especially across different regions and demographic groups.

The study addresses existing research gaps by analysing socioeconomic and development outcomes of DPI interventions through a comprehensive mixed-method approach that combines quantitative and qualitative techniques. By integrating these methods, the study will address both empirical and conceptual gaps in the existing literature.

4. Core Components and Global Perspectives on DPI

DPI is a relatively new idea, and it came into prominence during the COVID-19 pandemic, when the significance of expanding digital capabilities came to the forefront. It was evident that countries with better DPI components fared well. Thus, globally, the idea resonated, and in 2023, at the G20, the first international agreement on the importance of DPI for effective socioeconomic development took place (Smith, 2024). Consequently, agencies of the United Nations have adopted the idea as a viable way to influence sustainable development. Soon, the UN General Assembly adopted the Global Digital Compact, considering DPI as a key driver of inclusive digital transformation and innovation.

Several challenges exist with the definition of DPI, and experts are yet to arrive at a conclusive decision on its scope. DPI is an architectural approach to technology that makes it easier to provide reusable digital services for the general population. DPI gives internet applications the institutional, legal, and physical framework they need to perform public services through digital channels. Digital Public Goods (DPGs) are those services, the independent socioeconomic "building blocks" that may be used in various fields and contexts. DPGs should also have broad interoperability across the public and private sectors and beyond national boundaries.

The three most commonly discussed elements of DPI are digital ID, digital payment, and data exchange (Gates Foundation, 2024). Name, date of birth, and biometric information are just a few of the characteristics that digital ID systems store in a digital repository to uniquely identify a person or entity. Digital ID emphasizes reusability by centrally providing fundamental identification attributes that many actors can utilize, including civil society, commercial businesses, banks, and government ministries. When a government provides identification digitally that verifies a person's national residency, that is an example of digital identification or DPI. Then, to authorize that person to do transactions, a bank links account details to that identification. Instead of developing a separate validation system, the bank can use the DPI digital ID system to verify the person's identification when they wish to access their bank account. Mobile money and bank transfers are examples of digital payments, which are financial transactions made possible or provided by digital technology.

Digital payments relate to the interoperability standards that enable seamless collaboration between various digital payment providers. As a result, consumers can pay across different platforms and apps regardless of the service or payment method they are utilising. For instance, during a pandemic, a government ministry may have to distribute emergency aid payments. Regardless of the recipient's bank, the DPI payment system can send the relief funds into their allocated financial accounts after verifying beneficiary information with a national ID number.

As a type of DPI, data exchange refers to the use of a centralised platform that controls data sharing through rules and laws, going beyond ad hoc. This makes it possible for data to flow between sources in a trackable manner, which eventually makes it possible for various systems to communicate information freely and openly. For instance, a Ministry

of Education would wish to monitor the immunization records of its students. It can use a data exchange to retrieve pertinent information from the Ministry of Health's databases rather than gathering that data on its own.

DPI is an evolving concept, yet there is increasing agreement that it includes (i) networked open technology standards designed for the public good, (ii) facilitating governance, and (iii) a community of innovative and competitive market participants striving to foster innovation, particularly within public programs (UNDP, 2024). DPI refers to a collection of shared digital systems that must be secure and interoperable, constructed on open standards and specifications to ensure equitable access to public and/or private services at a societal scale. These systems are regulated by relevant legal frameworks and enabling regulations to promote development, inclusion, innovation, trust, competition, and respect for human rights and fundamental freedoms.

According to UNDP, DPI has four characteristics: (1) interoperability, forming the underlying infrastructure for diverse use cases alongside various tools, technologies, and service providers; (2) open standards, allowing anyone to build and integrate services for people; (3) operation at societal scale, unrestricted by geography or demographics; and (4) robust enabling rules and regulations, ensuring unified governance frameworks to safeguard people and prevent misuse.

As infrastructure, DPI cuts through the approach of designing and implementing digital solutions with interoperable, society-scale programs that shift innovation and competition to activities atop it. The global scale and scope of digital transformation necessitate DPI approaches to maximize opportunities to accelerate the Sustainable Development Goals (SDGs) and reduce risks posed by digital technologies. The conventional approach of creating specific solutions to isolated problems contrasts with the DPI approach, which combines the right technology architecture, transparent and participatory governance, and local digital ecosystems to drive sustainable innovation and scale (UNDP, 2023).

DPI constitutes the fundamental technological and administrative frameworks necessary for the operation of e-government services, facilitating the acceleration of economic growth and promoting equitable societal development. Successful real-world examples of DPI include Estonia's X-Road (data interchange), Brazil's Pix (payments), and India's Aadhar (digital identification), all of which function effectively at the societal level (Smith, 2024). Choudhuri et al. (2021) identify the factors affecting the diffusion of smart digital infrastructure for urban public services in India, which is in tune with the aim of Digital India. Key technical enablers include the integration of IoT and analytics to drive SmartCity projects. At the same time, challenges such as the cost of technology, gaps in digital literacy, and sustainable innovation emerge as non-technical barriers. In this case, ecosystem collaboration among private-public partnerships and citizen participation can drive innovation and enhance digital service delivery.

