

FOURTH INDUSTRIAL REVOLUTION IN DEVELOPING COUNTRIES: A CASE ON BANGLADESH

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ABSTRACT

This study particularly focuses on Industry 4.0 in developing countries and, in particular, that of Bangladesh, which has been recognised as one of the fastest growing economies in South Asia. Prior to collecting the required data, a review was carried out on Industry 4.0 and the current prospect of it in the developing countries. The field study consisted of ten semi-structured interviews comprising of ten main questions concerning Industry 4.0 with ten scholars from both the Bangladeshi universities and various worldwide corporate sectors. The interviews lasted approximately thirty minutes and were conducted in English. After a successful analysis of all the interview transcripts, the study finds five main challenges along with some opportunities to apply Industry 4.0 in Bangladesh. The challenges include poor infrastructure, availability of cheaper labour, and expensive installation of technologies, lack of government supports and lack of knowledge. With this being the first research project regarding Industry 4.0 in Bangladesh, the findings of the study generate some recommendations that could be effective for the decision makers both in government and the private sector.

Keywords: Industry 4.0, Worldwide Corporate Sectors, Government and the Private Sector.

INTRODUCTION

Industry 4.0 is a term often used to describe the developing process in the management of manufacturing and chain production hence, it possesses considerable significance for industrial countries which largely depend on production. Most developing countries, such as Bangladesh, Nigeria, India, Pakistan, the Philippines, and Vietnam, depend on the manufacturing of products to be delivered to foreign companies. Therefore, if these countries can develop the management of their manufacturing and chain productions, the current rate of unit output would be substantially increased, a strong indicator that Industry 4.0 is crucial for these countries to move forward. There have been many studies relating to Industry 4.0, which is considered to be the fourth industry revolution. However, there has been a lack of empirical research relating to

Industry 4.0 in the developing countries of South Asia, especially Bangladesh. Therefore, this study has been conducted from the perspective of Bangladesh, which has been one of the most significant apparel producing countries, coming second after China.

However, the country is criticised due to lack of production, working skills and the number of units generated when compared with other key countries that produce Ready Made Garments (RMG), such as Thailand, Vietnam and Mexico. In addition, Bangladesh is also criticised due to the lack of female leadership, factory infrastructure, technological application, and a low level of modification according to industry evolution and availability, all of which are identified as major challenges for this growing country (Islam and Jantan, 2017). Experts suggest that a country with technological integration and usages in production can tremendously increase production ranges; therefore, Industry 4.0 is significant as it automates and exchanges data in manufacturing technologies (Lasi et al., 2014; Buhr, 2015; Berawi, 2018). As a result, it is crucial for the country to improve its production efficiency to gain an increase in foreign currency and, as such, this paper empirically investigates Bangladesh's prospects regarding the integration of Industry 4.0.

Industry 4.0

The term Industry 4.0 was first publicly introduced in 2011 as "*Industries 4.0*" by a group of representatives from various fields, for example, business, politics, and the academic field, under the initiative to improve the German competitiveness of its manufacturing industry. The idea of the "*High-Tech Strategy*" was adopted by the German federal government for 2020. Afterwards, a working group of experts was formed so that they could provide further advice on the application, operation and implementation of Industry 4.0.

In addition, Industry 4.0 is also called the fourth industrial revolution, which is based on the "*Internet of things and services*" after mechanisation (Industry 1.0), mass production (Industry 2.0) and automation (Industry 3.0). The Internet of things and services is already an inevitable part of manufacturing in developed countries, especially in the sophisticated industries of manufacturing and services, such as car production, aircraft production, insurance, logistics and also the communications industry (Haller et al., 2008; Bandyopadhyay & Sen, 2011; Rießmann et al., 2015; Trappey et al., 2017; Hofmann & Rüsçh, 2017; Witkowski, 2017).

Experts forecast that businesses will be able to increase their productivity by about 30% using Industry 4.0 (BDI, 2016). In this regard, the integration of Industry 4.0 contributes to making prompt management decisions so that all kinds of opportunities can be swiftly seized (Lee et al., 2014). Being a developing country, Bangladesh needs the adaptation of Industry 4.0 not only to accelerate production but also intensify economic growth. It can also be a key process for women to develop in the Bangladeshi business sector where women are neglected in every position and are not allowed to take senior roles. Therefore, Industry 4.0 can be effective for the development of organisational performance and the development of female workers because the physical combination will be reduced based on technological integration.

