4th Industrial Revolution: Preparedness of the Banking Sector of Bangladesh

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4th Industrial Revolution: Preparedness of the Banking Sector of Bangladesh

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Forewords

As part of ongoing dissemination of BIBM research outputs, this key note paper presented in our research workshop series contains the findings of the research workshop topic "4th Industrial Revolution: Preparedness of the Banking Sector of Bangladesh". The study was conducted in 2023 and the paper was presented in an online seminar on October 18, 2023 at BIBM.

The Fourth Industrial Revolution (4IR) is sometimes described as an incoming thunderstorm over the ongoing customary traditional practices in diverse sectors of the economy, a sweeping pattern of change visible in the distance, arriving at a pace that affords little time to prepare. While some people are ready to face the challenge, equipped with the tools to brave the change and take advantage of its effects, others do not even know a storm is brewing.

Today, a significant portion of bank customers are young people and middle-aged people who have different expectations and preferences than the previous generation. Meeting these new generational expectations and preferences are no longer possible to cope with existing banking models, and it will only be possible with the use of fourth-generation tools, technologies, and mechanisms. Entering Industry 4.0 has two distinct natures: first satisfying new needs through new products and processes, and second, higher productivity that aids the implementation of process innovations.

Bangladesh Government and Bangladesh Bank have taken number of initiatives to promote 4th Industrial Revolution for providing secured, faster, cost minimizing and real-time reliable services in the banking sector.

It gives me immense pleasure, on behalf of BIBM, to offer this important resource of academic inputs to the practitioners of the banks and financial institutions, regulatory agencies, policy makers as well as to the academics and common readers. I hope, this research workshop keynote paper will be a valuable resource especially for the policy makers and practitioners to understand the scale and level of preparedness of the banking sector in aligning with Fourth Industrial Revolution. We do encourage feedback from our esteemed readers on this issue which certainly would help us improve upon our research activities in the coming years.

Dr. Md. Akhtaruzzaman
Director General

Acknowledgment

This research workshop keynote paper titled “4th Industrial Revolution: Preparedness of the Banking Sector of Bangladesh” has been completed with immense support from numerous individuals and organizations.

We express deep gratitude to Dr. Md. Akhtaruzzaman, Honorable Director General of BIBM for his valuable observations and guidance in finalizing the paper. The remarks and insight of Md. Shihab Uddin Khan, Associate Professor and former Director (Training) was significant at different stages of our work. We are also thankful to Md. Alamgir, Associate Professor and Director (Training) for his support.

We are thankful to all of our faculty colleagues for their opinions and positive suggestions to carry out our research. We are also thankful to the chief guest, panelists and participants of the roundtable discussion for their valuable comments that immensely helped us to improve the quality of the paper.

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Executive Summary

In recent years, the world has seen a tremendous dependence on technology in every sphere of our lives. Surely, we are at the peak of a technology revolution through 4IR that is changing the way we interact with one another and our workplace. Though its exact impact is yet unknown, one thing is certain: to adapt to it needs to have a comprehensive and integrated structure engaging all parties including the public and corporate sectors, academia, and civil society.

Undoubtedly, the adoption of new technologies, such as cloud computing, industrial automation, sensors, internet of things, predictive maintenance, simulation, advanced manufacturing solutions, additive manufacturing, augmented reality, big data analytics, cyber-security, and horizontal and vertical integration, is a prerequisite for the 4th industrial revolution or Industry 4.0. Industry 4.0's technological foundation is guaranteed by enabling technologies, cyber-physical systems (CPSs), real-time data availability and the ability to choose an optimal procedure based on information at any moment.

Similarly, technology is changing at a breakneck pace throughout the banking industry and the economy of the world as a whole. The process is enhanced by growing data consumption, artificial intelligence-driven machine learning, the Internet of Things, and digital technologies. Nearly, every bank in Bangladesh has made significant investments in ICT (information and communication technology) systems. For example, an estimate of approximately 2400 crore BDT was invested in ICT in 2022, according to a BIBM research titled IT Review of Banks-2022. Banks have set up several distribution channels so that their clients can access online financial services. Generally speaking, banks have been successful in reducing operating costs, improving customer service, developing innovative product features, and controlling inherent risks through the application of ICT and the concept of 4IR.

Moreover, reducing operational and administrative expenses is currently the bank management's top priority in an effort to increase profit. By maximizing the use of IT resources, reducing cash and paper-based transactions, encouraging digital payments and virtual currency, banks hope to bring comparative advantage in the banking industry. So, the banks in Bangladesh are launching cutting-edge digital

services like smartphone apps, QR code payments, and digital wallets to promote cashless transactions.

This paper explores the Preparedness of the Banking Sector of Bangladesh and presents the adoption status, opportunities and related obstacles in Bangladeshi banks. The study report also makes several recommendations for enhancing Bangladesh's preparedness for 4th industrial revolution in banking industry.

According to respondents, half of state-owned commercial banks have introduced artificial intelligence (AI) to their banking operation. While 67% of foreign commercial banks and 37% private commercial banks are currently applying AI. Regarding big data analytics, the respondents claimed that none of the state-owned commercial banks were using it or intended to do so. However, 33% of respondents admitted that foreign commercial banks have already implemented big data analytics and of private commercial banks, 4% acknowledged they had implemented big data analytics. 25% of state-owned commercial banks plan to utilize cloud computing, while 50% of them have already done so. Regarding foreign commercial banks, of those surveyed, 67% said they had already implemented cloud computing and of private commercial banks, 37% said they had implemented cloud computing. None of the state-owned commercial banks had implemented RPA or have any plans to do so. From foreign commercial banks, 33% of respondents said they were still in the planning stages and among private commercial banks, 52% said they had implemented RPA. According to the respondents, none of the state-owned commercial banks have embraced or plan to implement the Internet of Things (IoT). 67 % Foreign commercial banks were still in the planning stages and of private commercial banks, 12% said they had IoT. Respondents stated that none of the state-owned commercial banks had embraced AR/VR or planned to do so. All respondents (100%) stated that foreign commercial banks are currently in the planning stage and of private commercial banks, 4% said they had implemented AR/VR. 50 % of respondents stated that state-owned commercial banks intend to implement blockchain technology and of the foreign commercial banks surveyed, 33% said they had already implemented blockchain technology. when it came to private commercial banks, 4% said they had already adopted blockchain.

From the survey, some opportunities for the adoption of 4IR in the banking industry have also been explored. By utilizing cutting-edge technology like artificial

intelligence (AI) and machine learning, banks can improve their capacity to identify and track fraudulent activity, ultimately boosting the security of financial transactions. Banks can also lessen their exposure to financial risks by enhancing their risk assessment through IT platforms.

added to that, Unbanked populations can be brought into the financial system and digital transactions can be made more easier by inclusive banking services through the digital payment systems.

However, the study revealed that the financial constraints of banks are deterring banks from allocating enough capital for the adoption 4IR. Legacy systems are also making it more difficult for new, more cutting-edge technologies to be adopted. As the usage of digital technology is growing banks also need to safeguard financial transactions and client information against online attacks. In the digital age, gaining and retaining customer trust is essential and thus data security should be the prime concern of banks Moreover, Effective 4IR initiative implementation could be difficult for banks due to their restricted access to resources, which might include both people and financial resources. Our banking industry is yet to manage the workforce and make them prepared for the 4IR. To keep up with the rapid advancement of technology, bank could promote employees' upskilling and ongoing training. Talented and skilled employees are to be hired and retained for further development in this sector.

In order to thrive in the 4IR era, banks need to implement strong cybersecurity safeguards for financial operations. Banks need to follow strict data protection procedures and adhere to ever-changing data privacy laws like GDPR, PCI DSS, and ISO 27001. To maintain cyber security preparation, the banks, nevertheless, adhere to the ICT security guidelines issued by Bangladesh Bank. Banks could concentrate on deploying AI-powered chatbots for customer service and RPA to automate repetitive work. Banks can intend to build and deploy Big Data Analytics, Augmented Reality (AR), Virtual Reality (VR) and Internet of Things (IoT) infrastructure for better customer retention. Bangladesh Bank needs to publish extensive guidelines to support 4IR in the country's banking industry and can encourage digital transformation and awareness campaigns as a proactive approach to innovation. With the use of legal frameworks and close supervision, the central bank can guarantee the incorporation of digitalization into banking operations.
To effectively serve the unbanked and underbanked populations, this also entails the integration of online payment systems and mobile banking. In addition, the

central bank aggressively supports the expansion of fintech companies, which promotes competition and innovation in the financial industry. The central bank may incentivize the banks pioneer in implementing 4IR. These incentives could be in the form of tax benefit, less regulatory barriers, or funding for projects related to research and development. added to that, Banks might set aside a fund for innovative technologies and banks might set up innovation centers or incubators to generate new concepts with other banks in the industry as collaborations will be the key to success in the coming days. To stay ahead of the curve and gain access to developing solutions, banks may work with fintech startups and technology partners as well.

4th Industrial Revolution: Preparedness of the Banking Sector of Bangladesh

1.0 Introduction

We stand on the edge of a technological revolution that will fundamentally alter the way we live, work, and relate to one another. In its scale, scope, and complexity, the transformation will be unlike anything humankind has experienced before. We do not yet know just how it will unfold, but one thing is clear: the response to it must be integrated and comprehensive, involving all stakeholders of the global politics, from the public and private sectors to academia and civil society (Schwab, 2016).

The Fourth Industrial Revolution (4IR) is reshaping the global economic landscape at an unprecedented pace. Characterized by the convergence of digital technologies, the 4IR has brought forth transformative changes that impact industries across the world. In this context, the preparedness of the banking sector in Bangladesh assumes paramount importance. As the nation aspires to secure its place in the ever-evolving global economy, its banking sector stands as a linchpin in fostering economic growth, financial stability, and inclusive development.

The 4IR is not merely an incremental progression; it represents a seismic shift in the way businesses operate and interact with stakeholders. Technologies such as artificial intelligence (AI), blockchain, big data analytics, and the Internet of Things (IoT) are redefining the banking landscape, altering traditional banking practices, customer expectations, and regulatory dynamics. Bangladesh's banking sector, thus, faces a dual challenge: embracing the opportunities of the 4IR while navigating the intricacies of cybersecurity, compliance, and customer trust.

This research workshop paper embarks on an in-depth examination of the preparedness of the banking sector of Bangladesh in the era of the 4IR. In a landscape where adaptability and innovation are prerequisites for survival, comprehending the current state of the sector's technological infrastructure, regulatory framework, and strategic initiatives becomes imperative. The study endeavors to unveil the potential repercussions of the 4IR on the banking sector and

seeks to identify the strategies, investments, and innovations needed to ensure its resilience and competitive prowess in an era of profound change.

Through a comprehensive analysis of technological advancements, regulatory compliance, and strategic imperatives, this research strives to illuminate the pathway forward for Bangladesh's financial institutions. By critically assessing their readiness for the 4IR, we can pinpoint the areas that require immediate attention and action, thereby contributing to the sustainable growth and prosperity of the nation.

As we proceed, it is evident that the readiness of the banking sector for the 4IR is not a mere choice but an imperative for Bangladesh's continued progress. In an era defined by unprecedented technological advancements and global interconnectedness, embracing the transformative potential of the 4IR is not only a strategic advantage but a fundamental necessity for the nation's financial sector to thrive and lead in the evolving global economy.

In Bangladesh, all banks have made substantial investments in information and communication technology (ICT) platforms. According to a study conducted by BIBM titled IT Review of Banks-2022 showed that the investment on ICT was approximately 2400 crore BDT in the year 2022. Banks have established multiple distribution channels to offer online financial services to their customers. In general, banks have achieved success in creating cutting-edge product features, lowering operational expenses, enhancing customer support, and managing inherent risks.

Within the country, banks have set up extensive ATM, CRM, and point-of-sale (POS) networks to provide customers with round-the-clock access. They offer various services, including electronic payment options like e-cash and e-cards, ATM/POS transactions, mobile banking, internet banking, and app-based banking. Many banks have deployed POS terminals in prominent retail stores, hotels, and sales centers across the nation. Some technology-driven banks also provide internet banking with user-friendly features, enabling customers to perform banking activities from any location in Bangladesh at any time. Additionally, Near Field Communication (NFC) has recently gained tractions among the customers, so banks are offering NFC based payment technologies with innovative approach. For example, Eastern Bank Limited recently launched WEAREBL which is the nation’s first wearable NFC based contactless payment solutions device.

Bank management is currently prioritizing the reduction of administrative and operational costs to maximize profits. They intend to achieve this by optimizing the utilization of IT/IS resources, minimizing cash and paper-based transactions, promoting virtual cash and digital payments, and facilitating online communication among employees and stakeholders through intranet and extranet platforms. To encourage cashless transactions, banks are introducing innovative digital services such as mobile apps, QR code payments, and digital wallets.

Given that many financial products and services are directly or indirectly dependent on ICT, banks must efficiently utilize their IT resources and introduce innovative digital financial technology to cut costs, enhance employee efficiency and productivity, ensure secure and reliable internal IT operations, and deliver improved services to tech-savvy customers. Failure to do so could expose banks to significant IT and business risks in the competitive and digital era. 4IR technologies are the key enablers to sustain in the upcoming days especially for the financial institutions. With the above background, BIBM has prepared this research workshop paper with the following objectives.

1.1 Objectives

The broad objective of the study is to assess the preparedness level of banks in 4IR technologies. The specific objectives of the study are to

a) understand the conceptual issues related to 4IR technologies;
b) depict the global scenario of 4IR Technologies adoption in the banking sector;
c) identify the level of 4IR technologies adoption preparedness of the banking sector of Bangladesh; and
d) find out the opportunities and challenges regarding the 4IR technologies in banks.

1.2 Methodology

The study uses both primary and secondary data. Primary data were collected through semi-structured questionnaire and Focus Group Discussion (FGD). In this regard, a semi-structured questionnaire (Appendix-1) was sent to the IT departments of all banks in Bangladesh. We received 37 responses from banks (Appendix-2). Among the respondent banks, there were 4 State-owned Commercial Banks (SOCBs), 28 Private Commercial Banks (PCBs), 3 Foreign Commercial Banks (FCBs) and 2 Specialized Banks (SBs). Additionally, FGD was conducted among IT professionals of banks (Appendix-3). The secondary data were collected

from various research papers, publications, and websites. Extensive literatures were reviewed for developing the conceptual aspects.

