Research Report on

**Industry 4.0 to Implement Vision 2041 of Bangladesh: Bangladesh Small and Cottage Industries Corporation's Role to Generate Employment and Reducing Poverty through Industrialization**



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| | |
|---|---|
| 3D Printing | Three-dimensional Printing |
| 4IR | Fourth Industrial Revolution |
| AI | Artificial Intelligence |
| APA | Annual Performance Agreement |
| API | Active Pharmaceuticals Ingredients |
| BEPZA | Bangladesh Export Processing Zone Authority |
| BEZA | Bangladesh Economic Zone Authority |
| BIDA | Bangladesh Investment Development Authority |
| BSCIC | Bangladesh Small and Cottage Industries Corporation |
| BTI | BSCIC Training Institute |
| CAD | Computer-aided Design |
| Cobots | Collaborative robots |
| e-Commerce | Electronic- Commerce |
| e-Market | Electronic-Market |
| EPSCIC | East Pakistan Small and Cottage Industries Corporation |
| ERC | Export Registration Certificate |
| ERP | Enterprise Resource Planning |
| FGD | Focus Group Discussion |
| ICT | Information and Communication Technology |
| IE | Industrial Estate |
| Industry 4.0 | Fourth Industrial Revolution |
| IoT | Internet of Things |
| IRC | Import Registration Certificate |
| IT | Information Technology |
| KIIs | Key Informant Interviews |

| | |
|---|---|
| MIS | Management Information System |
| MoU | Memorandum of Understanding |
| OSS | One-Stop Service |
| SCITI | Small and Cottage Industries Training Institute |
| SME | Small and Medium Enterprise |

# Acknowledgments

# Executive Summary

This research study focuses on the potentials of Industry 4.0 for socioeconomic development in Bangladesh as well as Bangladesh Small and Cottage Industries Corporation (BSCIC)'s role in this transformation. The study's goal is to provide insights and recommendations for maximizing the benefits of Industry 4.0 and achieving Bangladesh's Vision 2041, which views the country as a developed nation.

The study begins by investigating the current condition of Industry 4.0 in Bangladesh and its importance in achieving Vision 2041. It emphasizes the significance of BSCIC in utilizing Industry 4.0 technology to create jobs and eliminate poverty through industrialization. The research draws on current literature, studies, and scholarly articles to provide an in-depth assessment of the difficulties and potential related with Industry 4.0 in Bangladesh.

The study emphasizes the need for a deeper understanding of various stakeholders' perspectives while mentioning the study's limitations, such as the small sample size and potential biases in data gathering. It implies that taking into account the opinions of small- and cottage-industry owners, workers, local communities, and experts could boost the research findings. The research also acknowledges the impact of external factors and macroeconomic situations, such as political stability, global economic trends, and policy changes, on the outcomes of Industry 4.0 efforts.

The research makes suggestions for BSCIC on how to successfully integrate Industry 4.0 in cottage and small businesses. It proposes doing in-depth requirements analyses to learn more about the challenges, objectives, and level of readiness for Industry 4.0 adoption of these businesses. The development of relevant activities and support systems can then be guided by this assessment. The study also highlights the significance of ongoing monitoring and adjustment to future changes in technology, regulations, and tactics throughout the implementation phase.

Overall, the purpose of this research study was to provide useful insights for policymakers, researchers, and practitioners interested in leveraging the potential of Industry 4.0 for socioeconomic development in Bangladesh. It emphasizes BSCIC's role in realizing Vision 2041 through the adoption of Industry 4.0 technologies and makes recommendations to enable the successful implementation of Industry 4.0 in accordance with the country's long-term development goals.

# 1.0 Introduction

Bangladesh, a South Asian developing country, has set its eyes on Vision 2041, a developed country status, an ambitious plan to transform the country into a developed nation by that year. To realize this objective, the country understands the significance of using Industry 4.0 ideas and technology to stimulate industrialization, create job opportunities, and alleviate poverty.

In recent years, the concept of Industry 4.0 has attracted widespread attention as a revolutionary force in a variety of industries. Industry 4.0 refers to the incorporation of sophisticated technology into production processes such as artificial intelligence, robotics, the Internet of Things (IoT), big data analytics, and automation. This industrial revolution has the potential to boost productivity, efficiency, and competitiveness, resulting in economic growth and social progress.

Bangladesh Small and Cottage Industries Corporation (BSCIC) plays a critical role in achieving Vision 2041 objectives by encouraging small and cottage enterprises. BSCIC is a government body in Bangladesh responsible for the development, expansion, and promotion of small-scale enterprises.

Through an in-depth investigation of the BSCIC's role in promoting Industry 4.0 adoption, this research study aims to provide insights and recommendations for policymakers, practitioners, and other stakeholders. Its purpose is to assist in the development of effective strategies and policies to support sustainable industrialization, job creation, and poverty reduction in Bangladesh by shedding light on the possible benefits, difficulties, and opportunities associated with incorporating Industry 4.0 into Vision 2041.

As Bangladesh strives to realize Vision 2041, the use of Industry 4.0 technology is critical for long-term development, job creation, and poverty reduction. Bangladesh Small and Cottage Industries Corporation (BSCIC) plays a critical role in this effort by encouraging technology adoption, giving access to finance, improving infrastructure, fostering entrepreneurship and innovation, and increasing market access. Bangladesh can leverage the revolutionary power of

Industry 4.0 and pave the way for a prosperous and developed nation by 2041 through strategic collaboration and coordinated efforts.

## 1.1 Objectives of the Study

- To examine the concept of Industry 4.0 and its relevance to implementing Vision 2041 in Bangladesh.
- To assess the impact of Industry 4.0 on various industries in Bangladesh and to explore how BSCIC's involvement can contribute to industrialization.
- To find out the 4IR maturity level of various industries in BSCIC industrial estates.
- To identify the challenges and barriers faced by BSCIC in adopting Industry 4.0 technologies and recommend strategies for overcoming them.
- To provide stakeholders, including policymakers, industry leaders, and researchers, with insights and recommendations on maximizing the potentials of Industry 4.0 for the socioeconomic development of Bangladesh.

## 1.2 Scope

This study is limited and bound to-

- Companies from BSCIC industrial estates are included in this study. Other industries are beyond its scope.
- Only Bangladesh-based businesses, including multinational corporations that are operating in Bangladesh are included. Its reach does not include companies outside of Bangladesh.

## 1.3 Limitations

There are some limitations that we faced while doing this research paper is:

1. Only 100 interviewees have been taken into consideration while preparing the report as majority of the respondents could not provide the necessary insights about the adaptation of 4IR in their respective companies. The validity and applicability of the research findings could be bolstered by a deeper understanding of their perspectives and insights.

2. The research may not account for external factors and macroeconomic conditions that can influence employment generation and poverty reduction beyond the scope of Industry 4.0 and BSCIC's initiatives. Factors such as political stability, global economic trends, and

policy changes could affect the outcomes, and their exclusion from the analysis may limit the research's completeness

3. Given the rapid evolution of Industry 4.0 and the dynamic objectives of Vision 2041, the findings of this research study may become obsolete or less relevant over time. It is possible that the paper does not account for potential shifts in technology, policies, and strategies that may occur during the implementation process, thereby limiting its long-term applicability. In Quantitative Gap Analysis, all the results were subject to respondents' given scores, this may vary for different interviewees.

# 2.0 Literature Review

This literature review investigates the potential of Industry 4.0 in Bangladesh and its importance in achieving Vision 2041, which seeks to transform Bangladesh into a developed nation. It concentrates specifically on the role of the Bangladesh Small and Cottage Industries Corporation (BSCIC) in utilizing Industry 4.0 technologies to create employment opportunities and reduce poverty through industrialization. The review synthesizes and evaluates existing research, reports, and scholarly articles in order to shed light on the current state, challenges, and opportunities associated with this topic.

**Vision 2041:**

Vision 2041, which is a continuation of vision 2021, has been embraced by the Bangladeshi government and seeks to lead the nation down the path of development Bangabandhu envisioned. The Bangladeshi administration is implementing the 2021-2041 Perspective Plan. Vision 2041's primary objective is to eradicate extreme poverty, attain Upper Middle-Class status by 2030, and become a high-income nation by 2041. This research aims to identify the top priority areas for a country to be developed by 2041 and realize Vision 2041.

Vision 2041 aims to eliminate extreme poverty and achieve the status of Upper Middle-Income Country (UMIC) by 2030 and the status of High-Income Country (HIC) by 2041, with the absence of poverty. The government is attempting to develop the Perspective Plan 2021-2041 (PP2041) with the necessary policies and legislation in place in order to transform Vision 2041 into a growth strategy (lam S, 2019). The government has developed a 20-year plan to acquire and attain the status of a developing nation by 2041. The government will implement the program from 2021 to 2041. According to the proposed proposal, 8.48% of the population is severely impoverished currently, and this percentage is projected to drop to 0% by 2031. Bangladesh is home to 17.83% of middle-income individuals at present. By 2031, it will decrease to 9.9%, and by 2041, it will fall below 5% (Zakaria M., 2019).

The objective of the 20-year strategy is to achieve a 9.9% increase in Gross Domestic Product (GDP) by increasing investment to 46.88% of GDP by 2041 and tax collection to 21.85% of GDP (The Business Standard (TBS, 2020). To be achieved by 2041 Bangladesh initially incorporated the SDG Agenda 2030 into the National Development Plan. As the SDG phase coincided with the start of the 7th Five-Year Plan, the two phases were concurrent. The eighth plan will continue the second perspective plan for 2021-2041. The 2021-2041 perspective plan is being implemented at a time when Bangladesh has made significant economic and social progress. Bangladesh is presently ranked 176th out of 190 countries in the 2019 WBDB Survey (Ahmed, 2019). In 2018, Bangladesh met for the first time all three UN Least Developed Countries (LDC) requirements for graduation. Bangladesh's economic growth and development performance over the past two decades has been remarkable. In 2018, the GDP growth rate surpassed the 8% threshold. Bangladesh's economic development has been less volatile than that of many developed nations over the past three decades (Raihan S., Khan S.S., 2020).

Bangladesh is consequently in the process of becoming a developed nation. Bangladesh's economic development has been robust over the past decade, and its expansion of 8.2 percent in FY 2019 was the fastest in the Asia-Pacific region (Asian Development Bank, 2020). Bangladesh has recently met the requirements to graduate from least developed country to a developing country, and if development remains satisfactory, the UN Economic and Social Council (ECOSOC) will confirm Bangladesh's graduation by 2024 (Badiuzzaman, et al., 2018). The GDP per capita based on Purchasing Power Parity (PPP) was estimated to be $1,410 in 2001 and $3,310 in 2016 (World Bank, 2018).

Bangladesh accounts for 19% of the GDP, 17.3% of the total population, and 13.6% of exports among the 48 LDCs [Tribune D (2018)]. In terms of progress in education, health, and deprivation over the past two decades, Bangladesh ranks third out of 178 countries in the 2011 UN Human Development Report (UNDP,2011). In contrast, Bangladeshi RMG exports grew at a double-digit rate of 11% last year, surpassing the single-digit growth rate of the previous four years. According to the 2019 World Trade Statistical Analysis, Bangladeshi apparel exports increased to $32.45 billion in 2018 from $29.33 billion in 2017 (Kibria A, 2019). The government allotted Tk40,000 crores in the outgoing budget for ten mega projects to improve the country's communications

network and expand the power and energy sector in order to stimulate the economy (Shaon IA, 2019). The government has developed a plan to create roughly 30 million additional jobs by 2030 (Munni. M, 2020).

The increasing strength of the ICT industry supports the four critical foundations that will facilitate Bangladesh's transition to a digital economy by 2021 and an information economy by 2041 (World Economic Forum, 2019). Bangladesh is now the second largest exporter of online labor due to accelerated digitalization and a high unemployment rate among skilled workers. According to the ICT Division of Bangladesh, the country's 500,000 active freelancers generate $100 million annually (Zaman A, 2019) out of a total of 650,000 freelancers registered in the country. Bangladesh's HDI score for 2018 is 0.614, which places it in the middle echelon of human development, at position 135 out of 189 countries and territories. Bangladesh's HDI increased by 58.3 percent between 1990 and 2018 (UNDP, 2019), from 0.388 to 0.614.