5. DPI and Its Implications: Bangladesh Perspective

As nations worldwide investigate and execute DPI policies, Bangladesh has become a significant case, endeavoring to use its potential for socioeconomic progress. Bangladesh has established over 366 digital services, creating a solid foundation for its DPI. Principal initiatives encompass the National ID (NID) system and the Surokkha platform. The NID system, including over 95% of the adult populace, facilitates secure identification and verification, granting access to essential services including financial transactions, healthcare, and social safety net programs. The Surokkha platform was created in response to the COVID-19 pandemic, assisted in the registration and immunization of more than 131 million individuals (Chowdhury, 2023).

Bangladesh's DPI plan is fundamentally based on the establishment of more than 9,000 Digital Centres across the nation, exemplifying a distinctive amalgamation of physical and digital infrastructure. These centers offer more than 300 public and private services, including birth registration, land record access, utility bill payments, and telemedicine services. Situated within walking distance of rural people, these centers serve as essential hubs for service delivery, especially for disadvantaged and marginalized groups. They exemplify the notion of "phygital public infrastructure," integrating physical access points with digital solutions to promote inclusion (Chowdhury, 2023).

The impact of these initiatives is substantial. Aspire to Innovate (a2i), a leading agency responsible for Bangladesh's digital transformation, estimates that the country's DPI efforts have saved citizens $22 billion, 19 billion working days, and 13 billion visits to government offices. Thus, it can be argued confidently that the integration of digital systems has streamlined governance, reduced bureaucratic inefficiencies, and enhanced transparency and accountability in public service delivery.

DPI in Bangladesh holds great prospects for economic development in respect of financial inclusion, governance, and an equal society. Bangladesh's commitment to gender inclusion further highlights the benefits of DPI. For the objective of developing DPI, it will be essential to maintain infrastructure, encourage innovation, and guarantee accessibility as well as inclusion. To support this assertion, women operate a significant proportion of Digital Centres, encouraging greater participation of rural women in the digital economy. Hence, this method not only promotes gender equality but also encourages community-driven growth by providing local business owners with more business opportunities.

The e-KYC regulations have enabled smooth Government-to-Person (G2P) and Person-to-Government (P2G) transactions as part of the digital payment systems in the country. The National Service Connection Helpline (333) offers voice-enabled services for citizens lacking internet connection. It also addresses the needs of the technologically disadvantaged (Chowdhury, 2023). The flexibility of the DPI to adapt to a variety of contexts can be seen by this method, which meets the immediate needs of marginalized communities. These systems underpin the Sustainable Development Goals, target financial inclusiveness (Goal 8.10) and social protection (Goal 1.3) (Chowdhury, 2023).

In addition, the integration of data exchange platforms for DPI enhanced targeting of social protection programs, thereby improving governance. This integration supports SDGs such as - safe water and sanitation for all (SDG 6.2) and women empowerment (SDG 5) while ensuring that people who are disadvantaged, such as women and the rural population, can get vital services.

Kirmakar (2023) explores the strategies to manage public sector service application use in public services in Bangladesh, emphasizing the use of accurate and effective digital technologies that improve access, efficiency, and transparency in the interaction between the citizen and government. Indeed, these applications have proved beneficial in governance by providing service delivery to citizens. However, there have to be measures regarding upgrading infrastructure, improving cybersecurity, boosting the number of digitally literate people, and promoting collaborations with the private sector and NGOs.

Haque and Ferdous (2024) discuss the establishment of e-service centres such as Union Digital Centres, Upazila Community e-Centers, and District e-Service Centres for better accessibility and efficiency in governance. Poor internet infrastructure, low digital literacy, digital divide, and aversion to change reduce widespread adoption. Overcoming these challenges requires considerable investments in technology, human resources, and public-private collaborations. These include recommendations like improvement in data security, addressing accessibility issues, and increasing citizen engagement. Digital service can completely revamp Bangladeshi governance if these challenges are overcome methodically so that it may become more efficient, transparent, and citizen-centric.

According to Ethan Zuckerman (2020), DPIs should be made possible to promote a healthier civic and social life online. This aspect is particularly relevant for countries like Bangladesh, which often witness real-life consequences spiraling out from online rumors and misinformation. The current digital platforms, such as Facebook and Twitter, are functional for the profit orientation with which they treat civic values, giving rise to polarizing views, false news, and surveillance capitalism. Public funding and a strong emphasis on decentralization, transparency, and self-governance in support of different communities are necessary for fostering democratic participation and providing alternatives to profit-driven models. A "Corporation for Digital Public Infrastructure" would manage the funding and inception of such projects, financed by taxes on surveillance advertising.

Cybersecurity and data privacy provide further challenges. It is vital to establish powerful cybersecurity systems and foster awareness both on an individual and an institutional level so as not to lose trust in the digital frameworks. With an increasing number of digital services, it is crucial to establish strong structures to safeguard citizens' data and uphold confidence in these services. Awareness initiatives and individual training are necessary for safeguarding the digital environment (Surid & Sharmin, 2024). Long-term planning, funding, and legislative backing are important to maintaining digital efforts.

