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Enhancing Public Service Delivery Efficiency through AI: Current Initiatives and Future Prospects in Bangladesh

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Abstract

The integration of Artificial Intelligence (AI) in public service delivery presents a transformative opportunity for Bangladesh, where bureaucratic inefficiencies, resource limitations, and unequal access to services persist as significant challenges. This study investigates the current applications of AI in society, its socio-economic impact, and challenges within major sectors in Bangladesh. Qualitative approaches, such as Key Informant Interviews with AI experts, as well as literature review was conducted to highlight AI innovations such as telehealth platforms, smart agricultural systems, and AI-enabled educational tools that greatly increase efficiency, accessibility, and equity in public services. Findings demonstrate that AI initiatives affected more than 40 million people by paving ways for flood prediction while enabling 2.7 million students for AI-enabled education and saving up to 87.5% costs in helpline servicing. AI-enabled healthcare provides services to over 600,000 pregnant women, while IoT-based farming systems increase profitability and yield for aquaculture. The future shows bright prospects for AI-related applications in predictive healthcare, urban planning, and sustainable agriculture. Some major challenges are infrastructure deficits, data privacy breaches, lack of digital literacy, and unpreparedness of the workforce. Policy frameworks emphasizing ethical AI use, scaling capacity building, and bridging the digital divide would lead to citizen-centered governance.

Keywords: Artificial Intelligence (AI), Public Service Delivery, Impact of AI, Prospects of AI, Bangladesh

1. INTRODUCTION

The phenomenal progress of digitization around the world has pushed artificial intelligence (AI) at the forefront of technological innovation in this era of fourth industrial revolution (4IR) [1]. Since it is growing more prevalent in our daily interactions with many sectors, it is also becoming more important for the delivery of public services by federal, state, and municipal governments. In the process of modernizing government agencies into open and accountable systems for providing public services, it is gaining more and more importance for countries [2]. Amidst widespread bureaucratic inefficiency, scarce resources, and unequal access to services, it offers novel approaches for public sector reforms. With promising

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outcomes for reforming the public sector, AI is an emerging opportunity for Bangladesh, where issues of bureaucratic inefficiency, limitation of resources, and uneven access to services continue to haunt the nation [3]. Bangladesh has been forayed into digital governance with its Digital Bangladesh initiative; concentrating on Digital Implementation for services that are accessible, transparent, and inclusive [4], [5]. This digital endeavor has now built strong grounds for public services to become fully integrated with artificial intelligence and has recently spurred some initiatives toward using AI to simplify processes, improve decision-making, and eventually elevate citizen satisfaction [6].

AI applications in Bangladesh's public sector are primarily focused on high-impact areas such as healthcare, education, agriculture, and administrative services. In healthcare, for example, AI has been employed to facilitate predictive diagnostics and improve health service accessibility, especially in rural and underserved regions where healthcare infrastructure is limited [7]. Preventive Models and data analytics in healthcare have been able to enable early detection of diseases and for healthcare providers to use resource efficiency in their work while screening patients for priority access to healthcare services. AI has transformed education by replacing traditional learning with intelligent learning platforms, replacing administrative tools that are more advanced, and personalizing learning experiences and educational outcomes by providing data-driven insights for educators and policymakers [8].

Among various sectors in Bangladesh, agriculture stands as the most important sector for the economy and livelihoods. AI-enabled agricultural technologies will help optimize productivity by allowing farmers to monitor crop health, predict weather patterns, and assess soil conditions [9]. These technologies would be a boon for farmers in avoiding wastage of resources and increasing yield while also contributing toward the food security and sustainability objectives of the nation [10]. In addition, AI-based data analytics and machine learning applications will improve administrative services by adding routine tasks, reducing processing times, and increasing service delivery efficiencies, enabling public officials to devote more time to complex and innovative decision-making approaches. The use of AI in public service delivery systems could greatly improve efficiency and transparency while also eradicating problems with corruption [11].

However, these continuities have been accompanied by difficulties in bringing AI-adoptive systems into the mainstream of the public sector in the country. Major barriers to adoption, such as infrastructure deficits, a lack of skilled workforce, as well as issues surrounding data privacy, prevail in that area in Bangladesh [4]. The application of Artificial Intelligence also needs huge expenses in the entire administrative conversion from a mostly paper-based and human-centered system and competency enhancement within organizational culture itself. All these hurdles

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should thus be dealt with to harness the broader perspectives of AI in the governance context of Bangladesh.

Researchers have undertaken numerous studies on the AI and the fourth industrial revolution landscape in Bangladesh; yet there remains a paucity of study about AI initiatives in public service delivery. Hence, the aim of this paper is to examine the public service initiatives currently being driven by artificial intelligence in Bangladesh and their potential future applications in ensuring better governance and public service provision. This study will also point the ways forward for policymakers, researchers, and technologists for leveraging the opportunities and facing challenges within the context of AI incorporation to contribute to their vision of digitally empowered and citizen-centered governance in Bangladesh.