**Role of BSCIC in Poverty Alleviation:**

Since 1960, the industrial estate program of BSCIC has made a contribution to the industrialization process. 3,352 businesses had been created in 80 industrial estates throughout several areas as of April 2023. These industries generate around Tk 2,46,830 million in goods and services each year and pay Tk 1,780 million in VAT, taxes, and other fees. The worth of exportable goods is roughly Tk. 1,33,240,000,000. There are 3.42 million individuals working in these industries directly. (Haider, 2015) The nation has attained salt production self-sufficiency thanks to a BSCIC program. 13.33 lac MT of salt are consumed worldwide each year. Additionally, BSCIC has been carrying out the project "Control of Iodine Deficiency Disorder through Universal Iotations of Salt in Bangladesh" in collaboration with UNICEF. According to this program's credentials, iodine deficiency condition prevalence decreased from 69 percent in 1993 to 33.80 percent in 2005.

BSCIC contributes to rising household spending. However, the cross-section approach, which takes into account both household-level and BSCIC-specific factors, demonstrates the influence of BSCIC on income over the poverty line. (Haider, 2015)

Following liberation, the BSCIC's operations took on new dimensions as it embraced a mission to hasten the growth of the SCI sector by proactive policy interventions. It has established backward and forward linkages between small and large enterprises, entrepreneurial development and skill development training, and subcontracting linkages between small and large industries. In addition, BSCIC participated in a microcredit program, beekeeping, and semi-intensive shrimp cultivation. (2012). (Banglapedia)

The BSCIC was established in 1960 with the goal of promoting industrialization. It began by creating industrial plots with utility connections and connectivity for SMEs. The organization contains 80 industrial parks with 11,922 plots total. Clothing, poultry, food processing, jamdani, hosiery, active pharmaceutical ingredients, light engineering and electrical items, plastics, printing, and chemicals are among the industries represented in the estates. They have produced more than 850,000 employments overall. 4,511 factories are running right now in the industrial estates. (Dailystar,2022)

Bangladesh is currently experiencing economic growth and must maintain this in order to become a developed nation by 2041. The use of EZs benefited developing nations. In terms of luring FDI, local investment, and employment, the real outputs of EZs are progressing at an efficient rate. Along with OSS, fiscal and non-fiscal incentives are contributing to Bangladesh's economic development in a dynamic way (Mustafizur, 2019).

BSCIC is a top government agency in charge of the quick industrialization of the nation's cottage and small businesses. Numerous businesses have been established throughout the nation and many entrepreneurs have been developed thanks to direct or indirect efforts from BSCIC. To help existing and new business owners grow their markets, improve their businesses, and thrive in a cutthroat industry, BSCIC offers facilities. (AssignmentPoint, 2022)

The industrial estates of BSCIC have been fostering small and cottage industries, which has resulted in job opportunities, achieved poverty alleviation and balanced regional growth, ensured optimal utilization of economic and human resources, and accelerated the nation's overall economic growth. It has one head office in Dhaka, four regional offices, 64 district offices

(Industries Service Center), 80 industrial estates, and fifteen skill development centers scattered around the nation to serve the needs of small- and cottage-industry enterprises. (bids, 2022)

Numerous nationally renowned industrial facilities, in particular Square Pharmaceuticals in Pabna, BSCIC estate, and RFL in Rangpur BSCIC estate, are maintaining their production operations and making significant contributions to the country in terms of meeting consumer expectations generally. With the intention of assisting the stakeholders in overcoming the Covid-19 fallout, the government launched the bailout package for the CMSME industry. According to Rezaul Sarkar, regional director of BSCIC, "We have distributed Taka 438.30 crore among 5,594 entrepreneurs as cottage, micro, small and medium enterprise (CMSME) loans," adding that 619 additional entrepreneurs received Taka 10.19 crore as Bangabandhu Youth loans. (Tbs, 2023)

However, there is little information in the literature about the micro-level poverty analysis in Bangladesh based on the BSCIC special economic zone. The literature does not explicitly specify how BSCIC's impact has been evaluated in terms of reducing poverty.

**Industry 4.0**

Industry 4.0 is the term used to describe the digital transformation of enterprises. It radically alters how a company conducts business. For instance, the transition from manufacturing to all other activities that take place both inside and outside the sector impacts all organizational functions (Rajnai and Kocsis, 2018). With the new wave of integrated digitization of the organization, the economic contexts and consumer needs also change (Lee et al., 2014). Whether this digitization of organizations qualifies as the fourth industrial revolution is a topic of academic discussion (Bassi, 2017). The idea was first developed in Germany, then it spread to other nations. Production of cyber-physical systems (CPS), which is based on the integration of heterogeneous data and knowledge, is the key component of Industry 4.0 (Lu, 2017; Zanero, 2017). To meet the production's agile and dynamic requirements, CPS plays a significant role. Additionally, they must to work to increase the organization's overall efficacy and efficiency. Internet of Things (IoT), Internet of Services (IoS), cloud-based manufacturing, radio frequency identification (RFID), and enterprise resource planning (ERP) are just a few of the technologies that make up Industry 4.0. A

recent study by Euromedia Research Group (Trappel Citation2019), concentrating on the digital transition in the context of modern new media and communication disparities, examines how digital media produce a knowledge gap that manifests as digital divides. It illustrates how the power grab by pricey industrial firms in the digital media era is being shaped by algorithmic modeling, digital monitoring, big data, and the Internet of things (IoTs). 014; Lin et al.; Lom et al.; Lu, 2017; Singer, 2015; Lin et al.

The "National IoT Strategy" that Bangladesh just developed in March 2020 mentions that IoT is a development enabler and contributor to economic prosperity of a nation. The future of IoT is dependent on how it is used to advance industries like manufacturing, healthcare, transportation, education, business process optimization, smart governance with public utility services, smart cities, etc. 2020 (M. N. Parvez)

Digitalization and Industry 4.0 are currently popular trends in businesses, yet in a recent poll, some business leaders from the industry claimed they had never even heard of it. Some leaders were aware of it, but they were unable to put it into practice or, to put it another way, prepare their organizations for the implementation of Industry 4.0 (Rajnai and Kocsis, 2018). It is a significant decision to make to transform a company to digitalization because doing so requires changing the organization's whole strategy. Based on a self-assessment tool, the organization's preparation for Industry 4.0 is evaluated. Some models (Gill and VanBoskirk, 2016; Gokalp et al., 2017; Leyh et al., 2016; Menon et al., 2016) look into the specific data on the organizations in IT. The PwC Industry 4.0 maturity model was introduced in the 2016 PwC Industry 4.0 survey (Industry, 2016). The ACATECH study (Schuh et al., 2017) provided a description of the Industry 4.0 maturity model. The complexity and maturity of an enterprise's digital transformation are captured in four dimensions by the Forrester digital maturity model (Gill and VanBoskirk, 2016). These models' assessment dimensions are conceptually different from one another, according to a theme analysis. Furthermore, none of these models (Lu, 2017; Rajnai and Kocsis, 2018; Schumacher et al., 2016) provides a universally recognized technique for evaluating an organization's readiness for Industry 4.0. By doing a thorough assessment of the past literature and looking at the variables that determine whether a company is ready for Industry 4.0, we hope to fill this vacuum in knowledge.

Manufacturers must be flexible, efficient, responsive, and cost-effective by consistently lowering operational expenses in order to meet the constantly changing client demands in a highly competitive environment (Fatorachian and Kazemi, 2018). According to Rashid and Tjahjono (2016), this is made possible by the extensive use of automation and digitization both inside and outside the organization's supply chain. Different functional subsystems including manufacturing, human resources, planning, and procurement are vertically integrated inside the firm. Automation has long been utilized in manufacturing settings. Although some manufacturing processes were automated, all other functional systems inside the company were not integrated, therefore the benefits of automation were constrained (Fatorachian and Kazemi, 2018; Da Xu, 2011). Lack of compatibility between various interfaces or communication methods, which resulted in misalignment between automation systems, was another factor in the limited success (Gruhier et al., 2017). In order to achieve the chosen strategic aim, Industry 4.0 entails the connecting and integration of the virtual and physical worlds through CPS and IOT through intelligent things that constantly communicate and interact with one another. Because of this, implementing Industry 4.0 is a crucial strategic choice, and before making such a choice, enterprises must determine their readiness for Industry 4.0 BIJ. Western Sydney University Library downloaded (Rajnai and Kocsis, 2018; Schumacher et al., 2016) at 09:08 on February 1st (PT). One of the most popular strategies for evaluating the maturity of an organization or a process or processes to determine the ability to attain desired goals is maturity modeling.

Although there is an increase in the research trend on Industry 4.0, the analysis of the maturity models indicates that there is still a research gap on the application of maturity models when adopting Industry 4.0 (Gokalp et al., 2017). There is no common and widely-accepted model, and many models have different evaluation criteria, dimensions, and items (Akdil et al., 2018; Gokalp et al., 2017; Schumacher et al., 2016). Additionally, evaluating IT readiness was the primary focus of the majority of these models' aspects. Understanding the essential components is, therefore, necessary to evaluate the level of readiness for implementing Industry 4.0 from a comprehensive standpoint.

*Figure 1: Key ingredients for evaluating Industry 4.0*

This study aims to offer useful insights for policymakers, researchers, and practitioners interested in leveraging the potential of Industry 4.0 to create employment opportunities and reduce poverty through industrialization, with a focus on the role of the Bangladesh Small and Cottage Industries Corporation (BSCIC), by conducting a thorough literature review on the implementation of Industry 4.0 to achieve Vision 2041 in Bangladesh.

## Challenges and Opportunities

Bangladesh is approaching the 4IR, which will have a significant impact on our daily lives. In the 4IR era, a comprehensive strategy and effective policymaking can aid in supporting equitable and sustainable development. Despite many issues, its economy has tremendous chances in this new technology era. To keep up with the current competition, entrepreneurs are adapting to a new reality and raising their production. The human staff is likewise adapting to a new reality and increasing productivity to compete globally.

**Industry 4.0 opportunities:**

The 4IR offers some benefits that will make it possible to use automation to boost productivity. It has boosted the standard of living while also generating new markets and business opportunities. It has made it easier for entrepreneurs to reap the rewards of cutting-edge technology. At the same time, both domestically and internationally, high-paying job opportunities have been generated. Bangladesh's manufacturing industry has steadily transitioned to the 4IR over the years. The Covid-19 outbreak, however, has quickened the pace. Due to a labor shortage and a broken supply chain, manufacturing must quickly convert to digital.

In the following ways, the new industrial revolution will assist a firm in becoming smarter and more effective:

● Optimization and automation lead to enhanced productivity
● Real-time data for real-time supply chains in a real-time economy
● Advanced maintenance and monitoring possibilities will enable greater business continuity
● Real-time monitoring, IoT-enabled quality improvement, and cobots (collaborative robots) will lead to higher-quality products
● Superior sustainability and better working conditions
● Earn the trust and loyalty of the modern consumer with personalization opportunities.

**Industry 4.0 Challenges**

The impact on employment may be positive, but no guarantee displaced workers will be able to find new jobs without the appropriate skills. On-the-job training and the development of new skills are critical for future employment. The present demand is for digital occupation reskilling and upskilling. Curriculum and technology in education must meet the demands of the industrial world. As a result, investment in human resource and man power development are required to produce a workforce equipped to tackle future challenges.

Many hurdles must be overcome before new technologies may be successfully adopted. Inequality in technological knowledge, skills, and infrastructure is difficult to overcome in comparison to the

industrialized world. Data sensitivity and advancements in technology have also raised worries about data and intellectual property privacy, ownership, and management. Cyber security risk, especially now that everything is connected, has increased the potential of hacking and data tampering. Inequality, unemployment, and a threat to social security might all have serious consequences for our economy.

The inappropriate use of data includes the lack of a clear digital strategy, developing a strong digital culture, level of digitization, data security, and danger with capturing, storing, and analyzing massive volumes of consumer data. There are both financial and technical concerns with integrating modern technologies.

When making wise investments in the factory of the future, the following potential roadblocks should be kept in mind:

1. **A Gap in Technical Skills:** The needs required of the workforce are all evolving. Are the employees able to keep up? When looking to fill open positions, look for applicants who possess "digital dexterity" in that they understand both the manufacturing processes and the digital tools that support those processes. Only with the right workforce will business models be able to successfully implement new technology and maintain operations.

2. **Data Sensitivity:** The rise in technology has also led to increasing concerns over data and IP privacy, ownership, and management. To successfully implement an AI algorithm, data is required to train it and test it. For this to happen, the data must be shared. However, many companies are reluctant to share their data with third-party solution developers. Further, our current data governance policies for internal use within organizations are inadequate to support cross-organizational data sharing. Data is a powerful asset – make sure to keep it secure!