1.3 Organization of the Paper

The paper is organized into five sections. The first section describes the introduction, objectives, methodology and the organization of the paper. Section two reviews the literature and discusses the conceptual issues on 4IR technologies; section three shares global 4IR technologies adoption scenario in the banking system; section four shows the current status, preparedness level, opportunities and challenges of 4IR technologies in the banking sector of Bangladesh, and section five concludes with recommendations and conclusion.

2.0 Literature Review and 4IR Conceptual Aspects

A good amount of literature has been found on the applications and uses of 4IR technologies in different sectors. However, very few studies have been conducted on the assessment of 4IR preparedness in the banking and financial sectors. I. Castelo-Branco, T. Oliveira, P. Simões-Coelho et al. (2022) developed an Industry 4.0 measurement model that is applied to a sample of Portuguese companies from several economic sectors beyond manufacturing. The study identified five constructs from literature, together with respective measurement indicators: IT strategy and cybersecurity, enablers, smart factory, value proposition, and customer experience.

Wagner Cezar Lucato et al. (2019) stated that the Industry 4.0 revolution is happening globally and concurrently through different 'words' characterized by same ideas. In Europe: Germany (Industrie 4.0), France (the Nouvelle France Industrielle), Sweden (Produktion 2030), Italy (Fabbrica Intelligente), Belgium/Holland (Made Different), Spain (IndustriaConectada 4.0) and Austria (Produktion der Zukunft) are all actively taking an interest. However, Klaus Schwab, Founder and Executive Chairman of World Economic Forum, stated that the First Industrial Revolution used water and steam power to mechanize production. The Second used electric power to create mass production and the Third used electronics and information technology to automate production. Now the Fourth Industrial Revolution is characterized by a fusion of technologies that is blurring the lines between the physical, digital, and biological spheres.

Cividino et al. (2019) defined the term "Industry 4.0" as the concept that technology has permeated all areas of society: production, finance, services, transportation, and

communications. Some researchers suggested that the notion of Industry 4.0 supposes blurring the differences between the work of people and the work of machines (Slusarczyk, 2018). Lu (2017) argued that the concept of Industry 4.0 can be summarized as an integrated, adapted, optimized, service-oriented, and interoperable manufacturing process that is correlated with algorithms, big data, and advanced technologies. The Fourth Industrial Revolution, also known as Industry 4.0, provides smart, efficient, effective, individualized, and customized production at reasonable cost (Erol et al., 2016). According to Stock and Seliger (2016), the concept of Industry 4.0 includes three fundamental dimensions of integration: (1) the horizontal integration across the entire value creation network, (2) vertical integration and networked manufacturing systems, and finally (3) end-to-end engineering across the entire product life cycle.

Having a company that uses 4IR means extending the level of knowledge, increasing the application of new enabling technologies, and involving the mechanism and technology through which the greater interrelation and collaboration of human, physical, and information resources, generate additional value in the company and the supply chain. The Industry 4.0 transformation of companies must necessarily take place through the introduction of new technologies, such as cloud computing, industrial automation, sensors, predictive maintenance, internet of things, simulation, advanced manufacturing solutions, additive manufacturing, augmented reality, big data & analytics, cyber-security, horizontal and vertical integration. The technological basis of Industry 4.0 is ensured by enabling technologies, cyber-physical systems (CPSs), real-time availability of all data, capacity to determine an optimized process at any time based on the information, and integration of people, objects, and systems into the value chain (Alfano, 2020).

The breakthrough speed of the fourth industrial revolution is now increasingly being felt and has a wide impact on all sectors. Compared to the previous several phases of the Industrial Revolution, the fourth industrial revolution evolved exponentially rather than linearly. IR 4.0 is the phase that encourages advancement in technology, which allows smartphone usage in the palm, high-tech gadgets at affordable prices, high-speed communication such as video conferencing that breaks the barrier of distance and time, as well as robots with artificial intelligence. The ability to progress and gain the benefits that can result from this revolution will depend on implementing early strategies and a willingness to overhaul business and

operational models to adapt and adopt the latest technology infrastructure (Schwab, 2016).

2.1 Industrial Revolutions in a Nutshell

Transition Phase

The transition phase in the Industrial Revolution was a period of rapid and dramatic change, as societies shifted from agrarian and handicraft economies to ones dominated by industry and machine manufacturing. This process began in Britain in the late 18th century and spread to other parts of the world in the 19th century.

The technological changes included the following: (1) the use of new basic materials, chiefly iron and steel, (2) the use of new energy sources, including both fuels and motive power, such as coal, the steam engine, electricity, petroleum, and the internal combustion engine, (3) the invention of new machines, such as the spinning jenny and the power loom that permitted increased production with a smaller expenditure of human energy, (4) a new organization of work known as the factory system, which entailed increased division of labor and specialization of function, (5) important developments in transportation and communication, including the steam locomotive, steamship, automobile, airplane, telegraph, and radio, and (6) the increasing application of science to industry (Hobsbawm, 1962)

The First Industrial Revolution

The First Industrial Revolution began in Great Britain in the late 18th century and was characterized by the mechanization of production using water and steam power. Till the period 1760 to 1830, the Industrial Revolution was largely confined to Britain (Allen, 2009). Aware of their head start, the British forbade the export of machinery, skilled workers, and manufacturing techniques. However, the British monopoly on the Industrial Revolution was short-lived. Britons saw opportunities abroad, and continental European businessmen sought British expertise. Two Englishmen, William and John Cockerill, brought the Industrial Revolution to Belgium by developing machine shops in Liège in 1807. Belgium became the first country in continental Europe to be transformed economically, with an industrial revolution centered on iron, coal, and textiles (Landes, 1969).

The Second Industrial Revolution

The Second Industrial Revolution began in the late 19th century and was characterized by the widespread adoption of electricity and oil as new sources of power, the development of new machines and manufacturing processes, and the

rise of mass production. This revolution led to even further increases in productivity and economic growth. It also saw the development of new industries, such as the automobile and aircraft industries (Chandler, 1977).

During the Second Industrial Revolution (1870-1914), the textile industry transitioned to synthetic materials, fertilizers were developed to boost agricultural output, and oil and gas mining joined iron and coal mining as major industries. Communication technologies such as the telegraph and telephone were also invented during this period.

One of the most notable inventions of the Second Industrial Revolution was the assembly line, developed by Ford Motors. This revolutionized manufacturing, allowing for mass production and lower costs. Large-scale production and mass factories became the norm during this period, which lasted until the mid-20th century (Chandler, 1977).

The main players of the Second Industrial Revolution were European countries such as the United Kingdom, France, Germany, and Italy. However, the United States economy began to lead the world during this period.

The Third Industrial Revolution

The Third Industrial Revolution, also known as the Digital Revolution, began in the mid-20th century and was characterized by the development of new digital technologies, such as computers, semiconductors, and the internet. These technologies led to a revolution in the way that information is processed, communicated, and stored. The Digital Revolution also saw the rise of new industries, such as the information technology industry. The telecommunications sector, especially mobile communication technology, the internet, and email communication, also made significant progress during this period, as did medical technologies, biotechnologies, and the pharmaceutical industry (Manuel, 1999).

The Third Industrial Revolution has had a profound impact on human civilization. The rise of information and communication technology (ICT) has transformed the way we live, work, and communicate. Open flows of goods, globalization, e-commerce, and e-business have created a more interconnected and interdependent world. Newer economies such as Japan, China, Brazil, India, and Russia have become major players in the global economy (Manuel, 1999).

The Fourth Industrial Revolution

The Fourth Industrial Revolution is still in its early stages, but it has the potential to transform the world in even more dramatic ways than the previous industrial revolutions (Schwab, 2016). It is important to note that the Fourth Industrial Revolution also brings with it a number of challenges, such as the potential for job displacement and the need to ensure that the benefits of new technologies are shared widely (Brynjolfsson, 2014).

The Fourth Industrial Revolution (4IR) is a period of rapid technological change that is transforming all aspects of society, including the economy, politics, culture, and social relations (Schwab, 2016). It is built on the foundation of the Third Industrial Revolution, which was characterized by the widespread adoption of digital technologies. However, the 4IR goes beyond digitization to encompass a convergence of digital, biological, and physical innovations, such as artificial intelligence, gene editing, augmented reality, robotics, and 3D printing (Schwab, 2016).

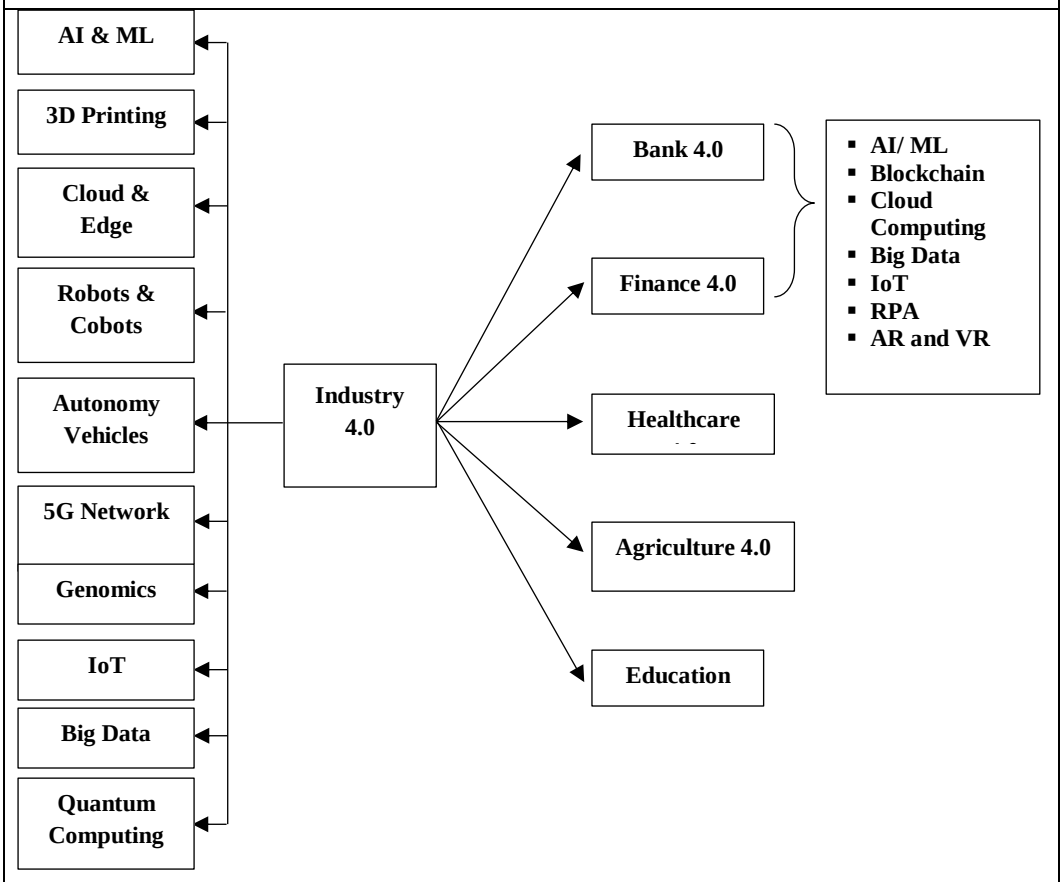
The 4IR is having a profound impact on the way we live, work, and interact with the world around us. It is creating new opportunities for economic growth and social development, but it is also raising challenges such as cybersecurity threats, the spread of misinformation, and the potential for job displacement (Brynjolfsson, 2014).

2.2 Banking in 4IR and Bank 4.0

Today, the rate of technological change in the banking sector and the entire economic ecosystem is extremely high. These changes have a significant impact on the dynamism of individuals and the socio-political community that no one could have imagined. Increasing data usage, machine learning based on artificial intelligence, the Internet of Things, and digital technologies play an important role in this process. Banking 1.0 is what we call banking, and this is the same traditional banking that services are provided at certain times in the branch. The contemporary banking theory argues that commercial banks, composed of other financial mediators, are essential in the distribution of wealth in the economy (Bhattacharya and Thakor, 1993). Then came the introduction of technologies such as the Internet and some Banking 2.0 services that were slowly pushing banking out of the branches. This is possible with the advent of ATMs and card readers, since we are witnessing the formation of off-branch services at different times. This period

began in 1980 and lasted until 2007. With the advent of self-service banking, things have changed, and we have come to realize that banking can also be portable, which is Banking 3.0 (It is related to the supply and expansion of mobile services. These services may be provided on a smartphone platform or even portable card readers. This period lasted from 2007 to 2015, but banking 4.0 is a major transformation that will live with you.

Figure-1: Industry 4.0 to Bank 4.0



Source: *Authors' own compilation*

Industry 4.0 is backed by different types of technologies mentioned in the Figure-1. Different industries are using different sets of technologies that are shaping the fourth industrial revolution positively. Technologies like AI & ML, Blockchain, Cloud Computing, Big Data, IoT, Robotic Process Automation, etc. are being used in the field of Bank 4.0 and Finance 4.0. We have seen that banks and other financial organizations are implementing these in several operations such as using

AI-powered chatbots to improve customer service, using AI algorithms to prevent and detect fraud, implementing blockchain technologies to secure payment systems, using Big Data to ensure personalized banking services, and so forth.

AI & ML: Artificial Intelligence refers to the science and engineering of making intelligent machines capable of mimicking human intelligence. It is a rapidly developing field which can make human activities easier. Machine Learning can be defined as a type of AI that allows software applications to become more accurate in predicting outcomes without being explicitly programmed to do so using historical data. In the realm of Bank 4.0, artificial intelligence can be defined as the use of AI tools to ensure an improved banking experience for both the customers and the banks. Rahman et al. (2021) found that Artificial Intelligence is being used in both banking and finance for detecting and preventing frauds for making transactions more secure. In Finance 4.0, AI and ML are used in improving the decision-making process, creating personalized experiences for customers, automating repetitive tasks, and so more (Noreen et al., 2023). Bangladesh Bank, a regulatory body, is proactively monitoring the innovative activities of the banking and financial institutions of Bangladesh. The Information Systems Development and Support Department of Bangladesh Bank published a circular dated June 16, 2020, about the use of AI in Banking. According to the national strategy for AI, there are some scopes of using AI in the financial sector which are AI-Based Credit Management System for Fraud Detection & Prevention, Credit Decision to Reduce Risk in Loan Sanction Process, AI-Based Risk Management Solutions, Personalized Banking Solutions, Financial Process Automation, Virtual Customer Support Assistance, and Shell Banking Monitoring.