Global DPI success stories offer significant insights for Bangladesh. India’s UPI, for example, has shown how interoperable systems can effectively lower transaction costs and enhance financial inclusion (Eaves et al., 2024). In a similar way, Estonia’s X-Road underscores the critical role of secure and interoperable data exchange in facilitating

effective governance. Thus, Bangladesh can follow this approach and create an interoperable system.

Rise in broadband internet availability and digital literacy campaigns must be combined with initiatives such as the Community Based Training Program. Collaboration with the private sector can assist in growing the DPI through lending creativity, technical expertise, and funding. All the public-private partnerships must be focused on inclusive service provision and creativity (Chowdhury, 2023). Emphasizing the capabilities to innovate and invest in infrastructures that are long-lasting and sustainable should be the key objective alongside policy frameworks. Improving the policy regarding the DPI environment would be achievable through sharing more best practices and adjusting other successful models to the local contexts as Bangladesh is a net exporter of knowledge.

6. Socio-economic Impacts of DPI in Bangladesh: Using the Propensity Score Matching (PSM) Method

The first phase of the quantitative analysis incorporates data at the micro level to find a potential link between socioeconomic well-being and access to DPI. The analysis is undertaken in two distinct steps: one using the PSM method and another using nightlight data as a proxy for economic activity.

The PSM technique was selected for this investigation as it offers a solid foundation for calculating the causal relationship between using DPI and socioeconomic results. Ideally, randomization is the way to check the causality of an intervention. However, it is often not feasible given practical and moral constraints. Such is the scenario here when evaluating the impact of DPI in Bangladesh. So, this method is ideal for observational research (Rosenbaum & Rubin, 1983). In terms of the evaluation, like any such case, selection bias is a likely problem. The people who access DPI may differ from those who do not, in a systematic and organized manner, based on several factors including location, education, money, and availability to technology. Exogenous issues like jobs may impact one's location and use of DPI. Thus, it would be unwise to compare DPI users and non-users directly, and such an approach would provide skewed estimates (Stuart, 2010).

PSM solves this problem efficiently, and it establishes a control group of non-users and a treatment group of DPI users in a statistically comparable way based on observable traits. To achieve this, a propensity score is constructed, which is a value showing the likelihood of accessing DPI calculated using variables like age, gender, locality, etc. (Austin, 2011). In the next step, individuals in the treatment and control groups are matched based on their propensity scores, thus ensuring their comparability other than DPI use. Thus, the impact of accessing DPI is isolated, and this process stimulates the situation of a randomized controlled trial (Guo & Fraser, 2014).

PSM's interpretability and openness are more beneficial. It is possible to clearly explain and justify the method's underlying assumptions, such as the selection based on observables. For example, the report will clarify why the selected covariates (e.g., household size, age, and location) are thought to represent the primary factors impacting DPI consumption. To ensure that there is adequate overlap in propensity scores between the treatment and control groups—a prerequisite for accurate matching—the study also looks for the "common support" condition (Caliendo & Kopeinig, 2008).

All things considered, the study can successfully address selection bias and draw conclusions on the causal relationship between DPI and socioeconomic outcomes in Bangladesh by the utilization of PSM. Although the method is unable to account for unobservable components, it is a rigorous way to estimate causal linkages in a non-experimental situation (Pearl, 2009).

The potential causal relationship between access and usage of DPI and an individual's socioeconomic position was analysed using the PSM approach. For the analysis, the "Survey on ICT Use and Access by Individuals and Households 2023" by Bangladesh Bureau of Statistics (BBS) was used. The survey provides a comprehensive overview of

the digital landscape of Bangladesh at both household and individual level. The survey includes the data on household access to key ICT infrastructure such as electricity, mobile phones, computers, internet connections, televisions, and radios. Additionally, the survey covers the usage of mobile phones, computers, and internet. The frequency and type of online activities were also included. The survey captured the demographic details such as age, gender, location, education etc.

The survey covered 1284 PSUs. Based on the available responses of the question on the individuals' use of government services over internet in the past 12 months, the sample size for the analysis was 36,195. In this analysis, a treatment group is formed of individuals who accessed DPI and a control group of those who did not.

Here, the Socioeconomic Status Index (SES Index), which has a range of 0 to 100 and is based on five factors- residence status, education level, employment status, asset ownership, and digital connectivity, is created to gauge results. Homeownership and electrical availability are taken into account by residence status. Education level looks at a person's highest level of education. An individual's employment status determines whether they are employed and, if so, what kind of work they do. The asset index evaluates who owns durable and necessary items like televisions, refrigerators/washing machines, electric fans, private cars/buses/trucks, chairs/tables, cots/chowkis, cupboards/wardrobes, and sofa sets. Lastly, digital connection quantifies the availability of digital tools and technologies, such as computers, smartphones, mobile phones, and the Internet.