1.1. Artificial intelligence

The term "artificial intelligence" describes computer systems that are able to simulate human intelligence. Learning, reasoning, and self-correction are all parts of this process. Learning entails acquiring information and rules for applying that information. Reasoning involves employing rules to obtain either approximate or definite conclusions. Some specific uses of AI include computer vision, voice recognition, and expert systems [12]. Figure 1 shows the different forms of AI and their implications in different fields.

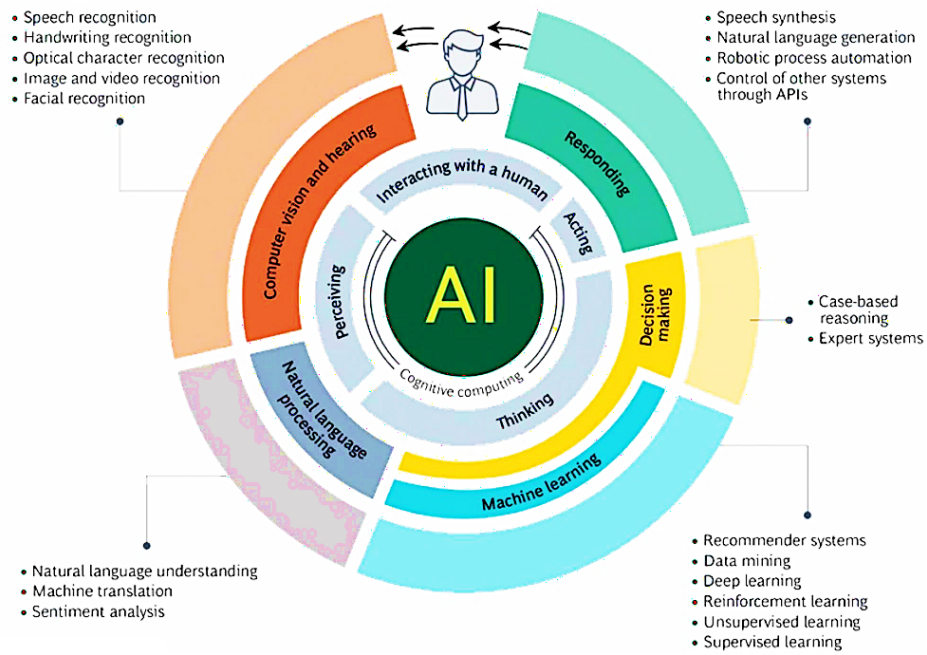

Figure 1. AI in different forms. Source: BCG [13]

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Artificial Intelligence is a field of study harnessing resources from Math, Psychology, Computer Science, Biology, Engineering, and Linguistics. AI can be classified into three types: Narrow AI, General AI, and Super AI. Narrow AI, also known as weak AI, has the potential to conduct only some tasks while it's not competent enough to function outside these specific tasks. Examples include weather predictions, Siri, or any other voice assistants, and controlling intelligent home automation devices. General AI would replicate human cognitive functions such as learning through experience, self-adjusting for latest information, and making independent decision. This type of AI tries to interpret data in a more complicated and contextual manner. Finally, Super AI is a hypothetical form of artificial intelligence that will, when actually created, exceed any type of human intellect in all domains: cognitive, emotional, and even creative. Such AI will have an extraordinary problem-solving capacity in the self-awareness category and will be able to function by itself, likely even orchestrating other AI by itself without human intervention. Although we are still very far from developing a General or Super AI, the developments of Narrow AI continue to bring us further along toward these sophisticated forms [14].

1.2. Benefits of Artificial intelligence

AI is transforming numerous industries with its vast capabilities. It can cross human limits by exploring dangerous areas like space and the deep ocean. In predictive analysis, AI helps sectors like healthcare and finance analyze large datasets to forecast outcomes and improve decision-making. In healthcare, AI aids in disease diagnosis, health monitoring, and cost reduction. In business, AI automates tasks, enhances customer service, and optimizes operations through machine learning. In education, AI personalizes learning and automates grading. In finance, AI offers financial advice, automates processes, and detects fraud. In the legal field, AI speeds up document searches and helps predict legal outcomes. Finally, in manufacturing, AI enhances automation, improves supply chain management, and boosts efficiency. Overall, AI is revolutionizing industries by improving productivity, efficiency, and decision-making [14].

