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Navigating the Socio-Economic Impact of Digital Bangladesh: An Overview

Rowshon Ara Romke

Assistant Professor, Department of Social Science, American International University-Bangladesh

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ABSTRACT

The Digital Bangladesh initiative envisions the widespread and effective use of modern information and communication technology across all sectors of governance aiming to create an efficient and transparent system and transform Bangladesh into a technologically advanced inclusive society. E-governance service delivery integrates into the core functions of the Bangladesh government to achieve sustainable development goals. This study examines the progress made towards this vision and analyses the socio-economic impact of e-governance in Bangladesh. This study employs a mixed-methods approach combining qualitative analysis of secondary data with primary data collection to explore the socio-economic impacts of Digital Bangladesh and its transition. To complement the secondary data analysis and provide a more nuanced understanding of the ground realities, primary data was collected through semi-structured interviews. 10 Key informants were selected using a purposive sampling strategy, targeting policymakers involved in the Digital Bangladesh and Smart Bangladesh initiatives as well as experts in ICT development. Additionally, employing SWOT (Strengths, Weaknesses, Opportunities, and Threats) and PESTEL (Political, Economic, Social, Technological, Environmental, and Legal) analyses, the study assesses the role of ICT infrastructure in fostering inclusive society. Case studies of various smart cities provide a comparative context for evaluating Bangladesh's current e-governance achievements. As Bangladesh stands on the verge of the Fourth Industrial Revolution, transitioning from automation to digitalization, the nation's embrace of technological advancement positions it to thrive in the dynamic global landscape. Bangladesh can achieve its goal of becoming a smart and inclusive nation, even amidst challenges such as limited resources, infrastructural limitations, and human resource constraints. The study concludes that with effective implementation strategies, a robust operational model and timely interventions of the government.

Keywords: Digital Bangladesh, E-Governance, Inclusive Society, Smart city, Sustainable Development.

INTRODUCTION

The remarkable progress of digital networked and advancements in Information and Communication technologies (ICT) combined with intense global competition, are undergoing a transformative impact on governance in Bangladesh. E-Governance plays a crucial role in this journey, offering more efficient and accessible services, enhancing transparency and accountability, and fostering a more inclusive society. Additionally, e-governance has the potential to promote transparency and accountability, thereby reducing corruption and boosting public trust in the government. Bangladesh has made significant strides towards digitalisation in recent years and the vision of digital Bangladesh has bridged the digital divide and improved the lives of millions of citizens. However, the country now aspires to take the next leap and transition into a "Smart city," building upon the foundation laid by the Digital Bangladesh vision. The Smart society vision focuses on leveraging emerging technologies such as Artificial Intelligence (AI), the Internet of Things (IoT) and Big Data Analytics to create a more efficient, connected, and sustainable society. To achieve this vision, the government has already initiated several steps, including the launch of the Bangabandhu Satellite-1 and the development of a national e-government master plan. The transformation from Digital Bangladesh to Smart Bangladesh underscores the government's commitment to utilising ICT to make Bangladesh a prosperous, equitable society and promote sustainable development. However, to navigate this digital transformation,

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government, businesses, and citizens should work together as well as addressing challenges such as the digital divide, skills gap, and cybersecurity threats.

Various government agencies in developed countries have taken progressive steps to embrace web and ICT use. These steps include fostering coherence in local online activities, expanding local access and skills, facilitating interactive services for local discussions, and increasing citizen participation in the management and promotion of their territories (Kaufman, 1997). While ICT holds significant promise for sustainable e-government growth, its potential remains largely untapped in poorer nations. ICT is often regarded as an 'enabler,' but it also poses challenges and risks of its own. Different countries face diverse human, organisational, and technological aspects, concerns, and difficulties, warranting the need for targeted studies and suitable approaches. However, certain government initiatives in developing nations, such as Brazil, India, and Chile, have achieved success. Effectively implementing e-Government necessitates addressing specific circumstances, requirements, and challenges. In addition to technological advancements, the adaptive problems associated with e-government require new forms of leadership, organisational structures, and public-private partnership transformations (UNDP, 2022). Given the concerted efforts of the UNDP and several governments to shift legal, social, and civil services online, digital transformation has become a reality across Europe and Central Asia. The acceleration of digitalisation is likely to create opportunities for digital leapfrogging in traditional industries and governance. The significance of ICTs as a development enabler was recognised by world leaders during the World Summit on Information Society (WSIS) in Geneva in 2003 and in Tunis in 2005 (Tunis Commitment). By 2021, the Digital Bangladesh vision aims to use ICTs to eliminate poverty, ensure good governance, create an inclusive society through quality education, healthcare, legal protection for all and prepare for the effects of climate change using ICTs (Karim, 2009).

Digital Bangladesh has revitalised its interest in the use of ICT for governance and service delivery by both government and commercial organisations. Digitisation has the potential to enhance operational efficiency and productivity if the necessary infrastructure is in place. It serves as a catalyst for accelerating economic development and increasing Bangladesh's competitiveness in the global market. Moving beyond these assertions, the aim of the present study is to analyze the socio-economic effects of the digital transformation and the challenges and opportunities in transitioning from 'Digital Bangladesh' to 'Smart Bangladesh.'

Research Qurstions

1. How has the "Digital Bangladesh" initiative impacted socio-economic conditions in Bangladesh, specifically in areas such as access to services, economic opportunities and social inclusion?

2. What are the key challenges and opportunities associated with the transition from Digital Bangladesh to Smart Bangladesh?

3. What lessons can be learned from other developing countries' experiences with e-governance and digital transformation to inform the implementation of "Smart Bangladesh"?

A LITERATURE INQUIRY

Bridging the gap between Digital Bangladesh and Smart Bangladesh advancements, government requires to execute a long-term strategy that weaves together technological innovation, economic opportunity and environmental responsibility. Hence, it is imperative for researchers to determine the impediments and proffer remedies for the conversion of underdeveloped countries into smart cities. This literature study is divided into two sections. The first section introduces an established framework for the transformation of smart cities. The second section delves into the challenges and approaches involved in transforming developing nations into smart cities.