The following formula is used to model the Socioeconomic Status (SES) Index:

$$SES_{\mathrm{i}} = B_1 + \beta_2\, DPI_{\mathrm{i}} + \beta_3\, Location_{\mathrm{i}} + \beta_4\, Age_{\mathrm{i}} + \beta_5\, Gender_{\mathrm{i}} + \beta_6\, HHSize_{\mathrm{i}} + e_{\mathrm{it}}$$

The dummy variable DPI is based on the binary answer to a pertinent question of the survey, which asks individuals if they have accessed public services utilising digital means. An individual's socioeconomic position is represented by SES, location is taken into consideration, demographic features are captured by Age and Gender, household size is indicated by HH Size, and the error term is e. By adjusting for important confounding variables, this model makes it possible to estimate the contribution of DPI to socioeconomic outcomes.

The results obtained from the logistic regression model, which would be the basis for the estimation of the propensity scores, are shown in Table 1.

Table 1: Coefficients of Probit Regression Model

Predictor	Coefficients
Location	0.051** (3.230)
DPI	-0.000 (0.000)
Gender	0.242*** (14.820)
Household Size	0.002 (0.480)
Constant	-1.120*** (-34.360)

*Source: Authors' Calculation; Note: Significance levels: * p < .05, ** p < .01, *** p < .001*

The results predict that location significantly impacts the socioeconomic condition of an individual. Gender also has a significant effect. However, household size does not have any effect on socioeconomic aspect. The positive and statistically significant coefficient for location indicates that geographic factors such as access to urban infrastructure and digital services have a strong role in determining DPI access. The individuals from digitally connected or economically advanced area are more likely to utilize DPI. Similarly, the coefficient for Gender being positive and highly significant suggests a gender disparity in DPI access. According to the results, men are more likely than women to gain from digital public services. This reflects the ongoing gender gap in digital technology that is seen in many developing nations, where social conventions, a lack of digital literacy, and restricted access to devices can all prevent women from using digital services. Conversely, the non-significant effect of household size indicates that a person's usage of DPI is unaffected by the number of individuals living in their home.

The significance of the indicators of the logistic regression ensures that there is sufficient overlap (common support) between the treated and untreated groups for valid matching (Table 2). Upon finding the propensity scores, untreated and treated subjects are matched across the model.

Table 2: Common Support Information

Assignment	Model
Untreated	29,815
Treated	6,380
Total	36,195

Here, more untreated participants (people who did not access DPI) are found than treated ones (people who accessed DPI). The technicality of matching requires a pool of controls at least as large as the treatment group. Hence, each participant with access to DPI was matched on the basis of propensity score matching with another participant who was not included in the realm of DPI (Table 3).

Table 3: Matching Results

Sample	Model 1 (LPL)
Unmatched	Treated: 68.665
	Controls: 63.325
	Diff: 5.340 *** (0.176)
ATT	Treated: 68.665
	Controls: 63.852
	Diff: 4.813*** (0.187)

*Source: Authors' Calculation; Note: Significance levels: * p < .05, ** p < .01, *** p < .001*

In this particular study, the socioeconomic index was used to analyse the impact of access to DPI in Bangladesh. The analysis for this research is carried out with the help of propensity score matching, where the treated group is matched with the control group.

The mean socioeconomic index value for the treated group is 68.665 pre-matching, whereas it is at 63.325 for the control group, arriving at a significant difference (5.340***). This implies that those who have accessed DPI are better in socioeconomic terms compared to their DPI-excluded counterparts. The socioeconomic index value after matching becomes 68.665 in the treated group and falls to 63.852 in the control group;

again, the difference is smaller but still significantly larger (4.813***). This means that DPI intervention has a positive impact on improving socioeconomic conditions, even after controlling for other covariates.

The result's stability after matching supports the causal explanation and shows how robust the relationship is. It suggests that access to DPI remains a reliable indicator of improved socioeconomic results even when people are matched based on factors like region, age, and gender. Additionally, this implies that the benefits of DPI have a positive, independent impact rather than just being connected with other benefits. These findings are highly relevant to policy as well. The findings emphasize that extending DPI's coverage can be a useful strategy for raising citizens' socioeconomic status, especially for those from marginalized communities.

7. Socio-economic Impacts of DPI in Bangladesh: Using Nightlight Data for Regional Analysis

Satellite earth observations are promising approaches for overcoming limited data availability on socioeconomic growth, such as night-time lighting (further NTL). The use of NTL satellite images for socioeconomic studies has significantly expanded during the previous two decades, covering a range of topics. The study uses nightlight data as an alternate indicator of socioeconomic activity at the regional level to supplement PSM analysis. Satellite photography of nighttime intensity is used as a stand-in for infrastructure development and economic activity. The data is taken from Li et al. (2020), a paper that calibrates NTL data from the Defense Meteorological Satellite Program (DMSP) - Operational Linescan System (OLS) acquired by the Visible Infrared Imaging Radiometer Suite (VIIRS) worldwide from 1992 to 2018.

