Adoption Intention of Technology in SMEs Conceptualizing and Framing the Adoption Intention of Next Level Technology in Food and Beverage Manufacturing SMES in Bangladesh

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DOI: https://dx.doi.org/10.47772/IJRISS.2024.8110246

Received: 15 November 2024; Accepted: 20 November 2024; Published: 22 December 2024

ABSTRACT

Small and Medium Enterprises (SMEs) are vital in national economy and gross domestic products (GDP). Thus, the performance of these enterprises will maintain the wheel of the country's economy. Upgrading the technologies, current used will in SMEs will make efficient the manufacturing process of food beverage industries in Bangladesh. Those firms are still using traditional equipment and machinery in their food and beverage manufacturing process is required to adopt next level of technologies which they can afford for maximizing the performance. Thus, the study focuses on the intention of adoption of next level of industrial revolution technologies in food and beverage manufacturing small and medium enterprises (SMEs) in developing countries (Bangladesh). The study will collect a total 230 SME owners (food and beverage manufacturing small and medium enterprises (SMEs) data and that collected data will be analysed using partial least square structural equation modelling (PLS-SEM) with SmartPLS software. For investigation of this intention, the study adopted two perspectives- the invasion and role of disasters and hazards on SMEs through disaster preparedness and business continuity plan and secondly unified theory of acceptance and usage of technology (UTAUT) for measuring the intention. The study is expected to contribute to these two theories in new context with constructs. The study will also contribute to policy makers of government in developing constructive policy and effective financial and non-financial support for small and medium enterprise in food and beverage manufacturing enterprises.

Keywords: Bangladesh, Business Continuity, Disaster Preparedness, Industrial Revolution, Adoption Inention, SMEs, UTAUT Model

INTRODUCTION

Small and Medium Enterprises (SMEs) are a vital part of an economy (Xing et al., 2023), and food and beverage manufacturing SMEs are overall the most vital within the SME sector (Chen et al., 2020). (World Bank, 2023) reports revealed that formal SMEs contributed around 40% to emerging countries. The technological advancement in this industry has also had far-reaching success, namely industry revolution. Industry revolution is a state-of-the-art business model (Wei et al., 2023), which is expected to be an influential driver of SMEs to enable them to flourish like large industries (Smith, 2022 #6128). However, not all SMEs can adopt the latest technology as larger enterprises do due to a shortage of capital, lack of skilled manpower, and efficiencies (operational efficiencies, experience, etc.) (Bruce, 2023). A particular enterprise adopts and uses the state-of-the-art technology or modern equipment according to its capabilities and affordability (financial and non-financial capacities and affordability) (Wei et al., 2023). Many small firms are still manufacturing with their indigenous technology or older version of equipment and machineries. This scenario is mostly found in the least developed countries (LDC) and developing countries (Sundaram, 2023). This current research focuses on industry revolution technology in food and beverage SME manufacturing industries.

BACKGROUND OF THE STUDY

Small and medium enterprises (SMEs) are the backbone of the economy of a country, regardless of the size of an economy- large, small or medium (Yadegaridehkordi, 2023) as these enterprises have a wider role and contribution to the world economy. With the help of small business, many countries have achieved a high level of development (Teoh, 2022)**.** (Marino-Romero, 2024) and (Kindström, 2024) portrayed the significance of SMEs in a national economy, such as employment, generating valuable input in society, a strong instrument of development, and meeting the local demand of society as per their requirements. Surprisingly, SMEs generate 52-57% of employment in developed countries and 61% in developing countries. A World Bank report (2024) showed that SMEs contribute 40% to GPD and 50% to employment generation.

'The Industrial Revolution' alludes to the period in history when there was a move from manual labor to machine-based fabricating (Oztemel & Gursev, 2020), which started in Britain in the late 18th century and afterward spread to other parts of Europe and North America (Stearns, 2020). This change brought about critical changes within the way products were delivered, transported, and expended, and it had a significant effect on financial, social, and political frameworks (Heubeck, 2023). Key advancements of the industry revolution included the improvement of machines for turning and weaving materials, the innovation of the steam motor, and the presentation of unused press and steel generation strategies (Sharma & Singh, 2020).

As stated earlier, the industry revolution is linked with technological advancement and invention of new equipment/machinery, business operation processes, and inbound and outbound logistics. Table A in the appendix depicts the gradual advancement of technology over the period.

Industrial Revolution in the Food and Beverage Industry

The food and beverage industry has experienced a transformative journey along with the industrial revolution due to a significant advancement and mass production methods (Almansoori, 2020). (Almansoori, 2020) also mentioned that the contribution of the Industry Revolution (IR) is widely evident in food processing, packaging, distribution through enhanced efficiency, productivity, accessibility, and innovation (Hassoun et al., 2023). This revolution surfaced in the 19th and 20th century when mechanization, automation, and increased food production were achieved (Haque et al., 2022). Steam engine, refrigeration, canning, and pasteurization allowed for the mass production and preservation of food, extending its shelf life, and enabling wider distribution were remarkable innovations in the food and beverage industry (Hassoun, 2022).

Industrial Revolution in Manufacturing Industry in Bangladesh

Bangladesh has experienced significant growth in the manufacturing sector in recent years, with the textile and garment industry being the largest contributor to the country's manufacturing output (Aziz & Naima, 2021). This growth has been driven by the country's low labor costs and large pool of unskilled workers, which has made it an attractive location for textile and garment manufacturing (Hossain & Abdullah, 2019). The textile and garment industry in Bangladesh has seen significant investment and modernization in recent years, with the adoption of new technologies and production methods to increase efficiency and productivity (Tumpa et al., 2019). The industry has also been focused on improving working conditions and environmental sustainability, following a series of tragedies in the sector that highlighted the need for better safety standards and labor rights (Hoque, 2020).