3. **Interoperability:** Another significant issue is the lack of separation between protocols, components, products, and systems. Unfortunately, interoperability impedes companies' ability to innovate. Further, since they cannot easily "swap out" one vendor for another or one part of the system for another, interoperability also limits options to upgrade system components.

**4. Security:** Threats in terms of current and emerging vulnerabilities in the factory are another significant concern. The physical and digital systems that make up smart factories make real-time interoperability possible—however, it comes with the risk of an expanded attack surface. When numerous machines and devices are connected to single or multiple networks in a smart factory, vulnerabilities in any one of those pieces of equipment could make the system vulnerable to attack. To help combat this issue, companies need to anticipate both enterprise system vulnerabilities and machine-level operational vulnerabilities. Companies are not fully prepared to deal with these security threats, with many relying on their technology and solution providers to scope out vulnerabilities.

**5. Handling Data Growth:** As more companies become dependent on AI usage, companies will be faced with more data that is being generated at a faster pace and presented in multiple formats. To wade through these vast amounts of data, AI algorithms need to be easier to comprehend. Further, these algorithms need to be able to combine data that might be of different types and timeframes.

**6. Adoption of New Technologies**

**7. Adoption of Digitalization and Get Oriented with That**

# 3.0 Methodology

This study was based on first-hand interviews with industry professionals to determine the degree of adoption of Industry 4.0 as well as the associated challenges and opportunities. Secondary sources such as Management Information System (MIS) reports, public databases, articles, and others were mined for information on the number of SMEs in Bangladesh, sectorial overviews, statistical data, and the BSCIC industrial estate (IE). Important Informant Interviews (KIIs) and Focus Group Discussions (FGDs) were then conducted with the industry owners of the selected industrial estate in different sectors to identify the important challenges faced by the industry owners and get comprehensive insights into the relevant concerns.

The research was purely exploratory. The research was conducted using a social survey strategy. The population was sampled to obtain the necessary information. The study's sample size was 100 people who were chosen at random using purposive sampling from various BSCIC IE.

Both primary and secondary data were utilized in this study. Face-to-face interviews were used to collect primary data from industry proprietors or their representatives as part of a sample survey. Utilizing structured questionnaires, interviews were conducted. Secondary data was collected from reports, publications, articles, government reports, and so on. After data collection, it was analyzed using various computer programs, such as Statistical Package for the Social Sciences (SPSS) and Microsoft Excel, etc.

## 3.1 Data Collection

As was stated before, the following strategies for data collecting are utilized in this research.

### 3.1.1 Desk Research

Extensive desk research was conducted to compile information about the various SME sectors. Journals, policy papers, MIS reports, Bangladesh Government reports, and newspapers are used as research materials.

### 3.1.2 Key Informant Interviews (KIIs):

There have been arranged Key Informant Interviews (KIIs) with the main stakeholder of the SME industry, i.e., industry owners or their responsible representatives from various sectors. The research crew consists of both men and women. Involvement in the KIIs. However, the number of female participants is relatively low, as male entrepreneurs dominate the SME industry as a whole.

There has been a total of 100 KIIs with industry proprietors or their authorized representatives. First, the research team segmented the interviewee according to their ages. This helps the team to understand the way of their interview approach. The result is shown in Figure 2:
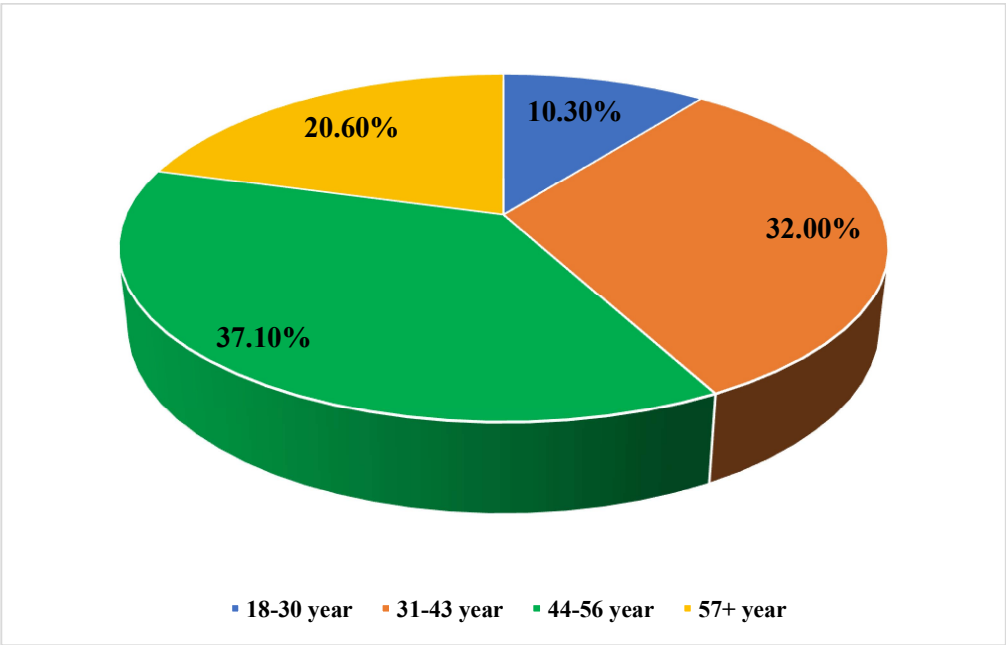


*Figure 2: Age level of the respondents*

Then, the research team studied the academic background of the interviewee. It helps them to understand the educational level to adopt the knowledge of the fourth industrial revolution. Around 65% of respondents had honours or equivalent degrees.
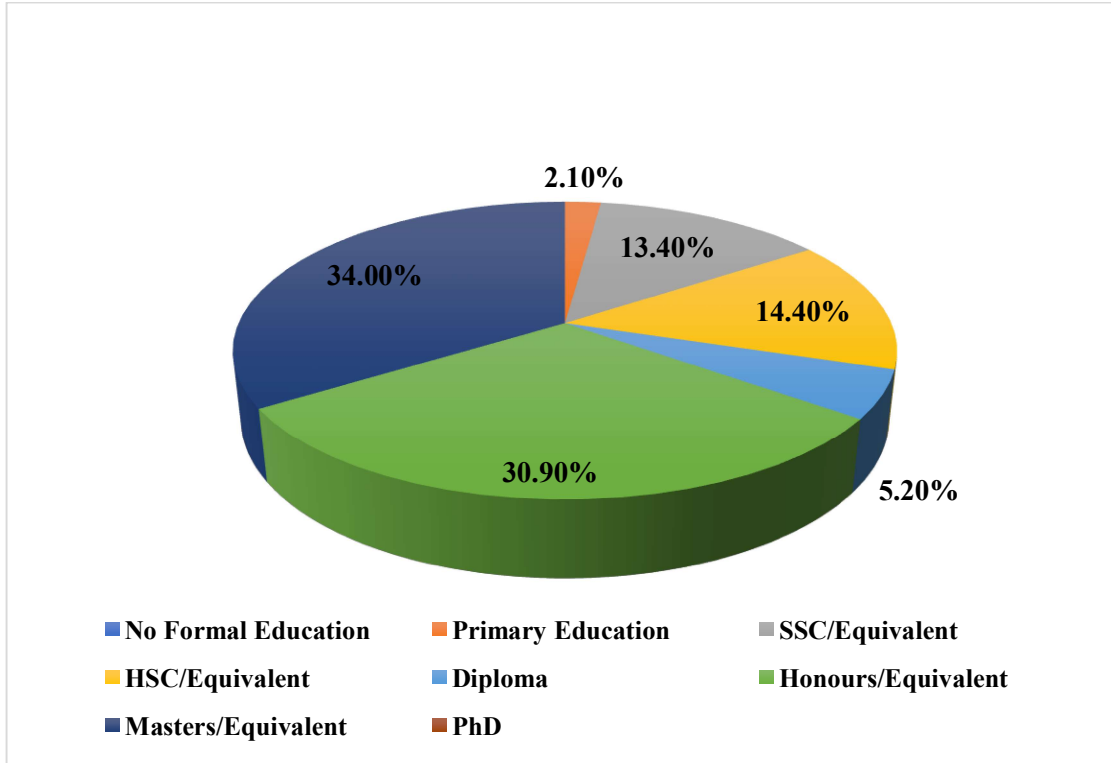
*Figure 3: Respondents' classification according to academic background*

The research team classified the respondent SMEs into four categories: cottage, micro, small, and medium. The team found that the majority of the respondents (48%) represents small enterprise. 22.40% and 24.50% represent the medium and cottage industries respectively. Only 5.10% of industries represent the micro industries.

*Figure 4: Size of the industries studied*

Again, the industries are classified into four types according to the type of the industries, such as manufacturing, agriculture, service, and others. The majority of the respondents (79.60%) represent the production sector. The percentage of the agro, service, and others were 8.20%, 10.20%, and 2% respectively.



*Figure 5:Types of the industries studied*

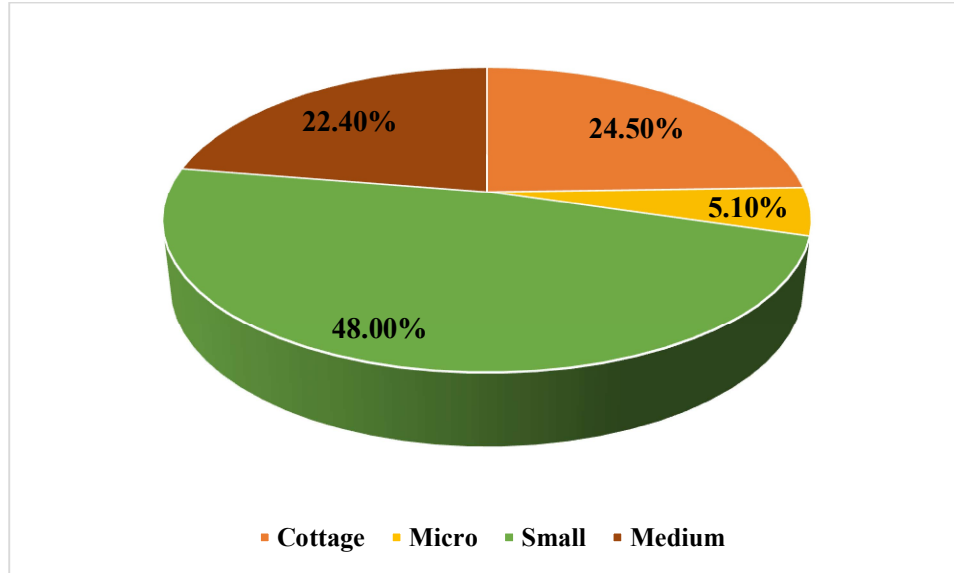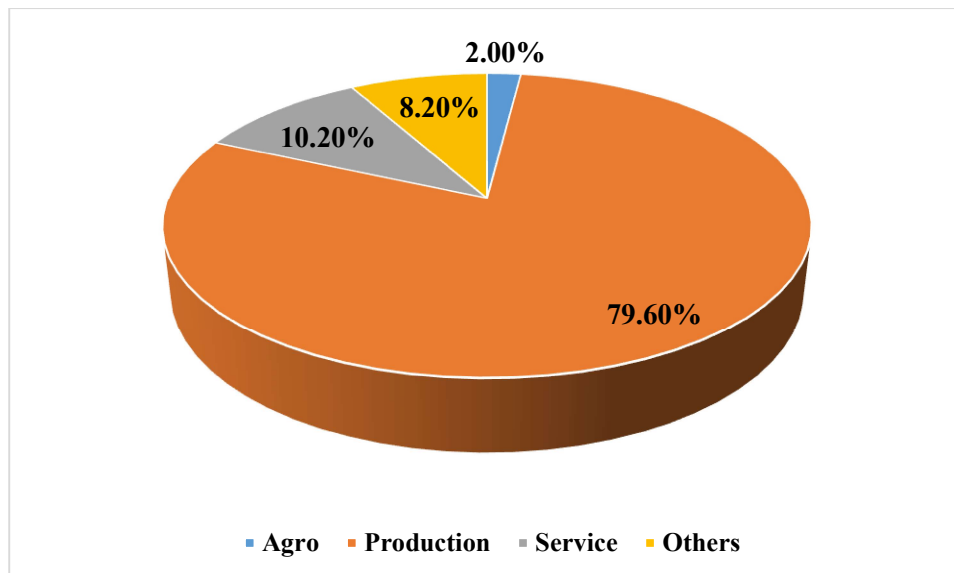Participating in the study were small and medium-sized enterprises (SMEs) from a variety of industries, including light engineering, electric goods, plastics, pharmaceutical, leather goods, agro and processed food, hosiery, etc. The research team has attempted to be uniform in its selection of interviewees from all selected sectors, with some success.