1.3. AI Envisioned National Priorities of Bangladesh

Bangladesh is already looking to Artificial Intelligence as one of the drivers for economic and social growth soon after its transition into a developing nation from a Least Developed Country in 2018. It lists eight priority areas for integrating AI which are public service delivery, manufacturing, agriculture, smart mobility, education, finance, foreign trade, and health. In fact, the country has dreams of enhanced productivity, improved services, and innovative systems by implementing AI in these fields. With the AI + X approach, new valuable fields will be adopted in time, percolating AI's impact over much a wider breadth like

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financial access, health, and agriculture. This AI-based approach will highly contribute to pushing Bangladesh high up the ladder among the fastest-growing nations in South Asia [14]. In line with this vision, Bangladesh has established national strategic stages for AI adoption, starting with research and development to industrialization of AI technologies, portrayed in Figure 2.

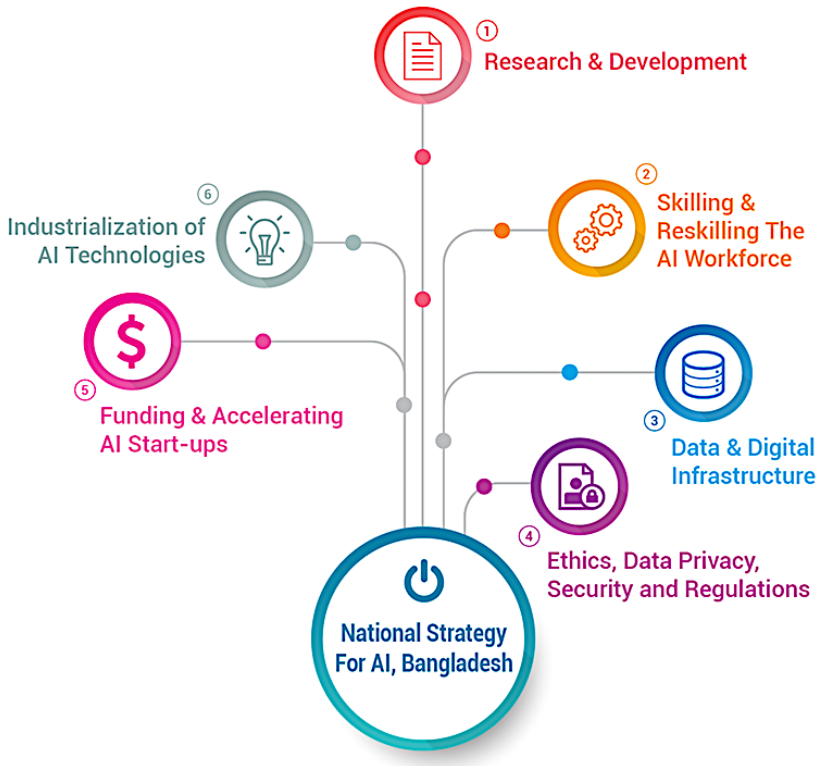

Figure 2. National Strategy for AI in Bangladesh [14]

1.4. AI for Public Service Delivery

Bangladesh Government has launched a digital platform named Eksheba Citizen, which provides citizens access to more than 2,700 government services with a single identity online. The initiative for the use of such digital platforms by the government is to have the services available in a more organized and efficient way. The service sector that constitutes 56.5% of Bangladesh's GDP can adopt more aspects of AI to relieve administrative burdens, ease citizen engagement, and automate processes such as inquiry answering, request processing, and the like [15]. At whatever angle you look from, AI applications are being tested in government offices worldwide for optimized services. With the adaptation of AI in public services, Bangladesh would gain further efficiency, responsiveness, and

inclusiveness in its public services. The horizon for AI in public service delivery in Bangladesh includes several important recommendations to enhance efficiency and accessibility. These include an Intelligent National Digital Information & Service Assistant, AI-Based Recruitment & Evaluation Systems, Paperless Offices, and a Virtual Service Location Assistants. An AI-Based Integrated Service Delivery Platform and Predictive Monitoring System will enhance the quality of services while AI-Based Training for government employees and a Life Event Service Delivery Platform will personalize the service. These require citizen and civil society engagement, awareness raising, collaboration with academics and partners to assess impact, and communication channels between humans and AI to allow effective, transparent service delivery [14].

2. METHODS

This research is qualitative in nature, combining primary and secondary data, in an effort to explore the role of AI in improving public service delivery in Bangladesh. The primary data were obtained through Key Informant Interviews (KII) with fifteen purposively selected experts who are either involved in or possess expertise in the areas of AI and public service delivery for a minimum of 10 years in Bangladesh. Purposive sampling ensures that informants have adequate competencies on a subject, thus furthering the richness and the applicability of that collected data [16]. Semi-structured interview was used for the flexibility of the responses, inviting respondents to share full account of their experiences with AI implementation and challenges in public services [17].