Industrial Revolution in the Food and Beverage Industry in Bangladesh

The food and beverage industry in Bangladesh has undergone significant transformation in recent years (Hossain, 2023), driven by a growing population, rising incomes, and changing consumer preferences (Pingali & Abraham, 2022). While Bangladesh did not experience an Industrial Revolution in the traditional sense, the country has seen significant growth and modernization in the food and beverage sector (Rahman, 2024). However, A major portion of this newly established food industry is managed by traditionally small scale domestic or family business (Projectsprofile, 2024). These enterprises are using common processing

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VIII Issue XI November 2024

knowledge for the conservation and handling of raw agricultural commodities to make them food and bread-cookies since 1960s. To date, this industry has failed to gain momentum in large-scale production and processing.

One of the key developments in the industry has been the growth of modern retail formats such as supermarkets and hypermarkets (Rahman, 2024), which have enabled consumers to access a wider variety of products and brands (Ahamed, 2024). This has led to increased competition among food and beverage manufacturers, and has incentivized companies to invest in product innovation, quality control, and marketing.

Disaster Situations in the World and in Bangladesh

Disasters and calamities are natural events that harm the community, establishment, economic conditions, human lives, agriculture, industry, etc. (Oliver-Smith, 2019 #6622). Besides natural disaster, man-made disasters are also responsible for harming the environment, including the business environment. Historically both these types of disasters have an impact on business activities (World Bank, 2023 #6181). In the last 20 years, the world has faced several economic crises due to causes such as 2001 World Trade Center (Twin Tower) attack; the global financial crisis in 2007-2008; the European debt crisis in 2009; Iraq attack in 2003; Afghanistan attack in 2001; Russian financial crisis in 2014; Brazilian economic crisis in 2014-2017; Chinese stock market crash in 2015; and Turkish currency and debt crisis, 2018 (Projectsprofile, 2024 #6621). These financial crises were not confined to the particular countries, rather they caused suffering throughout the whole world. Besides economic crises, various natural and human-made disasters shocked the world. In the last two decades, these catastrophic global disasters, such as Haiti's earthquake in 2010, Boxing Day Tsunami in 2004, Myanmar's Cyclone Nargis in 2008, and Pakistan's earthquake in 2005 were remarkable (World Bank, 2023). These natural disasters present a hurdle for business operations, especially small businesses where capital and assets are limited. During and post-disaster situation, business operations become paralyzed, and sometimes even leading to dissolution. It becomes a harder challenge to return to business operation and survive. Recently, the whole world faced the Coronavirus disease 2019 (COVID-19) crisis and WHO declared it a pandemic (WHO, 2022 #6623). It first broke out in Wuhan city in China and spread across the whole world. The impact of COVID-19 invades human civilization. Therefore, it is a global shock (Papadopoulos et al., 2020). The world economic operations were also stuck severely due to this pandemic.

Bangladesh, with a land area of 147,570 square kilometers, is located in South Asia, and lies between India and Myanmar. It is a low-lying deltaic country, which historically faces natural disasters (Hansen, 2023). In a study it is found that Bangladesh has experienced 219 natural disasters since her independence (1971) due to its land characteristics, the geographical location, multiplicity of rivers and the monsoon climate. Bangladesh is highly to vulnerable floods, cyclones, storm surge, river-bank erosion, earthquake, drought, salinity intrusion, fire and tsunami. Cyclones and floods in particular cause massive damage. Cyclones occurred in 1970, 1991, 2007 and 2009 and killed 364,000, 136,000, 3,363 and 190, respectively. The recent remarkable natural disasters are Cyclone Aila (May 2009: 190 people dead; 3,935,341 people affected; total damage was USD270 million); Cyclone Sidr (November 2007: 8,978,541 people affected; 4,234 people dead; damage USD2.3 billion); and Cyclone (April 1991: 15,438849 people affected; 138,866 people dead; total damage was UD$1.78 billion) (Hansen, 2023).

Besides these, other human-made disasters include fire (due to lack of safety measure), earth-quake damage (due to vulnerable construction and development), city-flooding and flash-floods (due to unplanned urbanization and lack of sewerage system), are all devastating calamities, which affect both the population and businesses. According to the World Bank (2023) (World Bank, 2023), at least 16,000 fire incidents have occurred around Bangladesh in the last 10 years contributing to the death of 1,590 people. These fire incidents happened in garment factories, restaurant buildings, commercial buildings, and residential buildings. The death toll, financial loss, infrastructure damage, and natural environment damage are obvious. Many small businesses face their end of business operation; many proprietors met their end of business (Hassoun, 2023). Many of those suffering enterprises could not stand again. Thus, disaster preparedness and continuation of their business are vital while these firms plan for the up gradating of their business operation and technological adoption.

Research Issues

Bangladesh imports a significant amount of food and beverage items from foreign countries. Presently, around 1,000 food processors are available across the country of which 10% are large and medium-sized enterprises and the remaining are small enterprises. The registered agro-processing enterprises are around 300 companies with food safety certifications. Bangladesh experiences the demand for packaged and convenient food in recent years and she is one of the countries that is embracing this new trend. In 2013 a market size was USD3.0 billion and it became to USD5.2 billion in 2018 and was projected to reach USD7.3 billion in 2023. The products are expected to see a continuous growth of 6% in 2023. Many F&B Manufacturing SMEs cant afford to adopt the lates technology. In this case, they may adpt the next level of technologies which they are currently using. This study will focus on this intention to adopt the next level of technology A growing need for food quality or safety, brought on by social media content consumption, will increase consumer knowledge and create a need for nutritious packaged and ready-to-cook food goods. This is especially true in cities where people are more aware of the nutritional value and health advantages of food and its contents. This would also give the nearby food processors additional chances to meet the demands of this specific market niche.