### 3.1.3 Focus Group Discussion (FGDs):

Seven focus group discussions (FGDs) have been conducted with the industry proprietor, their representative from multiple industries, the academician, and the panel. The arrangement of FGDs has begun prior to KIIS and after the execution of half of the KIIs. Consequently, we possess sufficient data to elicit more insightful information from the FGDs. Gazipur (Konabari & Tongi IE), Narsingdi, Narayanganj, Bogura, Cox's, Bazar and Chattogram were the locations from which the FGDS participants originated.

## 3.2 Data Analysis:

Interview transcripts from industry owners and their representatives make up the bulk of the material analyzed in this study. The literature review (academic and industrial studies), the Bangladesh government database, industry specialists, MIS reports of BSCIC, publicly available records, etc., all contribute to the study's conclusions.

# 4.0 Results and Discussions

**General Survey**

- **Regarding Bangladesh Government's Vision 2041**

During the survey, it was found that 65.3% of the respondents know somewhat about the Bangladesh government's vision 2041. Moreover 17.4% of the respondents know completely about the Bangladesh government's vision 2041. Also, 17.3% of respondents know not at all of it (Figure 6).
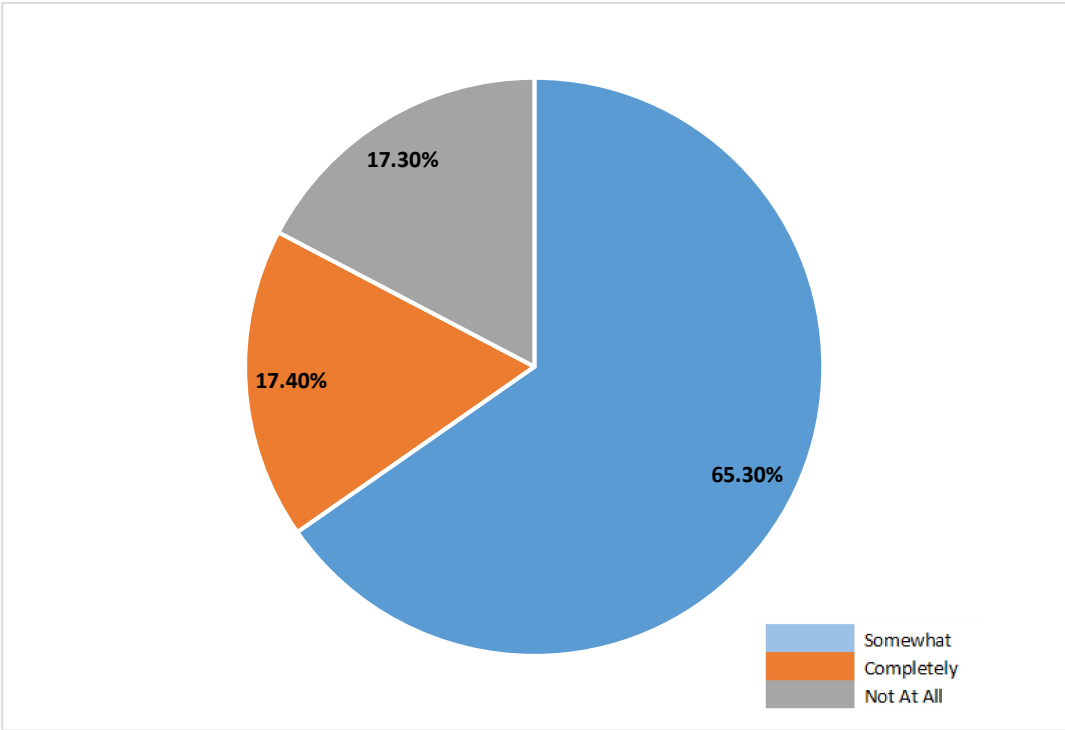


*Figure 6: Regarding Bangladesh government's vision 2041*

- **Regarding Knowledge of 4IR**

From the survey, it was found that 63.9% of the respondents know somewhat about the 4IR. Moreover 11.4% of the respondents know completely about the 4IR. Also, 24.7% of respondents know not at all about the 4IR (Figure- 7).
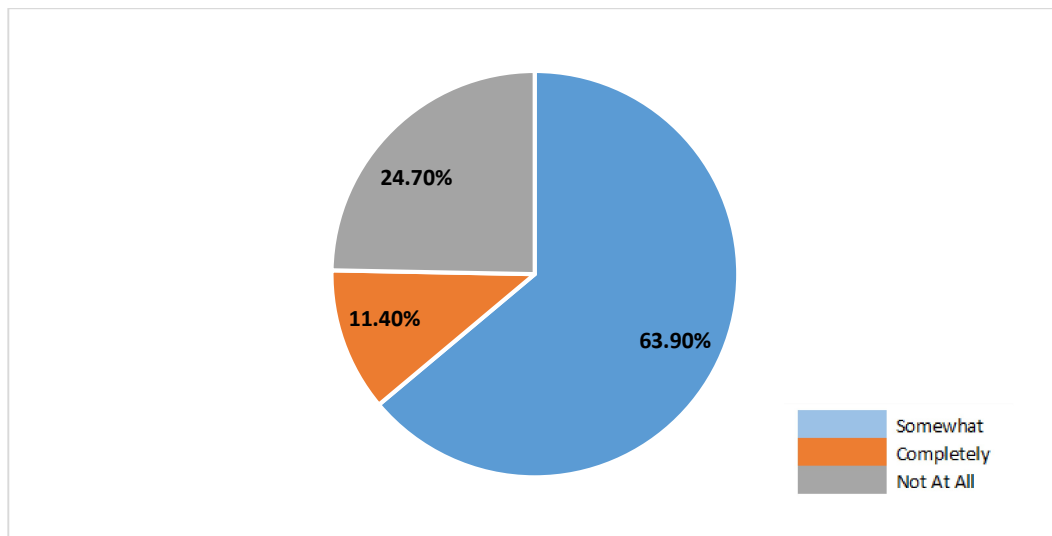


*Figure 7: Regarding Knowledge of 4IR*

- **Regarding Knowledge of 4IR Tools**

According to the survey, 37.5% of respondents are aware of artificial intelligence (AI). About 31.3% consider Machine Learning, while 26% consider IoT. 6.3% are considering Cloud computing, 2.1% are considering blockchain, 10.4% are considering big data, 24% are considering robotics, 17.7% are considering 3D printing, and 20.8% are unaware of 4IR (Figure- 8).
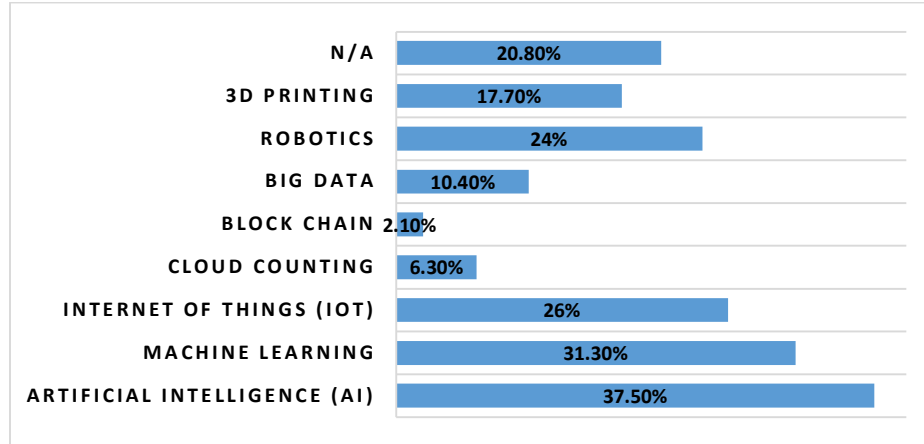
*Figure 8: Regarding Knowledge of 4IR Tools*

- **Uses of Different 4IR Tools**

From the survey it was found that 40.7% respondents are saying that their reporting is done by using digital tools. 19.8% saying their HR is done through digital way, 36.3% organization use e-marketing, 33% use digital tools in transaction, 38.5% organization use digital technology in production process, and 17.6% participants use digitalization process in supply chain (Figure- 9).
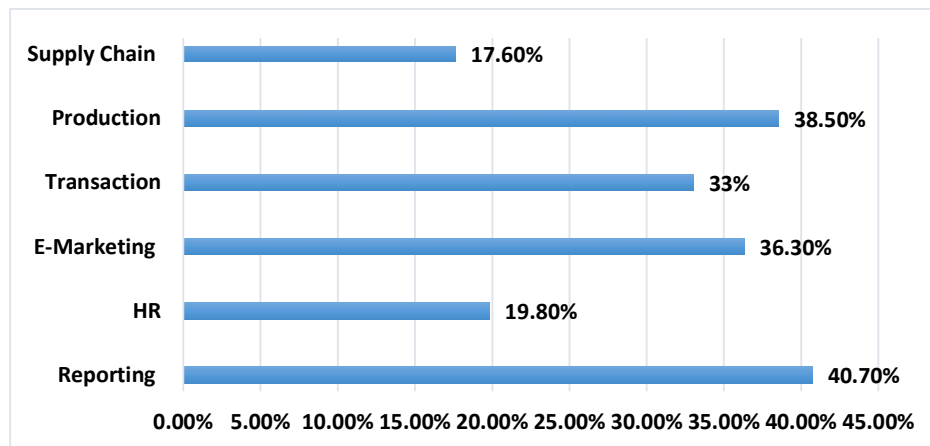


*Figure 9: Uses of Different 4IR Tools*

- **Skill level of the Workers**

From the survey, it was found that 18.3% respondents are saying that they don't have any digitally skilled employee. Also 41.1% saying that their 1-24 percentage of employees are digitally skilled. Moreover 15.1% organizations have 25-49 percentage of digitally skilled employees. In addition, 22.6% respondents are saying that they have more than 50 percentage of employees are digitally skilled (Figure- 10).
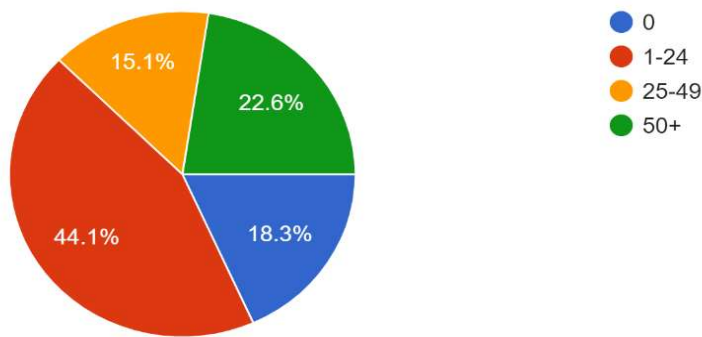


*Figure 10: Percentage of Skilled Workers*

- **Requirements for Technological Development**

From the survey it was found that 62.8% of respondents are saying that they need skilled workers. Also, 12.8% saying that they need R&D. Moreover 72.3% % respondents are saying that they need help from the government. In addition, 16% of respondents are saying that they need a budget for their organization. Finally, 16% of respondents are saying that they need infrastructure for their organization (Figure- 11).
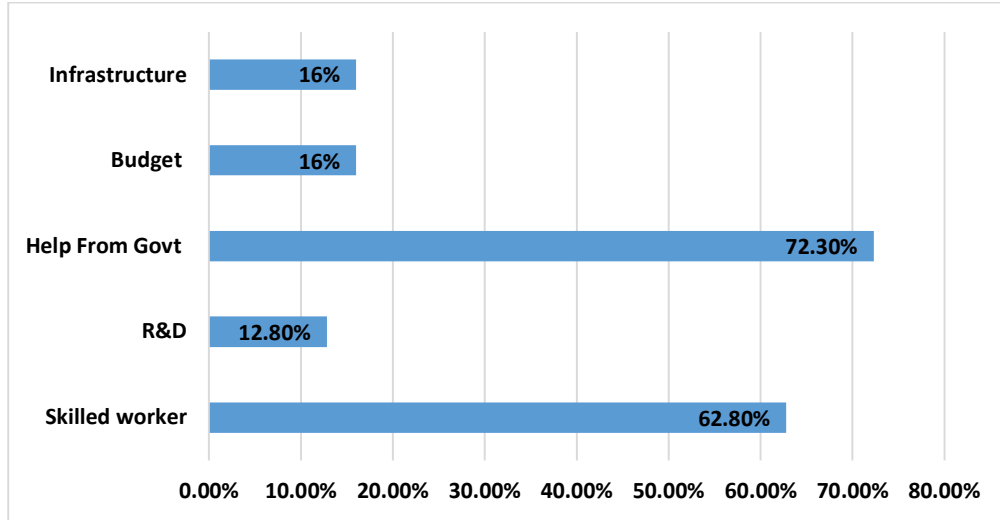
*Figure 11: Requirements for Technological Development*