Literature Review on Theoretical Framework for Transforming Smart Society

This part provides an outline of the existing literature on the conversion of cities into smart cities through the implementation of advanced technologies. It also introduces a theoretical framework for converting cities into

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smart, sustainable and inclusive cities. In this regard, Kumar et al. (2020) provides a comprehensive framework encompassing design, physical setup, ICT infrastructure setup and deployment of intelligent approaches. Kuru et al. (2020) stressed on a paradigm shift that emphasises four key aspects: active involvement of stakeholders, the establishment of smart city infrastructure, incorporation into various smart city domains, and alignment with national and international contexts. The objective of this framework is to integrate delivered services and resources, provide efficient and user-friendly guidelines, offer real-time assistance services, foster sustainability, and strengthen economic productivity. According to Shang et al. (2022), the approach enhances the resilience of converting traditional cities into smart cities, particularly in the transportation sector. A separate study examines the contribution of low-carbon technology (LCT) to sustainable urban development, focusing on three key areas: energy conservation, emission reduction, and the implementation of carbon capture, storage, and utilisation technologies (Shang, 2023).

Hamalainen (2020) proposed a paradigm comprising four areas—strategy, technology, government, and stakeholders—for enhancing good governance and establishing sustainable smart city programs. Helsinki City utilised the framework to ensure the continuity of operations and to execute smart city initiatives. Mishra (2020) introduced a novel framework that integrates the Internet of Things (IoT), Artificial Intelligence (AI) and cloud computing in smart cities with the intention of enhancing the eco-system. To address the obstacles of smart cities a framework was suggested encompassing issues related to financial constraints, limited resources, societal awareness and adaptability, technological capabilities, absence of a comprehensive smart city framework, absence of sustainable policies, and integration of systems. This paper examines the issues smart city networks face and proposes strategies to address them. The implementation of smart society transformation primarily takes place in developed countries, where high level of good governance, investment, infrastructure, and social awareness is existed. Hence, industrialised nations had fewer challenges in the process of smart city transformation compared to underdeveloped nations.

Literature Review on Weakness and Opportunities of Smart City Transformation in Developing Nations

The study conducted by Tan and Taeihagh (2020) examined the factors that contribute to the difficulties faced in the transformation of smart cities in developing nations. These factors include ineffective governance, insufficient infrastructure, limited finance, shortage of experienced personnel, lack of stakeholder involvement, lack of concerns around data security and privacy. The results of the study investigate that the implementation of transparent governance and a rigorous regulatory framework can facilitate the process of smart city transformation in underdeveloped nations. A recent survey done in Vietnam, revealed that the implementation of online government services has the potential to curb corruption in the process of city service growth (Vu and Hartley, 2018). This study reveals that the acceleration of city transformation can be facilitated by supporting ICT infrastructures, making strategic decisions, implementing operational management, and ensuring good governance. A study conducted in Nigeria utilises a fuzzy-synthetic approach to identify many hurdles to the establishment of smart cities. These challenges encompass political, social, economic, technological, environmental and legal elements (Aghimien, 2020). The research of the smart city framework in developing nations presents a paradigm for the sustainable growth of cities that emphasises the implementation of countrywide and local sustainability strategies, investment, infrastructure, services, data accessibility, and citizen engagement. Prior studies have primarily concentrated on constructing frameworks centred around a limited number of aspects of urban areas, resulting in a dearth of attention towards overseeing and managing concerns pertaining to the sustainable functioning of intelligent urban networks. In order to tackle these difficulties, the study proposes the implementation of a smart city management system and a fuzzy rule-based smart city prediction technique. The system encompasses all facets of a smart city and employs advanced ICT technologies to effectively monitor as well as control activities in a cost-efficient manner.

METHODOLOGY

This study employs a mixed-methods approach combining qualitative analysis of secondary data with primary data collection to explore the socio-economic impacts of Digital Bangladesh and its transition. This approach allows for a comprehensive understanding of the complex issues at hand leveraging existing knowledge while also capturing contemporary perspectives and experiences.

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Secondary Data Analysis

The qualitative method of this study is based on a thorough review of secondary data sources including books, published articles in peer-reviewed journals, reputable newspapers, academic theses and research reports. To ensure a systematic and transparent data collection process, specific inclusion and exclusion criteria were established. The search focused on materials published between 2013 and 2023 (inclusive), utilizing keywords such as "digital Bangladesh," "smart city," "e-governance," "ICT development," "socio-economic impact," "digital divide," "cybersecurity," and "sustainable development" across academic databases like Scopus, Web of Science, and Google Scholar. Sources focusing solely on developed countries were excluded unless they offered highly relevant lessons applicable to the Bangladeshi context.

This study employs a multiple case study approach to explore the social impacts of digital development drawing on examples from diverse contexts to provide a broader understanding of the challenges and opportunities associated with digital transformation. The case study method is particularly suitable for this research as it allows for in-depth examination of complex social phenomena within specific settings (Yin, 2018). While the primary focus of this overview is on the context of Digital Bangladesh, the inclusion of comparative cases serves to highlight transferable lessons and broader trends in digital development.

Primary Data Collection

To complement the secondary data analysis and provide a more nuanced understanding of the ground realities, primary data was collected through semi-structured interviews. Key informants were selected using a purposive sampling strategy, targeting policymakers involved in the Digital Bangladesh and Smart Bangladesh initiatives as well as experts in ICT development and social impact assessment. A total of 10 interviews were conducted throughout 2023. Interviews were conducted remotely via Zoom and audio-recorded with the consent of the participants. The interview guide explored perspectives on the achievements and challenges of Digital Bangladesh, the opportunities and risks associated with the transition to Smart Bangladesh and strategies for mitigating potential negative consequences.