This study aims to investigate the adoption of Industrial Revolution (IR) technologies in small and medium enterprises (SMEs), particularly in the food and beverage manufacturing sector. While technology adoption is universal, the viability of adoption is more favorable for western nations, compared to eastern and southern nations, due to cultural and national differences. The study explores the factors influencing SMEs' intentions to adopt IR technologies, including the contingent role of disaster preparedness, business continuity planning, and government support and policy in the process. The findings of this study provides valuable insights for policymakers, industry practitioners, and academics seeking to support the adoption of IR technologies in SMEs.

This manuscript presents the study background, industry introduction, SMEs scenario, Industry revolution, probable issues, and research questions along with research objectives, contribution, novelty, and study scopes. Chapter Two following provides the reviews of past and existing literature related to SMEs' technological adoption, Bangladesh SMEs and business models, various theories connected with conceptual model, and research hypotheses.

CONTEXTUAL AND LITERATURE REVIEW

Bangladeshi Food and Beverage Manufacturing SMEs

Food and Beverage (F&B) Small and Medium Enterprises (SMEs) in Bangladesh are significant contributors to the country's economy. The sector comprises a vast range of businesses, from street food vendors to packaged food manufacturers, and is an essential source of employment and income for millions of people in the country (Rahman, 2024 #6572). One of the primary challenges faced by F&B SMEs in Bangladesh is the lack of access to finance. Due to limited collateral and credit history, SMEs often struggle to secure financing from traditional sources like banks and other financial institutions. As a result, F&B SMEs often rely on informal channels such as family and friends, and moneylenders charging high-interest rates, which can limit their growth and expansion (Rashid et al., 2020). Another significant challenge faced by F&B SMEs in Bangladesh is the lack of access to modern technology and expertise. SMEs often have limited resources to invest in modern equipment and technology, which can improve the quality and efficiency of their products. Furthermore, SMEs often lack the necessary skills and knowledge to adopt modern technology, limiting their ability to compete with larger firms and access new markets (Saha et al., 2019).

Regulatory hurdles and bureaucratic procedures are also significant challenges faced by F&B SMEs in Bangladesh. Obtaining licenses and permits to operate and expand their businesses can be a time-consuming and complicated process, limiting the ability of SMEs to grow and innovate. Moreover, the lack of clarity and transparency in government regulations and policies can also limit the growth and expansion of F&B SMEs (Ullah et al., 2019). In brief, F&B SMEs in Bangladesh face several challenges that limit their ability to compete and grow, including limited access to finance, inadequate technological capabilities, and regulatory hurdles. Addressing these challenges will require a collaborative effort from various stakeholders, including

the government, financial institutions, and other support organizations, to create an enabling environment for F&B SMEs' growth and development.

Industry Revolution and Food and Beverage SMEs in Bangladesh

Industry revolution has been transforming various industries globally, including the food and beverage sector, by enhancing the efficiency of operations and improving the quality of products. In Bangladesh, the food and beverage SMEs can also benefit from the adoption of industry technologies (Hansen, 2023).

Intention to Adopt Industry Revolution in Bangladesh

The Industrial Revolution represents a new era of manufacturing characterized by the integration of advanced technologies in the particular era, including its latest technologies, machineries, equipment, and business model (Klingenberg, 2022). In the case of IR 4.0, the new era includes the Internet of Things (IoT), artificial intelligence (AI), and robotics. The adoption of IR has the potential to transform manufacturing processes, increase productivity, and enhance product quality. However, the level of adoption of industry technology in Bangladesh remains low, particularly among small and medium-sized enterprises (SMEs) (Nasir et al., 2022).

Factors Influencing the Adoption of Industry Revolution Technology

This section describes the constructs that affect the decision or intention to adopt new technology. The constructs were picked from business continuity theory and UTAUT model.

Disaster Preparedness

The provision of efficient solutions to a catastrophe-affected population's immediate, medium, and long-term health requirements depends on disaster preparation, including risk assessment and interdisciplinary management techniques at all system levels. On the other hand, emergency readiness relates to the preparedness pyramid, which defines practice, infrastructure, knowledge and skills, and training (Kahare et al., 2020). Disasters are abrupt accidents and natural disasters that result in significant property damage or fatalities (Bartholdson & Von Schreeb, 2020). Disaster results in significant losses in terms of people, property, economy, or the environment that are more than what the afflicted community or society can handle on its own (Kahare et al., 2020).

Business Continuity

Chaudhuri, 2022, 5925 investigated disaster risk reduction and management and explored significant world disasters, including the tsunami in 2004. With the help of technology and human awareness, the peril of disaster has been mitigated but not removed. Thus, the hazard to society and economies cannot be removed. Nonetheless, some losses from hazards must be realized because the failure to notice associated risks with the rapid growth of population and economy and changes in globalized supply chains (The United Nations, 2023). There is a need for business or an organization to integrate disaster risk management, including business continuity, into their business models and practices through disaster-risk-informed investments, especially in micro, small, and medium-sized enterprises (The United Nations, 2023).

Performance expectancy

Performance expectancy is the degree to which a person believes that using technology will improve their performance at work (Conte, 2023). Performance expectancy (PE) has been identified as the most important factor in predicting whether a technology will be adopted and used in the future by business users (Nguyen, 2022; Batucan, 2022). It may be characterized as the extent to which SMEs believe implementing IR technology would help them enhance their company performance. In this particular study, performance expectancy of driverless vehicles was approved by the users. Shahzad et al. (2022) investigated the green innovation technology to accelerate sustainable development among the manufacturing industry in Pakistan.