- **Training Facilities for the Development of Digital Skills of Employees**

From the survey, it was found that 62.5% of respondents have their own training system for the development of digital skills of their employees And, 37.5% saying that they do not have any training system for the development of digital skills of their employees (Figure-12).
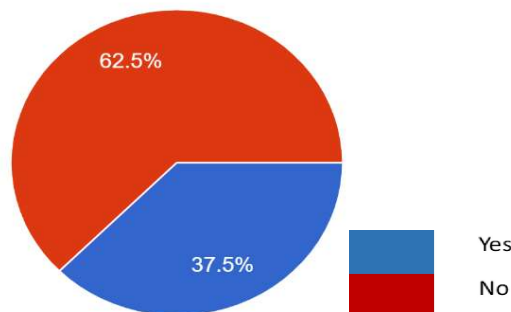


*Figure 12: Training Facilities for the Development of Digital Skills of Employees*

- **Types of Training Provided by The Organization to the Employee**

From the survey it was found that following training are provided by them to the employee:

    a) Computer & Internet,

    b) Digital Marketing,

    c) Dress Making,

    d) ERP software,

    e) Machine Operation,

    f) Fire safety,

    g) Skill development,

    h) Production Related Training,

    i) Quality Management,

    j) Sewing,

    k) Baking,

    l) Boutique,

    m) Good Manufacturing Practice,

    n) Hand Stitch & Hand Print,

    o) Health & Hygiene, etc.

- **Types of Training Needed by the Organization to the Employee:**

From the survey it was found that following training are required by the organization for the technological development of employees:

    a) Training on Advanced Computer Operation,

    b) HR related Training,

    c) Advanced design,

    d) Advanced Technology,

    e) Skilled Development,

    f) Digital skill,

g) Machine deign,

h) Quality Control,

i) e-Marketing, etc.

- **Changes In Production Process**

From the survey it was found that 54.3% of the respondents are saying that they have changed production process. And, 45.7% of the respondents are saying that they do not have any change in production process (Figure-13).
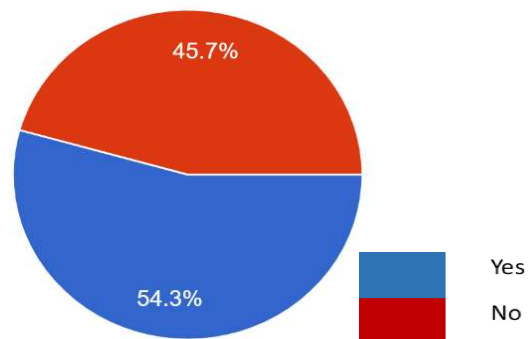


*Figure 13: Changes in Production Process*

- **Types of Changes in Production Process**

From the survey following changes were found:

a) Installation of Modern Machine,

b) Design,

c) Packaging,

d) Marketing,

e) Digital Machine,

f) Layout,

g) Skilled Man Power,

h) Recruitment Process, etc.

- **Analysis of 4IR Integration**

This analysis has been done based on the response and data provided by the interviewees.

**Sales & Marketing**

The Fourth Industrial Revolution (4IR) has significantly altered how businesses interact with their clients, analyze data, and carry out marketing plans.

Here are some key impacts of 4IR on the marketing of a company-
1. Data-Driven Decision Making
2. Personalized Marketing
3. Digital Marketing and Automation
4. Enhanced Customer Experience
5. Real-Time Marketing and Personalized Offers

Here is how BSCIC industries performed in 4IR adaptation in sales and marketing segment:
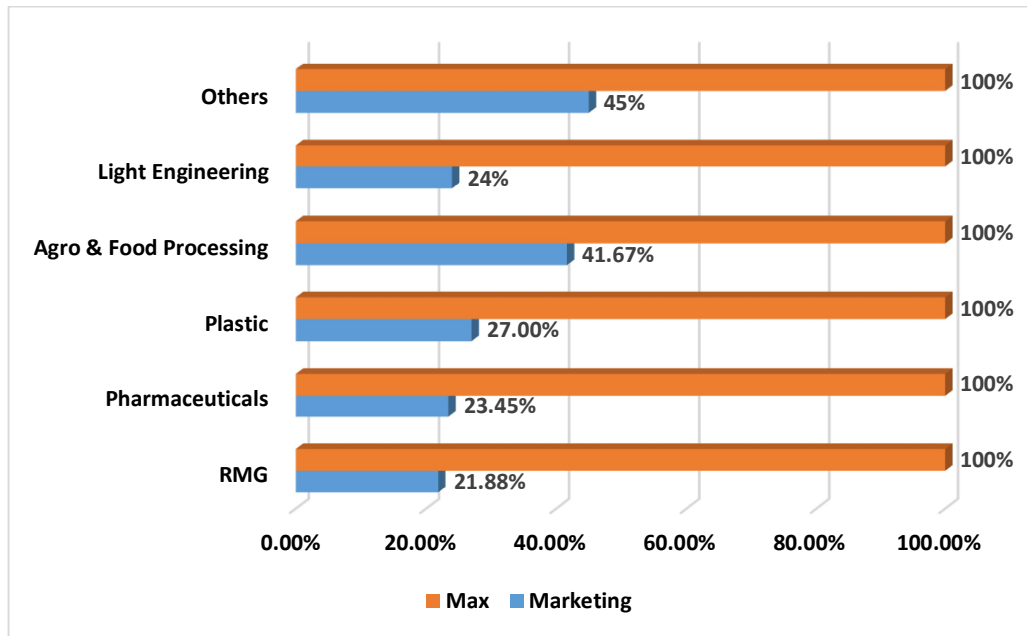
*Figure 14: 4IR adaptation level in marketing*

According to the graph above, agro-food processing and other small enterprises are more likely to use digital marketing tools and approaches than traditional industries such as RMG, pharmaceuticals, and light engineering. 4IR technologies offer real-time monitoring of client interaction and behavior. Marketers may respond to customer interactions quickly, adjust marketing messages based on real-time data, and give targeted offers and incentives. This real-time approach assists businesses in remaining agile, adapting to changing market situations and creating genuine client interactions. This is essentially why food processing and small businesses are adjusting swiftly since they must respond to varying customer demands as quickly as possible. Whereas traditional large organizations have enough time to strategize their marketing initiatives, they are adopting 4IR at a slower pace.

**Production & Supply Chain**

The introduction of cutting-edge technologies and the Fourth Industrial Revolution (4IR) have had a significant impact on how businesses operate in terms of production processes. Here are some major effects of 4IR on a company's production processes:

1. Supply Chain Optimization
2. Automatic Material Handling
3. Adaptive Maintenance
4. Digital Inventory Management
5. Human-Machine Collaboration
6. Additive Manufacturing

Here is how BSCIC industries performed in 4IR adaptation in Production & Supply Chain segment:
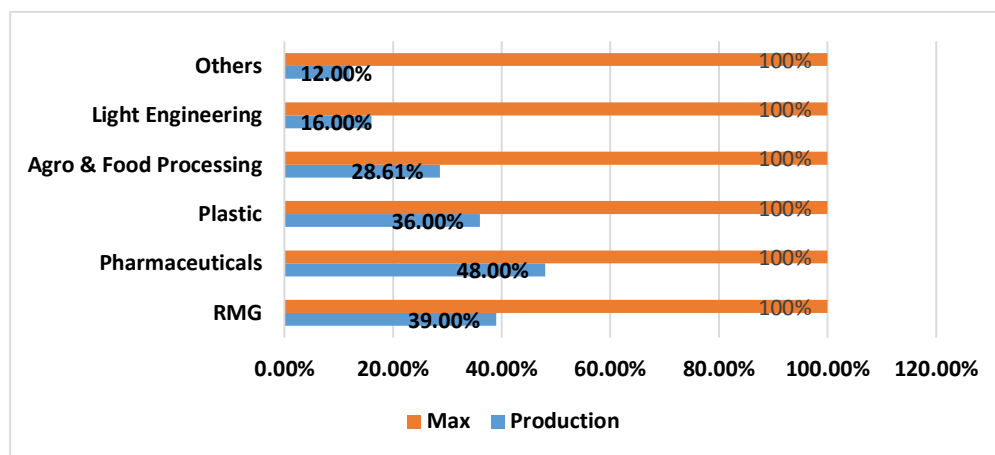


*Figure 15: 4IR adaptation level in production of BSCIC industries*

According to the graph above, Pharmaceuticals and RMG industries are more likely to use advanced production and supply chain tools and approaches than other industries. There are some valid reasons behind this outcome because-

- Automation and robotics have been adopted in the RMG sector thanks to 4IR technologies. Modern sewing machines, robotic arms, and automated systems are capable of accurately and effectively carrying out activities including cutting, stitching, and quality checking. Through automation, labor-intensive operations are reduced, manufacturing is accelerated, and product consistency is improved.

- Digital design and prototyping technologies are now widely used in the RMG sector due to the introduction of 4IR. Designers can build and visualize clothing in a digital setting

using computer-aided design (CAD) software and 3D virtual prototyping, which saves time and money on making real examples. Through digitization, design correctness is improved, teamwork is made easier, and the product development process is sped up.

- Increased automation and the incorporation of robotics in pharmaceutical production processes have been made possible by 4IR technology. Automation allows for precise and reliable execution of processes such drug formulation, mixing, filling, labeling, and packing. Robotic machines and arms are capable of handling delicate and exact tasks, lowering the possibility of contamination and errors.

- 4IR has helped the pharmaceutical industry to implement continuous manufacturing. The continuous flow of raw materials in continuous manufacturing processes enables real-time monitoring, precise control, and quality assurance. This method reduces batch-to-batch variability, waste, and production cycle length, resulting in greater efficiency and cost savings.

- Predictive maintenance and data analytics are made possible in pharmaceutical production by 4IR. In order to find patterns and forecast equipment failures or maintenance needs, machine learning algorithms can examine production data, sensor readings, and past maintenance records. With this proactive approach, unplanned downtime is reduced, equipment reliability is increased, and maintenance plans are optimized.

- Finally, RMG and pharmaceuticals are two of Bangladesh's most important industries. Both of these industries have the funds and capacity to incorporate cutting-edge technologies into their product lines.

Reasons for the slow adoption of digital technologies in the plastics, light engineering, and other industries-

- It can be challenging to integrate digital technology into current workflows and systems, particularly in sectors with manual or traditional procedures. It's possible that digital solutions won't be compatible with or easily adaptable to the old equipment and infrastructure. Workflow redesign, employee training, and significant changes to business processes may all be necessary as a result of the implementation of digital technologies, which can be difficult and disruptive. Majority of the plastics industries

in BSCIC use semi-automatic machines whereas the light engineering industries use semi-automatic o manual machineries. So, it's tough for them to adapt to modern technology with their existing setup.

- Many companies, especially small enterprises in BSCIC industrial estates, are risk-averse and uncertain to adopt new technology due to concerns about potential interruptions, operational downtime, and unforeseen obstacles. Employees may resist embracing new technologies or fear that automation may replace their roles, making change management a substantial hurdle. Addressing these concerns and cultivating a culture of creativity and adaptability are critical for effective adoption.

- Light Engineering & Small businesses do not have the necessary human or financial resources to carry out digital transformation projects. Progress can also be hindered by a lack of access to technical help, direction, and professional consulting services. SMEs need help locating suitable digital solutions, gaining access to finance options, and getting advice on implementation.