Secondary data collection includes a review of relevant documents, academic journals, government policy papers, and strategic frameworks related to AI and digital governance in Bangladesh. The documents are searched through systematic search processes on scholarly databases including Google Scholar, Scopus, DOAJ, and government websites for policy documents and reports. The search strategy is done using keywords such as "AI in public service delivery", "Bangladesh", "Digital Bangladesh", "AI Policy", "AI strategies", and "AI applications in governance," with Boolean operators for relevance in the current literature. Besides this, filters are applied for no more than ten years to make sure the study reflects current developments in policy and AI technology [18].

The data analyzing process employs both thematic and content analysis techniques. Thematic analysis conducted using NVivo software, is intended for identifying and organizing the patterns of interview data into a well-structured coding of the data with respect to the applications, advantages, and challenges of AI in public service delivery [19]. On the other hand, content analysis is used to analyze all secondary documents systematically, which allows this research to gather useful information regarding the policy objectives, AI implementation strategies, and outcomes for

different sectors in the public service. Ethical considerations are strictly being adhered with respect to obtaining informed consent from each participant, anonymization of their responses, and ensuring security for the data storage to protect the identity and confidentiality of the participants. Figure 3 depicts the flowchart that is used for this research.

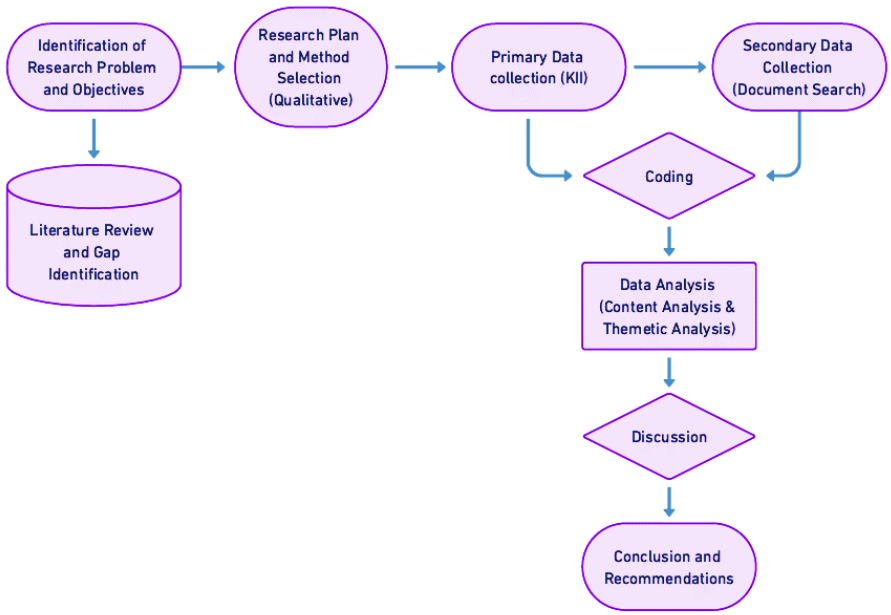

Figure 3. Research Flowchart

3. RESULTS AND DISCUSSION

3.1. Demographic information of the respondents:

Table I presents the demographic information of respondents. The sample consists of 15 respondents, of which 60% (n=9) are male and 40% (n=6) are female. The age distribution shows that 20% (n=3) are in the 18-to-24-year range, another 20% (n=3) are aged between 25 and 34 years old, 33.33% (n=5) are in the 35-44 years range, while 26.67% (n=4) fall within the 45-54 years old range. Regarding professional specialization, the greatest proportion among respondents (33.33%, n=5) is from the ICT sector. They are followed by 20% who are Academicians/Researchers (n=3), then another 20% serve as Civil Servants (Service Providers) (n=3). The remaining respondents consist of Public Health Experts (13.33%, n=2) and the Agriculture Sector (13.33%, n=2).

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Table 1. Demographic information of the respondents

		(f)	(%)
Gender	Male	9	60.00%
	Female	6	40.00%
Age	18 to 24.	3	20.00%
	25 to 34.	3	20.00%
	35 to 44.	5	33.33%
	45 to 54.	4	26.67%
Expertise	Academician/Researcher	3	20.00%
	Public Health Expert	2	13.33%
	ICT Sector	5	33.33%
	Agriculture Sector	2	13.33%
	Service Providers (Civil Servants)	3	20.00%

3.2. Current AI initiatives in Public Service Delivery

Bangladesh has embraced AI as a cornerstone of its Smart Bangladesh 2041 vision, which seeks to modernize governance, promote inclusive growth, and improve quality of life through AI and digital solutions. The a2i (Aspire to Innovate) program, launched by the Cabinet Division and ICT Division with support from the UNDP, has led this transformation by integrating AI into multiple aspects of public service. Current AI applications are wide-ranging and have already shown measurable benefits across healthcare, education, agriculture, and disaster management.