The aim of this analysis is to understand the impact that access to DPI brings to households, and how outcomes are influenced even for households possessing similar wealth endowments. Given the mechanism of impact that digitalization and access to digital public services and products bring linear, the Ordinary Least Squares (OLS) model is deemed fit for this analysis. Moreover, given that significant delay is not deemed likely between the moment of intervention and observation of outcome, cross-sectional data is utilized in this analysis.

For the econometric analysis, the calibrated nightlight data is considered the dependent variable. The variable is considered a proxy of economic prosperity, reflecting the well-being of a household. The specific value is found for the specific geographical coordinates of surveyed Primary Sampling Units (PSUs). The variable SDigitalStatus is an index that reflects the availability and usage of digital technology by individuals. This is built calibrating the digital presence of individuals, incorporating aspects like usage of telephonic devices, internet usage, etc. The variable SAsset is an index constituted by the accumulated values of the possessions of goods in the household and acts as a control variable to showcase how for similar households' economic wellbeing can differ. To incorporate the probable regional inequalities persisting within Bangladesh and the sociopolitical dynamics across the spectrum which may dictate access and usage of DPI, dummies for divisions of Bangladesh are taken with Dhaka serving as the base category. The analysis conducted for individuals using the calibrated nightlight value for the surveyed PSUs, access to DPI and wealth endowments reflect the impact that DPI access has on economic well-being, as modeled by the nightlight. The number of data observations in this case is 98605, eliminating any data unavailability.

The following formula is used to model the Nightlight Intensity (NI):

$$NI_{\mathrm{i}} = B_1 + \beta_2\ SDigitalStatus_{\mathrm{i}} + \beta_3\ SAsset_{\mathrm{i}} + e_{\mathrm{it}}$$

Thus, the analysis reflects how the prosperity of a household is impacted by using DPI, and the data shows trends that individual-level survey data could miss. Moreover, the regional dynamics show the potential regional inequality with long-term consequences.

The analysis conducted for individuals using the calibrated nightlight value for the surveyed PSUs and using the digital status and asset endowments reflect the impact that DPI access has on economic well-being, as modeled by the nightlight. The results are shown in Table 4.

Table 4: Results of Linear Regression Model

Predictor	Coefficients
SDigitalStatus	0.168 *** (0.002)
SAsset	0.092 *** (0.004)
Barishal	-13.921 *** (0.209)
Chattogram	-10.653 *** (0.167)
Khulna	-15.215 *** (0.181)
Mymensingh	-11.675 *** (0.258)
Rajshahi	-13.896 *** (0.178)
Rangpur	-21.257 *** (0.309)
Sylhet	-21.253 *** (0.256)
Constant	19.78 *** (0.198)

*Source: Authors' Calculation; Note: Standard errors in parentheses. Significance levels: * p < .05, ** p < .01, *** p < .001*

The coefficient for the Digital status index is statistically significant and positive/ this goes on to confirm that holding the wealth endowment of a household constant, DPI plays a significant role in uplifting a household's socioeconomic wellbeing. Despite possessing similar levels of capital goods to run productive activities, DPI has a unique contribution in terms of the economic outcome of a household. This might be attributed to enhanced human capital investments, which would not be perceived of or accessed without DPI. For income generating interventions, DPI unleashes new mechanisms or advanced systems in the forms of expediated logistical processes, better administrative proceedings, and similar pathways. Thus, the model reflects the positive role that access to DPI plays in ensuring economic well-being. The coefficients for divisions reflect the regional conditions, and the negative values show worse conditions for divisions other than Dhaka. This goes to reflect that the division with the capital has the best outcome in terms of economic wellbeing. Among the rest of the divisions, Chattogram, the region with a major port, has the least value, showing that the next developed region has better economic outcomes than others. Thus, the model duly captures the regional disparities across Bangladesh. Hence, the model incorporating the calibrated NTL of households brings additional weightage to the claims of the PSM model, and this shows the impact that DPI brings to households, bringing unique innovation and resilience to households and directly impacting their wellbeing.

8. Contribution of DPI to Economic Growth and Social Development: A Cross-country Econometric Exercise

In the second stage, the study investigates the macro impact that DPI intervention has on an economy and evaluates the global context of DPI by analysing cross-country data to find how economic development takes place. The values of key economic indicators are taken for 142 nations and territories to understand the comprehensive status of DPI. For the analysis, average values across five years (2016–2020) are taken to eliminate outliers.

The model for this stage of analysis is built on conventional models of economic growth, ones that involve a logarithmic equation of capital and labour to understand the resulting impact on GDP. However, alongside the conventional aspects of growth, this analysis utilizes the factor of DPI, to understand the causal mechanism through which DPI might impact GDP.