Blockchain: Bodkhe et al. (2020) stated that in Bank 4.0 and Finance 4.0, blockchain technology refers to the use of this distributed ledger technology to efficiency, transparency, and security of the online payment systems of banking and other financial organizations. Kharif (2023), in a Bloomberg report stated that American multinational financial services business JP Morgan Chase introduced JPM Coin in 2019 along with several other blockchain-based applications for payment settlement among institutional clients. According to the National Blockchain Strategy 2020 of Bangladesh, the uses of blockchain in banking, insurance, and finance are digital asset management, inter-bank settlement, trade finance, p2p lending, anti-money laundering, digital currency, credit rating, insurance, pension, payment, stock market, and so on.

Cloud Computing: Ghule et al. (2014) stated that Cloud Computing (CC) refers to the provision of computing services via the internet, encompassing software applications, storage of data, and processing power. Instead of investing in and managing their advanced computing infrastructure, banks can utilize cloud computing solutions to supplement or replace their existing data centres. This enables organizations to steer clear of the expenses and intricacies associated with maintaining modern IT infrastructures. For Bank 4.0 and Finance 4.0, CC means the use of on-demand, scalable, and pay-as-you-go computing resources over the Internet for delivering banking and financial services. According to Alam et al. (2023), 51.9 percent of Bangladeshi banks agree that cloud technology is relevant for them but not a strategic priority.

Big Data: Big Data is playing a crucial role in making industry 4.0 possible. Oracle India (2023) stated Big Data as the data which contains greater variety comes in an increasing volume and more velocity. As these data sets are highly voluminous (i.e. data generated from Facebook), traditional data processing software cannot process them and Big Data Analytics comes to solve this. Big Data can be understood with the help of three Vs: Volume, Velocity, and Variety. Volume refers to the amount of data, for example, Facebook data including texts, photos, videos, etc. Velocity refers to the fast rate at which data is received and acted on. Variety is the several types of data. There are two new Vs added which are Value and Veracity. Value refers to the usefulness of the data generated and Veracity refers to the truthfulness or reliability of the data. According to the Corporate Finance Institute (2022), Finance 4.0 can use Big Data in real-time stock market insights, financial models, customer analytics, risk management & fraud detection, etc. According to Marr (2016) from Forbes, to ensure their marks in Bank 4.0, Citibank uses big data to personalize its marketing messages to customers by sending different marketing messages to different customers based on their spending habits or investment goals. Customer segmentation and targeting, fraud detection, risk management, service development, etc. are some other uses of Big Data in Bank 4.0.

IoT: IoT or Internet of Things can be understood as a network of physical objects embedded with sensors, software, and other technologies to connect and exchange data with other devices through the Internet. Buddin (2015) mentioned that Goldman Sachs, which is the second-largest investment bank in the world by revenue, is using IoT data for detecting fraudulent transactions. According to Khanboubi et al. (2019), IoT can be used in Finance 4.0 and Bank 4.0 in several

ways. For example, in mobile banking, IoT can be used in account management on things, substituting physical signatures, real-time monitoring of collaterals and assets, automated payments, wallet of things, smart contracts, etc. It can help businesses from Industry 4.0 and Bank 4.0 by ensuring e-KYC, personal financial management, defending against cyber criminality, using virtual money, etc.

RPA: According to a research by Deloitte Consulting (2018), banks should use modern technology to replace the mundane work which is normally left to human beings. Robotic Process Automation refers to a form of business process automation that focuses on using software robots for automating repetitive, rule-based tasks for example in Finance and Operations, tasks like recording journal entries, reconciling general ledger accounts, claims processing, returns management, inventory processing and network monitoring can all be done using RPA. As the banking and finance industry has a lot of repetitive tasks, RPA can increase their efficiency, accuracy, scalability, etc. and reduce the cost of those operations. There John Napoli (2022) said that RPA mirrors the action of a human, that replaces with a bot that can work 24/7 with fewer errors.

AR and VR: The type of technology that enables organizations to graphically visualize the real environment in the Fourth Industrial Revolution is Augmented Reality (AR) (Yew et al. 2016). The development of software and hardware applications has led AR to act in various industrial processes and products as a guide in describing, planning, and monitoring real-time performance, error detection and recovery, and various training strategies (Doshi et al. 2017; Khan et al. 2011). The search for industrial reality also shows that manufacturing organizations use AR to support employee training programs, task simplification, control, and product design (Elia et al. 2016).

3.0 Adoption of 4IR Technologies in global Banking Context

Most of the advanced banks have already taken numerous initiatives to integrate 4IR technologies with their legacy systems. The emergence of Fintech startups accelerates the adoption of 4IR technologies by banks. Banks are proactively thinking to renovate and redesign their products and services and how they can deliver values to the customers. This section covers some strategic case studies of different banks and how they adopt 4IR technologies to deliver core competencies to their customers.

Box-1: DBS Bank Adopted 4IR Technologies

"DBS, one of Asia's leading financial institutions, has embarked on a transformative journey, embracing the Fourth Industrial Revolution (4IR) to reshape its banking operations. This case study explores how DBS has strategically employed artificial intelligence (AI) and digital transformation to enhance customer value, gain a competitive edge, and promote responsible data use. By leveraging AI technologies and a robust technological infrastructure, DBS has achieved remarkable results and is poised for further growth.

Digital Transformation Pillars: DBS architected its digital transformation around three key pillars

1. Being Digital to the Core: DBS has repurposed its technology stack to operate on the cloud and open source platforms, leveraging APIs and micro services. This digital core forms the foundation for becoming an AI-fuelled bank.

2. Embedding in the Customer Journey: The bank has integrated itself into the customer journey, providing hyper personalized services. For instance, it sends out 45 million hyper personalized nudges monthly to guide customers towards better financial decisions.

3. Operating Like a Start-up: DBS adopts a start-up mind set, allowing rapid development and deployment of AI models. Internal solutions like ADA and ALAN facilitate this by ensuring data governance, discoverability, and security while expediting AI deployment.

- AI/ML Success: DBS's commitment to AI/ML has yielded substantial results. In 2022, AI/ML use cases delivered SGD 180 million in economic value, including SGD 150 million in revenue uplift and SGD 30 million in cost avoidance and productivity gains. The bank has developed over 600 AI/ML models and 300 use cases, setting it apart from traditional banking competitors and fintech rivals.
- AI-Enabled Customer Support: DBS's AI capabilities extend to proactively assisting small and medium enterprises (SMEs) in navigating challenging economic conditions. The "DBS Quick Finance" application process, powered by AI, was reduced to just one minute for application and one second for approval. This instant disbursement, with no additional paperwork, illustrates DBS's commitment to customer-centric solutions.
- AI provides early alerts of credit risks to SMEs, enabling preemptive action. In 2022, DBS successfully identified over 95% of non-performing SME loans at least three months before credit stress, preventing 80% of at-risk borrowers from facing financial difficulties.
- Responsible AI and Data Security: DBS recognizes the significance of data security and ethical AI use in the highly regulated financial sector. The bank has implemented a responsible data use framework called PURE, ensuring that data usage aligns with criteria such as being purposeful, unsurprising, respectful, and explainable for customers. Access to data is strictly controlled and monitored, emphasizing security and suitability.
- Collaboration for Ethical AI: Recognizing the importance of ethical AI use, DBS collaborates closely with Singapore regulators, including the Monetary Authority of Singapore and the Info communications and Media Development Authority, to develop frameworks and tools for trustworthy and responsible AI deployment.

- Future Prospects: AI/ML has become a competitive advantage for DBS, projected to contribute SGD 1 billion to the bank's revenue over the next five years. The bank remains proactive in exploring emerging technologies, such as generative AI, to further improve employee productivity and operational efficiency.

DBS's strategic integration of AI and digital transformation has not only enhanced its competitiveness but also transformed the way it serves customers. Through responsible AI deployment, a focus on data security, and collaboration with regulators, DBS is leading the way in the responsible and profitable use of AI in the financial sector. As it continues to experiment with emerging technologies, the bank is well-positioned to deliver greater value to both customers and employees in the ever-evolving landscape of the financial industry."

Source: *https://www.dbs.com/artificial-intelligence-machine-learning*

Box-2: JP Morgan Harnessed the Transformative Potential of the 4IR to Enhance Efficiency in its Banking Operations

"JP Morgan, a global financial powerhouse, has harnessed the transformative potential of the Fourth Industrial Revolution (4IR) to enhance efficiency in its banking operations. This case study explores how JP Morgan strategically leverages 4IR technologies to streamline processes, reduce costs, and deliver superior services to its clients.

JP Morgan has embraced a multi-faceted approach to integrate 4IR technologies into its banking operations. Key areas of focus include artificial intelligence (AI), blockchain, data analytics, and automation.

1. AI and Machine Learning: JP Morgan has invested significantly in AI and machine learning to optimize various aspects of its operations. These technologies are used to analyze vast datasets, identify patterns, and make data-driven decisions. For instance, AI-powered algorithms are employed in risk assessment, fraud detection, and customer service.

2. Blockchain: The bank recognizes the potential of blockchain technology in enhancing security and efficiency in financial transactions. JP Morgan has developed its blockchain-based platform, Quorum, which is used for various applications, including improving the transparency and efficiency of settlement processes.

3. Data Analytics: JP Morgan's data analytics capabilities have been instrumental in gaining insights into market trends, customer behavior, and risk management. Advanced analytics tools allow the bank to make more informed investment and lending decisions while optimizing its operational processes.

4. Automation: The adoption of robotic process automation (RPA) and intelligent automation has revolutionized JP Morgan's back-office operations. Mundane and repetitive tasks are automated, reducing errors and processing times. This has significantly improved operational efficiency and reduced costs.

- Enhanced Customer Experience:JP Morgan's commitment to 4IR technologies extends to enhancing the customer experience. Through AI-driven chatbots and virtual assistants, the bank provides immediate and personalized customer support. This not only improves customer satisfaction but also frees up human resources for more complex tasks.

- Efficient Risk Management:In the ever-evolving financial landscape, risk management is critical. JP Morgan's use of 4IR technologies allows for more accurate and timely risk assessment. Machine learning algorithms analyze market data in real-time, helping the bank respond swiftly to potential risks and market fluctuations.

- Cost Savings and Operational Efficiency:The automation of manual processes has led to substantial cost savings for JP Morgan. RPA, for instance, has been deployed in areas like document verification and account reconciliation. By reducing manual intervention, the bank has lowered operational costs while improving accuracy and speed.

- Blockchain-Powered Solutions:JP Morgan's use of blockchain technology extends beyond internal operations. The bank has explored blockchain solutions for cross-border payments, trade finance, and supply chain management. These applications offer increased transparency, reduced fraud, and faster transaction processing, benefiting both JP Morgan and its clients.
- Collaboration and Innovation:JP Morgan recognizes the importance of collaboration and innovation in harnessing 4IR technologies. The bank actively engages with fintech startups and industry partners to stay at the forefront of technological advancements. By fostering a culture of innovation, JP Morgan continually identifies opportunities to enhance efficiency and customer value.

JP Morgan's strategic adoption of 4IR technologies has led to a profound transformation in its banking operations. From AI-powered customer service to blockchain-based solutions and automated processes, the bank is leveraging cutting-edge technologies to improve efficiency, reduce costs, and provide superior services to its clients. As the financial industry continues to evolve, JP Morgan's commitment to innovation and technology positions it as a leader in the 4IR-driven banking landscape, exemplifying how a global banking giant can adapt and thrive in the digital age."

Source: *https://www.jpmorgan.com/technology/artificial-intelligence*

Box-3: Santander Bank Saw the Potential of 4IR Technologies to Revolutionize the Financial Industry

"Santander is a multinational financial services company with a presence in numerous countries worldwide. With a commitment to serving its customers better, Santander saw the potential of 4IR technologies to revolutionize the financial industry.

1. Redefining Customer-Centric Experiences: Santander recognized the importance of designing customer-centric experiences in the digital age. This meant simplifying and automating processes to deliver exceptional value. One of their notable innovations was the introduction of a "one-click" sales model, making it easier and more convenient for customers to access and use financial services across various channels. This approach aligned with the Omni-channel, transparent, and simplified services customers increasingly demanded.

2. Scaling Personalization: Personalization was a key focus area for Santander. They utilized data analytics and machine learning to create tailored experiences for each customer. By analysing customer data, transaction history, and preferences, Santander was able to provide targeted product recommendations and personalized financial advice, fostering stronger customer relationships.

3. Empowering Self-Service: Recognizing the value of self-service capabilities, Santander invested in user-friendly digital platforms and mobile apps. Customers could now perform a wide range of banking transactions and access account information on their own, reducing the need for manual interventions and branch visits.

4. Leveraging Automation and Real-Time Insights: Santander embraced automation to streamline operations and enhance decision-making. They integrated artificial intelligence (AI) and real-time data analytics to provide customers with instant recommendations, such as investment opportunities or credit limit adjustments. This not only improved efficiency but also increased customer satisfaction.

5. Process Analysis with Data-Driven Methods: Santander enhanced its process analysis capabilities through data-driven methods like process mining. This allowed the bank to objectively identify bottlenecks, inefficiencies, and opportunities for automation within its operations. The data-driven approach enabled them to prioritize process improvements effectively.

6. Event-Driven Process Modelling: To adapt to rapidly changing customer needs, Santander adopted event-driven process modelling. This approach enhanced the flexibility and adaptability of their processes, ensuring that they remained customer-centric. By responding to real-time events and triggers, Santander improved its ability to meet customer expectations.

7. Hyper-Automation: Santander embraced hyper-automation, combining AI and cognitive resources to automate repetitive and time-consuming tasks. This not only reduced operational costs but also freed up employees to focus on creative and innovation-focused tasks. The bank recognized that by automating routine processes, employees could engage in more meaningful work, contributing to a culture of innovation.

- Enhanced Efficiency and Cost Reduction: Automation and process improvements led to significant efficiency gains, reducing operational costs and accelerating service delivery.
- Improved Customer Experiences: Santander's customer-centric approach resulted in higher customer satisfaction and loyalty. Personalization and self-service capabilities empowered customers, making their banking experiences more convenient and relevant.
- Culture of Innovation: By integrating 4IR technologies, Santander fostered a culture of innovation. Employees were encouraged to think creatively and explore new ways to leverage technology to improve processes and services.