3.2.1. Healthcare

AI applications in Bangladesh's healthcare system focus on extending access and efficiency, particularly in rural areas where healthcare resources are limited [20]. The AI-based telehealth and diagnostics platforms, including the Covid-19 Telehealth Center, have won international recognition for enabling remote healthcare. The integration of AI-powered diagnostic tools, such as automated imaging and risk assessments for high-risk pregnancies, has empowered citizens with timely healthcare access and minimized disparities in health service quality [7], [14]. AI-based Pregnancy Monitoring System in partnership with multiple health organizations including a2i, Directorate General of Health Services (DGHS), Directorate General of Family Planning (DGFP), Obstetrical and Gynaecological Society of Bangladesh (OGSB), and International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR, B) seeks to improve maternal and newborn healthcare via AI technology. The system creates a bidirectional communication platform enabling pregnant women from diverse backgrounds to obtain timely

health information and assistance. Key components are Behavior Change Communication, Interactive Systems, and AI Integration. Behavior Change Communication involves the distribution of specific messages and the gathering of essential health data using a digital framework. Interactive Systems pertains to the utilization of mobile phones, internet platforms, IVR, chatbots, and connected devices to deliver urgent services and lifestyle guidance. AI Integration includes to the identification of high-risk pregnancies via advanced data analytics, facilitating prompt and targeted interventions. This approach enhances healthcare delivery and empowers women by equipping them with knowledge and resources to proactively control their health. It illustrates the possibilities of AI to personalize healthcare, enhancing its accessibility and efficacy [15].

3.2.2. Agriculture

Significant advancements have occurred in Bangladesh's priority sectors, including Agriculture, Fisheries, and Livestock Management, through initiatives such as agricultural market analysis, harvest optimization, smart farming, fish feeders, temperature regulation, and optimal incubation ecosystem metrics [9]. The Department of Fisheries (DoF) has initiated a pilot program to transform fish farming in Bangladesh utilizing the Internet of Things (IoT). The IoT-based Smart Fish Farm Management System provides fish farmers with real-time data, automated controls, and enhanced decision-making capabilities. The Department of Fisheries employed an intuitive interactive IoT-based system to facilitate effortless access and management of real-time water quality data (dissolved oxygen, temperature, pH), regulate automated systems like as feeding, water management, and aeration, and get warnings and notifications regarding any deviations in water quality. Incorporation of Artificial Intelligence (AI) to augment the system's ability to analyze fish growth and disease, hence recommending ideal feeding schedules to reduce waste and boost efficiency. The IoT-based Smart Fish Farm Management System seeks to transform aquaculture in Bangladesh by enhancing farm management techniques, resulting in increased yields and enhanced profitability [21].

3.2.3. Education and Skills Development

MuktoPaath, an exemplary innovation of a2i, now provides individualized learning to 2.2 million learners with diverse backgrounds through AI-driven course recommendations. More than 600,000 educators on the Teacher's Portal can share their knowledge, skills, and expertise with peers, while Konnect now has 2.7 million enrolled learners [22]. These efforts, in partnership with many government entities including a2i, the Ministry of Education, the Ministry of Primary and Mass Education, educational directorates, and UN agencies, seek to improve the quality of access to education and skills development through the application of AI. The

government of Bangladesh aims to establish a Smart Bangladesh by 2041 through educational reform via the adoption of the updated National Curriculum [15], [23], [24].

3.2.4. Disaster Management and Climate Resilience

Given Bangladesh's vulnerability to natural disasters, AI's role in disaster management is critical. Based on cross-country border-based river data (ebbs & tides anomalies), Google and a2i have developed an AI Flood Forecasting Initiative a.k.a. FloodHub. It can notify 24-72 hours early to local authorities, covering forty million people, and alert for prompt action-collective evacuation, disaster management, and further protection of water resources. This level of preparedness exemplifies how AI strengthens resilience in climate-sensitive regions [25].

3.2.5. National Helpline 333

Through AI-driven automated conversations, query gathering, and information retrieval, callers can now obtain essential information regarding government service procedures and contact details for government personnel. The helpline stands 24/7, throughout the year, providing its services without any interruption to every citizen. One of the meanings of its tagline, "A Unique Helpline for Everyone," encompasses both inclusiveness and accessibility. This initiative has specific performance goals directed toward achieving more efficiency and cost-effectiveness in operations. The principal target significantly reduces average call handling time from 4 minutes to just 30 seconds for a better user experience. The second target relates to cost efficiency, where daily operation costs are supposed to come down from 3.2 million BDT to 0.4 million BDT, signifying the economic advantage that AI has to offer [26].