Analytical Framework

The study utilizes both SWOT (Strengths, Weaknesses, Opportunities, Threats) and PESTEL (Political, Economic, Social, Technological, Environmental, Legal) analyses. SWOT analysis was chosen to systematically assess the internal strengths and weaknesses of Bangladesh's existing digital infrastructure and initiatives, as well as the external opportunities and threats presented by the transition to a Smart Bangladesh. This framework facilitates the identification of key factors influencing the success or failure of digital transformation efforts. Complementing this, PESTEL analysis was employed to examine the broader macro-environmental context within which the transition is occurring. This framework allows for a comprehensive understanding of the political, economic, social, technological, environmental, and legal factors that may enable or constrain the implementation of Smart Bangladesh initiatives. These frameworks were selected because they provide a structured and holistic approach to analyzing the complex interplay of internal and external factors influencing digital transformation, which aligns directly with the research questions. While other frameworks like Porter's Five Forces or stakeholder analysis could have been used, SWOT and PESTEL were deemed most appropriate for this study due to their focus on both internal capabilities and the broader environment, providing a more comprehensive understanding of the challenges and opportunities at play.

Framework Development

Based on the analysis of both secondary and primary data, a framework for the transformation of Dhaka into a smart city is proposed. This framework incorporates cutting-edge technologies and proposes specific smart city management approaches tailored to the unique context of Dhaka aiming to address the city's current challenges and improve its livability. The framework seeks to connect the strategic insights from SWOT and PESTEL analyses with practical, actionable recommendations.

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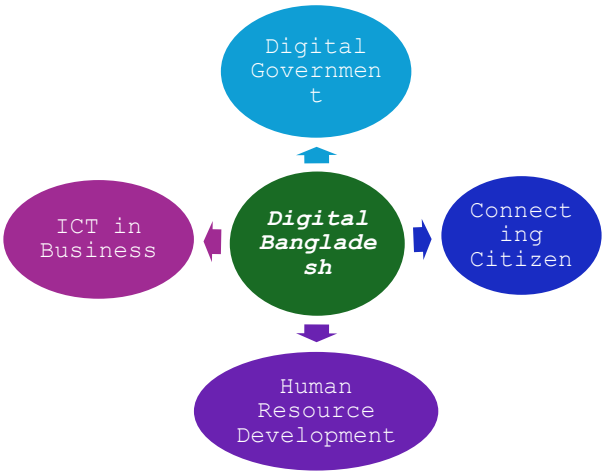
Conceptual Clarity

Digital Bangladesh

The term of "Digital Bangladesh" encompasses more than just the increased use of computers. It signifies the adoption and application of cutting-edge technologies like cloud computing (Habib, & Baizid, 2010). The notion of cloud computing is crucial but majority of citizens are not familiar with this concept. Hence, Bangladesh government showed favourable dispositions in its thought process and advocated for the execution of inventive concepts to ensure the triumph of its 'Digital Bangladesh' initiative (Islam, 2018). The concept of Digital Bangladesh encompasses the principles of human rights and democracy for the people of Bangladesh including transparency, responsibility, the establishment of justice and delivery of services to the grassroots population through the utilisation of digital technology.

Figure 1: Features of Digital Bangladesh

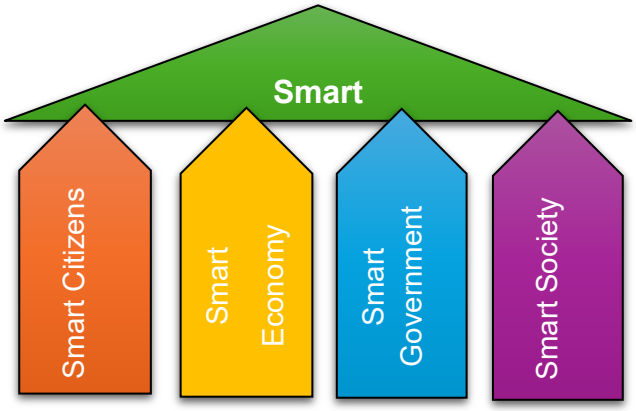


Source: Researcher's own construct

Inclusive Society

Inclusive society is more intelligent, linked and efficient, going beyond the process of digitisation. Implementation the four main pillars of the Smart society/government can construct a technologically advanced and efficient Bangladesh. Smart society is an enhanced iteration of Digital Bangladesh that emphasises the application of cutting-edge technologies to enhance the standard of living, foster sustainable progress and enhance governance. The four key areas are: 1. Intelligent Individuals, 2. Intelligent Economy, 3. Intelligent Governance, and 4. Intelligent Community.

Figure 2: Four Key Areas of Smart Government



Source: Researcher's construct

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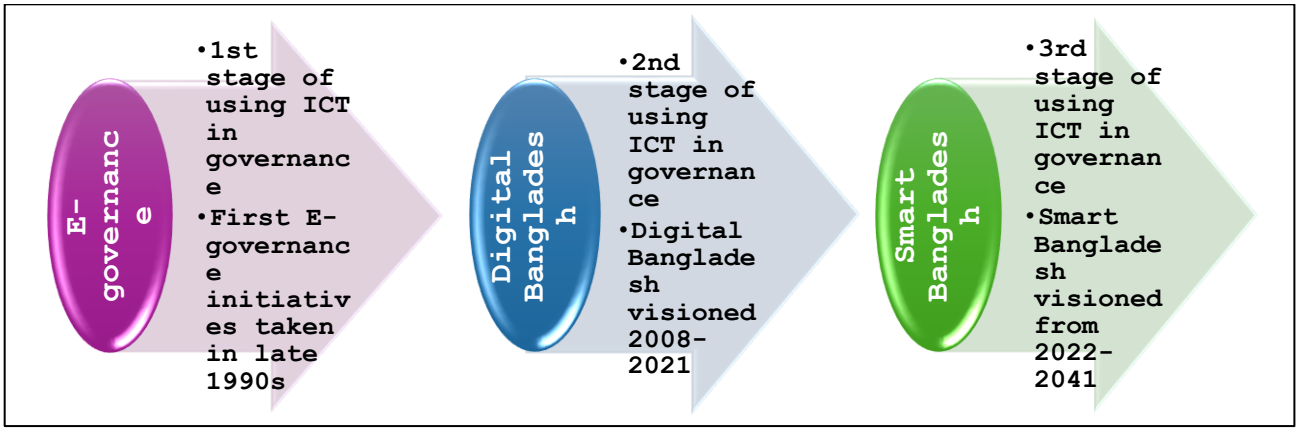
Smart Citizen and Smart Government will facilitate the digitisation of all services and media. Conversely, Smart Society and Smart Economy will support fostering an inclusive society and establishing a business-friendly atmosphere to guarantee intelligent economic expansion. In addition, the goal of Smart government/society will be achieved by harnessing the technologies of the fourth industrial revolution to bring about significant transformation across these four pillars. Smart society leverages the power of cutting-edge technologies like the Internet of Things (IoT), Artificial Intelligence (AI), and Big Data Analytics to establish a cohesive and intelligent network. To create a sustainable and ecofriendly environment, Smart society will bring a significant change in renewable energy sources, effective waste disposal methods, and efficient modes of transportation.