Santander's embrace of the Fourth Industrial Revolution represents a remarkable journey toward efficiency, innovation, and customer-centricity. By redefining customer experiences, scaling personalization, empowering self-service, and embracing automation, Santander positioned itself as a forward-thinking financial institution capable of meeting the demands of the digital age. This case study serves as a testament to the transformative power of 4IR technologies in reshaping the banking industry and providing a blueprint for other organizations seeking to remain competitive in a rapidly evolving landscape."

Source: *https://www.santanderdigitalservices.com/en/intelligent-automation*

Box-4: Heritage Bank in Australia Turned to 4IR Technologies to Drive Change

"Heritage Bank is a well-established financial institution with a commitment to providing high-quality services to its customers in Australia. Recognizing the need for innovation and efficiency in the financial sector, Heritage Bank turned to 4IR technologies to drive change.

Financial Crime Reporting: Heritage's journey into the realm of artificial intelligence (AI) commenced with a focus on Robotic Process Automation (RPA) in the context of financial crime reporting.

1. Manual Data Retrieval Challenge: The financial crimes team at Heritage often collaborated with law enforcement agencies to generate transaction records and other data. However, manually extracting data from core banking systems, CRM systems, and other applications was time-consuming and prone to errors.

2. Introducing RPA: Heritage Bank turned to RPA, to tackle this challenge. They developed a bot capable of interpreting input instructions, such as time, date, location, and transaction type, and autonomously extracting data from various systems to compile police reports. This automation saved significant labour hours.

Living Expense Reports: A Complex Challenge

The success of the financial crimes RPA use case led to another challenge in the area of living expense report management for loans.

1. Manual Data Compilation: Financial institutions faced increasing regulatory pressure to thoroughly investigate living expenses when assessing loans. Similar to their previous challenge, this process involved labor-intensive data extraction from multiple sources.

2. Initial Automation Efforts: Heritage Bank initially employed automated rules to identify keywords and classify specific transactions. However, this method could only classify around 40 to 50 percent of transactions, leaving a substantial manual workload.

3. Transition to Machine Learning: To address this, Heritage embarked on a machine learning challenge. They sought a solution to classify transactions on a larger scale than before. UiPath's AI Center platform played a pivotal role in introducing AI into the organization.

Overcoming Common Roadblocks

Heritage Bank faced and overcame several roadblocks during its automation journey:

1. Contention for Capital: Like many organizations, Heritage had to balance technology investments with the need to grow its capital base. Automation was seen as a cost-effective way to achieve efficiency.

2. Finding Top Talent: Acquiring skilled data scientists and engineers posed a challenge due to the global skills shortage in data science, automation, and AI. Heritage recognized the importance of nurturing in-house talent.

3. Organizational Structure: Heritage's unique organizational structure, with data science and automation teams reporting to the CFO, facilitated collaboration between teams, a challenge often encountered by other organizations.

By successfully automating complex processes and overcoming common roadblocks, Heritage Bank exemplifies the transformative power of 4IR technologies. This case study serves as an inspiration for organizations seeking to harness the potential of automation and AI to drive efficiency, innovation, and growth."

Source: *https://www.uipath.com/resources/automation-case-studies/heritage-bank-banking-rpa*

Box-5: HSBC Bank

"HSBC is a British multinational banking and financial services company, renowned for its global reach and vast customer base. With 130 branches and over 40 million customers, HSBC ranks among the world's largest banks, boasting total assets exceeding $2.9 trillion and an impressive 2021 revenue of approximately $49.52 billion.

Use Case #1: Enhancing the Personalized Customer Experience
In an era of fierce competition in the banking industry, personalization has emerged as a key driver of customer satisfaction and retention. HSBC recognized the potential of AI-based solutions to elevate customer experiences and improve relationships.

1. Behavioral Analysis with AI: HSBC invested in AI and analytics to gain deep insights into the spending and savings patterns of its retail and personal banking customers. By analyzing transactional data generated through banking operations, HSBC applied AI and machine learning algorithms to understand customer behavioral patterns.

2. Personalized Insights and Services: The bank aimed to provide personalized insights to customers, such as wealth portfolio views, highlights on gains and losses, and customized insurance recommendations based on factors like net assets, family size, and cash flow. For instance, HSBC could suggest increasing insurance coverage when the customer's financial position warranted it, enabling cross-selling opportunities.

3. Digital Budgeting Tool: HSBC launched a digital budgeting tool within its mobile application, leveraging big data and AI to categorize and analyze spending patterns. This tool allowed customers to automatically track expenses across HSBC accounts and credit cards, categorize daily expenses into 18 categories, and compare spending patterns over the past year.

4. Partnership with Personetics: HSBC collaborated with Personetics, a data company, to implement these customer-centric initiatives. Personetics' Enrich platform played a crucial role in making sense of transactional data, offering identifiable information like transaction descriptions, merchant logos, location data, and subscription information.
The results of these initiatives are yet to be fully disclosed, but HSBC noted that 98 percent of service transactions were made digitally after the fifth wave of the pandemic, with one in two customers banking through the mobile application.

Use Case #2: Accelerating Complex Analytics with Unified Data Platform
HSBC sought to innovate its payment processes and leverage data and machine learning. However, the challenge lay in modernizing legacy systems and enhancing data processing capabilities.

1. Legacy System Challenges: HSBC faced obstacles in processing and analyzing data at scale, with legacy systems requiring manual approval forms for data requests. Moreover, data scientists operated in isolated silos, limiting collaboration and data exploration.

2. Unified Data Analytics Platform: To overcome these challenges, HSBC adopted a unified data analytics platform and transitioned from multiple databases to a single Delta Lake. Azure Databricks, in combination with Delta Lake, enabled the secure provision of anonymized production data to data science teams in real-time, centralizing the analytics process.

3. Accelerated Data Processing: Azure Databricks provided the infrastructure needed for faster data pipelines, reducing data processing time from six hours to a mere six seconds. The migration from 14 databases to a unified data store streamlined data management.

4. Machine Learning with Databricks: HSBC deployed predictive data models with the help of Databricks machine learning, which offers automated model training using AutoML. This allowed HSBC to generate machine learning models from data efficiently, accelerating their path to production.

HSBC's commitment to embracing the Fourth Industrial Revolution is evident in its strategic adoption of AI and machine learning. By enhancing the personalized customer experience and accelerating complex analytics, HSBC is positioning itself as a modern, customer-centric financial institution. While specific business results are pending, the bank's initiatives demonstrate the transformative power of 4IR technologies in the banking sector. HSBC's journey serves as an inspiring example for organizations seeking to leverage technology for efficiency and innovation."

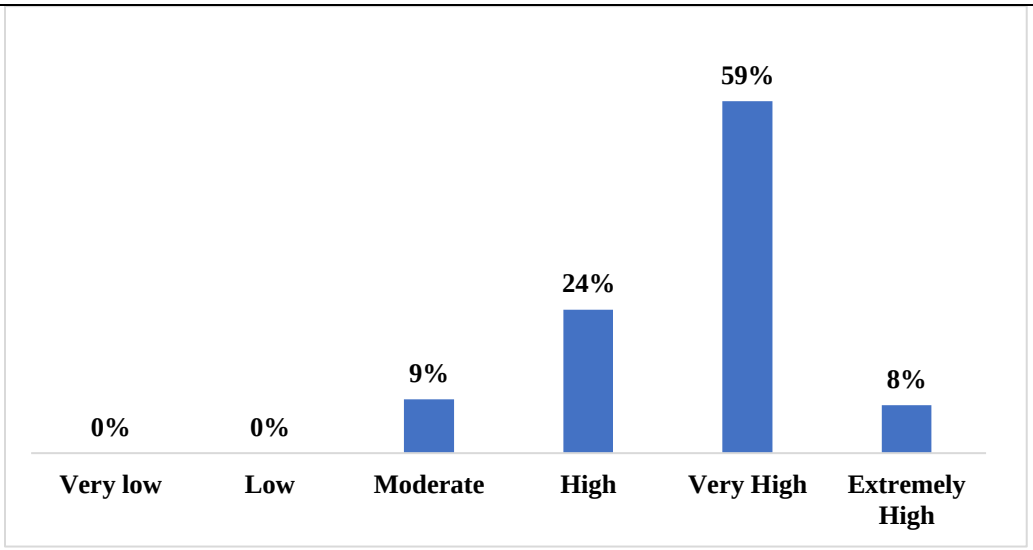
Source: *https://www.business.hsbc.com/isb/industry-4-0-a-treasury-revolution*

4.0 Data Analysis and Findings

4.1 Impact of Technological Advancement in the Banking Service

The IT team has to stay on top of the technological advancements happening around the globe to give the best possible user experience. The figure shows that the respondents, basically the HoITs and the IT teams all feel that there will be at least moderate level of technological advancement affecting the financial services in the near future. The survey found that approximately 91% of these respondents feel that there will be high to extremely high level of technological advancement affecting the financial services in near future (Figure-2).

Figure-2: Impact of Technological Advancement in the Banking Service

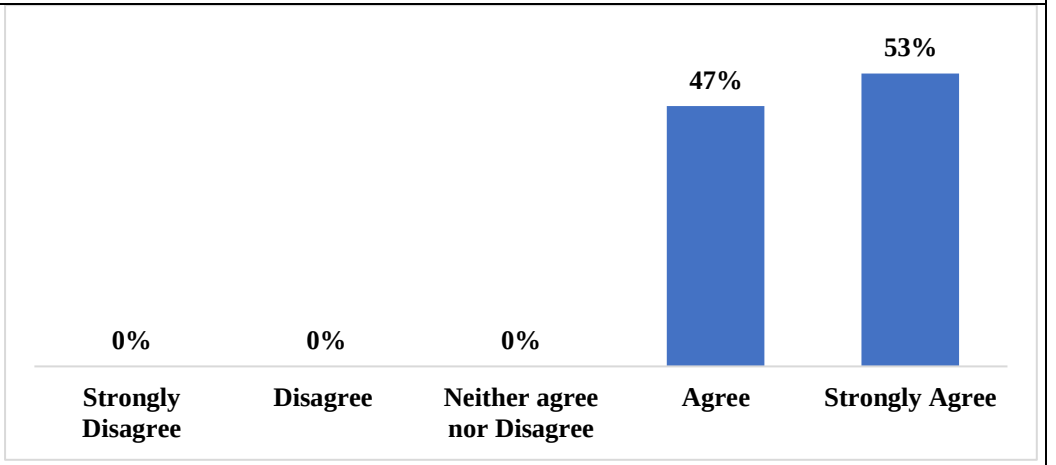


Source: *BIBM Survey*
Survey Question: *Level of technological advancement affecting the Banking services in near future.*

4.2 Familiar with the concept of the 4IR and Impact of 4IR in Financial Service Landscape

With the 4th Industrial Revolution near the horizon, the HoITs in the banks were asked about their familiarity with the concept. All the respondents said that they are indeed familiar with the concept of the 4th Industrial Revolution. 100% of the respondents agreed that the 4 th Industrial Revolution will change the financial services landscape soon with 53% of them strongly agreeing to the idea (Figure-3).

Figure-3: Impact of 4IR in Financial Service Landscape

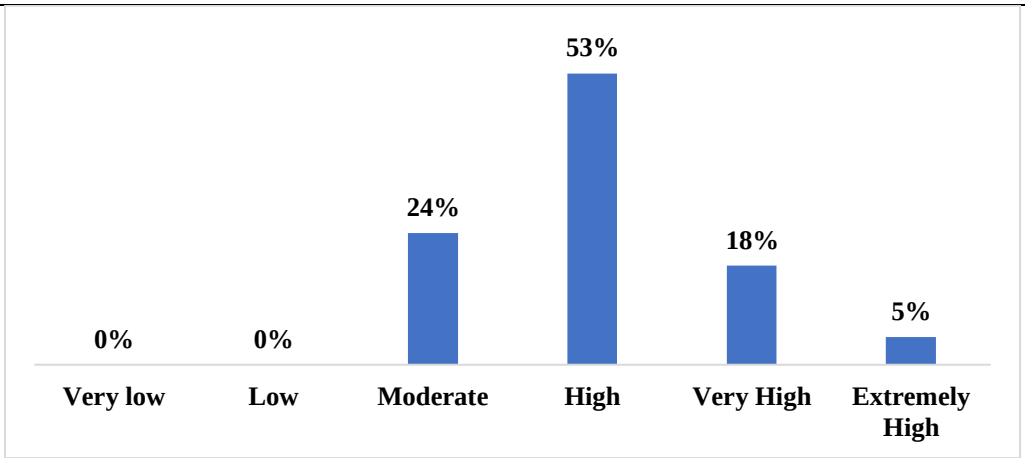


Source: *BIBM Survey*
Survey Question: *4th Industrial Revolution will change the financial services landscape soon.*

4.3 Awareness Level about the Technological Changes in 4IR

The HoITs/CTOs were asked regarding their level of awareness about the technological changes in the 4 th industrial revolution. All of the respondents claimed that they are at least moderately aware of the changes with the majority of 53% respondents claiming they are highly aware of the changes (Figure-4).

Figure-4: Awareness Level about the Technological Changes in 4IR

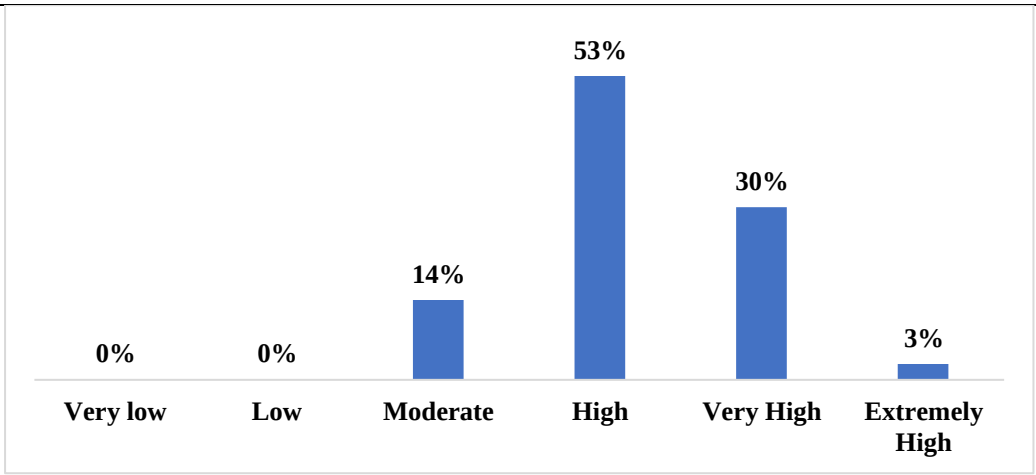


Source: *BIBM Survey*
Survey Question: *Your level of awareness about the technological changes in 4IR*

4.4 Impact of 4IR Technologies on the Banking System of Bangladesh

The HoITs/CTOs were asked about how they perceive the impact of 4IR technologies would be specifically in the banking system of Bangladesh. All of the respondents agreed that there will atleast be moderate impact of 4IR technologies in the banking system of Bangladesh with approximately 87% of them believing there will be high to extremely high impact (Figure-5).