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VIII Issue XI November 2024

Effort expectancy

An individual's effort expectancy (EE) refers to their belief that using technology is simple (K. C. Chang, 2021). Prior studies have shown that effort expectancy constructs will be more powerful predictors of the desire to use new technology (Batucan, 2022 #6682). Effort expectancy might be seen as the degree to which SME businesses anticipate that using IR technology will not involve significant physical and mental exertion.

Social influence

Social influence is using technology to influence others (Soares, 2021). SI measures how strongly SMEs feel that other significant individuals - such as friends, colleagues, and peers -believe they should implement IR technology in their organizations. According to (Liu & Hu, 2022), social influence is the degree to which a person believes that others who are important to them, including family and friends, think that they should utilize the system. Social variables may be considered as the individualized reference group's subjective culture. Specific social conditions or interpersonal relationships with others, such as co-workers and leaders, impact a person's behavior (Islam & Habib, 2021).

Facilitating conditions

A belief that an institution or enterprise and their technological set-ups are to facilitate the application of technology is said to be in a facilitative state (Hou, 2021). The extent to which students think Bangladesh SMEs have the organizational and technical infrastructure to facilitate the adoption of new industrial technology may be seen as one of the facilitating circumstances. The definition of the term "facilitating condition" by (Harb, 2021) is "the extent to which the person perceives the presence of resources and support to employ a certain technology whenever appropriate". Facilitating condition is being researched in many studies of innovation adoption and intention to adopt new technology.

Government Support and Policy

The government is a regulatory body that controls and regulates business activities by imposing various policies, and helps business organizations in multiple ways, such as financial and non-financial assistance. In adopting innovation, business organizations may take help from the government as an initiative and opportunity, which encourages adoption (Braga, 2020). By imposing lower freight (import cost, tariff) and tax (income tax and corporate tax) and subsidizing import cost, the government can facilitate the adoption of IR 4.0. The government often provides research facilities as part of a plan to influence how well corporations receive innovation.

Underpinning Theories of the Study

Business continuity planning (BCP) and disaster recovery planning (DRP)

Organizations are increasingly dealing with many forms of disruptions, which may happen one at a time or simultaneously, according to (Kapatsila, 2023). Each interruption might impact organizational resources differently. Business Continuity Planning (BCP) and Disaster Recovery Planning (DRP), the two primary contingency plans, are often implemented independently inside enterprises across various time frames (Gori, 2022). BCP attempts to create suitable preparations before a catastrophe to restart essential company activities to a minimally acceptable predetermined level (i.e., Minimum Business Continuity Objective (MBCO)) within the so-called Maximum Tolerable Period of Disruption(s) (MTPD). DRP, on the other hand, works to achieve the complete recovery (restoration) of all hampered activities to their regular operational condition after a catastrophe (Gangwal, 2022).

Unified Theory of Acceptance and Use of Technology (UTAUT)

Unified Theory of Acceptance and Use of Technology (UTAUT) is a very popular model for explaining technological adoption in an organization. Venkatesh et al. (2003) have suggested that UTAUT further improve technological acceptance models (Venkatesh et al., 2003). Performance expectancy, effort

expectancy, social influence, and enabling circumstances are the four main constructs of UTAUT (Tewari, 2023). The UTAUT model is helpful for examining skill and competency identification difficulties, as well as customized training to determine predictors of real technology use (Batucan, 2022).

Hypothesis Development

Disaster preparedness and intention to adopt IR technology

Planning for catastrophes presents a problem for organizations, as (Budiyanto, 2021) points out, since they are urged to do so even while there is a frequently accepted likelihood that such an incident will occur. The necessary course of action is needed to address the issues posed by the epidemic and tragedy. The loss of human engagement in the food production system and supply chain may ensure the spread of illness, dread, and uncertainty (Ghorbanzadeh, 2020). Adopting new technology that will provide these advantages is encouraged in this regard (Budiyanto, 2021). Recent global events remind all corporate organizations of the need to consider catastrophe risk preparation (Rolnick, 2022; Budiyanto, 2021). This idea would motivate the owners of SMEs to use industry technology in their operations to lessen the loss brought on by uncertain losses. Therefore, the following hypothesis was formulated:

H1: Disaster preparedness has a significant effect on intention to adopt IR technology

Business continuity and intention to adopt IR technology

SMEs have the power to influence how catastrophe risk is managed in the future. Even though SMEs make up a significant number of all companies and are located locally, they interact with various individuals daily, including their customers, business partners, staff, and the neighborhood in which they operate (Marzi, 2023). Additionally, SMEs play a crucial part in supply chains by occupying lower-tier supplier positions with specialized technology and significant market shares (Hossain, 2023). Disaster Recovery Planning (DRP) will lower the vulnerability of people and economic assets to catastrophes and guarantee the resilience of supply networks, helping to build a more resilient society if SMEs can incorporate it into their companies (Upadhyay, 2022). Thus, the hypothesis as follows:

H2: Business continuity has a significant effect on the intention to adopt IR technology.

Performance expectancy and intention to adopt IR technology

According to (Tewari, 2023), performance expectancy is a potent construct to quantify the desire to utilize technology, independent of the surroundings. The desire to utilize new technology in different contexts, such as education or e-learning, is shown to be influenced by performance expectancy, according to a recent study by (Upadhyay, 2021). Many researchers have looked into the impact of performance expectancy on behavioral intention to adopt new technological arrangements, including (Habib, 2021), (Khan, 2021), and (Jadil, 2021). (Akinnuwesi et al., 2022) suggested behavior and purpose of adopting new technologies.

H3: Performance expectancy has a significant effect on the intention to adopt IR technology.