E-governance

E-governance projects were initially implemented in Bangladesh during the late 1990s. The Local Government Engineering Department (LGED) opened its website in 1997, becoming the first government department in Bangladesh to do so. In the same year, the Bangladesh Computer Council (BCC) initiated the National Information Network (NIN), a system that facilitated internet access for government offices and educational institutions. The government initiated the e-Governance Project in 1999 with the intention of enhancing the effectiveness and openness of government services by using information technology. The government initiated the Digital Bangladesh Vision in 2008 to convert Bangladesh into a digitalised society. The Digital Bangladesh Vision encompassed several e-governance efforts, including creating a nationwide broadband network, installing digital centres in rural regions, and facilitating online government services for residents. Therefore, in 2022, the government declared the initiative for a technologically advanced Bangladesh.

Figure 3: Stages of Transformation of e-governance in Bangladesh



Source: Researchers own construct.

DISCUSSION

RQ-1: Socio-Economic Impact of Digital Bangladesh

To address Research Question-1 (How has the "Digital Bangladesh" initiative impacted socio-economic conditions in Bangladesh, specifically in areas such as access to services, economic opportunities, and social inclusion) the following thematic analysis is based on a literature review and responses from 10 Key Informant Interviews (KIIs):

The implementation of Digital Bangladesh should serve as the initial measure to bridge the gap between rural inhabitants and the secretariat or any other central location where the public engages in government. The technological advancements in the anytime-anywhere and death of-distance paradigms will facilitate the more efficient utilisation of limited resources, such as healthcare, education, agriculture, and other service delivery companies (Karim, 2009). The digital gap is present among various demographic categories, including urban and rural dwellers, affluent and impoverished individuals, and educated and illiterate individuals. India's IT industry has developed remarkably and Bangladesh can benefit from India's experience. Nevertheless,

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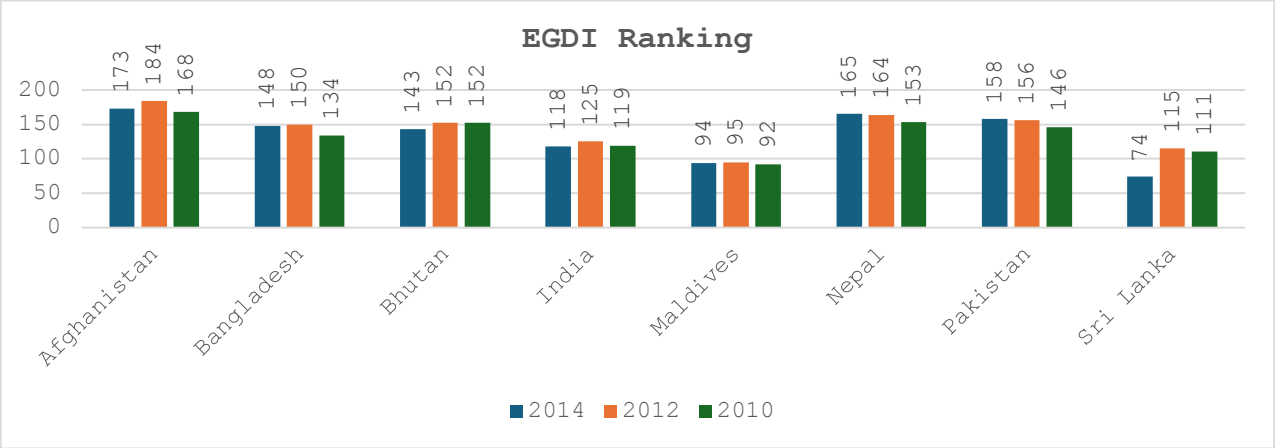
possessing technological proficiency is essential for the digitalisation of Bangladesh's economy (Khan, 2010). It is contended that though Bangladesh was an early user of ICT but it lagged behind than other countries in this region, as demonstrated by many indicators of ICT readiness, including PC penetration rate, internet penetration rate, and others. E-Government Development Index (EGDI) of UN evaluates the influence of Information and Communication Technology (ICT) on a country's political economy. This index specifically examines governments' utilisation of information and communication technology (ICT) to deliver services to their citizens, as well as the ability to participate actively in the decision-making process. The measurement of EGDI is based on the evaluation of online services, technology infrastructure, and human capital.