Figure-5: Impact of 4IR Technologies in the Banking System of Bangladesh

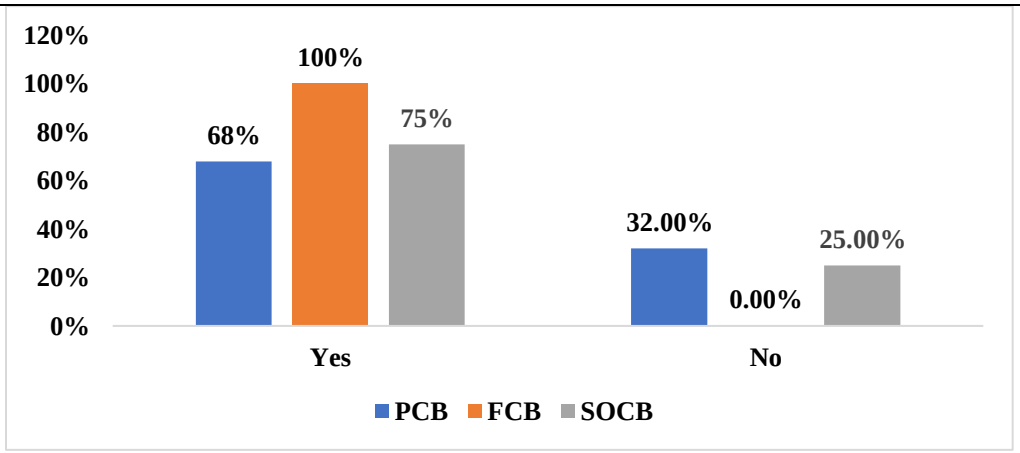


Source: *BIBM Survey*
Survey Question: *Impact of 4IR technologies in the banking system of Bangladesh.*

4.5 Strategy to Face 4IR

In terms of having strategy to face 4IR, all the foreign commercial banks claimed that they had strategies in place while 68% and 75% of private commercial banks and state-owned commercial banks respectively claimed that they have strategies in place (Figure-6).

Figure-6: Strategy to Face 4IR

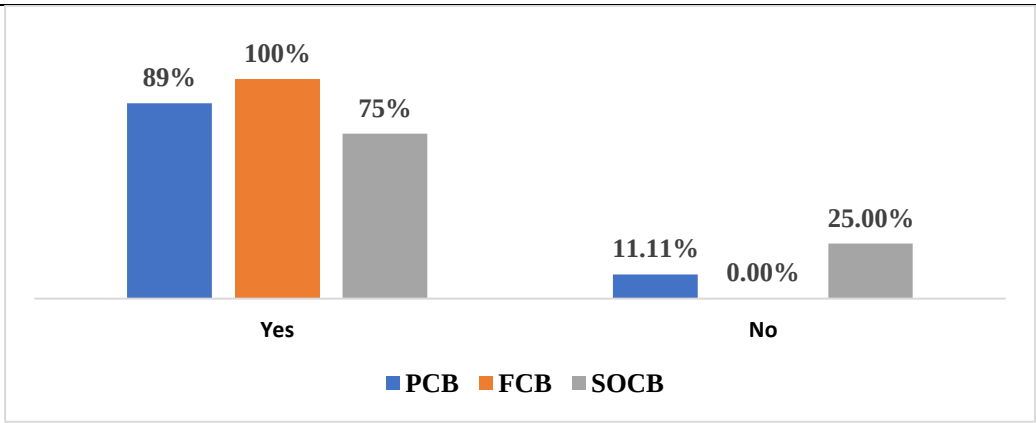


Source: *BIBM Survey*
Survey Question: *Does the bank have any strategy to face 4IR?*

4.6 Smart Bank Initiatives

In terms of taking initiative regarding smart banks, all the respondents from foreign commercial banks claimed that they have indeed taken initiatives. On the other hand, 89 percent of respondents representing private commercial banks and 75 percent respondents from State Own Commercial Banks claimed they had taken initiatives (Figure-7).

Figure-7: Initiative Regarding Smart Bank



Source: *BIBM Survey*
Survey Question: *Have you taken any initiative regarding smart Bank?*

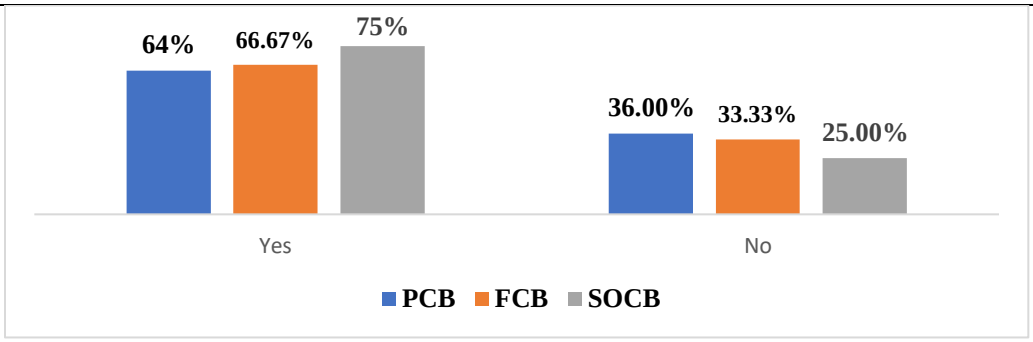
The following table-1 shows some initiatives regarding smart bank establishment in Bangladesh.

Table-1: Smart Bank Initiatives by Banks
• Super app development • Digital loan for retail and SME customers • eKYC • ChatBOT for addressing HR query • Paperless memo approval system • Digital loan application app • Online account opening app • Payment solutions for corporate client • Web portal for TD/DPS opening • 3D Secure Systems for Cards • Trade cloud solution • ATM reconciliation process • TSD RPA (For TSD dept, checks IRC and ERC approval) • Remittance RPA (Remittance process automation from Moneygram, Western Union, RIA) • Auditrail RPA (Update customer's static phone and Email changed information) • Islamic DPS Nominee verify RPA (Nominee verification for Islamic DPS) • Data Translation RPA • Nano loan data verification and translation RPA • A- Challan RPA (A challan Report verification and Upload RPA)
Source: *BIBM Survey*

4.7 Initiative Regarding 4IR Implementation

When asked if they have already taken initiative regarding 4IR implementation, state owned commercial banks were on top with 75 percent respondents claiming they already had taken initiatives. State-owned commercial banks were followed by foreign commercial banks and private commercial banks where 66.67 percent and 64 percent of the respondents respectively claimed they had already taken initiatives (Figure-8).

Figure-8: Initiative Regarding 4IR Implementation

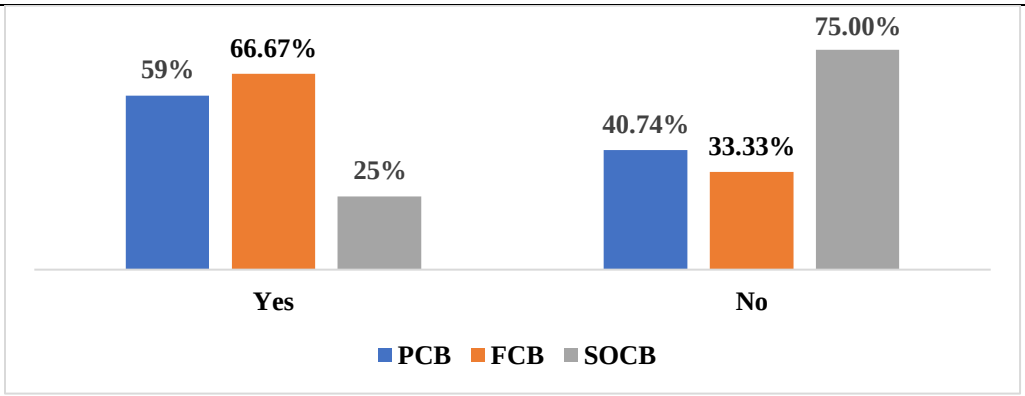


Source: *BIBM Survey*
Survey Question: *Have you taken any initiative regarding 4IR implementation?*

4.8 Projects Regarding 4IR as Advised by BB

Bangladesh bank has advised banks on implementing projects regarding 4IR. According to the respondents, foreign commercial banks were leading in terms of implementing such projects with 66.67 percent of them having Bangladesh bank advised projects followed closely by 59 percent of private commercial banks (Figure-9).

Figure-9: Project Regarding 4IR as Advised by BB



Source: *BIBM Survey*
Survey Question: *Do you have any project regarding 4IR as advised by BB?*

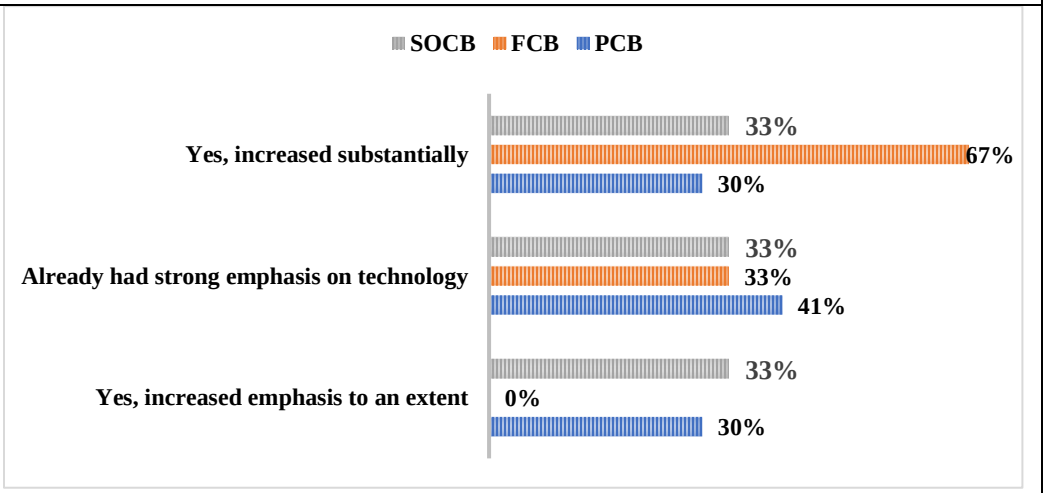
The following table-2 shows some projects which are taken by banks to address 4IR.

Table-2: 4IR Related Projects in Banks
• Cloud Computing • Big data analytics-based lending • Robotics Process Automation (RPA) • Blockchain based remittance solution • Artificial Intelligence (AI) • Digital Banking App • EKYC • Chatbot • Contactless Payment • Biometric • Remittance Automation, • Self-service DPS, LOAN, FDR information update portal • Instant account opening • CIB Analyzer • LC Automation • AML Automation using AI/ML • SCF (Supply Chain Financing) Project using AI/ML • MSME Digital Loan Platform using AI/ML • Collection Module using AI/ML • Anti-theft alarm system • Bangla QR • Digital Loan • Digital Customer Onboarding • Cyber security Threat Intelligence
Source: *BIBM Survey*

4.9 Changed its Emphasis on Technology Over the Last 2 years

With the advent of new technology, banks globally are now putting larger emphasis on technology. In our survey, 67 percent respondents from foreign commercial banks claimed that they have substantially increased their emphasis on technology over the last 2 years, while the rest claimed they had a strong emphasis on technology even before. There were equal number of respondents from state owned commercial banks claiming for the three options. On the other hand, for private commercial banks, 41 percent of respondents claimed they already had strong emphasis while the rest 60 percent were equally divided on that they had substantially increased emphasis and increased emphasis to an extent (Figure-10).

Figure-10: Changed its Emphasis on Technology Over the Last 2 years



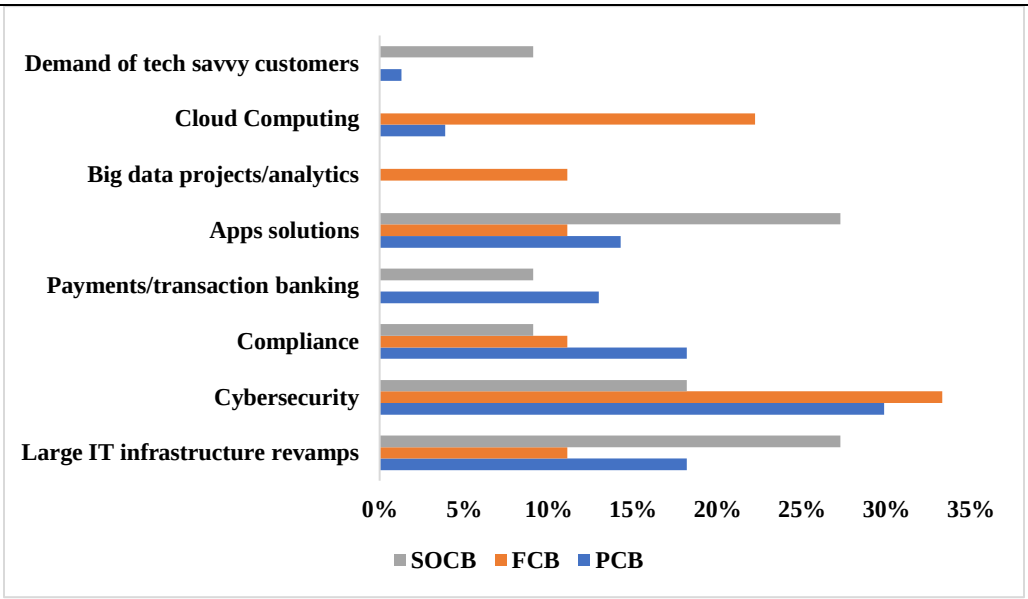
***Source**: BIBM Survey*

***Survey Question:** Has the bank changed its emphasis on technology over the last 2 years?*

4.10 Priority areas for IT spending in the bank

In terms of priority areas for IT spending, the areas most picked by foreign commercial banks were cybersecurity followed by cloud computing. In case of state-owned commercial banks, the two areas with the most frequency were large IT infrastructure and apps solution followed by cybersecurity. In case of private commercial banks, the most picked area was cybersecurity followed by large IT infrastructure and compliance (Figure-11).