Elements or Pillars of Industry 4.0

There are some elements of Industry 4.0. These are crucial for the successful integration of the Industry 4.0 in a country context. In this regard, the autonomous or self-governing robots are identified as very significant part of the Industry 4.0. Long used to handling complex assignments, robots give an ever more extensive scope of administration and are becoming more self-sufficient, adaptable and agreeable (Bahrin et al., 2016; Iyer, 2018). They will interface with each other and work securely with people (the expression “*cobotics*” is utilised to portray robots helping administrators play out their undertakings) (Gilchrist, 2016; Iyer, 2018). Eventually they will have the capacity to gain knowledge and learn from people (Gilchrist, 2016). On the other hand, simulation is another element of the fourth industrial revolution. However, the 3D simulation of product advancement, material improvement and a product’s creation procedures will be available and widespread (AbouRizk, 2010; Gilchrist, 2016; Jaghbeer et al., 2017). It will use continuous information to reflect the physical world in a virtual model that will incorporate machines, products or items and people (Gilchrist, 2016). Administrators and operators will be capable, for instance, to test and streamline the machine settings for the item even before creation begins, accordingly reducing the time-consuming machine setup process and enhancing quality (Jaghbeer et al., 2017). Today, data frameworks and information systems in organisations in various countries are not completely coordinated (Avgerou & Walsham, 2017). Companies are rarely connected with their suppliers and customers. Engineering design departments are seldom linked directly to production within its own organization (Avgerou & Walsham, 2017). But with Industry 4.0, the entire organization will be interconnected, and companies could be connected with one another (Gilchrist, 2016). Therefore, vertical and horizontal system combination is required in the organisations to get the benefits of Industry 4.0 (Avgerou & Walsham, 2017).

At present, hardly any machines are fitted with sensors and are not interconnected. With the Internet of Things, an ever more noteworthy number of items will increase and the improved knowledge can be utilised to improve standard conventions (Gilchrist, 2016). This will decentralise examination and basic leadership, empowering continuous reactions (Gilchrist, 2016). On the other hand, to ensure excellent cyber security, the time of unconnected and closed operational management systems has come to an end (Gilchrist, 2016; Berawi, 2018). Network and correspondence conventions are becoming the standard. Shielding data frameworks and assembling lines from cybercrime dangers is turning into a real issue. Sophisticated identity and machine access management systems will be used to provide secure, reliable communications through the use of the Industry 4.0 (Drath & Horch, 2014). The working procedures of Industry 4.0 require more information sharing across destinations and organisations. The execution of cloud advances will enhance reaction times by significant milliseconds (Liu & Xu, 2017). This will cultivate the advancement of an ever more prominent number of Manufacturing Execution Systems (MESs) in light of cloud-put-away machine information (Coronado et al., 2018). On the other hand, there are still massive sets of untapped data in the industrial world. In this regard, the big data analytics is required for the fourth industrial revolution because it examines large to uncover hidden patterns, market trends, unknown correlations, customer preferences and other useful information (Martinet and Stedman, 2018). Their analysis will optimise production

quality, save energy and improve services (Witkowski, 2017; Martinet and Stedman, 2018; Lotti et al., 2018).

Current Prospects of Industry 4.0 in Developing Countries

According to the above presented elements of Industry 4.0 devised by Boston Consulting Group, it has been identified that the physical efforts of the human being would be reduced while face-to-face meeting is also not required for the decision making in management level for any action. Industry 4.0 is described in different ways in order to present a manufacturing revolution; for example, it is called the Manufacturing Renaissance in the US, whereas it is made in China 2025 in China (MAPI Foundation, 2015; BDI, 2016).

However, the advancement of Germany is much more salient than other countries; for example, the experts of Germany believe that they are now at level 3.8 and that it will take a decade, maybe less, to reach 100% of Industry 4.0 manufacturing. This is because a company cannot move from 3.0 to 4.0 in a single day or step, since the migration takes time and there are various stages. Although Industry 4.0 has been familiar and active in some western countries, the term is not overly familiar among many organisational decision-makers or key planners in various countries (Leiden et al., 2018; Cleverism, 2018). However, Industry 4.0 is very much important for the manufacturing dependent countries, which are economically growing fast based on their production of different products and services.

