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Smart Bangladesh: Bridging Technology and Economy for a Bright Future

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Abstract: Bangladesh, with its diverse population and rapid development, is embarking on an unorthodox journey to become a "Smart Bangladesh." Bangladesh aims to apply technical breakthroughs to improve the living standards of its citizens and promote sustainable economic growth. The research is all about finding ways to build a smart Bangladesh by fusing the economy and technology. "Smart Bangladesh" aims to build a bright future by combining technology and economy in a dynamic way. The study used a qualitative technique to analyze secondary data in order to draw its results. According to the study, big data analytics, blockchain, IoT, and artificial intelligence are the most often utilized smart technologies. The research also highlighted the challenges of using smart technology to support Bangladesh's economic growth and offered solutions to these issues. It also included information on the several programs that the Bangladesh government has introduced to support the IT industry in order to promote sustainable development.

Keywords: Smart Technology, Smart Bangladesh, Smart Economy, Sustainable Development, Government Initiatives

INTRODUCTION

The term "smart Bangladesh" emphasizes a technological method of living where all kinds of public works can be executed properly. Every citizen will receive rights that are impermeable and will get an excellent chance to perform out their tasks without suffering [1]. At this time when technology is shaking up economies all over the world, Bangladesh is getting ready to dive into a digital future with its neat plan called "Smart Bangladesh." The main aim is to use technology's power to pump up economic growth and make life better for everyone.

Since it is still in its early stages, research on the smart economy within smart cities is limited to a single nation or field. This study is to visually look into mapping and investigating trends in the field of the smart economy on an international scale, according to a bibliometric review [2].

In December 12, 2022, Bangladesh's Prime Minister, shared the idea of a smart Bangladesh. And we've got these four canons - "Smart Citizen", "Smart Government", "Smart Society", and "Smart Economy" - laying down the groundwork for making this idea happen [3].

Smart Economy can only be formed by implementing smart technologies. Smart technologies, which involve big data analysis, artificial intelligence (AI), and the Internet of Things (IoT), have become vital in encouraging innovation and effectiveness in a variety of industries.

Not only is the adoption of these technologies transforming traditional enterprises in Bangladesh, but it's also opening new emerging sectors. It is clear that the economy of any nation may expand effectively and continuously when practical innovations are used. prosperous nations are currently focusing on technological advances in their efforts to find a sustainable growth plan [4].

In order to turn Bangladesh into "Smart Bangladesh" by 2041, the government has started a variety of projects. This vision focuses on embracing innovation and technology to promote economic growth, strengthen the government, and raise citizens' standards of living.

The initial development plans for Bangladesh aimed to improve GDP growth and reduce poverty with the aim to strengthen the national economy. The nation needed to accomplish a lot, particularly a stable economy, a reduction in foreign aid, strong infrastructure, and economical rehabilitation, since it had been devastated by violent conflict and terrible natural disasters [5].

A smart economy is significantly supported by sustainable development. A smart economy is one that utilizes the use of innovation, technology, and effective resource management to boost GDP, enhance living

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standards, and ensure sustainability over the span of time.

Many countries embrace the concepts of sustainable development, and sustainability has taken lead role in the fields of ecology, consumption, economics, science, and other fields. The fundamental concepts of sustainable development apply to every aspect of human activity. The development of the concept of Economy, which is a manifestation of the main sustainability concepts, is one response to these demands [6].

Research Gaps

The beginning of a new phase in the transformation of economic relations in the framework of globalization is prompted by the developing issues with the smart (intellectual) economy. It is essential to make the shift to the smart economy because of the root causes that set the direction of change in every aspect of society. The conducted research indicates that consumer preferences are increasingly dominated by high-quality goods, capable of satisfying the increased aesthetic demands of consumers [7].

Since Bangladesh's economy continues to grow and not all of its sectors have embraced the concept of a digital economy, primary data collecting is not achievable. Therefore, it is essential for all economic sectors to adapt and describe techniques from highly technological civilizations. Despite a lot of study has been done on particular technologies like blockchain, IoT, and AI in the context of smart economies, there aren't a lot of studies on how these technologies may be combined to have beneficial outcomes. The analysis is limited to the data that is available and accessible. There may be gaps or limitations in the existing data. Secondary data may reflect the biases of the original authors or institutions. Efforts will be made to mitigate this through critical analysis.

Objectives

- RO 1: To evaluate how the smart economy functions in an emerging country.
- RO 2: To identify the opportunities of smart technology in Bangladesh.
- RO 3: To determine the correlation between smart economy and smart technology.

LITERATURE REVIEW

A key precondition for the development of the Smart Economy is accelerated intellectualization, which takes the form of enhanced production process innovation and creativity, a continuing increase in knowledge and information, the creation of novel products, and the emergence of intellectual demands. The term "smart" first emerged and most frequently refers to the digitalization process, which is the widespread adoption of information and communication technologies and their intellectual uses across all areas of life, networking, artificial intelligence (AI), and the Internet of Things (IoT)[8].Several aspects of urban life, such as travel planning and making, time management, energy consumption, family and social life, health-related activities, leisure and relaxation activities, residential location, and working and learning modes, might experience major shifts as the outcome of these technologies[9].

The majority of researchers acknowledge that there is a direct correlation between natural environment and economic progress. The term "green economy" has gained acceptance in international environmental policy debates and discussions, and it has been selected as one of the main issues for the June 2012 Rio+20 United Nations Conference in Brazil. The objective of a smart city is to produce an urban development model that is safer, healthier, and greener. The relationship between innovation-driven and green economy development of smart cities has not, however, gained much attention in the field of research, with the vast majority of studies that have been conducted recently primarily qualitative [10]. In addition to being recognized by governments and international organizations, the green economy has drawn a lot of attention in academia, particularly in the past ten years. Established a framework for the green economy, among other things, illustrating how its concepts, methods, and tools might help with the shift to a sustainable economy [11].