Figure-11: Priority areas for IT spending in the Bank

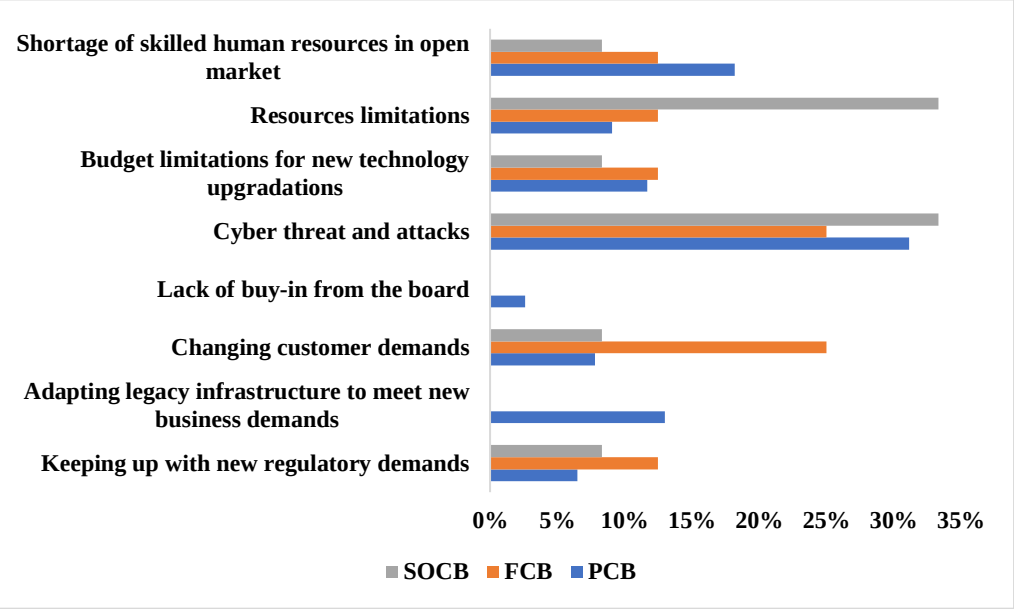


Source: *BIBM Survey*
Survey Question: *What are the priority areas for IT spending in the bank? (Select up to three)*

4.11 Biggest Technological Challenges that the Banks are Facing Now

When asked about the biggest technological challenges the banks are facing now, respondents representing private commercial banks picked cyber threats and attacks the most followed by a shortage of skilled human resources. In case of state-owned commercial banks, respondents the frequency of picking resource limitation and cyberthreats were the largest and almost equal. In case of foreign commercial banks, the respondents picked cyberthreats and attacks and changing customer demands the most (Figure-12).

Figure-12: Biggest Technological Challenges that the Banks are Facing Now



Source: *BIBM Survey*

Survey Question: *What are the biggest technological challenges that the banks are facing now? (Select up to three)*

4.12 4IR Technologies Adoption Status in Banks

For AI, in case of state-owned commercial banks, respondents claimed that 50 percent of them have adopted it. 25 percent of them claimed that the bank has no plan to adopt it while the other 25 percent claimed that the bank is not ready to adopt AI. In case of foreign commercial banks, 67 percent of the respondents claimed that they already have adopted AI while the other 33 percent are in the planning phase. Lastly for private commercial banks, 37 percent claimed that they had adopted AI, 45 percent were in the planning phase while the rest claimed that they had no plan to adopt or the bank was not ready to adopt [Figure 13(a)]

Figure-13 (a): Artificial Intelligence

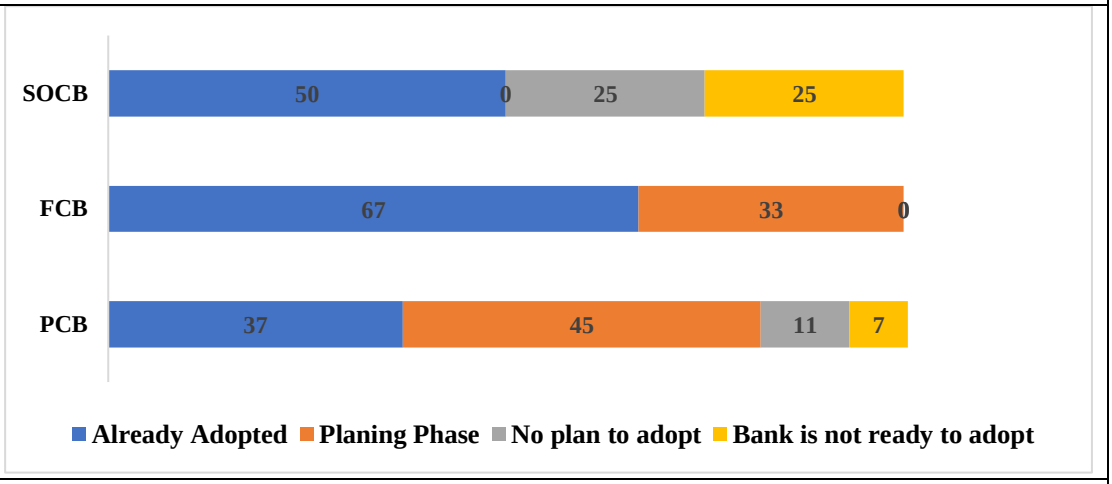
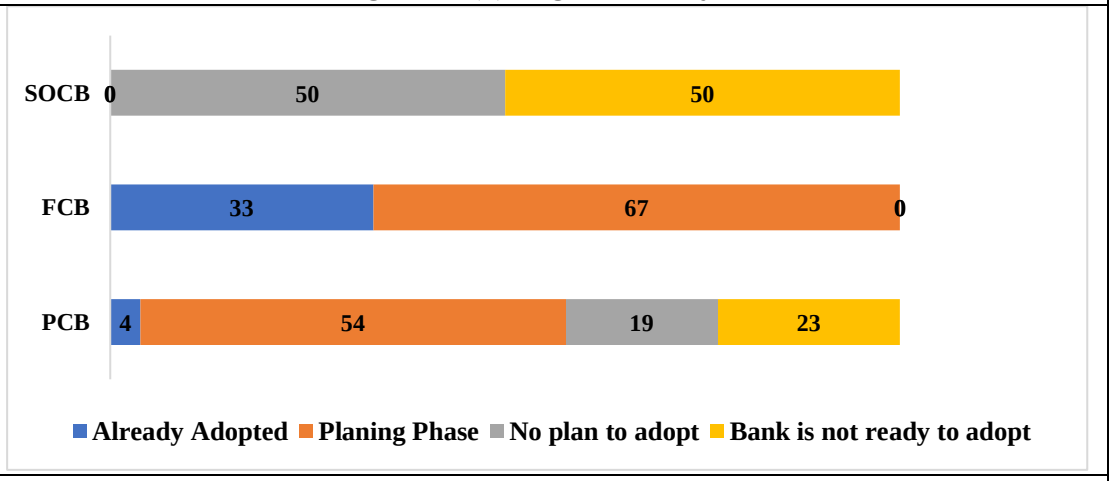


Figure-13 (b): Big Data Analytics



Source: *BIBM Survey*
Survey Question: *Please put Tick mark in the following table where applicable.*

For big data analytics, in case of state-owned commercial banks, respondents claimed that none of them have adopted or plan to adopt it. 50 percent of them claimed that the bank has no plan to adopt it while the other 50 percent claimed that the bank is not ready to adopt big data analytics. In case of foreign commercial banks, 33 percent of the respondents claimed that they already have adopted big data analytics while the other 67 percent are in the planning phase. Lastly for private commercial banks, 4 percent claimed that they had adopted big data analytics, 54 percent were in the planning phase while the rest claimed that they had no plan to adopt or the bank was not ready to adopt [Figgure 13(b)]

For cloud computing, in case of state-owned commercial banks, respondents claimed that 50% of them have adopted and 25 percent plan to adopt it. The other 25 percent claimed that the bank is not ready to adopt cloud computing. In case of foreign commercial banks, 67 percent of the respondents claimed that they already have adopted cloud computing while the other 33 percent are in the planning phase. Lastly for private commercial banks, 37 percent claimed that they had adopted cloud computing, 56 percent were on the planning phase while the rest claimed that they had no plan to adopt or the bank was not ready to adopt [Figure13(c)].

Figure-13 (c): Cloud Computing

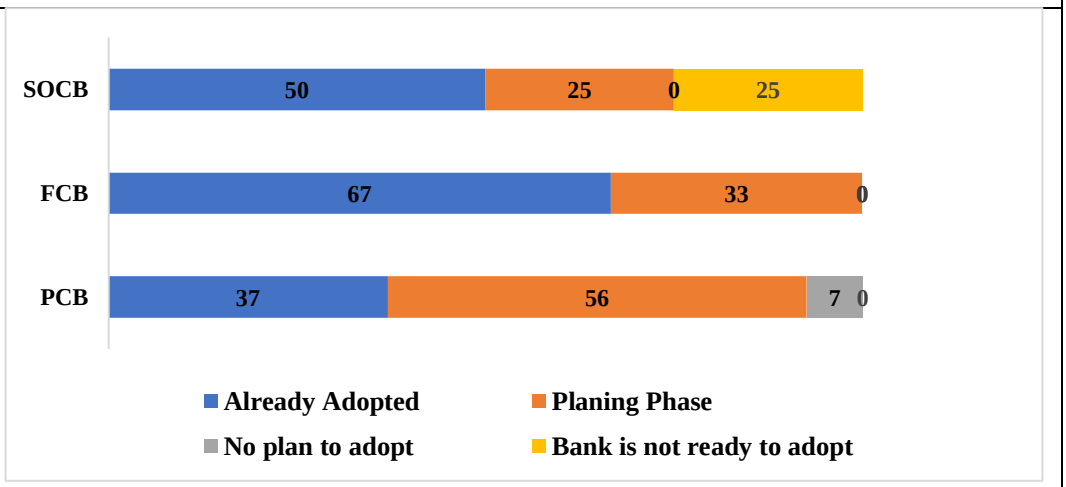
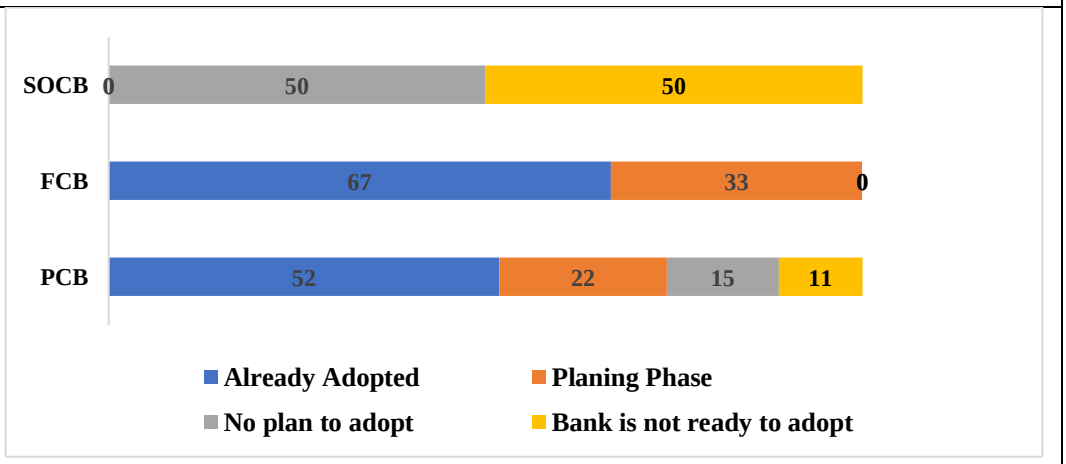


Figure 13 (d): Robotic Process Automation



Source: *BIBM Survey*
Survey Question: *Please put Tick mark in the following table where applicable.*

For RPA, in case of state-owned commercial banks, respondents claimed that none of them have adopted or plan to adopt it. 50 percent of them claimed that the bank has no plan to adopt it while the other 50 percent claimed that the bank is not ready to adopt RPA. In case of foreign commercial banks, 67 percent of the respondents claimed that they already have adopted RPA while the other 33 percent are in the planning phase. Lastly for private commercial banks, 52 percent claimed that they had adopted RPA, 22 percent were on the planning phase while the rest claimed that they had no plan to adopt or the bank was not ready to adopt [Figure13(d)].