The following econometric model serves as the foundation for the analysis:

$$ln(GDP_{it}) = ln(B_1) + \beta_2\, ln(K_{it}) + \beta_3\, ln(L_{it}) + \beta_4\, ln(EGI_{it}) + BD + a_i + e_{it}$$

For the econometric analysis, the $\ln(GDP_{it})$, the natural logarithm of the GDP of a country, is considered the dependent variable. For the independent variables, capital stock's natural logarithm, ln(K), the labour force's natural logarithm, ln(L), and the E-Government Development Index's (EGI) natural logarithm are incorporated. The EGI effectively captures a nation's digital infrastructure and ability to provide public services online. A dummy variable for Bangladesh has been incorporated to understand if the situation of Bangladesh differs significantly from global trends. The data for GDP, capital stock, and labour force have been taken from the Penn World table 10.01, and the data of the E-Government Development Index have been taken from the United Nations' E-Government surveys. Any missing data has been interpolated by considering the neighborhood values. This step separates the precise effect of DPI on growth while accounting for conventional growth inputs.

The cross-country analysis hinges on macro data and was conducted based on the mean value over the span of the last five years and utilizes the linear regression model. The results are shown in Table 5.

Table 5: Results of Linear Regression Model

Predictor	Coefficients and Significance
lnK	0.631 *** (0.033)
lnL	0.357 *** (0.031)
lnEGov	0.479 *** (.096)
BD	-0.244 (0.296)
Constant	3.299 *** (0.438)

*Source: Authors' Calculation; Note: Standard errors in parentheses. Significance levels: * p < .05, ** p < .01, *** p < .001*

The outcomes reflect the findings from expected roles of the regressors on the GDP. The coefficient for capital is found to be significant and positive, showing the importance of investment and capital inducive planning. On the other hand, the role of labour is positive and significant, too, showcasing that albeit the value might be lower than that of capital's, the contribution of labour to economy is enormous.

The contribution of this analysis is reflected through the regressor EGov. The coefficient for EGov is statistically significant and positive, highlighting the importance of adaptation of DPI by governments. This goes to show that even accounting for capital investments and labour endowments, the role of DPI is paramount in an economy. Countries with similar levels of capital intensity and labour endowments will have differing outcomes based on the utilization of its digital sphere. Countries with better DPI systems are more likely to generate innovation by allowing more interoperative systems that allow businesses to reach consumers and achieve economies of scale. The individuals of such countries are more likely to generate better products and services by having the advantage of access to and information of consumers and markets. The governments, too, are more equipped to provide better reaching and enhanced systems of services. These include but are not limited to aspects of improved healthcare, infrastructural enhancements, expediated logistics, etc. these improved systems ultimately result into significant virtuous cycles, where innovation and growth manifests each other.

Finally, the coefficient for Bangladesh is not statistically significant, showcasing that the country is not an outlier in global trends. This reflects that unlike other events of industrial revolutions, the era of adapting the digital sphere is so rapid and instantaneous that countries like Bangladesh, despite the differences in national income, can catch up to the trends of high-income countries. This has significance in terms of its implication, that when used duly, DPI has the potential to converge the discrepancies across countries. However, Endogeneity has been identified in the variables and the appropriateness of the model is in doubt. This shows the shortage of data that exists in the realm of DPI and the resulting problems that arise in analysing quantitatively the impacts of DPI adaptation.

9. Insights from Key Informant Interviews (KIIs)

In the final step of the analysis, KIIs were used to supplement qualitative insights to the quantitative findings. The interviews provide expert opinions on the difficulties and prospects concerning DPI in Bangladesh. This also involves understanding the relevant strategies for raising inclusivity and improving public service. The study thus also focused on the governance challenges of DPI, institutional capabilities, and the necessary cross-sectoral cooperation. Not all trends and insights can be measured, and hence, the qualitative data extracted from this stage were subjected to a thematic analysis. The KII questionnaire and stakeholder list have been added in the Annex.

One of the biggest obstacles to understanding and analysing the condition and impacts of DPI in Bangladesh is obtaining accurate and current data. Although much effort has been put into data infrastructure, there are several discrepancies in the way data is managed and stored by government and non-governmental organizations. Moreover, there are no centralised data repositories to accurately reflect the recent data. Currently, data is dispersed among many organizations, thus hindering the capacity to obtain a complete picture.

The efficiency of DPI interventions in fields such as agriculture, education, and health has declined by this fragmentation, which also restricts interoperability between systems. In order promote a thorough and useful understanding of development priorities, experts underlined the necessity of integrated, interoperable systems with consistent data standards.

In Bangladesh, accessing data can often be a critical challenge. Bureaucratic red tape and logistical challenges make it more difficult to access datasets, particularly those that are considered proprietary or sensitive. This hampers research and analysis, as stringent laws and ambiguous privacy and data-sharing practices hinder collaboration. Organizations frequently hesitate to share data with researchers or the general public without a thorough legal framework controlling data collection and usage. This ambiguity is also relevant regarding data in the DPI domain.

Additionally, respondents stressed out that DPI systems are vulnerable to ethical and legal issues due to the lack of a strong legislative framework governing digital rights, data privacy, and contractual enforcement in the digital domain. In addition to safeguarding individual rights, a well-defined legal framework that promotes accountability, builds confidence, and makes it easier to enforce digital contracts is desperately needed.