In order to transform Bangladesh into a brighter country, Industry 4.0 is affecting a wide range of areas, including manufacturing, education, government, citizens, the economy, healthcare, and agriculture. Bangladesh has excellent individuals and environmental resources, therefore implementing Industry 4.0 could contribute to significant economic growth [12]. A large number of developing nations, including Bangladesh, Nigeria, India, Pakistan, the Philippines, and Vietnam, are dependent upon manufacturing products to be supplied to global businesses. As a result, the current rate of unit output would be substantially increased if these countries could improve the management of their manufacturing and chain productions, a strong indication that Industry 4.0 is necessary for these countries to continue moving forward [13]. The complete impact of the Fourth Industrial Revolution is yet uncertain as it grows. Still, it is obvious that it will have a significant impact on people, companies, and culture all over the world.

For those who are involved in economic development at the national and regional levels, research and development (R&D), skills, and human capital development become increasingly important as the global economy shifts toward more knowledge-based sectors (including the manufacturing of ICT devices, pharmaceuticals, telecommunications, and other ICT-based services). Human capital development is the

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process of obtaining and growing the number of people who have the knowledge, training, and experience that are essential for the nation's economic success. Human capital refers to the expertise and abilities of human resources. Therefore, in Bangladesh, the most important things are the people's empowerment and the channeling of economic surplus into profitable financial possibilities. In order to encourage rapid economic growth, the Bangladeshi economy must additionally reduce or eliminate the barriers to the development of human capital [14]. Technology improves productivity through promoting improved resource management, increasing efficiency, and simplifying procedures. As workers can accomplish more with the same resources, this encourages economic growth and the development of human capital.

The widespread implementation of ICT (information and communications technology) to increase productivity across all industries represents the basis of the digital economy. Some traditional assumptions about how new companies are started, how consumers obtain products and services, and how state-level laws affect these topics are being called into question by the digital revolution. It's a term used to define a financial system that makes significant use of digital computing technologies. Digital communication and networking infrastructures give people and organizations a global platform to plan, interact, trade and receive information, and work together on projects in the modern economy. The concept of the "digital economy" is an update to the study of e-commerce of zero-marginal-cost intangible products [15]. The GDP of Bangladesh is projected to rise mainly a result of digital transformation, which will boost productivity, encourage innovation, and enable enhanced delivery of services in a number of sectors. By means of programmers including Digital Bangladesh and sustainable mobilization of resources towards digital infrastructure, Bangladesh may establish itself as a pioneer in the area regarding the rapid growth of the digital economy, consequently promoting sustainable economic development.

Developing e-Government is essential to smart governance and bringing information technology (IT) closer to the level of common citizens in Bangladesh, where more than half of the population experiences the digital divide. Through e-Government, people in general will be able to engage with the government at different levels regarding governance-related issues and offer opinion to decision makers. Three A's can be utilized to highlight the problems observed during Bangladesh's e-Government system formation process: Access, Awareness, and Applications. Sustaining capital-intensive projects like communication infrastructure and access backbones has never been easy for a developing country [16]. The Bangladeshi government is making significant progress towards achieving the goal of Digital Bangladesh and the deployment of e-governance, despite certain challenges. The adoption and acceptance of e-governance initiatives has produced significant benefits for both individuals and businesses across the country [17]. A smart economy and smart Bangladesh rely on smart governance that offers efficient public services, permanent infrastructure, and a society that is transparent, truthful, and innovative. Bangladesh could ensure quick progress toward becoming the region's leader online economy by combining modern technology with smart principles of governance.

Conceptual framework

The "Smart Bangladesh" approach aspires to promote a tech-driven economy, expand access to digital services, and boost innovation in order to speed up the digital revolution. The objective is to develop a "smart" ecosystem which utilizes data-driven solutions, artificial intelligence (AI), and other innovative technologies to improve industries like the agricultural sector, healthcare, education, transportation, and governance. “Smart Bangladesh" is a comprehensive national strategy designed to ensure sustainable development, human capital empowerment, and global competitiveness while converting Bangladesh into a smarter, efficient, and inclusive society. It extends beyond simply technological advancement.

Figure.1 illustrates that bridging smart economy and smart technology is the only way of forming Smart Bangladesh. The main instruments for building a smart Bangladesh are the elements of a smart economy and smart technology. The elements are explained briefly as follows:

Nowadays, the implementation of a circular economy has been made possible by Industry 4.0, which simplifies operations, utilizes assets, boosts labor output, manages records, improves quality, reduces time to market, connects supply and demand, and supports logical after-sales and service. The appropriate compatibility between data-driven sustainable organizational capabilities and smart-centric resource performance is the primary goal of Industry 4.0-based manufacturing systems [18].

The Green Economy Statement will employ modelling and economic analysis processes to illustrate how investments in "green" economic, agricultural, and industrial sectors may encourage economic recovery, future prosperity, and job creation while simultaneously dealing with global ecological and social problems [19]. Green technology is essential for developing a green economy since it stimulates environmentally conscious actions that reduce the adverse impact on the environment while generating economic benefits.

Human capital in every organization provides an overview of individual experiences that are incorporated into the company's general capacity to recognize the best approach from each one of its unique personnel [20]. Technology enhances individual's

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abilities, knowledge, and skills in order to meet the demands of the modern workforce, leading to an impact on human capital development.