Figure 4: Ranking of Bangladesh and its bordering nations according to the EGDI



Source: UN-E-Government-Survey-2022

Figure 4 displays Bangladesh's position in the EGDI rating out of a total of 193 countries, along with the rankings of its neighbouring countries. Within the South Asian region, Bangladesh holds a higher position in the rankings compared to Afghanistan, Nepal, Pakistan, and Myanmar. Bangladesh is ranked 148, whereas Afghanistan is ranked 173, Nepal is ranked 165, Pakistan is ranked 158, and Myanmar is ranked 175. Sri Lanka holds the top place in the area, ranking at 74. Bangladesh achieved a ranking of 111th in the E-Government Development Index (EGDI) 2022, showing an improvement of eight positions compared to the previous year and a significant advancement of 37 positions over the past eight years. A number of factors were found by the researchers to be contributing to the lagging progress, including poverty, lack of direction and knowledge about how to achieve Digital Bangladesh, lack of political vision, bureaucratic attitudes, low educational attainment, inadequate infrastructure, and limited resources (Hoque, Mohiuddin, & Alam, 2011). Bangladesh's economy and society are significantly impacted by e-governance initiatives. By 2041, It is estimated that the digital economy could contribute up to 20% of Bangladesh's GDP. The citizens of Bangladesh are immensely impacted by the e-governance services:

E-governance

E-governance in Bangladesh has seen progress but a deeper analysis reveals both successes and areas for improvement. Several initiatives such as online tax filing, digital land records and citizen portals have been launched. While online tax filing has simplified the process for some, accessibility remains a challenge for those without internet access or digital literacy. Digital land records, while promising, face hurdles in implementation due to issues like data accuracy and corruption. Citizen portals, intended to be a one-stop shop for government services, often suffer from limited functionality and lack of integration. A key challenge is the lack of interoperability between different government systems, leading to data silos and hindering seamless service delivery. A unified digital identity system is crucial to streamline access to services and enhance security. Furthermore, open data initiatives, while gaining traction, need stronger legal frameworks and implementation to truly promote citizen engagement and government accountability. Releasing anonymized government data can empower citizens to monitor government performance, identify areas of improvement, and participate more effectively in policymaking.

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Digital Banking

The rise of mobile financial services (MFS) like bKash, Rocket, and Nagad has revolutionized financial inclusion in Bangladesh particularly for the unbanked population. These platforms have enabled millions to access financial services like money transfers, bill payments and savings accounts, often for the first time. The implementation of efficient and user-friendly financial services such as SMS has greatly expedited self-employment and entrepreneurial endeavours. Moreover, it has dramatically increased women's participation in financial operations. Individuals are conducting money transfers, receiving funds, and making bail payments using mobile devices or mobile-to-mobile networks, even without a traditional bank account. Bkash, Rocket, and Nogod are the three primary platforms for doing mobile financial transactions. However, this rapid growth also presents cybersecurity challenges. Instances of fraud, money laundering and data breaches are increasing, requiring robust security measures and regulatory oversight. The Bangladesh Bank plays a critical role in regulating and promoting digital financial services, balancing innovation with security. The central bank needs to continuously update its regulatory framework to address emerging risks and ensure consumer protection. Furthermore, promoting financial literacy among users is essential to minimize their vulnerability to fraud and scams.

Cybersecurity

The cybersecurity landscape in Bangladesh is complex and evolving. While the Digital Security Act exists, its implementation and effectiveness are debated. The capacity of law enforcement agencies to investigate and prosecute cybercrimes needs significant strengthening. Training law enforcement personnel in digital forensics and cybersecurity best practices is crucial. Citizen awareness about online safety is also a major concern. Many individuals are unaware of basic cybersecurity precautions, making them vulnerable to phishing attacks, malware, and other cyber threats. Public awareness campaigns and educational programs are essential to improve digital literacy and promote responsible online behavior. Emerging technologies like AI present both opportunities and challenges for cybersecurity. AI can be used to detect and prevent cyberattacks, but it can also be used by malicious actors to create more sophisticated attacks. Therefore, Bangladesh needs to invest in AI-driven cybersecurity solutions and develop expertise in this area.

Public-Private Partnerships (PPPs)

The transition to a Smart Bangladesh necessitates strong collaboration between the public and private sectors. While Bangladesh has a framework for PPPs, it needs further refinement. Challenges include bureaucratic delays, lack of transparency in procurement processes and concerns about risk sharing. Learning from successful PPP models in other countries, such as those in smart city development can be beneficial. For example, some countries have established dedicated PPP units to streamline project approvals and provide guidance to both public and private sector partners. Adapting these models to the Bangladeshi context requires careful consideration of local conditions and priorities. Ensuring transparency and accountability in PPPs is paramount. Clear guidelines for project selection, procurement and contract management are essential. Public access to information about PPP projects can help prevent corruption and ensure that projects are implemented in public interest. Furthermore, mechanisms for resolving disputes between public and private sector partners need to be established.

Furthermore, the KII responses highlighted the following socio-economic impacts also:

Agriculture: Agriculture is the primary economic sector in Bangladesh employing 41.6% of the total workforce and contributing 14.23% to the nation's GDP (World Bank, 2000). The advent of digitalisation and information and communication technology (ICT) has led to significant transformations in various aspects of the agricultural sector and social life also. This agricultural revolution has been increase the fast and easy service to the farmers life.

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Table 1: Agricultural Productivity Growth

Year/Sector	2009-10	2020-21
Food Grain	40 million ton	55 million ton
Growth/hector	4176 kg/h	479kg/h
Fishes	2.5 million tons	4.7 million tons
Livestock	95 million	187 million

Source: Banglapedia 2021

Sanitation and Heath: The digitalisation and use of ICT have brought about revolutionary developments in the sanitation and healthcare sector. Initially in 2012, the death rate among children and senior citizens in rural areas was significantly higher. Annually, a million pregnant women residing in rural and isolated regions succumb while delivering their babies. The establishment of satellite health centres in every hamlet along with the implementation of telemedicine services and videoconferencing for disease treatment has led to a substantial improvement in the overall condition.

Reduction of Poverty: The digital transformation in Bangladesh has led to a swift socio-economic transition, impacting economic growth and poverty alleviation. Every economic statistic in Bangladesh has experienced a significant increase leading to a rapid decline in the poverty rate. The overall Gross Domestic Product (GDP) has increased significantly from $102.47 billion in 2009 to $409 billion in 2021. Similarly, the GDP per capita has also experienced a notable acceleration, rising from $702 in 2009 to $2554 in 2021. Additionally, the poverty rate has seen improvement, decreasing from 30.9% in 2009 to 20.5% in 2020, according to the World Economic Outlook 2021.