For thorough analysis and research, consistency across datasets and departments is a critical aspect. Often, many efforts to gather data are carried out without following established procedures, resulting in redundant, erroneous, or incomplete information. This hinders research efforts, as a lack of standardisation makes it difficult to integrate and compare data from many sources. In many cases, capacity constraints or political motivation dictate data manipulation, and this results in a complex challenge.

In order to deal with this, experts recommended creating an independent data oversight organization with legal and technological know-how to examine and validate DPI-related

data across departments. It is important for institutions to create standard operating procedures (SOPs) for the collection, storage, classification, and privacy of data.

However, Bangladesh's bureaucratic infrastructure is new to the concept of DPI. The bureaucracy, already suffering from a lack of modernisation and capacity constraints, lacks the sophisticated technical know-how required to manage such a comprehensive system. The challenges are more complicated when it comes to the issue of integrating databases created by private entities. Thus, the hurdles in terms of centralising or coalescing datasets persist. A significant institutional challenge that the respondents recognized was the lack of frameworks for collaborative governance. Because DPI requires coordinated input from several ministries, agencies, and the private sector, isolated operations and a lack of cross-sectoral communication frequently led to inefficiencies, overlap, and lost possibilities for expansion.

DPI is dynamic, and its aspects are constantly evolving, complicating the process of accurate data management. With new technologies constantly developing and new services becoming more relevant, it becomes challenging to maintain data and evaluate the long-term effects. The respondents agreed that ongoing regulatory changes must go hand in hand with DPI's ability to adapt to evolving technology. In order to guarantee that DPI is scalable and prepared for the future, respondents also emphasized the significance of implementing flexible concepts.

Data regarding DPI differ significantly based on socioeconomic circumstances and cultural variances. Biases might often surface in studies, which overlook the requirements and viewpoints of various demographic groups. Lack of sensitivity to the nuanced nature of DPI in remote regions is a major hurdle to assessing the condition of data. It is difficult to state that the data appropriately depicts the reality.

The respondents also mentioned that policymakers might fail to consider the challenges that women, minorities, and the people from rural areas experience if they do not have the access to gender and geographical disaggregated data. For instance, limited digital literacy or automated services without human alternatives may cause procedural delays for disadvantaged users. Because these groups frequently don't have a voice in feedback processes, it is important that inclusive user feedback methods and participatory monitoring systems be incorporated into DPI architecture.

Furthermore, the private sector was highlighted as an important partner in the development of DPI. Respondents mentioned a warning that the absence of robust governance protections may result in monopolization, inadequate service delivery, or inconsistent incentives. Public-private partnerships must therefore be governed by transparency and inclusive frameworks to ensure that innovation does not compromise equity.

10. Recommendations

Based on the findings of the qualitative and quantitative analyses, certain recommendations can be chalked out to guide the pathway of Bangladesh's DPI interventions. Implementation of these measures would allow Bangladesh to build an inclusive and future-ready DPI. Only then can the country venture out to having better governance and wider access to basic services.

Developing Supporting Infrastructure

DPI is contingent on several key supporting structures. The current national ID system has to be developed, and the scalability and interoperability should be expanded to achieve the holistic component of DPI. In this case, better capacity building among government agencies and the usage of modern systems like biometrics have to be incorporated. Ensuring widespread access to the internet requires increasing mobile and broadband connectivity, especially in underserved and rural areas. To facilitate smooth data sharing and service delivery throughout government departments, interoperable technologies must also be developed.

Enhancing the Data Ecosystem

Despite the progress made in several aspects of its ICT revolution, Bangladesh has yet to enhance mechanisms for data governance. Bangladesh should enact a thorough data protection law that complies with international norms to guarantee the safe and moral use of personal information. Innovation need not be at odds with data security, and open data projects can be supported by anonymized government data with the public and private sectors. To guarantee consistency, dependability, and ensure interoperability among agencies, defined procedures for data classification, collection, storage, and management should be put into place. It will be easier to monitor the success of DPI interventions if unambiguous key performance indicators (KPIs) are established for digital adoption and service delivery. Interactive channels for citizen feedback must be encouraged to ensure diversity and responsiveness.

Expediting Unified Portals

Bangladesh's public digital platforms still exist in a rudimentary stage and require massive improvement before DPI can be deemed successful. The creation of unified government service portals as "one-stop" online resources can expedite the provision of social welfare, healthcare, and education services. Latest inventions like artificial intelligence and advanced analytics have to be utilized to improve decision-making and service delivery. Establishing a strong incident response system is essential for maintaining public confidence and system dependability.

Improving Digital Finance

In order to stimulate digital payment systems and streamline interoperability, it is crucial to expand the national payment gateway to facilitate safe, affordable, and real-time

transactions. Reaching rural communities can be facilitated by integrating with mobile financial service providers.

Developing Digital Literacy

The success of DPI interventions depends on expanding digital literacy and skills among the populace. This is especially true for the capacity building of the public sector. Hence, the government should implement training programs in data science, cybersecurity, and software development. There exists significant inequality when it comes to digital literacy, so special attention must be paid to rural areas in campaigning to teach people how to use digital services efficiently.