3.2.6. AI-based Poverty Mapping Tool for Beneficiary Selection

The MobileAid approach utilizes an innovative method known as CIDER to address the needs of those suffering poverty. CIDER employs phone metadata (Call Detail Records) and machine learning to precisely ascertain the poverty status of individual mobile phone customers based on their usage habits. This facilitates the identification of those requiring assistance. With the assistance of GiveDirectly, a2i is presently executing a trial initiative that provides direct cash transfers in the Cox's Bazar and Bandarban districts of Bangladesh. The initiative aims to assist community members affected by poverty in the most destitute regions of Cox's Bazar and Bandarban districts, with particular emphasis on women [26].

3.3. Socioeconomic Impact of AI in Public Service Delivery

AI integration has not only enhanced efficiency and effectiveness in public service delivery but also ensured socio-economic development by increasing accessibility and inclusion.

3.3.1. Cost Efficiency and Resource Optimization

Impact of incorporating AI in public service delivery includes the reduction of operational costs by the automation of processes and less dependence on humans to perform repetitive jobs. For instances, the automated query resolution and information retrieval systems employed by the National Helpline 333. Instead of spending four minutes, a given request can be responded to in thirty seconds, and the cost would have been BDT 3.2 million, reduced to just BDT 0.4 million daily. Such efficacy demonstrates the monetary aspect of AI in public service delivery [26], [27].

3.3.2. Increased Accessibility and Inclusivity

AI has democratized access to services, especially in remote areas with scarce resources. Programs such as EkSheba and EkSheba Sorkar allow citizens to tap into more than 2,800 online government services and thereby minimize the physical need for visits to government offices and inclusive service rendering. This accessibility enhances social equity by promoting access for marginalized communities to government services [15].

3.3.3. Job Creation and Skill Development

While automation may replace some manual roles, AI in Bangladesh has spurred job creation in the technology sector. Training programs through initiatives like the Teacher's Portal and MuktoPaath have upskilled a workforce ready for the Fourth Industrial Revolution, equipping citizens with the skills required to navigate AI-driven job markets. As AI reshapes industries, skill-based education is pivotal to maintaining employment and enabling economic mobility [24], [26].

3.4. Challenges in Implementing AI for Public Service Delivery

Implementing AI for public service delivery in Bangladesh presents challenges, including infrastructure limitations, data security, ethical concerns, and the digital divide.

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3.4.1. Digital Divide and Limited Infrastructure

While internet penetration is increasing, access to digital infrastructure remains uneven, especially in rural areas [28]. This disparity limits the reach of AI-driven services to all demographics, particularly those in low-income or remote communities. A2i's commitment to reducing this divide through initiatives like the e-Quality Center is a significant step; however, further investment in nationwide digital infrastructure and literacy programs is required [27]. One of the respondents claimed that,

> *"Implementation of AI in service delivery is definitely a must need for any country. But for developing countries like us, there is big challenge of having digital literacy and sound internet connectivity of the service recipients, specifically in rural areas (KII 1, September 29, 2024)".*

3.4.2. Data Privacy and Security Concerns

In these days of AI dependence on enormous datasets, protection of data privacy becomes critical. Bangladesh has no proper legal structure at present for data governance such that sensitive citizen data may be misused because of lack of regulation. These AI systems, if left uncontrolled, could result in cyber-attacks or data breaches, as has happened in countries like Kenya and Brazil, where AI has raised security and privacy issues. It will therefore be crucial to set up data protection regulations and ethical codes for the use of AI to ensure citizen trust [24]. As one respondent raised his concern as,

> *"Do we really have a secured data policy? Every day we are getting shocking news of breaching our cyber protection like money from reserved banks has been stolen, information from National ID has been leaked or sold. Then will the public feel comfortable to get services using AI? (KII 9, October 11, 2024)."*

3.4.3. Bias and Ethical Risks

Training AI on biased datasets can lead to the continuation of societal biases, and thus create the potential for unfair treatment in public services. In situations where the bias across gender, ethnicity, and socioeconomic status exists, the AI could cause inadvertent aggravation of these biases. The AI policy framework of Bangladesh upholds principles like transparency and accountability concerning AI decision-making, but the ethical uses of AI need to be continuously monitored and audited [15], [27]. One of the respondents argued that,

> *"Application of AI in service delivery could be failed to ensure level playing field for all citizens leading to increase inequality in the country as the more digital skills one has, the more he/she will get services from AI. Hence, educated, male, urban, and upper-class people will get more services where illiterate or having little education, female or third gender, rural and poor people will face different challenges to get the services (KII 3, October 1, 2024)."*

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3.4.4. Skill Gaps and Workforce Readiness

A skilled workforce, able to manage as well as deploy AI solutions, is required for implementing AI. Bangladesh is indeed facing a shortage of qualified AI professionals which confines AI initiatives from being employed completely. Educational programs and AI-emphasis oriented curriculum are being expanded progressively in secondary as well as higher education to bridge this talent gap. However, there is a dire need for investing more in training personnel in AI and technical education to build a competent workforce [15]. As one of the respondents stated,

> *"For proper implementation of AI in public service delivery, we need to have skilled workforce specially who will provide or monitor the services. As we do not have this type of skill test in the recruitment process specially in civil service, there are shortage of skilled human resources regarding implementing and using AI in service delivery (KII 5, October 7, 2024)."*

3.5. Future Prospects and Policy Implications

This Government of Bangladesh outlines an entire roadmap towards AI to ensure sustainable citizen-centric growth. Future steps will include the establishment of AI into governance, education, agriculture, healthcare, and environmental management.