Addressing these issues involves a multifaceted approach that includes raising awareness, skill development programs, financial incentives, and specialized support services. Government efforts, industry groups, and technology suppliers can all play an important role in supporting digital technology adoption in various industries by providing guidance, financing possibilities, and collaborative platforms for knowledge sharing and best practices.

**Finance**

The financial industry has been significantly impacted by the Fourth Industrial Revolution (4IR), which has transformed numerous sectors of banking, finance, and investment. Digital technologies are being adopted by an increasing number of businesses for resource planning and financial management. Following are a few of the main effects of 4IR on the financial management and resource planning:

1. Digital Banking and Mobile Payments
2. Enhanced Security and Fraud Prevention

3. Real-time monitoring of resources.

4. Automatic replenishment.

Here is how BSCIC industries performed in 4IR adaptation in Production & Supply Chain segment:
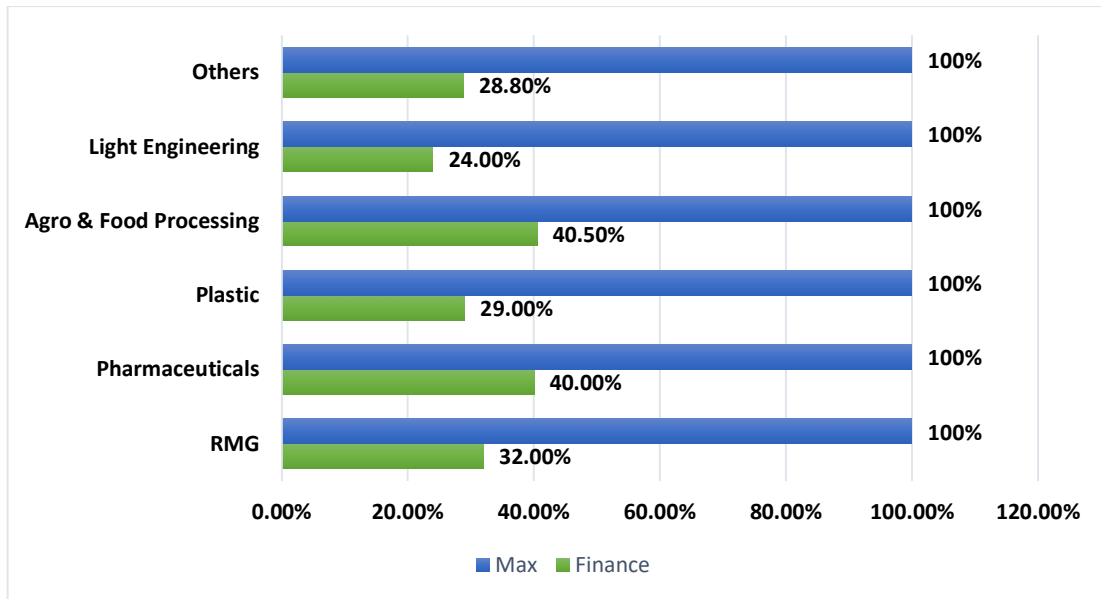


*Figure 16: 4IR adaptation level in finance*

All the industries in BSCIC industrial estates performed more or less the same in this segment because, with the advent of digital banking services and mobile payment options, 4IR has revolutionized the banking experience. Customers can use mobile apps and web platforms to access their accounts, conduct transactions, and manage their finances. Mobile payment systems and digital wallets have grown in popularity, allowing for convenient and safe transactions without the use of actual cash or credit cards. Almost all the industries we interviewed accept digital payments.

However, compared to other sectors, the RMG and pharmaceuticals sectors embraced fintech and resource planning techniques more successfully. Because a wide diversity of inventory is maintained in these two industries. Therefore, if inventory managers don't employ some sort of software or digital tools, it will be difficult for them to stay on top of the total situation. Therefore, ERP software is used by the majority of industries in these sectors. Though due to a lack of knowledge and technical resources, light engineering and small businesses are still far behind in using this type of software.

**Human Resource**

Human resource management (HRM) has been greatly influenced by the Fourth Industrial Revolution (4IR), which has revolutionized several processes related to hiring employees, employee engagement, skill development, and HR operations. Here are a few of the main effects of 4IR on HRM:

1. Digital Recruitment
2. Online Training and Skill Development
3. Digital performance monitoring
4. Automation of HR operations

Here is how BSCIC industries performed in 4IR adaptation in Production & Supply Chain segment:
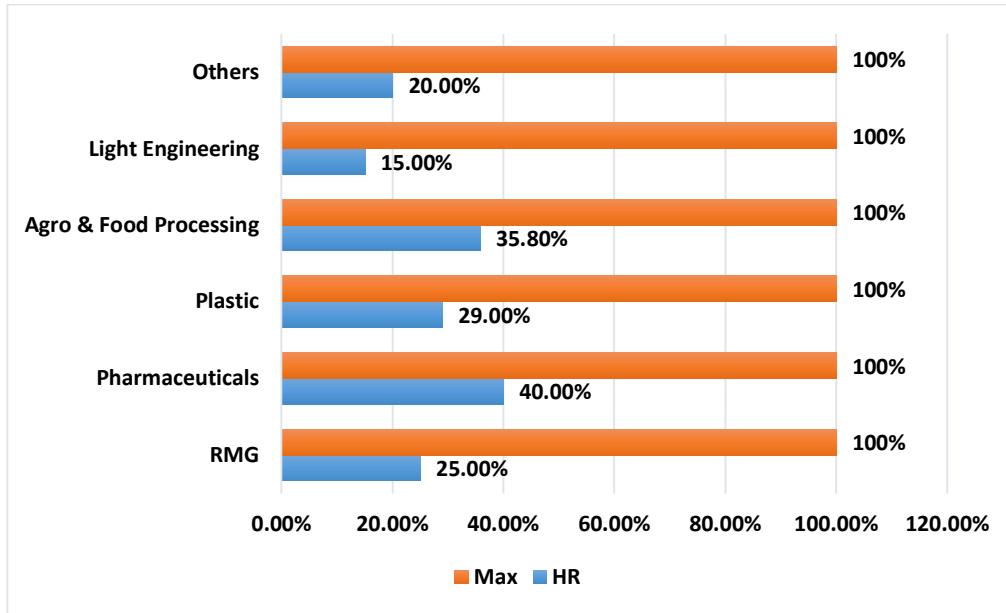
*Figure 17: 4IR adaptation level in HR*

As expected, Pharmaceuticals and Agro-Food Processing industries adopted digital HR tools more than other industries. Though in this segment all the industries performed the least than all other segments because-

1. Lack of skilled workforce in the HR department.
2. Management is not interested in funding the digitalization of the HR department since they do not consider it to be a wise investment.
3. In some industries employees are reluctant to adopt new technologies because they worry about losing their jobs or having their positions altered.
4. Many firms still use outdated HR systems and procedures, which may make it difficult to adopt 4IR technologies. It may be necessary to make large investments in infrastructure upgrades, system integration, and data migration in order to implement new technologies. Successful implementation may be hampered by compatibility problems and interoperability problems between current systems and upcoming technology.

**Employment Generation Scenario in BSCIC**

Bangladesh Small and Cottage Industries Corporation (BSCIC) is a significant generator of employment in Bangladesh. BSCIC is a government body that was founded to promote and grow the country's small and cottage industries. Its principal goal is to provide chances for entrepreneurs, especially for rural people and neglected populations. For the last three years, the following are the new employment generation data from BSCIC registered entrepreneurs/companies:
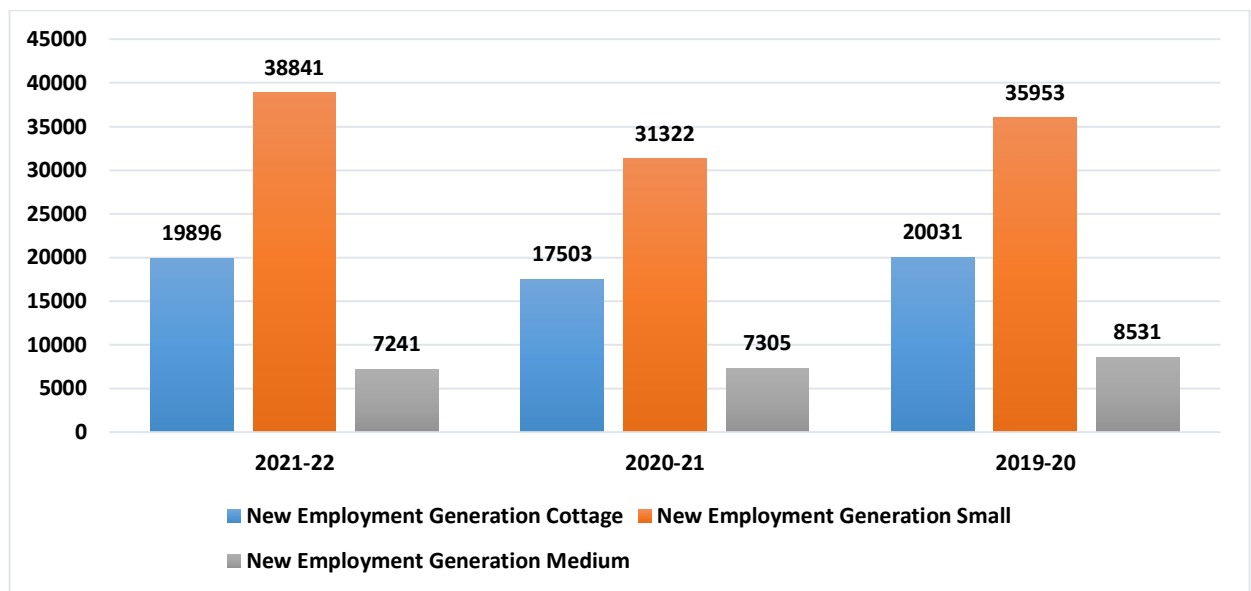


*Figure 18: New Employment Generation year by year*

If we examine closely, we can see that, aside from the small industries, there is a declining trend in the creation of jobs in the medium industries. There are several major reasons for this. Though the number of machines and manufacturing is expanding year after year, employment generation is not keeping pace. Because the vast majority of modern machines are automated or semi-automated, some of which do not even require human supervision. Many monotonous and normal jobs can now be performed by machines because of improvements in automation and robotics. In certain industries, like manufacturing, supply chain management, and agriculture, this minimizes the requirement for human labor. For

the cottage industry, Covid-19 can be a reason behind the declining trend. Though there can be other underlying reasons like lack of access to market & finance, skill shortages, infrastructure challenges, etc.

- **Challenges to Implement Industry 4.0**
a) Shortage of budget
b) Dearth of skilled manpower
c) Lack of advanced skill development training
d) Weak cyber security

- **BSCIC One Stop Service (OSS)**

Following BSCIC's inclusion in the One Stop Service Act of 2018's "A" Schedule, BSCIC One Stop Service (OSS) officially launched on June 13, 2021, to attract both domestic and global investment. Previously, four government institutions (BIDA, BEZA, BEPAZA, and Hi-Tech Park Authority) were included in the list of One Stop Service (OSS) providers. On July 19, 2020, when the fifth one-stop service provider BSCIC was listed, BSCIC started working to provide the services under its purview through One Stop Service. In addition to its own 29 services, BSCIC also offers 13 services from other departments or organizations through One Stop Service. New services will be offered under this OSS based on demand, allowing business owners to quickly and easily access a variety of services.

From the survey, it was found that 74% of the respondents are registered in OSS. Twelve (12%) of the respondents received IRC-ERC recommendations from OSS. Also, 42% of respondents registered themselves in different training programs through OSS (Figure- 18). In addition to that, respondents want more services related to Trade Licenses, Fire licenses, Environment licenses, and Service Charge Payment Options through the BSCIC OSS.
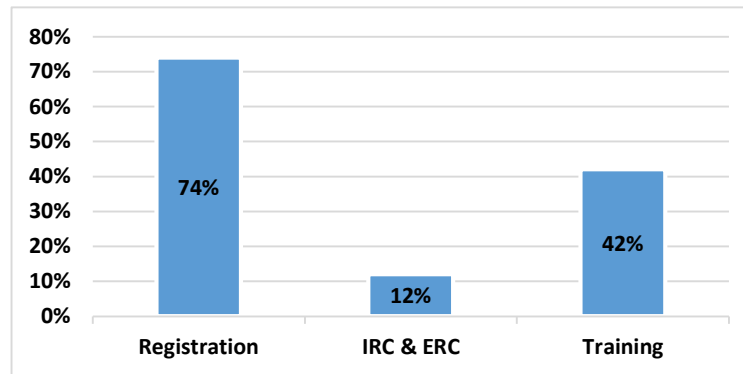
*Figure 19: Services received from BSCIC OSS*

## Focus Group Discussion

The purpose of the focus group discussion for the research titled "Industry 4.0 to Implement Vision 2041 of Bangladesh: Bangladesh Small and Cottage Industries Corporation's Role to Generate Employment and Reducing Poverty through Industrialization" is to gather insights, perspectives, and experiences from the academicians, expert panels and BSCIC stakeholders to identify recommendations and strategies regarding the role of BSCIC in implementing Vision 2041 through the adoption of Industry 4.0 technologies.