Eliminating the Risks

Given the risks associated with data and information, resilience and cybersecurity must be guaranteed for the protection of citizens. Bangladesh ought to set up a national cybersecurity framework and build capacity and manpower to protect digital systems from cyberattacks. This also involves establishing emergency teams to manage assaults and carrying out security assessments.

Promoting Innovation

Innovation does not occur in a vacuum and requires collaboration among multiple entities of many ranges, like the government, domestic and foreign IT firms, non-profit organizations, etc. This would allow them to co-develop public services, financial resources, and technical know-how. In a developing country like Bangladesh, with limited government capacity, public-private ecosystems are essential. Innovation hubs promoting cooperation and talent pipelines through partnerships between corporate companies and academic institutions could provide multifaceted benefits.

11. Conclusion

This report provides a comprehensive analysis of the impact of DPI on socio-economic outcomes in Bangladesh. PSM was used as the primary analytical method to address selection bias and ensure a more reliable estimation of causal relationships between DPI usage and various socioeconomic indicators. The research findings demonstrate that DPI has a statistically significant and positive effect on financial inclusion along with digital literacy, increased access to public services, and household-level welfare indicators. The study shows that people who have access to DPI have improved results in multiple socioeconomic areas than individuals without access.

Additionally, the study incorporates an analysis using nightlight data as an alternative measure of economic activities. The findings from this analysis also show a positive correlation between higher DPI usage and increased nighttime luminosity, which suggests higher economic activity in areas with higher DPI penetration.

Moreover, the study acknowledges the limitations, such as the inability to control for unobservable factors and the challenges of data availability. Despite these limitations, the findings consistently represent that DPI contributes to improved development outcomes and it plays a vital role in enhancing socioeconomic well-being.

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Annex 1: KII questionnaire

1. What are the risks associated with data ownership in DPI, and how can they be mitigated to ensure accountability and transparency?
2. How can DPI address information asymmetry between government and citizens to ensure equitable access to services for all population groups?
3. What strategies can mitigate the psychological and practical costs that underprivileged communities face due to the automation of services and lack of technical know-how?
4. How does an LDC like Bangladesh deal with the challenges regarding the lack of hardware infrastructure?
5. How do we develop DPI in a way that puts people's rights at the center?
6. What are the key challenges and strategies for transitioning from digitalization to a fully integrated DPI system in Bangladesh?
7. How does a country, as a sovereign entity, maneuver its digital sovereignty?
8. What are the fundamental building blocks of repurposing services in the digital realm?
9. What legal frameworks are needed to ensure proper governance, rule of law, and contract enforcement in the digital realm?
10. What motivates government-driven innovation regarding DPI?
11. How do factors such as education, internet access, and mobile penetration shape access to and the socioeconomic impacts of DPI?
12. How can Spatial Data Infrastructure aid decision-making and service delivery processes?
13. How can DPI help countries achieve national priorities and accelerate the Sustainable Development Goals?
14. How can the educational, agricultural, and health sectors benefit from DPI?
15. How do we prepare legal frameworks for the new sectors that are emerging, like e-commerce?
16. How can we re-factor core data infrastructures of society to encourage interoperability in the digital era?
17. What are the key incentives and challenges in engaging the private sector for the successful development and implementation of DPI?
18. What are the challenges regarding defining DPI, and disseminating the understanding of DPI across government, private and nonprofit institutions?
19. What challenges does Bangladesh face regarding the availability of data about DPI?
20. What is the importance of sex-disaggregated data in understanding the gendered perspective about the status quo of DPI?
21. How does DPI raise the efficiency of government capacity?
22. What mechanisms can be used to monitor and evaluate the effectiveness of DPI interventions in achieving socioeconomic outcomes?
23. How can DPI systems ensure data privacy, cybersecurity, and protection against misuse of information?
24. How can DPI incorporate user feedback mechanisms to continuously improve service delivery and governance?
25. What initiatives are needed to increase public awareness and capacity-building efforts for effective DPI usage?
26. How can international collaboration and best practices contribute to the development of DPI in Bangladesh?

Annex 2: Stakeholders for KIIs

- Bangladesh Computer Council
- Bangladesh Telecommunication Regulatory Commission
- Information and Communication Technology Division
- Aspire to Innovate (a2i)
- Bangladesh National Digital Architecture (BNDA)
- National Skill Development Authority (NSDA)
- Internet Service Provider Association of Bangladesh (ISPAB)
- Bangladesh Association of Software and Information Services (BASIS)
- Bangladesh Investment Development Authority (BIDA)

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GDN Global Development Network

INDIA: 2nd Floor, West Wing ISID Complex, 4,
Vasant Kunj Institutional Area, New Delhi-110070, India

EUROPE: 63 Boulevard François Mitterrand - CS 50320,
63009 Clermont-Ferrand Cedex, France

US: Clifton Larson Allen LLP, 901 N. Glebe Road,
Suite 200, Arlington, VA 22203, USA