3.5.1. Advanced AI-Driven Healthcare Solutions:

The incorporated applications of future healthcare would use higher predictive analytics for early diagnosis and management of chronic diseases, while reducing treatment costs and disease management through AI systems automated preventive care. Combining AI with digital health records and telehealth services would complement the expanding reach of remote healthcare in underserved regions as well [27]. According to a Public Health expert,

> *"The Covid-19 pandemic has highlighted the necessity for a digital healthcare system in our country. As a developing nation with insufficient medical personnel and technical resources, the integration of AI into the healthcare system could present an opportunity for the government to provide services to all inhabitants and reduce the rural-urban divide (KII 8, October 10, 2024)."*

3.5.2. Smart Cities and Sustainable Development

In upcoming decades, AI will play a key role in urban management by integrating some most important applications, such as infrastructure optimization, traffic congestion elimination, waste management, energy conservation, etc. AI-based urban planning tools, including predictive traffic systems and intelligent waste

disposal solutions, can further assist in promoting sustainable urban development. One respondent stated that,

> *"Our country is an overpopulated country and most of our cities are unplanned, hence we face different challenges in our daily lives specifically traffic jam and poor waste management systems. AI applications in these services could be live survivor for us and it will also reduce government cost (KII 10, October 19, 2024).*

3.5.3. Ethical AI Policy Development

Establishing a legal framework that addresses ethical and social implications of AI is essential for Bangladesh's AI-driven public services. Bangladesh's National AI Policy 2024 emphasizes human-centered AI principles, promoting fairness, accountability, and inclusivity. Ensuring transparency in AI decisions, particularly in critical services like healthcare and social welfare, will be vital to building public trust [15], [24]. One of the respondents shared,

> *"Artificial intelligence has the potential to revolutionize public policy in Bangladesh by facilitating the resolution of societal challenges and advancing development (KII 14, October 30, 2024)."*

3.5.4. Enhanced Agricultural AI Applications

The expansion of AI applications in agriculture will further strengthen food security. AI's potential to improve crop management, pest prediction, and supply chain optimization will make agriculture more resilient to climate impacts, helping Bangladesh meet its food security and economic growth targets [9], [29]. Respondent from Bangladesh Agricultural Development Corporation (BADC) stated,

> *"By enabling disease identification, providing accessible consultations, supporting start-ups, updating educational curricula, and learning from global success stories, AI can significantly enhance agricultural productivity and sustainability (KII 15, November 1, 2024)."*

3.6. Discussion

AI-embedded delivery of public services in Bangladesh has shown remarkable potential as well as some achievements particularly in the field of healthcare, education, agriculture, and disaster management. Initiatives like telehealth platforms, AI-based educational tools, IoT-based agricultural systems, etc., have contributed greatly to access, efficiency, and equity in public service. Despite these achievements, significant hurdles remain in the form of infrastructure deficits, human resources preparedness, and digital literacy. These problems are prevalent with other developing countries attempting to implement AI and are not unique to Bangladesh.

The unequal availability of digital infrastructure is perhaps the most glaring of all challenges, especially for rural populations. Most AI-enabled solutions are either totally dependent on the uninterrupted internet connectivity or access to digital devices, which is a distant dream for a majority of the population. As far as digital divides are concerned, they restrict the reach of AI solutions further demonstrating the acute need for strategic investments in digital infrastructure. India's Digital India initiative has provided tremendous lessons regarding improving internet penetration through public-private partnerships [30]. In a similar vein, programs such as Brazil's National Artificial Intelligence Strategy emphasize digital inclusion and ethical considerations, offering interesting insights for the policymakers of Bangladesh [31], [32]

.

Another intractable problem is the potential for bias in AI decisions caused by the datasets used to train these systems. Such biases often worsen existing inequalities in society and usually affect excluded communities disproportionately. For instance, a study involving an AI healthcare system in the United States showed how it offered preferential treatment to white patients over Black patients through biased training data [33]. This really brings to light the much-needed emphasis on coining stringent standards for data collection and auditing algorithms. This should also be complemented by ensuring that Bangladesh adopts treasurable AI practices like the European Union's AI Act, which protects fairness and accountability [34]. Furthermore, the exclusion of individuals who are digitally illiterate or poor carries a serious threat. More and more AI systems are enabling the access of important services; therefore, they would not have such access without requisite skills to enable them to access those services. Therefore, accessibility-focused inclusive artificial intelligence policies must be put in place. The Brazilian approach to ethical AI research and initiatives promoting digital literacy may offer ample lessons for Bangladesh [31], [32].