Urban regions that have been successfully made safe, environmentally friendly, and efficient can be referred as smart cities. Advanced integrated sensors, electronics, and networks are used to maintain the governance of all utility services, including gas, water, electricity, and transportation. Furthermore, computerized systems which involve databases, tracking, and decision-making algorithms are interfaced with the services [21].

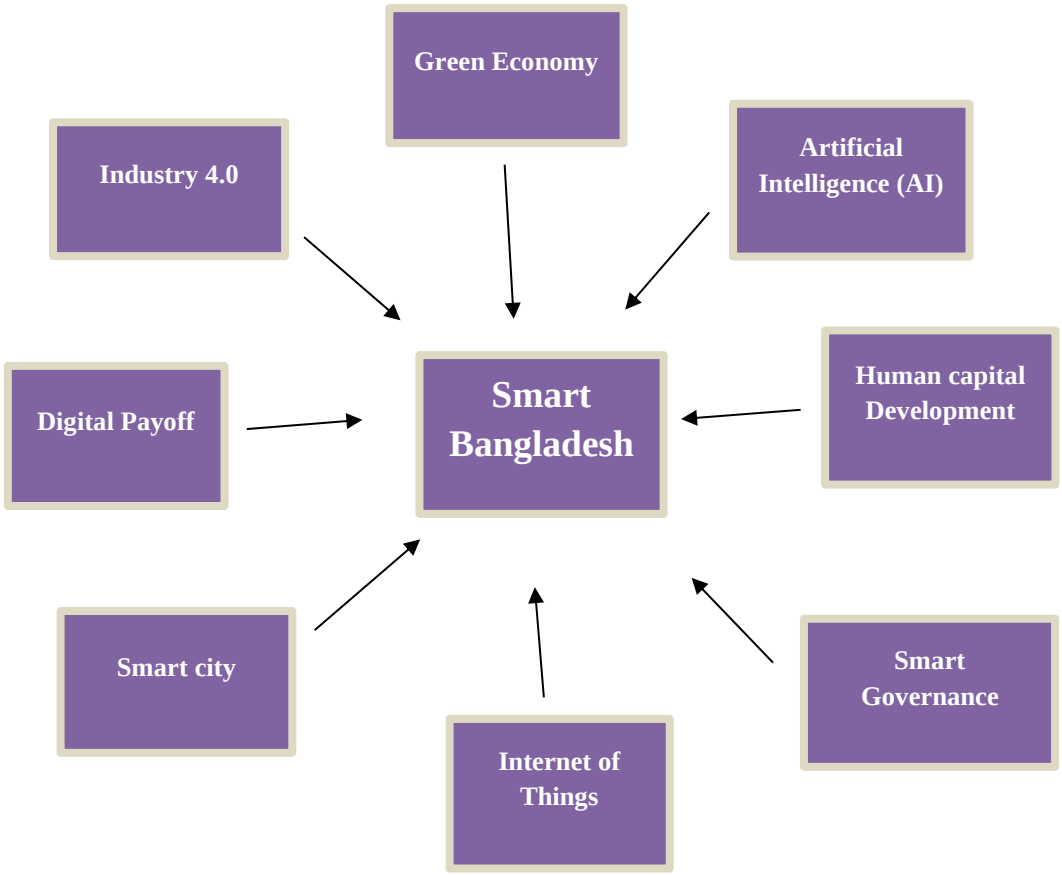

Figure 1: Smart Bangladesh Framework
Source: Author's work

Smart governance focuses a priority on enhanced interaction between the government and the people and can use electronic tools for spreading information about the rural development process. Enhancing smart governance in Bangladesh's rural development is currently necessary [22].

The majority of individuals understand that one of the core and basic technologies that is going to power the next FIR is blockchain technology. Acknowledging its potential, many developed and developing nations globally are now looking into how blockchain technology can help them deal with numerous complex issues. Bangladesh, unfortunately, is lagging behind in this regard [23].

Implementing Internet of Things is not easy, especially in developing countries like Bangladesh where resources and wealth are limited. However, it is obvious that IoT will ease the learning process and provide improved learning options [24].

Artificial intelligence has become significant in today's world. The aim of the Bangladeshi government is to establish fully digitally connected workplaces in both the public and private sectors, utilizing advanced technology and artificial intelligence [25].

SMART ECONOMY

When it comes to their Smart Economy plan in Bangladesh, they're super focused on boosting financial inclusion by boosting people's tech skills. Thanks to the Smart Bangladesh Taskforce led by Bangladesh's prime minister, there are loads of plans in place to bring more tech into everyday economics. The grand scheme of having a Smart Economy involves loads of cool stuff like modernization, a healthy system in place, and loading it with top-notch tech tools [26].

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This whole concept of a "Smart Economy" takes all kinds of new economy aspects mashed up with sustainability and eco-friendliness vibes - think productive economy vibes along with global economic growth buzzes. Plus, they're all about sparking innovation and creativity matched with science-y research wonders to keep things eco-friendly while booming economically both now and later on.

Key Components of a Smart Economy

The concept of a smart economy encompasses various elements that leverage technology, innovation, and data to enhance efficiency, productivity, and sustainability. In the context of Bangladesh, the key components of a smart economy might include:

Digital Infrastructure:

1. Boosting high-speed internet availability in both rural and urban regions.
2. The expansion of 4G and 5G networks aims at improving connection.

Fintech and Digital Payoff:

1. Strengthening financial inclusion through introducing mobile banking and payment methods accessible to more people.
2. Exploring open reliable financial transactions utilizing blockchain technology.