Effort Expectancy and intention to adopt IR technology

According to Abushakra and Nikbin (2019), business owners will not use IoT technology until it helps their operations and procedures. Additionally, they did not support the association between effort expectation and behavioral intentions, which contradicts earlier research (Yein & Pal, 2021). In their e-learning study, (Cabrera-Sánchez et al., 2021) discovered that the expectation of effort substantially impacts the desire to utilize technology in e-learning. In recent research, (Blut et al., 2021) found that effort expectancy is a key factor in demonstrating an intention to use new technology in various contexts, such as education or e-learning. According to research by (Yein & Pal, 2021), there is a significant positive association between intention to utilize mobile learning and effort expectations.

H4: Effort expectancy has a significant effect on the intention to adopt IR technology.

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VIII Issue XI November 2024

Social influences and intention to adopt IR technology

IoT adoption was also significantly and favorably influenced by social impact. Another finding that agreed with prior research by (Amalia, 2019) was that businesses would use IoT if they see that their rivals are doing so. Additionally, it was shown via the research that entrepreneurs had a stronger desire to embrace IoT in more straightforward and easier situations, which is consistent with the findings of (Baabdullah, 2019). In defining social impact (SI), (C.-M. Chang et al., 2019) explained how adopters' perceptions of their friends, family, co-workers, and other stakeholders affect whether they should utilize the new technology. It will be simpler and more successful if the individual or company discovers that their stakeholders also anticipate using this technology. From their studies, (Merhi, 2019) and (Rahi et al., 2019) discovered that social factors are the primary element influencing how people perceive and intend to utilize technology. Thus, the hypothesis is follows:

H5: Social influence has a significant effect on the intention to adopt IR technology.

Facilitating conditions and intention to adopt IR technology

The findings of (Tewari, 2023) in terms of e-service adoption and intention to use supported prior findings that the enabling condition had a substantial impact on the intention to use e-service. According to (Popova & Zagulova, 2022), conducive circumstances considerably impact a person's intention to use. Earlier literature, such as those by (Pasaribu, 2022) and (Osei et al., 2022), revealed comparable conclusions. This shows that a citizen's inclination to utilize e-participation is substantially influenced by how much access they have to ICT resources. According to a recent study by (Ivanova & Kim, 2022), conducive circumstances impact people's intentions to utilize new technology in various contexts, including SMEs.

H6. Facilitating conditions have a significant effect on the intention to adopt IR technology.

Mediating role of government support and policy with intention to adopt IR technology

Previous empirical research shows that government policies- specifically, government IT assistance and attitudes toward IT applications- significantly influence a firm's first choice to implement an IT system. The government's support includes rules and a commitment to promoting IT applications, tax incentives, information provision, the availability and caliber of public IT infrastructure, IT training and workshops, laws protecting personal information security and privacy, laws addressing cybercrime, and other initiatives (Yein, 2021;Tamilmani, 2021; Khan, 2021).

In many countries government has developed various authorities, units, committees, agents, foundations, academies, and governing bodies wherein entrepreneurs become members and take part in various events. Government seeks information, ideas, and views from the entrepreneurs through these governing bodies and entrepreneurs can suggest, comments, guide and show their opinions when government initiate any policies or steps. Thus, government policies and financial and non-financial support are influenced by the initiative or activities, steps by the entrepreneurs.

The ambition to embrace new technology is thus strengthened by this support and flexible policy, bearing in mind that government assistance is accessible. Considering this scenario, this study formulated the following mediating hypotheses:

H7a: Government support and policy mediate the relationship between disaster preparedness and intention to adopt IR technology.

H7b: Government support and policy mediate the relationship between business continuity and Intention to adopt IR technology.

Moderating role of entrepreneur's age and experience

Age influenced the impact of performance expectancy on behavioral intention. This argument is supported by (Hu, 2024; Ahamed, 2024) in their research. According to earlier UTAUT investigations, age has moderation on the association between performance expectancy and adoption intention (Mariani, 2021).

H8a1-Ha2: Entrepreneurs' age and experience moderate the relationship between performance expectancy and intention to adopt IR technology.

Using new word processing software, (Maritz, 2021 #6864) evaluated 107 MBA students and found that experience mitigated the impact of effort expectation on behavioral intention. There is a claim that becoming older has a detrimental moderating impact on effort expectancy.

H8b1—H8b2: Entrepreneurs' age and experience moderate the relationship between effort expectancy and intention to adopt IR technology.

According to (Ho, 2022 #6640) , a person's frame of reference may be shaped by their experience with technology. Individuals with minimal technological experience tend to conform more readily to social pressure, while users with high levels of expertise are less sensitive to other people's judgments. Thus, the following hypothesis was created:

H8c1-H8c2: Entrepreneurs' age and experience moderate the relationship between social influence and intention to adopt IR technology.

UTAUT's significance was underlined by (Akinnuwesi et al., 2022). It is simple to comprehend that customers have developed a consumption pattern before their real consumption behavior. However, the design of a new technology that boosts consumer interest may now be what draws users to adopt and utilize it.

H8d1-H8d2: Entrepreneurs' age and experience moderate the relationship between facilitating conditions and intention to adoption of IR technology.

Proposed Theoretical Model

The study proposed the following research model that explains the factors affecting the intention to adopt industrial revolution for SMEs in Bangladesh for their next level compared to current level of usage. This study's framework is conceptualized based on three theories: a. Disaster Preparedness, Business Continuity and UTUAT Model (Figure 2.7). The proposed model explains that disaster preparedness and business continuity have direct relationships with intention to adopt the next possible level of industry revolution technology in food and beverage manufacturing SME industry in Bangladesh. These relationships are underpinned with business continuity theory. It indicates that intention to adopt next of level of industrial revolution technology is shaped whether disasters e.g. manmade and natural disaster will interrupt this progress or advancement. In making the decision process of adopting the next level of IR technologies, enterprises' disaster preparedness planning is required.