Bangladesh has high ambitions to address these issues through its policy frameworks, including the National AI Strategy, through capacity building and bridging the digital divide. Their actions reflect a deep commitment that AI adoption must be citizen centered and inclusive. Then again, all the policies will rely on effective implementation; thus, formation of independent regulatory bodies for overseeing AI applications and ensuring public participation in policy form making can magnify trust and transparency. Another way of doing this is by promoting international collaboration. Partnerships with countries leading in AI innovation can facilitate knowledge exchange and provide access to advanced technologies. For instance, Singapore's collaboration with Microsoft to develop ethical AI guidelines demonstrates how international cooperation can strengthen national strategies [35].

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Bangladesh's journey into adopting AI has a major factor in strong institutional backing and investing in research and development compared with other countries. Adapting extensive infrastructure with a strong policy framework enabled countries like China and Estonia to integrate AI into public services. This is also taken by China's Smart City initiative, which has heavily improved urban management concerning traffic congestion and energy efficiency [36]. The AI-enabled e-governance system in Estonia has simplified administrative procedures to make public services well accessible and more effective [37]. These successes put emphasis on well-planned and allocated resources. On the contrary, some challenges such as those faced by countries like Kenya indicate a need for ethical AI governance. Using AI in agriculture by Kenya has proven effective because it has increased productivity significantly; however, data privacy and algorithmic accountability issues have cropped up [38]. From these experiences, Bangladesh can strike a balance between driving innovation and protecting citizens through comprehensive data protection laws.

4. CONCLUSION

Artificial intelligence has become a revolution for public service delivery in Bangladesh, fighting long-standing challenges related to inefficiency, rationing of resources, and inequalities in access to essential services. This study outlines the various strides taken in using artificial intelligence in healthcare, education, agriculture, and administration, and examines some barriers to be crossed before harnessing entirely inclusive and sustainable utilization of AI. AI integration in healthcare has been invaluable in extending its services to the remote population in the form of telemedicine, predicting chances of a disease with a better future prognosis, and using data for decision-making in health. In education, AI-enabled platforms have personalized learning experiences and made them available to the various levels and types of learners. Likewise, agriculture, after initiating the AI technology and employing tools for crop health monitoring, weather predictions, and resource management, actually has paved the road for optimized productivity as far as the national food security goals are concerned.

However, the advancements are accompanied by some challenges; the most common being the digital divide, which in particular affects rural areas and limits the number of AI-enabled services reaching marginalized communities. Poor digital infrastructure, insufficient data privacy measures, and the unavailability of all-encompassing legal frameworks make real threats to the public's trust and security. In addition, algorithmic injustices in AI systems can worsen inequalities in society and hit the most vulnerable population groups hard. Also, the lack of human resources with the knowledge and skills that deal with scaling of initiatives shows the need for capacity building and training in technical skills. The National Strategy for Artificial Intelligence and National Artificial Intelligence Policy 2024

provides a pathway to solving these challenges and fully harnessing AI potential for the delivery of public services.

However, measures must be taken proactively to manage the risks associated with AI adoption-such as danger, bias, exclusion, and ethical risks. AI systems trained on diverse and representative datasets can reduce bias, whereas continuous monitoring and auditing of algorithms will ensure fairness. Campaigns on public awareness and stakeholder engagement are critical in ensuring trust in AI systems. Finally, addressing the gap in workforce readiness will require targeted education and training programs. This is an encouraging stride for a growing nation like Bangladesh in pressing forward with the gradual introduction of AI content into the secondary and higher education curricula. However, more needs to be done in developing a workforce skilled enough to manage and deploy these AI solutions. Investing in building infrastructure, enhancing digital literacy, and creating robust ethical frameworks can enable the country to use AI in governance and in the improvement of citizens' lives. Adoption of lessons from global best practices with contextualization will be key in ensuring very inclusive and impactful AI adoption.

The potential of AI in predictive healthcare, urban management, and sustainable agriculture seems very promising for the future. From urban problems like traffic congestion and waste management to addressing rural livelihoods through innovative agricultural practices, AI-powered solutions can improve the quality of life. Integration of AI will streamline governance in terms of administrative processes, encourage citizen engagement, and perpetuate inclusive growth. Strengthening the network of public-private partnerships and establishing collaboration with academia and international organizations will accelerate progress and innovation in all aspects of AI applications.

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