Although the majority of the focus group discussion participants are aware of the current operations of BSCIC, a quick introduction to BSCIC was made at the very beginning of this focus group discussion. The conversation then started with a few open-ended questions.

1. **Evaluation of BSCIC's Role:**
   a. How effective do you think BSCIC's current activities and support systems are working to encourage small and cottage industries to adopt Industry 4.0 in line with the goal of Vision 2041?
   b. Are there any areas where BSCIC can improve its role or provide better support?

2. **Collaboration and Partnerships:**
   a. Are there any opportunities for collaboration or partnerships between BSCIC and other stakeholders to accelerate the adoption of Industry 4.0 in small and cottage industries?
   b. What types of support or resources would be beneficial for BSCIC to enhance its role in facilitating Industry 4.0 implementation?

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3. **Recommendations and Strategies:**

   a. Based on your experiences and insights, what recommendations would you provide to BSCIC to effectively promote Industry 4.0 adoption among small and cottage industries? Are there any specific strategies or best practices that BSCIC should consider to ensure the successful implementation of Industry 4.0 in line with Vision 2041?

**Findings and Recommendations from FGDs:**

## 1. Evaluation of BSCIC's Role:

Every participant is adamant that BSCIC is essential to fostering inclusive industrial growth by emphasizing small and cottage industries, creating jobs, and eradicating poverty. By undertaking various efforts, such as seminars, workshops, training programs, and other events, it is assisting in the achievement of Vision 2041's aim and encouraging small and cottage industries to adopt Industry 4.0.

BSCIC's initiatives align with Vision 2041's goal of creating a robust and inclusive industrial sector. BSCIC encourages small and cottage businesses to employ environmentally friendly and sustainable practices. This means boosting energy efficiency, reducing waste, and using environmentally friendly production techniques in line with Vision 2041's emphasis on sustainable development and reducing the environmental impact of industrial activities.

The work of BSCIC helps to build value chains in cottage and small industries. By fostering connections between various industries, encouraging teamwork among industry participants, and facilitating market access for these sectors, BSCIC helps these companies increase efficiency, competitiveness, and overall value addition while also offering a variety of training programs.

BSCIC fosters entrepreneurship and innovation by promoting a culture of innovation, providing incubation and mentorship programs, and supporting small and cottage

industries in developing and commercializing innovative products and services. This aligns with Vision 2041's focus on fostering a knowledge-based economy.

Areas BSCIC can improve its role or provide better support may include:

**Awareness and Education**: Intensifying efforts to educate small and cottage industries about the ideas, advantages, and implementation strategies of Industry 4.0 technologies through education and training programs for these industries.

**Technical Expertise**: Strengthening BSCIC's technical expertise in Industry 4.0 technologies, data analytics, automation, and related fields to provide better guidance and support to small and cottage industries.

**Collaboration and Partnerships**: Collaborations with technology companies, research organizations, academic institutions, business groups, and governmental organizations to use their knowledge, resources, and networks to advance the adoption of Industry 4.0.

**Monitoring and Evaluation**: Establishing mechanisms to monitor and evaluate the impact and effectiveness of BSCIC's initiatives and support mechanisms to identify areas for improvement and make data-driven decisions.

**2.   Collaboration and Partnerships:**

Yes, there are several opportunities for collaboration and partnerships between BSCIC and other stakeholders to accelerate the adoption of Industry 4.0 in small and cottage industries. Some potential collaborators and partners could include:

**Technology Providers:** BSCIC can find acceptable Industry 4.0 solutions and gain access to the required hardware, software, and knowledge by working with technology providers. Technology providers can help cottage and small industries by providing them with technical assistance and training.

**Research Institutions and Universities**: Collaboration with academic institutions and research centers helps speed up training initiatives, R&D projects, and knowledge exchange. Through these partnerships, BSCIC can keep up with the newest best practices, emerging technologies, and Industry 4.0 trends.

**Industry Associations**: Participating in industry associations can encourage communication, networking, and information sharing amongst small and cottage industries. BSCIC can collaborate with these organizations to plan conferences, workshops, and seminars centered on the adoption of Industry 4.0.

To enhance its role in facilitating Industry 4.0 implementation, BSCIC would benefit from the following support and resources:

**Technical Expertise**: BSCIC can profit from collaborating with or hiring specialists in automation, data analytics, Industry 4.0 technology, and related services. These professionals can assist small and cottage industries with technical advice, consulting services, and training.

**Training and Skill Development Programs**: The BSCIC personnel and owners/workers of small businesses can better comprehend and make use of Industry 4.0 technologies by investing in training and skill development programs. Training in data analytics, IoT, automation, and cyber security are some examples of this.

**Information and Knowledge Sharing Platforms**: BSCIC can assist small and cottage industries by disseminating pertinent information, success stories, and case studies by establishing channels for information and knowledge sharing, such as online portals, newsletters, or workshops.

**Collaborative Partnerships:** Expanding BSCIC's reach, proficiency, and resources in encouraging Industry 4.0 adoption can be accomplished by actively pursuing and nurturing

partnerships with technology providers, research institutions, universities, industry groups, and government organizations.

BSCIC can strengthen its role as a facilitator of Industry 4.0 implementation and offer more extensive help to small and cottage companies in Bangladesh by utilizing these collaborations and getting the required support and resources.

### 3. Recommendations and Strategies:

To effectively promote Industry 4.0 adoption among small and cottage industries and ensure the successful implementation in line with Vision 2041, experts provide the following recommendations to Bangladesh Small and Cottage Industries Corporations (BSCIC):

**Conduct Needs Assessments**: To understand the unique difficulties, demands, and readiness of small and cottage enterprises regarding Industry 4.0 adoption, BSCIC should undertake thorough needs assessments. This assessment can be used to appropriately design activities and support systems.

**Awareness and Training Programs**: Create and implement training programs and awareness campaigns to inform cottage and small industries about Industry 4.0 technologies, their advantages, and implementation methods. These initiatives ought to concentrate on fostering an innovative culture and addressing the needs of both employers and employees.

**Create Technology Adoption Roadmaps:** Develop technology adoption roadmaps for various segments of small and cottage industries in collaboration with industry experts, technology providers, and other stakeholders. These roadmaps can serve as a step-by-step manual by outlining the particular technology, application procedures, and anticipated results for each sector.

**Facilitate Access to Technology**: Encourage access to affordable Industry 4.0 technologies for small and cottage companies This can include providing subsidies, grants, or incentives for technology acquisition, forming partnerships with technology providers for discounted rates, or establishing technology-sharing platforms among industries.

**Foster Industry-Academia Collaboration**: Encourage collaboration between small and cottage industries, universities, and research institutions. Facilitate joint research and development projects, technology transfer initiatives, and training programs to bridge the gap between academia and industry.

**Develop Cyber Security Measures:** Promote cyber security awareness and provide guidance on implementing robust security measures to protect against potential cyber threats associated with Industry 4.0 technologies. This includes ensuring data privacy, implementing secure networks, and training employees on cybersecurity best practices.

**Enable Policy and Regulatory Support:** Advocate for the development of supportive policies and regulations that facilitate Industry 4.0 adoption among small and cottage industries. This includes policies related to investment incentives, intellectual property protection, data governance, and standards compliance.

**Establish Collaboration Platforms**: Establish collaboration, networking, and knowledge-sharing platforms for small and cottage industries so they may adopt Industry 4.0. Industry clusters, innovation hubs, or online communities are a few examples of these venues where stakeholders can share ideas, problems, and best practices.

**Monitor and Evaluate Progress:** Maintain a close eye on and analyze how small and cottage industries are using Industry 4.0. Gather input, assess the impact, and, in light of the results, make the required adjustments to projects and support systems.

By considering these recommendations and implementing strategies aligned with Vision 2041, BSCIC can effectively promote Industry 4.0 adoption among small and cottage industries, driving economic growth, innovation, and competitiveness in Bangladesh.

By holding the focus group discussion, this research hopes to offer insightful analysis and practical suggestions to BSCIC and other important stakeholders for encouraging the adoption of Industry 4.0 in small and cottage industries, ultimately assisting in the achievement of Vision 2041 and sustainable economic growth in Bangladesh.

# 5.0 Recommendations

This research provides several recommendations that BSCIC should take on board to implement Industry 4.0 to achieve Vision 2041 of Bangladesh:

## Recommendation for Policy Makers

I.     Government should introduce 4IR friendly policies such tax reduction for IT/4IR related products/services.

II.    Basic and Advanced level courses should be offered by government to equip the human resources with required skills to do well in the era of 4IR.

III.   Modern age infrastructure should be built across the country to support the 4th Industrial Revolution. Easy access and cheap internet, Tier 3 or 4 Data Centers etc. will help the people and private entities to take advantage of 4IR.

## Recommendation for Private Entities

I.     Top down approach from leadership for faster adoption of digital transformation.

II.    Companies should spend more on R&D for figuring out the best possible way for harnessing the perks of 4IR

III.   Companies should ensure learning tools for their employees to upskill themselves since international vendors can be expensive, perhaps partnering with local IT startups to develop digital tools like CRM, forecasting tools, etc.

IV.    Stakeholders and investors should invest for the long-term development of industries with 4IR skills rather than aiming for short-term success.

## Recommendation for BSCIC

a)  In order to understand the particular challenges, desires, and readiness of small and cottage firms for Industry 4.0 adoption, BSCIC can conduct extensive needs

assessments. This assessment can be used to develop appropriate activities and support systems.

b) BSCIC may offer more awareness programs and capacity-building initiatives to educate stakeholders, including small and cottage industry owners, workers, and policymakers, about the potential benefits and implications of Industry 4.0 and Vision 2041 of Bangladesh.

c) BSCIC should prioritize skill development and training programs that equip the workforce with the necessary digital and technical skills required for Industry 4.0. These programs can include vocational training, apprenticeships, and re-skilling initiatives tailored to the needs of the small and cottage industries sector, ensuring that workers are prepared for the changing demands of the digital era.

d) BSCIC may actively collaborate with local and international stakeholders, including industry associations, academia, research institutions, and technology providers. Building strategic partnerships can facilitate technology transfer, knowledge exchange, and access to resources, fostering innovation and enabling the small and cottage industries sector to leverage the full potential of Industry 4.0.

e) BSCIC can develop Industry 4.0-focused innovation and research centers. These centers can act as hubs for new technology exploration, prototyping, and testing. They can also allow collaboration between industrial actors, academia, and researchers, encouraging innovation and producing tailored solutions that answer the sector's specific demands and challenges.

f) BSCIC should promote technology dissemination and adoption by offering incentives and assistance to small and cottage companies that embrace Industry 4.0. Subsidies for purchasing modern machinery, tax breaks for technology investments, and streamlined procedures for technology acquisition and deployment are all examples of this. Creating a supportive environment that rewards early adopters can hasten the transition and drive the widespread use of Industry 4.0 technologies.

g) BSCIC may raise awareness of cyber security and provide advice on implementing robust security measures to protect against potential cyber threats linked with

Industry 4.0 technology. This includes safeguarding data privacy, putting in place secure networks, and educating personnel on cybersecurity best practices.

h) BSCIC's technical competence in Industry 4.0 technologies, data analytics, automation, and related sectors in order to better guide and support small and cottage companies should be improved.

i) BSCIC should create systems to track and assess the impact and efficacy of BSCIC activities, as well as support mechanisms to identify areas for improvement and make data-driven decisions.

BSCIC can effectively encourage Industry 4.0 adoption among small and cottage enterprises by adopting these ideas and executing strategies associated with Vision 2041, hence boosting economic growth, innovation, and competitiveness in Bangladesh.