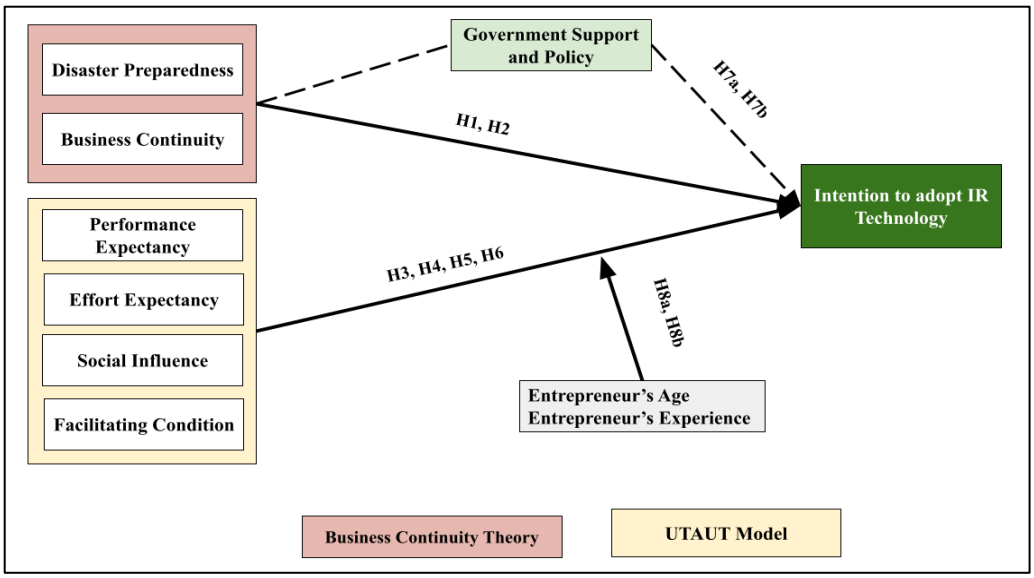

Figure 1. Conceptual Model

METHODS AND METHODOLOGY

Population and Sample Framing

The population for this cross-sectional research topic is small and medium-sized (SME) food and beverage manufacturing enterprises in Bangladesh. According to the Bangladesh Bureau of Statistics and registry office, the food and beverage manufacturing industry is one of the largest manufacturing industries in the country. The current study will use the lists of F&B SMEs from several sources: SME Foundation (SMEF), Bangladesh Agro-Processing Association (BAPA), and Bangladesh Standard and Testing Institute (BSTI). There is another list of drinking and beverage SMEs for beverage enterprises, but it is not a complete one for F&B SMEs. There are many unregistered SMEs in Bangladesh. However, this sampling frame is comprehensive and accurate to ensure that all potential participants take part in this study. This sampling frame should also be free from biases and avoid the non-random selection of participants, missing data, or incorrect inclusion of certain individuals or units.

Sample Size and Its Determination Techniques

Many researchers will adopt the simple approach of the "rule of 5" or "rule of 10" under the normal distribution theory to obtain appropriate significance tests (Hunziker, 2021). Considering the above criteria of variables to number of cases ratio (Bell, 2019; Rosenstein, 2019), the present study aims to examine 10 constructs including moderator and mediator and 41 items within the model; therefore, the minimum required sample size needed is 205 (i.e., 41x5=205) to 410 (i.e., 41x10=410).

Research Instrument and Measurement

The five-point Likert scale will be applied to the current study as it is the most widely used in many fields, although it originated in the field of psychology and social sciences (Martino, 2018). However, it is widely used in medical, educational, administrative, psychological, business and career research (Creswell, 2018). It is a measure of the degree to which respondents agree to paragraphs, attitudes, opinions or views of people. Five scores were given for 'strongly agree', four for 'agree', three for 'neutral', two for 'disagree', and one for 'strongly disagree' answers. The selection of an appropriate measurement is considered critical after determining the appropriate approach for data collection of this thesis. The next subsection deals with the instrument of all constructs involved in this study:

Validity and reliability of instrument

The validity of the instrument was conducted through face validity and content validity. Instrument reliability indicates the degree to which a construct is free from random error. Instrument (scale) reliability can be determined in several ways. Among them, test-retest reliability and internal consistency techniques are widely used (Sekaran, 2017).

Scale Development and Operationalization

The scale is used to receive respondents' responses and opinions on each question and expresses how strongly the respondents maintain that belief (Myers, 2019 #42). This study will use the non-comparative scales with the itemized rating of Likert scales as the measurement scale. The responses adopted in this study are 'strongly agree' to 'strongly disagree'.

Plan for Data Analysis

SPSS version 25 will be used to screen the data in terms of coding, missing data, and normality (i.e., using skewness, kurtosis and Levene's test of normality). Structural Equation Modeling (SEM) has been introduced as a second-generation method for multivariate data analysis (Hair et al., 2019). This method has several distinct advantages compared to the statistical first-generation techniques, such as factor analysis, discriminant analysis, or multiple regression. Construct validity is one type of the most desirable validity that is often characterized by a rigorous time consuming process in its establishment (Creswell, 2018).

Mediation is the presence of a significant intervening mechanism between antecedent and the consequent variable that can affect the outcome (Ramayah et al., 2018). Mediation is also known as special case for 'indirect effect' as it relies on strong a priori theoretical/conceptual support, which is the key foundation in exploring meaningful mediation effects (Boateng, 2020 #9). Hence, SEM that can handle non-normally distributed data is believed a preferable basis as its regression techniques for testing mediation permit modeling of both measurement and structural relationships and yields overall fit indices (Hair, 2021).