Figure-13 (e): Blockchain Technology

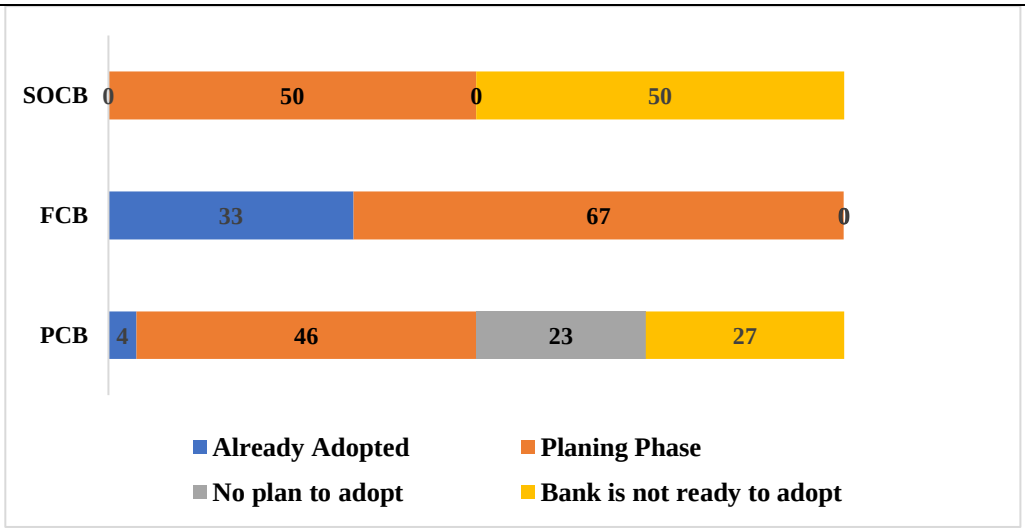


Figure-13 (f): AR and VR

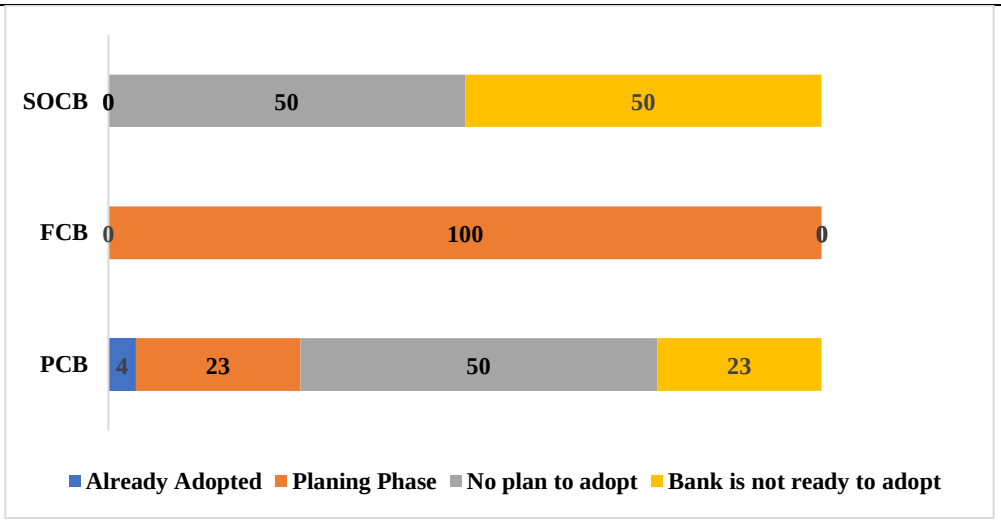
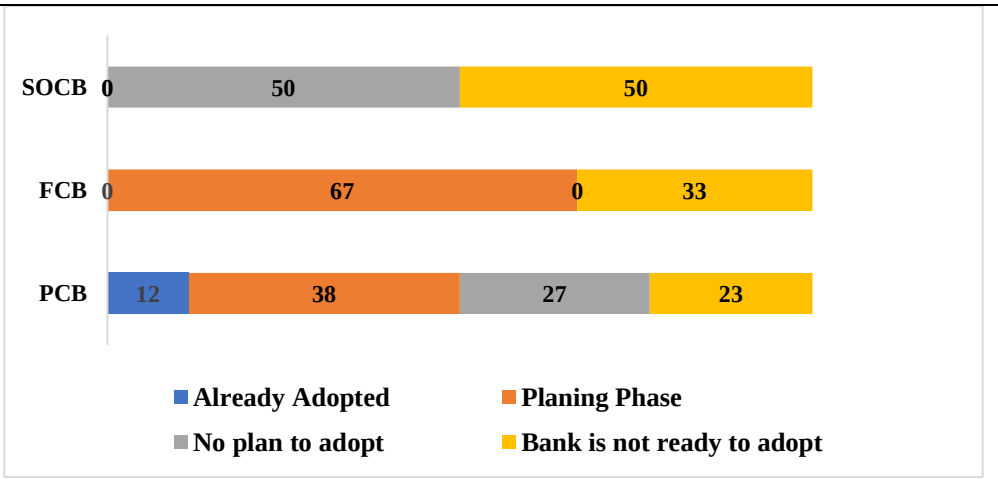


Figure-13 (g): Internet of Things (IoT)



Source: *BIBM Survey*
Survey Question: *Please put Tick mark in the following table where applicable.*

For blockchain, in case of state-owned commercial banks, 50 percent respondents claimed that they plan to adopt it while 50 percent of them claimed that the bank is not ready to adopt blockchain. In case of foreign commercial banks, 33 percent of the respondents claimed that they already have adopted blockchain while the other 67 percent are in the planning phase. Lastly for private commercial banks, 4% claimed that they had adopted blockchain, 46 percent were in the planning phase while the rest claimed that they had no plan to adopt or the bank was not ready to adopt [Figure 13(e)].

For IoT, in case of state-owned commercial banks, respondents claimed that none of them have adopted or plan to adopt it. 50 percent of them claimed that the bank has no plan to adopt it while the other 50% claimed that the bank is not ready to adopt IoT. In case of foreign commercial banks, 33% of the respondents claimed that they were not ready to implement IoT while the other 67 percent are in the planning phase. Lastly for private commercial banks, 12 percent claimed that they had IoT, 38 percent were in the planning phase while the rest claimed that they had no plan to adopt or the bank was not ready to adopt [Figure 13(f)].

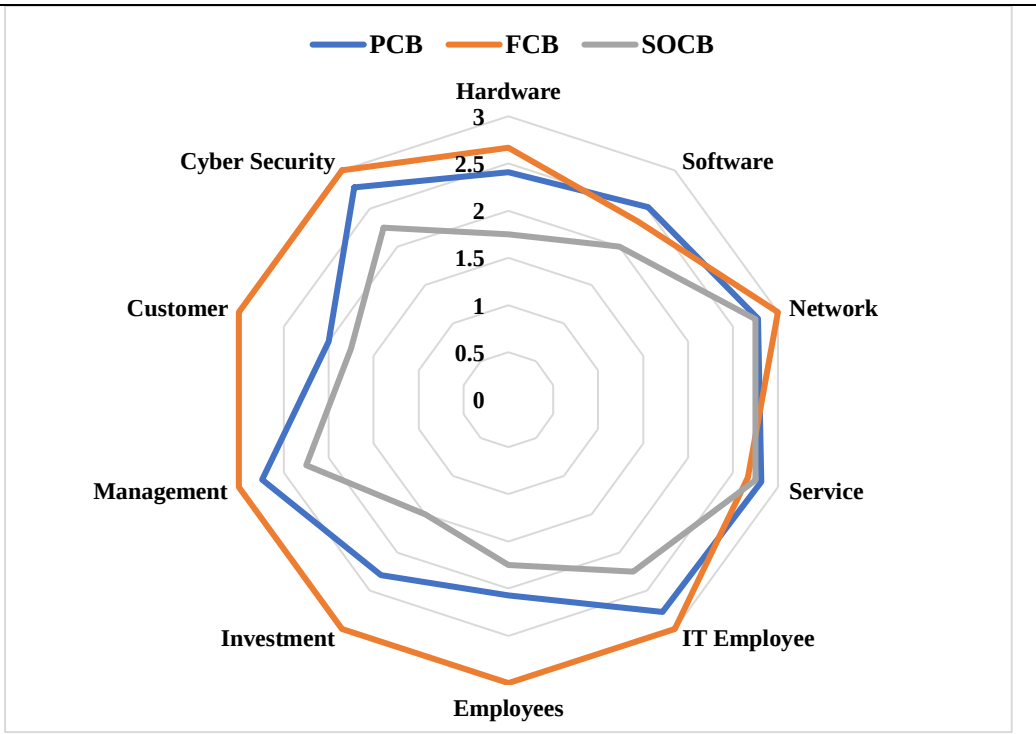
For AR/VR, in case of state-owned commercial banks, respondents claimed that none of them have adopted or plan to adopt it. 50 percent of them claimed that the bank has no plan to adopt it while the other 50 percent claimed that the bank is not

ready to adopt AR/VR. In case of foreign commercial banks, 100 percent of the respondents claimed that they are in the planning phase. Lastly for private commercial banks, 4 percent claimed that they had adopted AR/VR, 23 percent were in the planning phase while the rest claimed that they had no plan to adopt or the bank was not ready to adopt [Figure 13(g)].

4.13 Preparedness Level to Address 4IR Technologies

The graph shows the level of preparedness claimed by respondents to address different 4IR technologies of their respective banks. Respondents from private commercial banks and foreign commercial banks claimed that on an average their level of preparedness was between 2 to 3 on the scale of 5 to all the parameters. On the contrary for state owned commercial banks the level of preparedness was below 2 for hardware, customer, investment and employees, while the rest were above 2 but below 3 (Figure-14).

Figure- 14: Preparedness level to Address 4IR Technologies



Source: *BIBM Survey*
Survey Question: *Please assess the preparedness level to address 4IR technologies of your banks on the different parameters.*
Scale: *Very Low=0, Low=1, Moderate=2, High=3, Very High=4, Extramly High=5*

4.14 Opportunities and Challenges of 4IR in the Banking Sector of Bangladesh:

The following table-3 shows some opportunities of 4IR for the banking sector of Bangladesh. These opportunities reflect the potential for the banking sector in Bangladesh to leverage technology and innovation to enhance customer experiences, manage risks more effectively, and remain competitive in the evolving financial landscape. Embracing these opportunities can help banks thrive in the 4th Industrial Revolution.

Table-3: Opportunities of 4IR in Banks of Bangladesh

Serial no.	Opportunities	% of Banks
1.	**Fraud detection and monitoring** Banks can leverage advanced technologies, such as AI and machine learning, to enhance their capabilities in detecting and monitoring fraudulent activities, thereby increasing the security of financial transactions.	58
2.	**Better risk management** Advanced data analytics and AI can enable banks to improve their risk assessment and management practices, reducing exposure to financial risks.	87
3.	**Enhanced customer experience** The use of technology can lead to personalized and convenient services for customers, enhancing their overall banking experience.	76
4.	**Enhanced cyber security and data protection** Advanced cybersecurity solutions can help banks protect sensitive customer data and maintain the integrity of their digital platforms.	40
5.	**Digital payments and financial inclusion** Digital payment solutions and inclusive banking services can bring unbanked populations into the financial system and facilitate seamless digital transactions.	96
6.	**FinTech innovation** Collaboration with fintech companies can drive innovation in the financial industry, potentially leading to new products and services.	23
7.	**Increased innovation and competitiveness** Embracing 4th Industrial Revolution technologies can make banks more innovative and competitive in the financial services sector.	53
8.	**Real-time monitoring and market accessibility** Advanced analytics and technology allow banks to monitor markets in real-time, enabling quicker responses to changing conditions and opportunities.	48

9.	**Better service quality** By leveraging technology, banks can improve the quality and efficiency of their services, leading to higher customer satisfaction.	57
10.	**Data-Driven decision making** Banks can harness data analytics to make informed decisions, enhancing their strategic planning and operational efficiency.	27
11.	**Cost optimization** The adoption of 4IR technologies can lead to cost savings through improved operational efficiency and automation.	40
12.	**Operational efficiency** Enhanced automation and streamlined processes can lead to greater operational efficiency within banks.	30
13.	**Better collaboration** Technology can facilitate collaboration with partners, fintech firms, and other institutions, leading to new opportunities and synergies.	30

Source: *BIBM Survey*

Challenges of 4IR in Banks

These challenges underscore the complex landscape that the banking sector in Bangladesh faces in adapting to the 4th Industrial Revolution. Addressing these challenges will require a multi-faceted approach, including financial investment, regulatory compliance, talent development, and a focus on ethics and customer trust (Table-4).

Table-4: Challenges of 4IR in Banks of Bangladesh

Serial no.	Challenges	% of Banks
1.	**Budget constraints** Many banks in Bangladesh may face financial constraints, making it difficult to allocate sufficient funds for the adoption of 4th Industrial Revolution technologies and initiatives.	32
2.	**Legacy systems** Legacy systems refer to outdated or traditional technology platforms that can hinder the adoption of new, more advanced technologies. Banks in Bangladesh may be struggling to upgrade or replace these systems.	64
3.	**Cyber security** With the increasing use of digital technologies, banks must protect customer data and financial transactions from cyber threats. The high percentage indicates the critical importance of cybersecurity in the banking sector.	98

4.	**Resources limitations** Banks may have limited access to resources, which can include both financial and human resources, making it challenging to implement 4IR initiatives effectively.	18
5.	**Lack of skilled manpower** The banking sector may face a shortage of skilled professionals who are knowledgeable about emerging technologies and capable of driving digital transformation.	93
6.	**Inadequate training and development facilities** Banks may not have sufficient training and development programs in place to upskill their employees and prepare them for the 4th Industrial Revolution.	19
7.	**Regulatory compliance** Compliance with evolving regulations related to the use of technology and data in banking operations can be a significant challenge.	39
8.	**Digital infrastructure** The existing digital infrastructure may not be robust enough to support the adoption of advanced technologies required for the 4th Industrial Revolution.	46
9.	**Customer trust and education** Gaining and maintaining customer trust in the digital age is crucial. Banks may face challenges in educating customers about new digital services and ensuring their trust in online banking.	75
10.	**Market Competition** Intense competition in the banking sector can pressure banks to keep up with technological advancements to maintain their market share.	7
11.	**Ethical and societal concerns** As technology advances, ethical and societal concerns, such as data privacy and the responsible use of AI, become more prominent and challenging for banks to address.	18
12.	**Costs and return** The costs associated with implementing 4IR technologies and the expected return on investment may not align, making banks hesitant to invest.	21

Source: *BIBM Survey*

4.15 Role of Bangladesh Bank to Promote 4IR in the Banking Sector

The following table-5 shows the role of central bank for promoting 4IR in the banking sector of Bangladesh. The central bank's role in Bangladesh is pivotal in guiding, regulating, and facilitating the transition of the banking sector into the 4th Industrial Revolution, ensuring that it benefits both the industry and the country as a whole. These responsibilities help shape a stable and forward-looking financial landscape.

Table-5: Role of Bangladesh Bank to Promote 4IR in the Banking Sector of Bangladesh

Serial no.	Role of the Central Bank	% of Banks
1.	**Implementation of 4IR guidelines** The central bank plays a critical role in creating and implementing guidelines and regulations to govern the adoption of 4th Industrial Revolution technologies in the banking sector, ensuring a standardized and secure approach.	56
2.	**Research and Development** Encouraging and supporting research and development activities in the banking sector helps banks stay at the forefront of technological advancements, fostering innovation and competitiveness.	43
3.	**Promoting financial literacy** The central bank can promote financial literacy programs to educate both consumers and industry professionals about the benefits and risks of new financial technologies and services.	53
4.	**Facilitate training, seminars, and workshop** Organizing training sessions, seminars, and workshops helps banks and their employees acquire the necessary skills and knowledge to effectively implement 4IR technologies.	17
5.	**Promoting digital transformation** The central bank can advocate and encourage banks to undergo digital transformation, supporting the adoption of digital technologies throughout the industry.	73
6.	**International collaborations** Collaborations with international organizations, central banks, and financial institutions can help banks in Bangladesh gain insights, expertise, and access to global best practices in 4th Industrial Revolution technologies.	30
7.	**Ensuring regulatory compliance** The central bank is responsible for ensuring that banks adhere to regulatory requirements related to 4IR technologies, safeguarding the industry's stability and security.	31
8.	**Developing digital infrastructure** The central bank can invest in and promote the development of digital infrastructure, which is essential for the effective implementation of modern technologies in banking.	46
9.	**Develop and enforce cybersecurity standards** Establishing and enforcing cybersecurity standards helps banks protect customer data and maintain the integrity of their digital platforms.	37
10.	**Promoting financial inclusion** Encouraging and monitoring initiatives that promote financial inclusion is crucial for ensuring that the benefits of 4IR technologies reach all segments of the population.	79

Source: *BIBM Survey*

5.0 Recommendations and Conclusion

One, Developing and Implementing 4IR Strategies

The study reveals that 32 percent of PCBs and 25 percent of SOCBs do not have any strategy regarding 4IR respectively. Without having appropriate strategy in action, it will be very difficult for banks to move forward in the upcoming days.