Table 2: Success of Bangladesh in the Indicator of Economy

Year/Indicators	2009	2012	2015	2018	2021
GDP ($ Billion)	102.47	133.36	195.08	218.13	409
GDP/Capita ($)	681,12	856.34	1210.16	1675.08	2554
GDP Growth Rate (%)	5	6.52	6.55	7.5	6.8
Unemployment Rate (%)	11	8.7	4.38	4.29	4.2
Poverty Rate (%)	33.05	28,7	25	21.0	20.5

Source: World Economic Outlook 2021

RQ-2: Key challenges and opportunities in transition of Digital Bangladesh

In response to Research Question 2 (What are the key challenges and opportunities associated with the transition from Digital Bangladesh to Smart Bangladesh), a thematic analysis of the following discussions was conducted, drawing from a literature review and responses from 10 KIIs:

Opportunities

Improved Accessibility to Education and Information: The Internet and other digital technologies have provided inhabitants of Bangladesh with a wide range of educational and informational resources. Students residing in geographically isolated regions now have the ability to avail themselves of digital educational

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materials and engage with educators and peers from all parts of the nation through online platforms. ICT played a crucial role in supporting the resilience and continuity of the education sector in Bangladesh during the COVID-19 pandemic. It facilitated the continuation of education, notwithstanding the shutdown of educational institutions.

Enhanced government services, efficiency and transparency: Digital Bangladesh is bolstering government efficiency and transparency by digitising and providing online access to government services. Furthermore, this facilitates citizens' access to government services and mitigates the potential for corruption. For instance, activities such as land registration, tax payments, and passport applications.

Empowered citizens: Digital Bangladesh is empowering citizens by providing them with access to knowledge and technology that can enhance their quality of life and means of subsistence. For example, women entrepreneurs can use digital platforms to sell their products and services to a global audience, students with disabilities can use online learning platforms to access education, and people with disabilities can use digital tools to find jobs and start businesses. Bangladesh has also seen a rapid increase in its skilled freelancing community. Bangladesh right now has the world's second-biggest pool of freelancers.

Challenges

However, some negative impacts and weaknesses still need to be addressed to achieve the full vision of Digital Bangladesh. Syed Abul Maksud, in 'The Dark Side of Digital Bangladesh' (2021), portrays the loopholes of digital Bangladesh. Different study reveals relevant negative impacts of digital government:

Increased online fraud and scams: A report discloses that there was a 50% increase in online fraud and scams in 2021, and the average amount of money lost per victim was BDT 200,000 (Bangladesh Police Cyber Crime Unit Report, 2022).

Increased cyberbullying and online harassment: Another study unveils that 70% of women in Bangladesh have experienced cyberbullying or online harassment and victims' mental and physical health is adversely affected (Bangladesh Women's Rights Movement Study, 2020).

Increased youth addiction to digital devices: A study reveals that 60% of young people in Bangladesh are addicted to digital devices, and this addiction is leading to problems such as sleep deprivation, anxiety, and depression (Bangladesh Medical Research Council Study, 2021).

Increased social isolation and loneliness: A study shows that 50% of young people in Bangladesh feel lonely and isolated, and this loneliness is leading to problems such as depression and anxiety (Bangladesh University of Social Sciences Study, 2021).

Analysis of Existing Smart Cities

This part entails the performance of a SWOT analysis on the current smart cities worldwide, based on another recent research. Additionally, it presents a PESTEL study of the obstacles faced by Dhaka, Bangladesh, in its endeavour to become a smart city. These strategic evaluations pinpoint the obstacles and possibilities for developing smart cities. SWOT is an acronym for Strengths, Weaknesses, Opportunities, and Threats, while PESTEL stands for Political, Economic, Social, Technical, Environmental, and Legal. The SWOT analysis consists of two fundamental components: internal factors, which encompass strengths and weaknesses, and external factors, which encompass opportunities and threats. This analysis serves to highlight the current difficulties and potential for smart cities. Moreover, the PESTEL analysis reveals the difficulties faced in the traditional setting of Dhaka, Bangladesh. Figure 5 depicts the SWOT analysis, while Figure 6 illustrates the PESTEL study used to identify problems and opportunities in the smart city transformation.

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Figure 5: SWOT analysis for existing smart cities