The moderator specifies the conditions under which a given effect occurs, as well as the conditions under which the direction (nature) or strength of an effect varies (Ramayah et al., 2018). In this study, demographic information such as experience and age are moderators. To measure the moderating effect of experience and age, these moderators are categorized as high, medium and low age and experience.

Partial Least Square Structual equation modeling PLS-SEM will be used due to analysis the direct relationships, moderation relationship and mediating relationship. For complex research model with limited sample size, PLS-SEM is the best option (Ramayah et al., 2018)

CONCLUSION AND CONTRIBUTION

The study has significance from at least two perspectives- theoretical and managerial (practical). Theoretical significance of this study lies in the identification of factors affecting the adoption of Industry revolution in SMEs in the food and beverage manufacturing industry in Bangladesh. The study underlines two theories- unified theory of acceptance and usage of technology (UTAUT) and business continuity theory (plan). From a business continuity perspective, this study addresses two factors a firm's disaster preparedness and its business continuity planning in adoption of technologies. In the second theory the study utilizes factors- performance expectancy, effort expectancy, social influence and facilitating conditions with adoption intention of next level of technologies, which are being used by the firms. Entrepreneur's age and experience are also considered. The first theory is the first time it is being used in technology adoption research. Thus, the study findings will contribute to business continuity theory (plan) enrichment in the body of knowledge. The second theory will be enriched with finding of the study where food and beverage manufacturing SMEs that have not upgraded with the latest technologies due to their shortage of resources and capabilities are considered. The study investigates those firms or enterprises that intend to upgrade their business operation to the next possible level by technology from what they are using currently. To the best of the researcher's knowledge, the UTAUT model has not been used in previous studies. Rather it has been used only in adoption of the latest technologies. This is an imperative contribution to the body of knowledge. From a theoretical perspective, the study findings will contribute to an established theory, namely the UTAUT model, by explaining how non-western countries like Bangladesh face various disasters and hazards and continue their business operations.

The government will use the findings of this study to assist in developing policies and programs aimed at enhancing the intention of SMEs. Government emphasizes that SMEs turn the economic wheel of the nation and are the backbone of the economy. As SMEs constitute more than 98% of businesses, there is no alternative but to develop this sector. Industry revolution is the best instrument to address such government programs. The study investigated the government support for developing SMEs; and will provide an insight to enable the materialization of the government programs and enhance the supports- lower or free interest rate for bank loans, government grants, lower income and corporate tax, tax exemption initiative, flexible and SME-friendly import policy and various training programs.

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ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VIII Issue XI November 2024

APPENDIX

Table A Industry Revolution, IR Technology and its Impact

IR	Technological and Process changes	Impact
Pre-Industrial era (1700-1760)	Improvements in farming techniques and equipment, such as Jethro Tull's seed drill.	Increased agricultural productivity
	Flying shuttle, spinning jenny, and water frame in textile industry	A revolutionised textile production, laying the foundation for industrialisation
First IR (1760-1840)	Steam Power	A revolutionised industry by providing a reliable and efficient source of power.
	Iron and Coal Industries	Iron production techniques and coal as a fuel in industrial growth, construction of railways and machinery.
	Canal and Railway Networks	Canals construction and expansion of railway networks facilitated transportation and trade, connecting distant regions and boosting economic development.
	Factory System	Large-scale factories establishment and division of labour transformed the way goods were produced, increasing productivity and output.
Second IR (1840-1870)	Steel Industry (Bessemer process for mass-producing steel in construction, machinery, and transportation).	A significant advancement in construction, machinery, and transportation.
	Electrical Power (electricity and electrical systems: incandescent light bulb, manufacturing processes).	A revolutionised manufacturing processes and transformed urban life.
	Communication and Transportation (Telegraph and expansion of railway networks).	Accelerated communication and trade on a global scale.
	Mechanical Engineering (Breakthroughs in machinery and engineering: sewing machine and the mechanical reaper).	Increased productivity in various industries.
Third IR (1870-1914)	Mass Production and Assembly Line	Innovations like Henry Ford's assembly line and the introduction of interchangeable parts revolutionised manufacturing, enabling mass production and making goods more affordable.
	Chemical Industry	The development of chemical processes, such as the Haber-Bosch process for ammonia production, opened

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		up new possibilities in agriculture and industry.
	Automobile Industry	The invention of automobiles and the widespread use of internal combustion engines changed transportation forever and ushered in a new era of mobility.
	Advancements in Communication	The telephone, radio, and early forms of television improved communication and entertainment, connecting people across long distances.
Fourth IR (1914-2020)	- Convergence of digital technologies - Artificial intelligence, - Internet of things - Robotics	Data is the new currency Data Analysis Decision Support System Automation and intelligent machines
Fifth IR (2020-present)	- Quantum computing - Nanotechnology - Biotechnology - Renewable energy	The Fifth Industrial Revolution has the potential to revolutionise every aspect of our lives

Table A Measurement of Constructs with sources

	Original Statements	**Sources**	**Adapted Statements**
A.	**Performance Expectancy (PE):**		**Performance Expectancy (PE)**
1.	PE1: I find my mobile phone is useful in my studies	Venkatesh et al. (2012)	We think that IR technology is useful for our firms.
2.	PE2: Using my mobile phone increases my chances of achieving things that are important to me		We think that adopting IR technology will increase the chances of achieving our firm's goal.
3.	PE 3: Using my mobile phone helps me accomplish various activities related to my studies more quickly		We think that adopting IR technology will help accomplish many activities in our firm quickly.
4.	PE4: Using a mobile phone increases my productivity in my studies		We think that adopting IR will increase our firm's productivity.
B.	**Effort Expectancy (EE)**		**Effort Expectancy (EE)**
5.	EE1: Learning how to use a mobile phone is easy for me	Nikolopoulou et al. (2020), Greece et al. (2012)	We think learning how to use IR will be easy for our firm.
6.	EE2: My interaction with my mobile phone is clear and understandable		Our interaction with IR will be clear and understandable.