Enhancement of Skills:

1. The offering of digital skills and emerging technology training programs.
2. Boosting industry and academic cooperation to advance innovation and skill development.

Smart Cities:

1. Making efficient utilization of data and technology for urban management and planning in “smart cities”.
2. Using green technologies to control waste materials, cut off pollution, and consume less resources.

Sustainable Development:

1. Technological developments in renewable production, waste management, and clean energy are the primary forces supporting the green economy and sustainable development.
2. Minimizing waste through recycling, reuse, and extending product lifecycles.

These components can significantly contribute to the development of a smart economy in Bangladesh.

USAGES OF ICT TO FORM SMART ECONOMY

The four basic pillars of the "Smart Bangladesh" approach are "Smart Citizen," "Smart Government," "Smart Society," and "Smart Economy". Currently, as "Smart Economy" is so crucial, let's emphasis on it.By 2041, Bangladesh wants to bring in a lot of money through ICT. They are aiming for the ICT industry to reach over USD 50 billion by then. Plus, they want at least 50 unicorn businesses to be ruling the market in Bangladesh. It's not going to be easy for the government to make this big dream of having a “Smart Bangladesh” by 2041 a reality. Bangladesh is looking to have ICT as a major source of revenue by 2041. They predict that the whole ICT sector will be valued at a hefty USD 50 billion by then. And they're hoping that at least 50 unicorn companies will be on top of the market. But here's a little snag - universities need to step up their game when it comes to integrating technology into their teaching. There's a big gap between what's being taught and what the industry actually needs. This vision is for a poverty-free country with social and economic equality and shared prosperity. Vision 2041 aims to continue building on Digital Bangladesh Vision 2021 by eradicating extreme poverty and turning Bangladesh into a high-income nation by 2041. The speed at which this goal is achieved depends on the actions taken now. It's going to take teamwork between the government and businesses to make “Smart Bangladesh” a reality [27].

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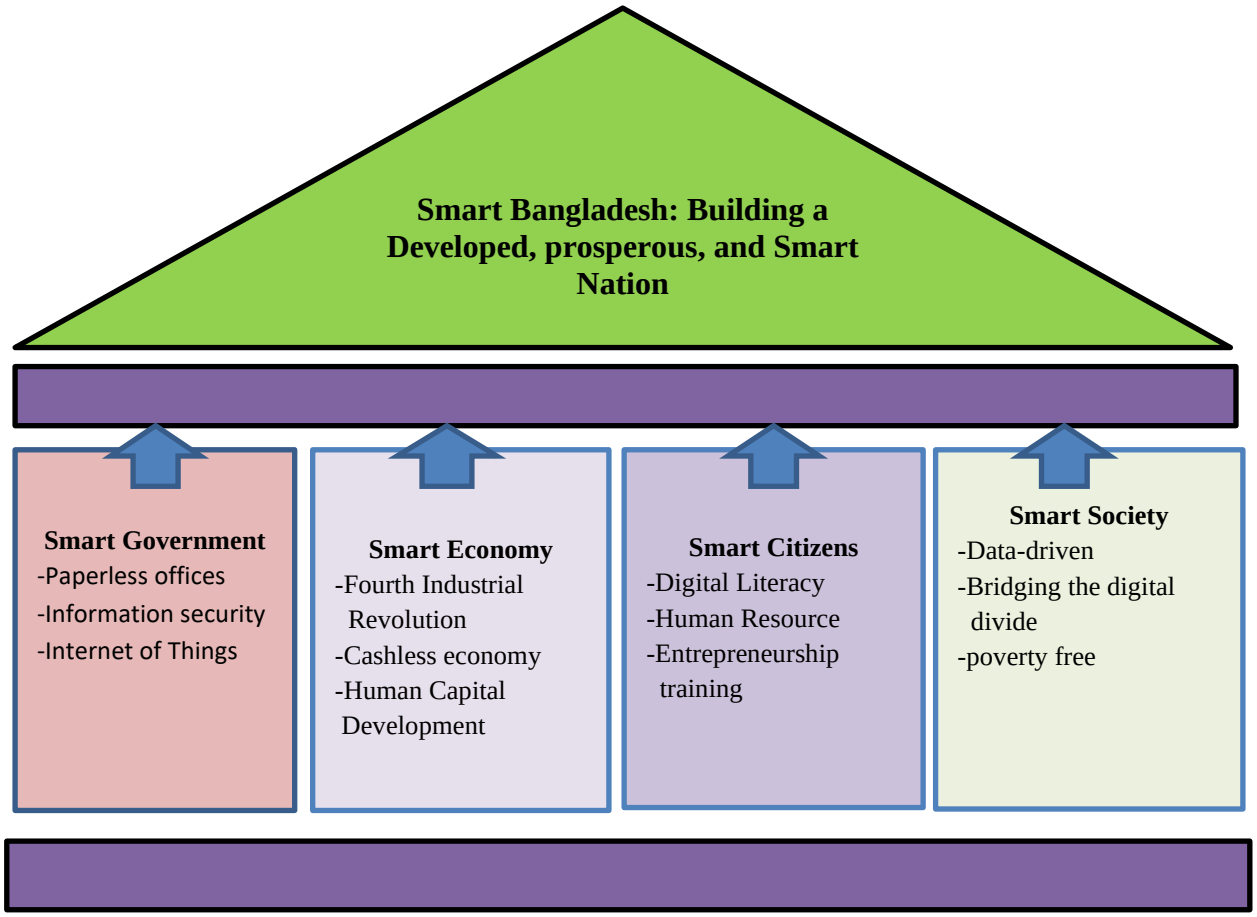

Figure 2: Four main pillars of vision Smart Bangladesh
Source: Author's work

The use of Information and Communication Technology (ICT) to form a smart economy involves integrating various digital tools and technologies to enhance economic efficiency, productivity, and innovation. Here are some key areas where ICT is pivotal in developing a smart economy:

E-Commerce: Online marketplaces and platforms allow businesses to reach a global customer base, increasing sales and market opportunities. Payment gateways and digital wallets facilitate secure and convenient financial transactions**.** E-commerce transaction would ensure the Gross Domestic Product (GDP) growth and thus, assistance Bangladesh can acquire the Millennium Development Goals (MDGs) [28].