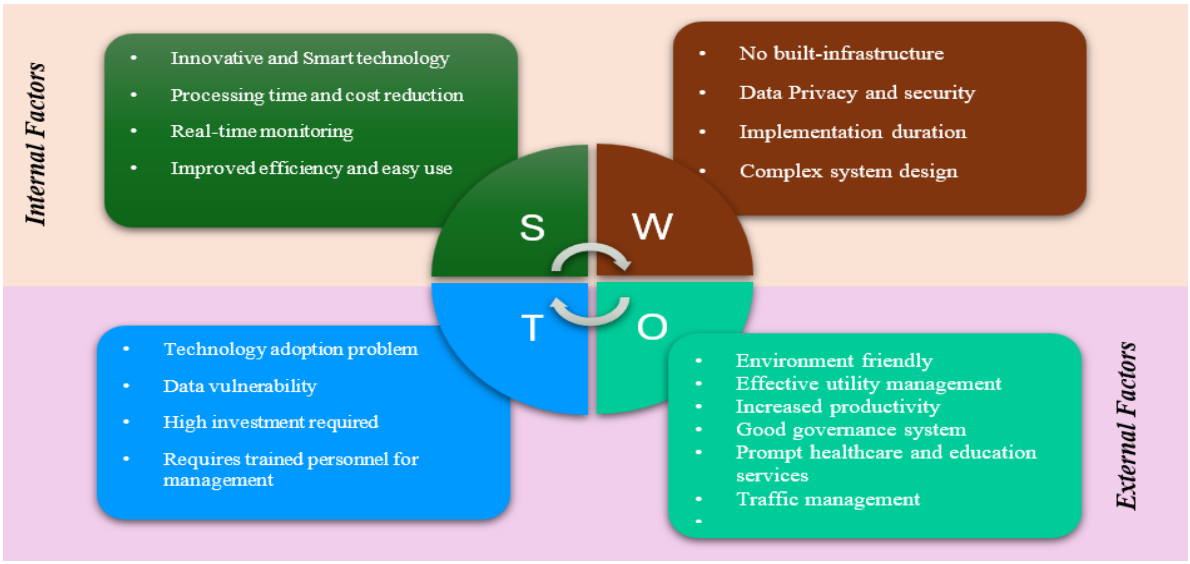

Figure 6: PESTEL analysis of Dhaka, Bangladesh

Source: Researcher's own construct

As input variables of smart city transformation, some essential parameters (governance, transportation, healthcare facilities, utility management systems, waste management systems and industrial automation) were selected whereas as the output variable the smart city is considered. These input and output variables have been selected using the SWOT and PESTEL analyses.

RQ-3: Sustainable Smart City Governance: Case Studies

In response to Research Question 3 (What lessons can be learned from other developing countries' experiences with e-governance and digital transformation to inform the implementation of "Smart Bangladesh"), an analysis of the following discussions is conducted using relevant case studies:

Case Study 1: Al-Madinah Knowledge Economic City (KEC)

Al-Madinah Knowledge Economic City (KEC) aims to utilise technology and innovation to improve the standard of living for both its residents and tourists. ICT has a crucial role in facilitating economic progress. Madinah Knowledge Economic City is set to become one of the pioneering Smart Cities globally, distinguished from other cities in Europe, the US, and Asia by its comprehensive integration of Smart City elements.

Smart Water Management. KEC implements an intelligent water management system that utilises sensors and data analytics to oversee water consumption and identify any leaks. In addition, the city is equipped with a desalination facility that converts seawater into potable water.

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Smart Transportation. Kinetic Energy Corporation (KEC) implements an intelligent transportation system that uses sensors and data analytics to enhance traffic efficiency and mitigate congestion. Additionally, the city boasts a comprehensive electric transportation and charging infrastructure system.

Smart Waste Management. KEC implements an intelligent waste management system that utilises sensors and data analytics to enhance the efficiency of garbage collection and recycling processes. KEC provides its inhabitants an assortment of intelligent urban services, including online governmental services, intelligent parking, and intelligent street lighting.

Sustainable Energy. The city has implemented solar panels on numerous buildings and uses smart meters to assist residents in minimising their energy usage.

Furthermore, KEC is specifically built to enhance its liveability and sustainability as a city. The city is encompassed by a green belt, which has several parks and open spaces. In addition, KEC boasts a meticulously planned public transportation infrastructure and a diverse range of residential, commercial, and recreational amenities. KEC is one of the glaring example of smart city that leverage ICT to enhance the well-being of its inhabitants and tourists through several means.

Case Study 2: Malta-Smart City

Malta is anticipated to generate investments of approximately US$ 300 million. The central emphasis of Malta to turn it smart city is to establish an well-equipped ICT and advanced media communication that deliver services in fast and easy way. Smart City Malta is a technologically advanced business park situated near Kalkara. It serves as a central focus for enterprises that rely on knowledge-based activities. The development showcases cutting-edge infrastructure, encompassing high-speed internet, intelligent energy management systems, and environmentally friendly building design.

Smart public transportation: Malta has successfully established an intelligent public transportation system that utilises real-time data to optimise bus routes and schedules. The technology additionally furnishes passengers with up-to-the-minute data regarding the exact times and whereabouts of bus arrivals.

Smart waste management: Malta is currently in the process of creating an advanced waste management system that will utilise sensors and data analytics to improve the collection and disposal of waste efficiently. The technique will additionally aid in diminishing waste generation and fostering recycling.

Smart healthcare: The Maltese government has implemented an electronic health record system that allows doctors and other healthcare professionals to share patient information securely and efficiently. Malta is also making progress on a number of other smart city goals, such as reducing its carbon footprint, improving air quality, and promoting social innovation.

Case Study 3: Dubai Internet City

Dubai Internet City (DIC), a prominently managed ICT cluster, reported a 33% increase in the number of companies choosing to establish their operations at the cluster in 2007. This rise amounts to 112 new companies joining DIC, making it one of the largest ICT clusters globally. The new participants consist of prominent global corporations such as Google, British Telecom, Layton International, Qualcomm, Telecom New Zealand, Dimension Data, Logo Business Solutions, and VeriSign. These firms are well-established and highly regarded in the ICT field. From the inception of its establishment, Dubai Internet City has contributed in actively to foster the growth of the regional ICT industry. Implementing government initiatives has effectively assumed a leadership role in bringing knowledge and experience to the region through partnerships with commercial partners. The government has positioned DIC as a leading player in the ICT industry in this region, ensuring steady growth and attracting foreign enterprises to enrich the business community. A significant number of enterprises within the ICT cluster have had a twofold increase or expansion of their facilities, leading to an 84 per cent growth rate in rented areas from 2006 to 2007. Dubai Internet City has enabled the establishment of more than 1000 IT enterprises in the free zone, providing advantageous business opportunities for its partners, such as a networking platform, cooperation opportunities, and company growth. TECOM Investments, the parent