# 6.0 Conclusions

In conclusion, Industry 4.0 presents a significant opportunity for Bangladesh, particularly in the context of implementing Vision 2041 and addressing the critical challenges of employment generation and poverty reduction. The Bangladesh Small and Cottage Industries Corporation (BSCIC) has a crucial role to play in harnessing the potential of Industry 4.0 and driving industrialization in the small and cottage industries sector.

Through this research, we have explored the concept of Industry 4.0 and its relevance to the vision of Bangladesh for the year 2041. We have examined the role of BSCIC in this transformative process and identified its potential to generate employment opportunities and reduce poverty through industrialization. The research has also shed light on the challenges and barriers that may hinder the adoption of Industry 4.0 technologies and has provided recommendations to overcome these obstacles.

To successfully implement Industry 4.0, it is essential to enhance awareness and build the capacity of stakeholders, foster collaboration and partnerships, develop supportive policies and regulations, and establish innovation and research centers. Moreover, facilitating access to financing, promoting skill development and training programs, encouraging technology diffusion and adoption, and conducting pilot projects and case studies are vital steps towards realizing the vision of Vision 2041.

While the implementation of Industry 4.0 holds great promise, it is important to acknowledge the limitations of this research. These limitations include the availability and reliability of data, the generalizability of findings, the lack of long-term impact assessment, and the influence of external factors and macroeconomic conditions. Moreover, the research may not fully capture the perspectives of stakeholders and the evolving landscape of Industry 4.0 and Vision 2041.

Nevertheless, the findings of this research contribute to the existing literature on Industry 4.0 and its implications for developing countries, with a specific focus on Bangladesh and its small and cottage industries sector. The recommendations provided can guide

policymakers, industry leaders, and stakeholders in leveraging Industry 4.0 to achieve the objectives of Vision 2041 and foster sustainable economic growth and social development.

In conclusion, by embracing Industry 4.0 and capitalizing on the strengths of the Bangladesh Small and Cottage Industries Corporation, Bangladesh can unlock new avenues for employment generation and poverty reduction. With concerted efforts, collaboration, and strategic interventions, Bangladesh can position itself as a dynamic player in the global digital economy, contributing to the overall well-being and prosperity of its people.

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# বিসিক ট্রেনিং ইনস্টিটিউট (সাবেক স্কিটি)

প্লট ২৪/এ, রোড নং: ১৩/এ, সেক্টর – ৬, উত্তরা মডেল টাউন, ঢাকা - ১২৩০

## 'রূপকল্প ২০৪১ বাস্তবায়নে চতুর্থ শিল্প বিপ্লব: শিল্পায়নের মাধ্যমে কর্মসংস্থান সৃষ্টি ও দারিদ্র্য বিমোচনে বিসিকের উদ্যোগ' শীর্ষক গবেষণা

<u>শিল্প মালিক/উদ্যোক্তাদের জন্য প্রযোজ্য</u>

(উত্তরদাতার গোপনীয়তা রক্ষা করা হবে)

<u>উদ্যোক্তা/তথ্য প্রদানকারীর তথ্য</u>

| নাম | : | | |
|---|---|---|---|
| প্রতিষ্ঠানের নাম ও ঠিকানা | : | | |
| পদবি | : | | |
| শিক্ষাগত যোগ্যতা | : | ১. প্রাতিষ্ঠানিক শিক্ষা নেই | ৬. মাস্টার্স/সমমান |
| | : | ২. প্রাথমিক শিক্ষা | ৭. পিএইচডি |
| | : | ৩. মাধ্যমিক/সমমান | ৮. ডিপ্লোমা |
| | : | ৪. উচ্চ মাধ্যমিক/সমমান | ৯. অন্যান্য (উল্লেখ করুন) |
| | : | ৫. অনার্স/সমমান | |
| বয়স | : | | |
| মোবাইল নম্বর | : | | |
| ই-মেইল | : | | |
| প্রতিষ্ঠানের আকার | : | ১. কুটির   ২.মাইক্রো ৩. ক্ষুদ্র ৪.মাঝারি | |
| প্রতিষ্ঠানের ধরন | : | ১. কৃষি<br>২. উৎপাদন<br>৩. সেবা<br>৪. অন্যান্য (উল্লেখ করুন) | |
| পণ্য/সেবার বিবরণ | : | | |

১. বাংলাদেশ সরকার প্রণীত রূপকল্প ২০৪১ সম্পর্কে আপনি কতটুকু অবহিত?

☐ সম্পূর্ণরূপে   ☐ মোটামুটি   ☐ মোটেই না

২. '৪র্থ শিল্প বিপ্লব' সম্পর্কে কতটুকু অবহিত?

☐ সম্পূর্ণরূপে   ☐ মোটামুটি   ☐ মোটেই না

৩. ৪র্থ শিল্প বিপ্লব কথাটি শুনলে আপনার মাথায় কি কি Term আসে?

- Artificial Intelligence (AI)
- Machine Learning
- Internet of Things (IoT)
- Cloud Computing
- Robotics
- Big Data
- 3D Printing
- Block Chain
- N/A

৪. আপনার প্রতিষ্ঠানের কোন কাজটি Digitally হয়?

- Reporting
- HR
- N/A
- E-Marketing
- Production
- Transaction
- Supply Chain

৫. আপনার প্রতিষ্ঠানের কত শতাংশ কর্মকর্তা-কর্মচারী Digitally Skilled?

- N/A
- 1-24
- 25-49
- 50+

৬. আপনার প্রতিষ্ঠানে মেশিনের সংখ্যা -

| মেশিনের ধরন | বর্তমান মেশিন সংখ্যা | ৫ বছর পূর্বে মেশিন সংখ্যা |
|---|---|---|
| Smart Automation | | |
| Semi-Automatic | | |
| Manual | | |
| Total | | |

৭. কারখনার মোট বার্ষিক উৎপাদন

| বার্ষিক উৎপাদন | বর্তমান উৎপাদন | ৫ বছর পূর্বে উৎপাদন |
|---|---|---|
| | | |

৮. কারখনার মোট জনবল

| জনবল | বর্তমান জনবল | ৫ বছর পূর্বে জনবল |
|---|---|---|
| | | |

৯. আপনার কোম্পানিতে প্রযুক্তিগত উন্নয়নের জন্য কী কী করা দরকার বলে মনে করেন?

- Skilled Workers
- Help From Govt
- R & D
- Budget
- Infrastructure
- N/A

১০. কর্মীদের ডিজিটাল দক্ষতা উন্নয়নের জন্য প্রশিক্ষণের ব্যবস্থা আছে কি?

☐ হাঁ ☐ না

১১. ১০ নং প্রশ্নের উত্তর হ্যাঁ হলে, কী কী প্রশিক্ষণ করানো হয়?


১২. ১০ নং প্রশ্নের উত্তর না হলে, কী কী প্রশিক্ষণ করানো দরকার বলে মনে করেন?

১৩. আপনার প্রতিষ্ঠানের পণ্য উৎপাদনের প্রক্রিয়ায় (ডিজাইন, মার্কেটিং) কোন পরিবর্তন এসেছে কি না?

    ☐ হ্যাঁ  ☐ না

১৪. ১৩ নং প্রশ্নের উত্তর হ্যাঁ হলে, কী ধরণের পরিবর্তন উল্লেখ করুন:



১৫. আপনার প্রতিষ্ঠানের একজন অপারেটরের গড় মাসিক বেতন কত?

| গড় মাসিক বেতন | বর্তমান | ৫ বছর পূর্বে |
|---|---|---|
|  |  |  |

১৬. আপনার প্রতিষ্ঠানের একজন হেল্লারের গড় মাসিক বেতন কত?

| গড় মাসিক বেতন | বর্তমান | ৫ বছর পূর্বে |
|---|---|---|
|  |  |  |

১৭. 4IR প্রয়োগের ক্ষেত্রে কী কী চ্যালেঞ্জ আছে বলে মনে করেন?

- o  Budget
- o  Manpower
- o  Training
- o  Help From Govt
- o  Others

১৮. **BSCIC One Stop Service (OSS)-এ আপনি নিবন্ধিত কিনা?**

    ☐ হ্যাঁ  ☐ না

১৯. ১৮ নং প্রশ্নের উত্তর হ্যাঁ হলে, **BSCIC OSS** থেকে আপনি কী কী সেবা গ্রহণ করেছেন?

- o  Registration
- o  IRC-ERC
- o  Training

২০. ১৮ নং প্রশ্নের উত্তর হ্যাঁ হলে, **BSCIC OSS** এ কী কী সেবা যুক্ত করলে সুবিধা হবে বলে আপনি মনে করেন?

| কোড | বিবরণ | প্রযোজ্য নয় (০) | নগণ্য (১) | মোটামুটি (২) | ভাল (৩) | অতি ভালো (৪) |
|---|---|---|---|---|---|---|
| P-1 | কারখানার যন্ত্রপাতিসমূহ স্বনিয়ন্ত্রিত | | | | | |
| P-2 | নতুন যন্ত্রপাতি ব্যবহারের জন্য কারখানা প্রস্তুত | | | | | |
| P-3 | যন্ত্রপাতিসমূহের ডিসপ্লেতে যন্ত্রপাতি পরিচালনার নির্দেশনা আছে | | | | | |
| P-4 | যন্ত্রপাতি নিজে থেকে মেইনটেনেন্সের সিগন্যাল দেয় | | | | | |
| P-5 | কারখানার ইনভেন্টরি ডিজিটালি ম্যানেজ করা হয় (RFID, QR code, Bar code, etc.) | | | | | |
| P-6 | পণ্যের অবস্থান ডিজিটালি নির্ণয় করা যায় (RFID, QR code, Bar code, etc.) | | | | | |
| P-7 | কারখানার ম্যাটেরিয়াল হ্যান্ডলিং ডিজিটালি হয় (Robotics) | | | | | |
| P-8 | প্রতেকটি যন্ত্রপাতি সেন্ট্রাল কন্ট্রোল রুমের সাথে সংযুক্ত | | | | | |
| P-9 | কারখানায় CAD/CAM-এর ব্যবহার হয় | | | | | |
| P-10 | কারখানার ডাটা হ্যাকিং হতে নিরাপদ (এন্টি ভাইরাস/ অন্যান্য সফটওয়্যার) | | | | | |
| M-1 | সিজন্যাল ডিমান্ড নির্ণয়ের জন্য ফোরকাস্টিং টুল ব্যবহৃত হয় | | | | | |
| M-2 | কোম্পানির মার্কেটিং ডিজিটালি করা হয় (ই-মার্কেটিং/কৃত্রিম বুদ্ধিমত্তা) | | | | | |
| M-3 | ডিজিটালি পণ্যের মার্কেট সার্ভে করা হয় | | | | | |
| M-4 | কাস্টমারদের অনলাইন ডাটাবেজ আছে | | | | | |
| F-1 | অনলাইন পেমেন্ট ব্যবস্থা আছে (মোবাইল ব্যাংকিং, ইন্টারনেট ব্যাংকিং) | | | | | |
| F-2 | Enterprise Resource Planning (ERP) সফটওয়্যার ব্যবহার হয় | | | | | |
| H-1 | কোম্পানির ডিজিটালি দক্ষ কর্মী আছে | | | | | |
| H-2 | কর্মীদের পারফরমেন্স ডিজিটালি মনিটর করা হয় | | | | | |
| H-3 | কর্মীদের ডিজিটাল দক্ষতা উন্নয়নের জন্য প্রশিক্ষণের ব্যবস্থা আছে | | | | | |

স্বাক্ষর

# Annexure B : Questionnaire of FDGs

1. **Evaluation of BSCIC's Role:**

   a. How effective do you think BSCIC's current activities and support systems are working to encourage small and cottage industries to adopt Industry 4.0 in line with the goal of Vision 2041?

   b. Are there any areas where BSCIC can improve its role or provide better support?

2. **Collaboration and Partnerships:**

   a. Are there any opportunities for collaboration or partnerships between BSCIC and other stakeholders to accelerate the adoption of Industry 4.0 in small and cottage industries?

   b. What types of support or resources would be beneficial for BSCIC to enhance its role in facilitating Industry 4.0 implementation?

3. **Recommendations and Strategies:**

   a. Based on your experiences and insights, what recommendations would you provide to BSCIC to effectively promote Industry 4.0 adoption among small and cottage industries? Are there any specific strategies or best practices that BSCIC should consider to ensure the successful implementation of Industry 4.0 in line with Vision 2041?

# Annexure C : Photos of Different FDGs and KIIs