Big Data & Analytics: Companies can investigate big datasets to get deeper understanding of consumer behavior, industry trends, and operational efficiency. Demand forecasting, supply chain optimization, and enhanced decision-making are all made accessible by predictive analytics.

Internet of Things (IoT): IoT devices are capable of maintaining an eye on industrial operations, ensuring a decrease in waste and boosting output. Environmental monitoring, energy efficiency, and asset management can all be improved using smart sensors and gadgets.

Artificial Intelligence (AI) and Machine Learning (ML): By automating repetitive operations, ML and AI allow firms to focus on strategic planning and innovation. Chatbots with customized recommendations powered by advanced algorithms can enhance customer service.

Blockchain: Blockchain technology makes sure that transactions are visible and safe, which reduces fraud and boosts credibility in online interactions. By automating and enforcing agreements, smart contracts can cut down on administrative work.

E-Governance: Digital platforms for government services improve accessibility, transparency, and efficiency in public administration. E-governance initiatives can streamline processes like tax collection, licensing, and social services**.**

Industry 4.0: The term "industry 4.0" highlights the fourth industrial revolution, which has been defined by the implementation of digital technologies to produce "smart" systems in industrial operations. Technological developments like cloud computing, robotics, big data, artificial intelligence (AI), and the Internet of Things (IoT) are all components of this revolution.

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Human capital development: The process of upgrading human capacities—their knowledge, skills, and overall abilities—in addition to maximize their productivity and contributions to the economy and society is known as human capital development.

By leveraging these ICT applications, economies can become more efficient, innovative, and resilient, paving the way for sustainable growth and improved quality of life.

ECONOMIC GROWTH THROUGH SMART TECHNOLOGY

Impact of technology on economic sectors in Bangladesh: The impact of technology on economic sectors in Bangladesh has been profound, influencing various aspects of the economy and contributing to growth and development. Here are some key areas where technology has made a significant impact:

Agriculture: Agriculture is the biggest economic origin which innovate 41.6% of the total labor force and contribute for 14.23% of the nation GDP of Bangladesh [World Bank 2000][29]. The Government of Bangladesh has initiated several strategic plans, including the e-Krishi Vision 2025, the National Agricultural Policy 2018, and the 8th Five Year Plan (2021-2026), to effectively integrate digital systems within the agricultural sector. Despite these efforts, gender disparities remain prevalent in the agricultural food system, and digital innovations have not been universally inclusive. The ICT wing of the Department of Agriculture Extension (DoAE) has identified issues related to the disbursement of incentives to eligible farmers by banks.In response to these challenges, the government plans to launch a project introducing 'smart agriculture' cards for farmers. These cards will serve as digital identities, or individual digital profiles, for farmers, ensuring that agricultural services are tailored to the specific needs and areas of each farmer. By digitally accessing farmers' personal and farming-related details, the concerned department can generate necessary information and respond promptly to farmers' requirements. Initially, these digital profiles will cover 16.2 million farmers out of a total of 50 million farmers. The smart agriculture cards will first be distributed across 14 agricultural regions and will be designed based on each district's geographical profile. This approach aims to enhance the DoAE's ability to communicate more effectively with these 16.2 million farmers in a digital context [30].

In simple words, Agriculture is highly dependent on

Precision Farming and Information Access

- **Precision Farming**: Technologies such as GPS, remote sensing, and IoT are being used for precision farming, leading to more efficient use of resources and increased crop yields.
- **Information Access**: Farmers have better access to market information, weather forecasts, and modern farming techniques through mobile applications and the internet, helping them make informed decisions.

Blue Economy: The idea of the blue economy is very recently introduced in Bangladesh, not the international border. For this reason, there are not much research works on this idea. But recently, it gained much attention from researchers around the world. This term was served by Gunter Pauli and later became popular after the United Nations Conference on Sustainable Development held in Rio de Janeiro in 2012. The term 'Blue Economy' does not have any universally agreeable definition. However, it can be understood that blue economy endeavors to utilize the oceans and coastal resources in a proper way [31]. The Blue Economy (BE) refers to the sustainable use of ocean resources to foster economic growth, enhance livelihoods, and create jobs, all while preserving the health of ocean ecosystems. By integrating technological advancements, the Blue Economy aims to meet the increasing demand for jobs and improve living standards without compromising the marine environment. This approach holds significant potential for driving economic development and employment opportunities [32].

Technology plays a crucial role in advancing the blue economy by enhancing productivity, ensuring sustainability, and enabling new economic opportunities. Here's how technology impacts the blue economy in Bangladesh:

Aquaculture and Fisheries

- **GPS and satellite technology:** This minimizes fishing time and fuel expenses through improving navigation and assisting in the location of fish stocks.
- **Advanced Aquaculture Systems:** These systems increase fish farming production and sustainability through the implementation of automated feeding, disease management, and water quality monitoring.