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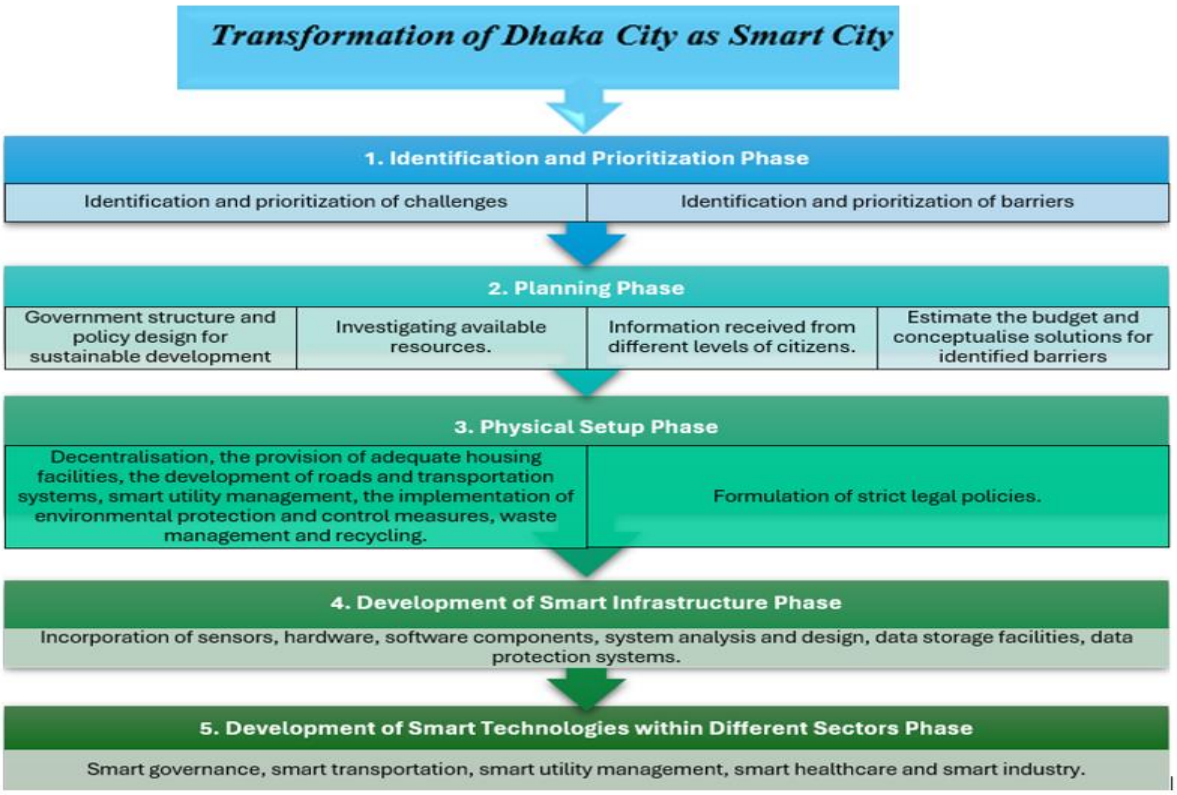
company of Dubai Internet City, introduced the Smart City concept in collaboration with Sama Dubai, a worldwide property development organisation owned by Dubai Holding. This initiative aims to expand the successful model of Dubai Internet City outside the limits of Dubai. The partnership has led to the creation of self-sufficient communities in two strategic areas - Smart City Malta, Europe and Smart City Kochi in the southern Indian state of Kerala - with other projects in progress. Dubai Internet City has become a global hub for the information and communication technology sectors, hosting a majority of Fortune 500 corporations and over 1,000 specialised industry leaders from various categories.

Dhaka as a Smart City: A Framework

Karmaker and others presented a comprehensive plan for attaining long-lasting and environmentally friendly changes in the Dhaka metropolis. The framework consists of five sequential phases: problem identification and prioritising, planning phase, physical setup phase, development of IoT infrastructures and lastly monitoring and controlling (Karmaker et al, 2023). To transform Dhaka into smart city, each stage of the process entails a distinct sequence of plan and actions that must be accomplished. The framework stages of Dhaka as smart city is depicted in Figure 7.

Figure 7: Smart city transformation framework for Dhaka



Source: Karmaker, A.K., Islam, S.M.R., Kamruzzaman, M., Rashid, M.M.U., Faruque, M.O., Hossain, M.A., 2023.

Policy Recommendations

In response to KIIs suggestions, following short term and long term recommendations are required to ensure inclusive, smart and sustainable Bangladesh:

Short-Term

Launch a nationwide **digital literacy program** targeting all segments of the population, with a focus on rural areas and marginalized communities as well as invest in expanding and **upgrading the country's digital**

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infrastructure including broadband internet access and mobile connectivity. Implement policies to promote the release of government data in open formats, fostering transparency and citizen engagement.

Long-Term

Invest in training and equipping law enforcement agencies to effectively investigate and prosecute cybercrimes.

Create a favorable investment climate to attract private sector participation in smart city projects, particularly in areas like transportation, energy, and waste management.

Create a dedicated fund to finance smart city initiatives across the country, prioritizing projects that address critical urban challenges.

CONCLUSION

Although Bangladesh faces constraints in terms of resources, capacity and expertise, it possesses a significant reservoir of human resources that can be efficiently tapped into through the proper application of ICT. In order to address these difficulties, SWOT and PESTEL analysis is a potential avenue for innovation. To address these challenges, we can implement smart solutions like intelligent infrastructure, efficient data management, and innovative smart products and services. In order to convert Dhaka into a smart city, it is urgent to deliver online services to the residents, provide real-time monitoring for traffic and healthcare systems, digitize education systems and foster a knowledge-based culture. It is essential to allocate resources towards the adoption of intelligent technology and the advancement of efficient utility management. The obstacles of smart city development can differ from country to country due to infrastructure, skilled manpower, resources, budget etc. The journey from Digital Bangladesh to Smart Bangladesh is an ambitious one but with a strong foundation and a focus on innovation and inclusiveness, it is achievable. By harnessing the potential of its human resources and embracing cutting-edge technologies, Bangladesh can transform into a nation that offers a high quality of life, increased efficiency, and a thriving knowledge-based economy. This transformation will not only benefit its citizens but also serve as an inspiration for other developing nations seeking to embrace a smarter future. Although this research offers useful insights into the difficulties and solutions for smart city development, there are still some areas that necessitate additional research and exploration. Through persistent research and advancement of intelligent urban solutions, we may strive to establish urban settings that are more effective, environmentally friendly, and conducive to human habitation on a global scale.

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