Banks may develop a comprehensive digital strategy that aligns with the bank's business goals and customer needs. The strategy maybe short term, mid-term or long-term. The strategy must be approved by the competent authority and the the board must be aware of the strategy.

Two, Cybersecurity and Data Privacy

The study shows that FCBs and PCBs have high priority in the cyber security domain on the other hand SOCBs are prioritizing apps solution development. The study also depicts the preparedness level in Cyber Security of SOCBs is not up-to the mark. Cyber Security is the key concern in the upcoming days.

All categories of banks may take robust cybersecurity measures to safeguard customer data and financial transactions to survive in the era of 4IR. They may also stay compliant with evolving data privacy regulations such as GDPR, ISO 27001, PCI DSS and implement strong data protection practices. However, the banks may follow the latest version of ICT security guidelines issued by Bangladesh Bank to uphold their Cyber security preparedness.

Three, Preparing Workforce to Face Upcoming Challenges and Developing Agile Work Culture

The study explores that out of a five point scale of readiness parameters, where scale 5 shows extremely high preparedness and 0 reflects Very low preparedness. FCBs get 3 out of 5 which reflects a high level of preparedness in both IT executives and business executives. On the other hand, the scenario is not good in PCBs and SOCBs. In case of PCBs and SOCBs, IT executive gets the level below high but above moderate scale. The preparedness level of business employees is below moderate in SOCBs which may hamper the growth in 4IR movement of banks.

Banks may develop and cultivate a culture of agility and adaptability to respond to rapid technological changes. They may also encourage continuous learning and upskilling among employees to keep pace with evolving technologies. They may attract and retain top talent with expertise in emerging technologies.

***Four,* Focus on Cutting-Edge Technologies to Sustain in the Competitions**

The study shows the status of different types of cutting edge technologies orientation in banks of Bangladesh. It is seen that some banks have adopted AI, Cloud Computing, RPA, Big Data Analytics and Blockchain Technologies whereas some are planning and and some do not have any plan and rest believe that they are not ready to adopt. In the upcoming days, it will be very difficult to survive in the competition without adopting all these technologies.

Banks may focus on implementing AI-powered chatbots for customer support and automate routine tasks by implementing RPA to free up employees for more strategic activities. Transition to cloud-based infrastructure maybe helpful to enhance scalability and reduce operational costs. Implementing robust data protection measures and disaster recovery plans in the cloud environment which maybe a good decision for banks. Banks may plan on implementing and developing infrastructure for IoT, Big Data Analytics, and Augmented Reality (AR), Virtual Reality based solutions.

***Five,* Investing in 4IR Technologies and Fostering Innovation**

The study identifies that SOCBs are positioning below moderate level and PCBs are at moderate level in case of investing in 4IR technologies. To reach a level of preparedness, banks need to focus on investing in ICT infrastructure. Also it is important to foster innovation for future development.

Banks may keep a certain budget for new technology development and adoption. Also they may establish innovation labs or incubators to encourage employees to experiment with new technologies and ideas. In upcoming days, collaborations are the key to success. Banks may collaborate with fintech startups and technology partners to access emerging solutions and stay ahead of the curve.

***Six,* Developing Infrastructure to Adopt 4IR Technologies**

The study revels that Foreign Commercial Banks are having good position in case of strengthening ICT infrastructure which includes hardware, software, network etc. On the other hand, SOCBs are not adequately equipped with ICT infrastructure.

PCBs and SOCBs may focus on strengthening their ICT infrastructure to adopt 4IR technologies in near future.

***Seven*, Promoting Financial Inclusion**

Primary emphasis on advancing financial inclusion, the central bank is actively engaged in promoting the adoption of cutting-edge technologies and innovative financial services. This strategic approach aims to expand access to banking and financial services to a larger cross-section of the population.

The central bank may ensure the integration of digitalization into banking operations through regulatory frameworks and vigilant oversight. This includes the integration of mobile banking and online payment systems, which are essential in efficiently catering to the unbanked and underbanked demographics. Furthermore, the central bank actively nurtures the growth of fintech startups, thereby encouraging innovation and competition within the financial sector. This, in turn, results in a more extensive range of cost-effective financial products for the benefit of the population.

***Eight,* Initiatives from Government and Central Bank**

Bangladesh Government has taken numerous initiatives to promote 4IR in different sectors. National strategy for AI, National Blockchain Strategy are some of the key initiatives from the Government to promote 4IR in Bangladehs. The Central Bank of Bangladesh is also taking various steps to uphold the positions of banking sector in Bangladesh. Collaboration among the Government, Central Bank, financial institutions, and technology providers is a pivotal catalyst for the swift and successful adoption of 4th Industrial Revolution (4IR) technologies in the Bangladesh banking industry. Establishing these partnerships can expedite the integration process and provide essential support.

The Central Bank may publish a comprehensive guideline to promote 4IR in the banking sector of Bangladesh. They may promote digital transformation, facilitate various awareness programs among the banking community.Bangladesh Bank may offer tangible incentives and rewards to financial institutions that display proactive engagement in innovation and the adoption of 4IR technologies. These incentives may take various forms, such as tax benefits, reduced regulatory hurdles, or grants for research and development initiatives.

The world is moving towards a newer version of the industrial revolution. Some are talking about the 7th Industrial Revolution, although we are still thinking and planning about the 4th Industrial Revolution. Technological changes are inevitable; banks need proper strategy and skilled human resources to cope with the changes. If banks do not accept the changes, they will face severe difficulties in the coming days.

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Appendix 1: Questionnaire

4th Industrial Revolution (4IR) and Preparedness of the Banking Sector of Bangladesh

Respondent Information (HoIT/CTO/CIO)			
Name		Cell Phone No.	
Designation/ Rank			
Name of the Bank			
Bank Type	☐ State-owned 1 ☐ Specialized 2 ☐ Private 3 ☐ Foreign 4		

(Please don't change any formatting or numbering of the questionnaire. For questions demanding opinion you may add spaces by entering new lines only.)

1.	Level of technological advancement affecting the financial services in near future.					
	☐ Very Low0	☐ Low1	☐ Moderate2	☐ High3	☐ Very High4	☐ Extremely High5
2.	Are you familiar with the concept of the 4th Industrial Revolution?				☐ Yes1	☐ No0
3.	In your opinion, how would you define the 4th Industrial Revolution in the context of Bank?					
4.	4th Industrial Revolution will change the financial services landscape soon.					
	☐ Strongly Disagree0	☐ Disagree1	☐ Neither agree nor	☐ Agree 3	☐ Strongly Agree4	
5.	Your level of awareness about the technological changes in 4th IR					
	☐ Very Low0	☐ Low1	☐ Moderate2	☐ High3	☐ Very High4	☐ Extremely High5
6.	Impact of 4IR technologies in the banking system of Bangladesh.					
	☐ Very Low0	☐ Low1	☐ Moderate2	☐ High3	☐ Very High4	☐ Extremely High5

7.	Does the bank have any strategy to face 4IR?	☐ Yes$_1$	☐ No$_0$
8.	Have you taken any initiative regarding 4IR implementation?	☐ Yes$_1$	☐ No$_0$
9.	Have you taken any initiative regarding smart Bank?	☐ Yes$_1$	☐ No$_0$
10.	If Yes, please mention some initiatives:		
11.	Do you have any project regarding 4IR as advised by BB?	☐ Yes$_1$	☐ No$_0$
12.	If Yes, please mention the name of the projects.		
13.	Do you have any live 4IR system?	☐ Yes$_1$	☐ No$_0$
	If Yes, please mention the name of the projects:		

14.	Has the bank changed its emphasis on technology over the last 2 years?
	☐ We have reduced emphasis$_1$ ☐ Yes, increased emphasis to an extent$_2$ ☐ Already had strong emphasis on technology$_3$ ☐ No change$_4$ ☐ Yes, increased substantially$_5$ ☐ Others (Please specify)$_6$
15.	What are the priority areas for IT spending in the bank? **(Select up to three)**
	☐ Large IT infrastructure revamps$_1$ ☐ Cybersecurity$_2$ ☐ Compliance$_3$ ☐ Payments/transaction banking$_4$ ☐ Apps solutions$_5$ ☐ Big data projects/analytics$_6$ ☐ Cloud computing$_7$ ☐ Demand of tech savvy customers$_8$ ☐ Others (Please specify)$_9$

16	What are the biggest technological challenges that the banks are facing now? **(Select up to three)**
	☐ Keeping up with new regulatory demands$_1$ ☐ Adapting legacy infrastructure to meet new business demands$_2$ ☐ Changing customer demands$_3$ ☐ Lack of buy-in from the board$_4$ ☐ Cyber threat and attacks$_5$ ☐ Budget limitations for new technology upgradation$_6$ ☐ Resources limitations$_7$ ☐ Shortage of skilled human resources in open market$_8$ ☐ Others (please specify)$_9$

17. **Please put Tick mark in the following table where applicable?**

SL. No	Technologies	Already Adopted	Planning Phase	No plan to adopt	Bank is not ready to adopt	Name of the solutions if already adopted
a.	Artificial Intelligence					
b.	Cloud Computing					
c.	Robotic Process Automation (RPA)					
d.	Big Data Analytics					
e.	Blockchain					
f.	IoT					
g.	Augmented Reality / Virtual Reality					

18. **Please Assess the Preparedness Level to Address 4IR Technologies of your Banks on the following Parameters.**

SL. No	Parameters	Scale					
a.	Hardware	☐ Very Low$_0$	☐ Low$_1$	☐ Moderate$_2$	☐ High$_3$	☐ Very High$_4$	☐ Extremely High$_5$
b.	Software	☐ Very Low$_0$	☐ Low$_1$	☐ Moderate$_2$	☐ High$_3$	☐ Very High$_4$	☐ Extremely High$_5$
c.	Network	☐ Very Low$_0$	☐ Low$_1$	☐ Moderate$_2$	☐ High$_3$	☐ Very High$_4$	☐ Extremely High$_5$
d.	Service Digitalization	☐ Very Low$_0$	☐ Low$_1$	☐ Moderate$_2$	☐ High$_3$	☐ Very High$_4$	☐ Extremely High$_5$
e.	IT Employee	☐ Very Low$_0$	☐ Low$_1$	☐ Moderate$_2$	☐ High$_3$	☐ Very High$_4$	☐ Extremely High$_5$
f.	Employees	☐ Very Low$_0$	☐ Low$_1$	☐ Moderate$_2$	☐ High$_3$	☐ Very High$_4$	☐ Extremely High$_5$
g.	Investment	☐ Very Low$_0$	☐ Low$_1$	☐ Moderate$_2$	☐ High$_3$	☐ Very High$_4$	☐ Extremely High$_5$
h.	Management	☐ Very Low$_0$	☐ Low$_1$	☐ Moderate$_2$	☐ High$_3$	☐ Very High$_4$	☐ Extremely High$_5$
i.	Customer	☐ Very Low$_0$	☐ Low$_1$	☐ Moderate$_2$	☐ High$_3$	☐ Very High$_4$	☐ Extremely High$_5$
j.	Cyber Security	☐ Very Low$_0$	☐ Low$_1$	☐ Moderate$_2$	☐ High$_3$	☐ Very High$_4$	☐ Extremely High$_5$
k.	Others (If any)	☐ Very Low$_0$	☐ Low$_1$	☐ Moderate$_2$	☐ High$_3$	☐ Very High$_4$	☐ Extremely High$_5$

19.	How may workshop did you arrange as advised by BB?	
20.	How many 4IR projects are under implementation phase?	

21.	What are the major challenges to adopt 4IR technologies in banks?
22.	What are the opportunities of bank regarding the use of 4IR technologies?
23.	What roles can be played by the Central Bank to promote 4IR in Bangladesh?
24.	Please give your opinion on how can bank prepare for the upcoming challenges of 4IR?

Appendix 2: List of Respondent Banks

SL No.	Bank Name
1	AB Bank Limited
2	Agrani Bank PLC
3	Al-Arafah Islami Bank Limited
4	BASIC Bank Limited
5	Bengal Commercial Bank Limited
6	BRAC Bank Limited
7	Citizens Bank PLC
8	Commercial Bank of Ceylon PLC
9	Dhaka Bank Limited
10	Eastern Bank PLC
11	EXIM Bank Limited
12	First Security Islamic Bank Limited
13	HSBC Bangladesh
14	IFIC Bank PLC
15	Islami Bank Bangladesh PLC
16	Jamuna Bank Limited
17	Janata Bank PLC
18	Midland Bank Limited
19	Modhumoti Bank Limited
20	National Bank Limited
21	NRB Bank Limited
22	ONE Bank Limited
23	Palli Sanchay Bank
24	Prime Bank Limited
25	Probashi Kallyan Bank
26	Rajshahi Krishi Unnayan Bank
27	SBAC Bank Limited
28	Shahjalal Islami Bank PLC
29	Social Islami Bank Limited
30	Sonali Bank PLC
31	Southeast Bank Limited
32	Standard Chartered Bank, Bangladesh
33	The City Bank Limited
34	The Premier Bank Limited
35	Trust Bank Limited
36	United Commercial Bank PLC
37	Uttara Bank PLC

Appendix-3: List of Participants in FGD

Sl. No.	Name of the Participant	Bank Name
1.	Khalid Hossin	Mutual Trust Bank Ltd.
2.	Kashef Rahman	United Commercial Bank PLC
3.	Ms. Nurun Nahar Begum	BRAC Bank Ltd
4.	A Y M Mostafa	Prime Bank Limited
5.	Mohammed Rezwan Al Bakhtiar	Sonali Bank PLC
6.	Md. Mushfiqur Rahman	FSIBL
7.	Abul kalam Azad	RAKUB
8.	Md. Nurul Islam Mozumder	Janata Bank PLC

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