Infrastructure and Maritime Transportation

- **Automation of Ports:** By having automated processes in place, ports boost efficiency and reduce ship turnaround times.
- **Smart shipping:** reduced expenses and environmental effect by utilizing IoT and AI for fuel economy, predictive maintenance, and route optimization.

Renewable Energy

- **Offshore Wind Farms:** Creating technologies to capture wind energy offshore can help the world become less reliant on fossil fuels by providing a renewable energy source.
- **Tidal and Wave Energy:** Examining these energy sources' potential as replacements for renewable energy sources.

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Garments Industry: Bangladesh is a small country in Southeast Asia with high population density. The readymade garments industry of Bangladesh generally known as the RMG sector is the top pioneer of Bangladesh as a country in the global market. The ready-made garments (RMG) sector has a greater potential than any other sector in terms of employment and foreign exchange earnings to lessen poverty and make a significant contribution to the national economy [33]. As the country's largest export sector, it has seen remarkable growth over the past few decades. This industry provides approximately 4.2 million jobs and plays a crucial role in the national GDP. Globally, Bangladesh is the second-largest clothing exporter, following China [34].

The technological impact on the garments industry in Bangladesh has been profound,shaping the industry in several key areas. Here's an overview:

Automation and Machinery

Innovative Machinery: Productivity and efficiency have grown with the use of automated cutting and sewing.

Computer-Aided Design (CAD): CAD software enables designers to quickly and accurately generate detailed designs, which speeds up manufacturing and reduces material waste.

Digitalization

Enterprise Resource Planning (ERP) Systems: ERP systems helps in the effective management of savings, production schedules, supplies, and supply chain logistics.

Digital marketing and e-commerce: A lot of garment manufacturers are using digital platforms for sales and marketing, directly connecting with clients throughout the world through e-commerce.

Labor and Training

Skill Development Programs: As a result of technological enhancements calling for new abilities, training programs are put in place to upskill employees in utilizing modern technology and software.

Workplace Safety: Technologies such as IoT (Internet of Things) devices and wearable tech improve workplace safety by monitoring working conditions and providing real-time alerts.

Tourism: The tourism industry has experienced a dynamic shift in recent years due to the advent of advanced technologies. As one of the early adopters of information and communication technologies (ICT), the tourism sector has integrated these tools extensively into its business operations [35]. The way that technology is used in the travel and hospitality sectors affects visitors' experiences both directly and indirectly. Bangladesh's tourism and hospitality sectors are adapting different tastes. When it comes to collect information about the goods and services that travelers frequently use, the deployment of advanced technologies adds unique dimensions [36].

Digital marketing and social media:

- **Promotion:** Facebook, Instagram, and YouTube are just a few of the social media sites that are now vital for promoting Bangladesh's tourist attractions. A greater number of individuals frequently shares stunning images, videos to influence others.
- **User Ratings and Recommendations:** Based on consumer reviews and ratings, travel-related sites such as TripAdvisor and Google Reviews give travelers advice regarding where to go, what to eat, and where to stay.

Online Booking Systems:

- **Convenience:** Travellers may now make cheaper and easy travel arrangements by booking hotels, airlines, and tour packages online. Agoda, Airbnb, and Booking.com are just a few of the popular websites and apps.
- **Customization:** Travelers can choose services which meet their needs and budgets, compare expenses, and modify their travel plans using online platforms.

Mobile Applications:

- **Guides and Maps:** These apps assist travelers' exploration of Bangladesh by offering dynamic maps, travel guides, and navigation support. Real-time directions and information about nearby attractions can be found in apps like Google Maps.
- **Language Translation:** By overcoming the language divide, translation applications facilitate more effective interactions among visitors and locals.

Freelancing: Freelancers are skilled professionals who offer their services on a temporary basis through contractual agreements. They are independent workers, not classified as employees or employers, and they provide their expertise to various business clients in exchange for a fee [37]. Recently, freelance jobs have become one of the most popular career options and getting acceptance in Bangladesh that people from different levels of the society are coming into this occupation. Instead of working inbound and stiff nine to five routine work, people are becoming more interested in working in the shifts of their own choice rather go to the office. Freelance workers can show versatility and dynamism according to their expertness to any organization [38].

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The impact of technology on freelancing in Bangladesh has been profound and multifaceted, transforming the landscape in several key ways:

Increased Accessibility

- **International Platforms:** Bangladeshi freelancers now have access to international platforms which connect them to clients all over the world, such as Upwork, Freelancer, Fiverr, and Toptal. The work market is now broader than only local opportunities as a result.
- **Remote Work:** Thanks to technological advancements, Bangladeshi freelancers can now operate from anywhere and meet no geographical restrictions while serving global clients.

Skill Development

- **Online Learning:** Freelancers may improve their existing skills and learn new ones by registering in courses offered by websites such as Coursera, Udemy, and Khan Academy. The competitiveness of freelancers from Bangladesh has grown as a result.
- **Community and Collaboration:** Freelancers may exchange resources, expertise, and support with one another through social media groups and online forums, fostering a collaborative atmosphere.

Economic Impact

- **Increased Income:** In Bangladesh, many people who are freelancers can make a lot more money than they might from traditional local employment. As a result,Their level of living has increased and the national economy has benefited.
- **Foreign Exchange:** The country's economy benefits from foreign exchange brought in by earnings from outside customers.

Flexibility in Work

- **Work-Life Balance:** Individuals can more effectively manage both their private and professional lives when they freelance since it provides freedom in terms of work hours and location.
- **Diverse Opportunities:** By taking on a range of assignments, freelancers may expand their skills in a variety of areas and can escape from the boredom of working in a single position.