7.	EE3: I find mobile phones easy to use		We think that using IR technology will be easy for us.
8.	EE4: It is easy for me to become skilfull at using a mobile phone		We believe that it will be easy for us to become skillful at using IR technology.
C.	**Social Influence (SI):**		**Social Influence (SI)**
9.	SI1: People who are important to me think that I should use a mobile phone (and) in my studies	Shorfuzzaman and Alhussein (2016), Celik et al. (2014), Wang et al. (2009), Abu et al. (2015)	People who are important to our firm expect us to adopt IR technology.
10.	SI2: People who influence my behavior think that I should use a mobile phone in my studies		People who influence our business think that we should use IR technology in our firm.
11.	SI3: People whose opinions I value prefer that I use a mobile phone (and) in my studies		People whose opinions we value prefer that our firm should use IR technology.
12.	SI4: In general, my organisation has supported the use of m-learning.		In general, other organisations will support the adoption of IR in our firm.
13.	SI5: Top manager is very supportive of the use of this technology		We think that employees will be supportive in adopting IR.
	Original Statements	**Sources**	**Adapted Statements**
D.	**Facilitating Conditions (FC)**		**Facilitating Conditions (FC)**
14.	FC1: I have the resources necessary to use a mobile phone in my studies	Venkatesh et al. (2012), Shorfuzzaman and Alhussein (2016), Abu et al. (2015)	Our firms has the resources necessary to adopt IR technology.
15.	FC2: I have the knowledge necessary to use a mobile phone		Our firm has the knowledge capacity that is necessary to adopt IR.
16.	FC3: Mobile applications of my mobile phone are compatible with other technologies I use		We think that IR technology will be compatible with other technologies our firm is using.
17.	FC4: I can get help from others when I have difficulties using my mobile phone		We think that we can get help from other firms when we will have difficulties using IR technology.
18.	FC5: Using this technology fits into our employees' working style		We think that using IR technology will fit into our employees' working style.
19.	FC6: Our employees have received necessary training to use this technology		Our employees will have received the necessary training to use IR technology.
E.	**Intention to adopt**		**Intention to adopt**
20.	INT1: I intend to use m-learning in the future.	Venkatesh et al. (2012),	We intend to use IR technology in our firm.

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21.	INT2: I predict I would use m-learning in the future.	Nair et al. (2015), Shorfuzzaman and Alhussein (2016)	We predict we will continue to use IR technology in the future.
22.	INT3: I would say positive things about Industry Revolution		We would say positive things about IR 4.0 technology.
23.	INT4: I would recommend others to adopt Industry Revolution		We would recommend other firms to adopt IR 4.0 technology.

Table 3.2 (continued)

	Original Statements	**Sources**	**Adapted Statements**
K.	**Disaster Preparedness**		**Disaster Preparedness**
24.	DP1: We have procedures for detecting disasters.	Kadlec and Shropshire (2010)	We will have procedures for detecting disasters.
25.	DP2: We have a means of assessing the magnitude of disasters.		We will have a means of assessing the magnitude of disasters.
26.	DP3: We have procedures for alerting individuals responsible for disaster recovery.		We will have procedures for alerting individuals responsible for disaster recovery.
27.	DP4: We have established an alternative means of communications (i.e. cell phones) to use in emergencies.		We will establish an alternative means of communications to use in emergencies.
28.	DP5: We have a disaster recovery team.		We will have a disaster recovery team.
29.	DP6: We have standardized work procedures.		We will have standardized work procedures.
L.	**Business Continuity**		**Business Continuity**
30.	BC1: We have a secondary site (primary site go offline).	Kadlec and Shropshire (2010)	We will have secondary sites (if primary site goes offline).
31.	BC2: We have procedures for relocating our valuable resources.		We have procedures for relocating our valuable resources.
32.	BC3: Our plans account for possible losses of human resources.		We will maintain account for possible losses of human resources.
33.	BC4: We have procedures for restoring physical facilities such as physical buildings, power, and cooling systems.		We will have procedures for restoring physical facilities such as physical buildings, power, and cooling systems.
34.	BC5: We have procedures for recovering communications technologies such cellular phones, email, and VOIP.		We have procedures for recovering communications technologies such as cellular phones, email, and social media.
	Original Statements	**Sources**	**Adapted Statements**

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35.	BC6: We have procedures for recovering budget/funds.		We have procedures for recovering budget/funds.
36.	BC7: We have procedures for recovering applications and software.		We have procedures for recovering applications and software.
37.	BC8: We have procedures for resuming plans.		We have procedures for resuming plans.
M.	**Government Support and Policy**		**Government Support and Policy**
38.	GSP1: It needs to receive financial support for e-commerce from the government.	Lian et al. (2014), Rowe et al. (2012), Kuan and Chau (2001), Li (2008).	It needs to receive financial support for IR technology from the government.
39.	GSP2: It needs government's support (orientation, direction, information, etc.) encouraging E-commerce development.		It needs government's support (orientation, direction, information, etc.) encouraging IR technology.
40.	GPS3: If healthcare cloud computing development is becoming one of the government's major policies.		It needs IR technology to become one of the government's major policies.
41.	GPS4: The government's schedule to develop Electronic Medical Records.		The government should have a schedule to develop IR technology.