Role of digital transformation in boosting GDP in Bangladesh: Digital transformation plays a significant role in boosting GDP in Bangladesh through several key channels:

1. **Enhanced Productivity and Efficiency:**The implementation of digital technologies optimizes processes, reduces manual labor, and increases efficiency across various sectors, such as agriculture, manufacturing, and services. This boost in productivity contributes directly to economic growth.
2. **Fostering Innovation and New Business Models:** Embracing digital technologies spurs innovation and the development of new business models. This environment supports the rise of startups and tech-driven enterprises, generating employment and contributing to GDP.
3. **Expanded Market Access:** Digital platforms and e-commerce enable businesses, particularly small and medium-sized enterprises (SMEs), to reach national and international markets. This broader market access can lead to higher sales and revenue.
4. **Automated Government Services**: E-governance projects improve the overall efficiency of government operations, lower corruption, and provide more efficient public services. A more favorable environment for investment and economic activity is produced by this enhanced governance.
5. **Encouraging Foreign Investment:** Investors from overseas are more drawn to economies with excellent digital infrastructure. Infrastructure and technological investments can boost creation of employment and economic growth.

METHODOLOGY

Research Design

A qualitative research design is used to conduct this study, with a focus on secondary data source analysis. Government reports, academic studies, industry reports, news pieces, and other relevant publications are some examples of these sources. A comprehensive investigation of the themes and patterns associated with Bangladesh's adoption of technological advancement and economic development has been made attainable by the qualitative approach.

In the structure of this qualitative research model, whereby the researcher and participants engage in extensive and interconnected interactions, the focus is on understanding the dynamic nature of reality as shaped by individuals' experiences. In addition, the study includes a detailed investigation of many electronic databases including Web of Science, Scopus, Science Direct, Research Gate, and Google Scholar [39].In all, about 150 documents were collected in order to carry out this investigation. Of them fifty publications have been selected as a subset and used according with the particular research goals.

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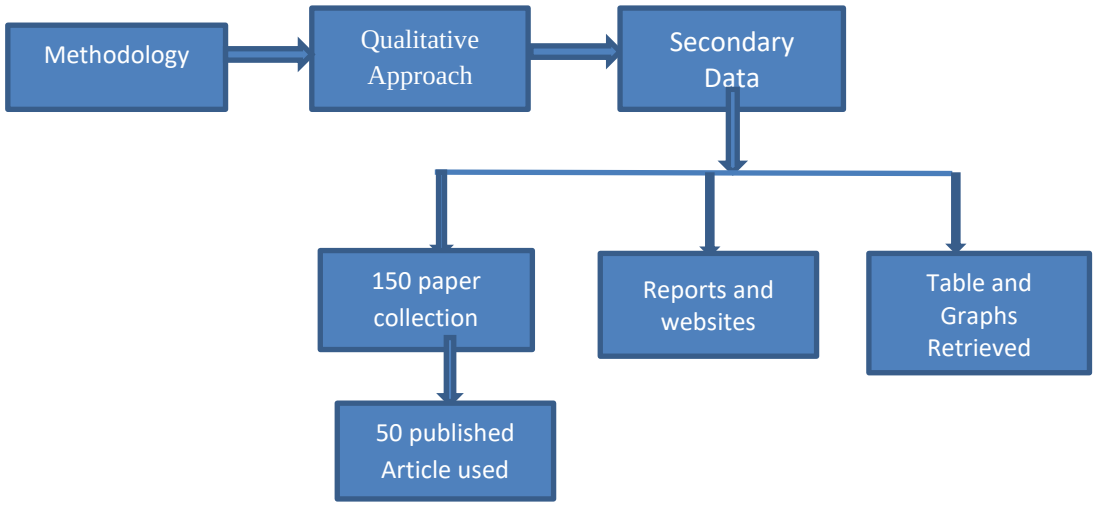

Figure 3: Research Methodology
Source: Author's Work

Data Collection

Identification of Sources :

1. **Government Reports:** Ministry of Information and Communication Technology, Bangladesh Bureau of Statistics, and other relevant departments.

2. **Academic Articles:** Peer-reviewed journals, conference papers, and theses on topics related to technology, economy, and development in Bangladesh.

3. **Industry Reports:** Publications from ICT industry bodies, consultancy firms, and market research companies.

4. **News Articles:** Reputable newspapers and online news portals covering technology and economic developments in Bangladesh.

5. **Other Publications:** Books, policy briefs, and white papers from think tanks and research institutions.

Criteria for Inclusion:

- Relevance to the topic of technology and economic development in Bangladesh.
- Published within the last ten years to ensure contemporary relevance.
- Credible and reliable sources with a clear methodology.

DISCUSSION

Practical Implications: Bangladesh is a young, independent nation that aims to transform into a "Digital Bangladesh" by 2021 by moving into the world of technology[40]. The expression "Digital Bangladesh" implies to a modernized way of thinking about using and integrating modern technologies, not just a more widespread adoption of computers[41].The initiative is a key component of Bangladesh's greater development strategy, which is in accordance with its "Vision 2021" as well as "Vision 2041," aiming at making the country middle-income by 2021 and high-income by 2041, respectively.

Overall, Bangladesh has achieved success in certain areas associated with Digital Bangladesh; however, more thoughtful and cautious progress will be needed for a smart Bangladesh. The government of Bangladesh has begun a number of measures to carry forward Smart Bangladesh Vision 2041[42]. Several ongoing and proposed projects with multiple phases and timelines are shown in Figure 4 below:

Timelines and Phases: It is projected that the Smart Bangladesh program is going to be executed in three stages, featuring a short-term aims (expected by 2025), the mid-term targets (expected by 2030), and long-term targets (expected by 2041). Here's an explanation of the predicted timelines:

Timeline of projects	Projects	Implementation
Short-Term (2025)	**Smart city**	In Bangladesh, the concept of "smart city" has attracted a lot of attention in recent years. Recently, a large number of cities—mostly in wealthy nations—have started, implemented, and progressed into smart cities[43].In the framework of "Smart Bangladesh," this vision is an aspect of the government's overall objective to make Bangladesh a more economically developed and digitally integrated country.

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	E-governance services	Since the main goal of e-governance is to ensure good governance, which is a measure of the satisfaction of citizens with the services provided by the government, it may assist in fostering "good governance" by ensuring increased civic engagement involvement in the decision-making process of the government [44]. The term "e- Governance " emphasizes the application of information and communication technology (ICT) to improve citizen participation, boost speed in the delivery of government services, and ensure transparency. Bangladesh, with its ambition of creating a "Smart Bangladesh" by 2041, has accepted e-governance as a vital pillar of national growth.
Mid-Term (2030)	**Advanced Technologies (5G, AI, IoT)**	Technology is regarded as a vital component of numerous forms of economic activity and has transformed the economy to one which is knowledge-based. A large and rising collection of study has examined the connections between technology and economic growth, with the majority of the investigators finding that technology boosts economic progress [45]. A vital part of realizing the "Smart Bangladesh" vision is modern technology. Implementing 5G, AI, IoT is going to transform our nation's governance, economy and society.
Long-Term (2041)	**Expansion of smart city initiatives to smaller cities and towns**	Despite the global transfer of talent, trade, and technology, local urban identity, culture, and knowledge ecosystems continue to determine creative capacity and adoption of technology. This has significant implications for the design and development of upcoming smart cities. Without taking into consideration such local cultural variations, smart cities have been represented as a generic, universal determination in the last 20 years of smart city research[46]. In Bangladesh, expanding smart city initiatives to smaller towns and cities is a big step toward upgrading the lives of people who don't live in the nation's biggest towns and cities and toward equitable urban growth.
	Smart financial services integrated with AI and blockchain	The financial services sector is rapidly discarding the outdated model in favor of advanced digital client and transactional methods in recent years. The financial services industry, financial service providers, and customers are all experiencing a digital transformation [47]. Having the ability to significantly cut down on transaction costs and times, blockchain technology is becoming increasingly attractive to a wide range of businesses. Because exchanges and banks are involved, settling a transaction in a typical financial system can take several days. However, since BCn technology is automated and removes the need for intermediaries, transactions can be resolved almost immediately. Since BCn technology has the potential to tackle issues like corruption, lack of accountability, and inefficient systems, it is gaining acceptance in Bangladesh[48]. The integration of artificial intelligence (AI) aims to change operations in the financial services sector, increasing efficiency and intelligence to levels that were previously unattainable [49]. Financial organizations can enhance operational effectiveness, enhance customer satisfaction, and improve service delivery through the use of AI and predictive analytics. Financial institutions are able to make accurate, efficient, and strategic choices due to these technologies, which sets them in an effective and quickly shifting market. To attain operational excellence and keep an edge over others in the financial services industry, it is essential to adopt these technological developments [50].

Figure 4: Smart Bangladesh: Reality and Visions
Source: Author's Work

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

The Smart Bangladesh vision lays forth a revolutionary route to a highly integrated and technologically transformed society. Through the use of cutting-edge technology, smart policy, and cautious investment, Bangladesh seeks to bridge the gap between technology and the economy and to promote sustainable growth and development. The primary goals of Smart Bangladesh's work are to improve digital infrastructure, advance technological education, and create a robust environment for entrepreneurship and innovation [51]. As it accepts these advances, the nation will be in a strong position to take advantage of new economic opportunities, raise the standard of life for its citizens, and ensure a pleasant and prosperous future.

RECOMMENDATIONS

Strengthen Digital Infrastructure: For Smart Bangladesh to accomplish its full potential, digital infrastructure must be improved and engaged in. This entails improving current networks, guaranteeing strong cybersecurity, and expanding high-speed internet access to underprivileged and rural areas.

Encourage teaching and literacy in digital media: A smart future depends on digital literacy. Develop thorough programs for digital literacy at every educational level, from kindergartens to universities. In order to offer instruction in digital skills, coding, and advanced technologies like artificial intelligence and machine learning, promote collaborations between the public and private sectors and academic institutions.

promote innovative thinking and entrepreneurship: To create a favorable atmosphere for innovation and entrepreneurship byby offering guidance to entrepreneurs and small and medium-sized enterprises (SMEs). Grants, which are low-interest loans, and startup programs can be helpful to achieve this. We can create technological parks and innovation hubs as well to promote cooperation between companies, investors, and researchers.

Improve the Services of E-Government: Government services should be modernized and optimized to increase availability, efficiency, and transparency. Provide a single, easily accessible digital platform for all government services so that citizens may apply for permits, transact online, and get information more easily. Using data analytics to enhance the creation of policies and decision-making procedures [52].

Limitations:

Dependence on Available Data: The analysis is limited to the data that is available and accessible. There may be gaps or limitations in the existing data.

Potential Bias in Sources: Secondary data may reflect the biases of the original authors or institutions. Efforts will be made to mitigate this through triangulation and critical analysis.

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