Some experts have opined that people in countries who are new to the industrial sector are confused and are facing structural challenges over the term Industry 4.0; therefore, it has taken time to apply and adopt the elements of Industry 4.0 and to gain the benefits of this (Drath & Horch, 2014; Schläpfer et al., 2015; Gilchrist, 2016; Ludwig et al., 2018; Lasi et al., 2014; Lotti et al., 2018). However, developing and emerging countries, such as India, Pakistan, Indonesia, Brazil, Malaysia, Nigeria, and Thailand, have been trying to adapt to Industry 4.0 (Bahrin et al., 2016; Lyer 2018; Ezenwa et al., 2018; Berawi, 2018). Hence, they have been investing in the technologies so that humans can be integrated for the development of the production level. Nevertheless, there has been a lack of empirical research that reveals the prospects of Industry 4.0 in Bangladesh, which is projected to be the twenty-eighth largest economy in the world by 2030.

The next section is about the methodology, outlining how the data has been collected from the participants, and how the results and implications have been analysed.

METHODOLOGY

This study has been carried out through the phenomenology design because Industry 4.0 is considered here as a phenomenon, which allures researchers to explore it relating to the perspective of Bangladesh. Hence, it has been an explorative study. The researcher has been able to include ten experts who are lecturers in universities and industry experts from different countries, including Bangladesh. Convenience sampling method has been used to get the participant's appointment according to their availability. The sample collection protocol of the study was based on the experience and knowledge of the population regarding the topic area. 25 scholars were invited to provide their valuable views on fourth industrial revolution relating to

Bangladesh; however, we got positive response from only 12 scholars, who participated in the interviews. However, we reached at the saturation point at the 10th interview, because similar information was coming from last interview, therefore we stopped taking further interviews. The data was collected through the use of a semi-structured interview over the telephone. The collected data has been analysed through the use of inductive content analysis (thematic analysis=identify key themes, concepts and categories) of the interview transcripts. Based on the transcripts of all the interviews, I determined the main themes that have been identified by the interviewees.

RESULTS

All the participants gave similar overviews that there has been very little application or use of automation in the key manufacturing industries, such as RMG, leather, shipbuilding, tourism and agriculture in Bangladesh. Hence, the existence of Industry 4.0 and its level of establishment have not yet been evidenced in Bangladesh. However, we tried to obtain insights regarding what the challenges or barriers are for Industry 4.0 in Bangladesh. The collected data regarding the challenges in implementing Industry 4.0 in Bangladesh have been allocated some themes. The description of the themes based on the interview results has been shown in Table 1.

Table 1				
DESCRIPTION OF THEMES				
Industry 4.0 in Bangladesh				
Lack of government support	Lack of knowledge	Poor infrastructure	Availability of cheaper labour	Expensive installation of technologies
9/10	7/10	10/10	10/10	10/10

A lack of government support has been identified from the interview results of participants. Kouhei opined *“Although Government has been speaking loudly regarding technological improvement in every sphere of life in every area of Bangladesh; however, it does not have any clearer supporting policies regarding automation in the industries such as RMG, agriculture, tourism, shipbuilding etc”*. This view is also supported by seven other participants. However, Noinul has opined that corruption in government bodies is another challenge that has been keeping Bangladesh out-dated and taking a long time to take the advancement of the technologies to automation. In contrast, Zirala and Rous opined that the *“Government of Bangladesh has been trying to be digitalised; soon, therefore, we can expect that we are going to automate our industries and adapt the elements of the Industry 4.0”*.

According to Khurana and Shoailay, *“Lack of knowledge of the employees, especially in management level and key planners, has been identified as a major challenge that has been creating a barrier for the implementation of the technological integration to create automation in the manufacturing industries in Bangladesh”*. It is also supported from Afifa and Chowdhury that *“some employees have misconception of data theft if the data is saved in computers while some of them also believe automation may create complexity rather than increased production”*. Rahim added that *“Owners of the manufacturing companies, especially in readymade garments factories, are not much educated and well-known to technologies; therefore they do not like to*

create automation. In addition, they have very cheap labour to produce cloths that also create a barrier for the automation of the manufacturing process finally Industry 4.0”.

On the other hand, all the participants have opined that the poor infrastructure of the country, such as poor road and transportation, technological device markets, and productions are still creating the barriers for the Bangladeshi key planners to think regarding industry 4.0. Houque quoted that *“there are many infrastructural issues such as poor communication processes, poor Internet broadband disbursement, and prone to floods and natural disasters in Bangladesh that is creating barriers for the development of the automation”*. In addition, Nirjol quoted that *“the durability of the developments such as industrial parks and computer automation facilities in Bangladesh has not had for a long time the features that are needed for the automation”*. This also creates challenges for the country to take the advantage of Industry 4.0.

The participants provided similar opinions regarding the issue of availability of cheaper labour in Bangladesh, which is another barrier for quicker automation in the manufacturing companies in Bangladesh and also another significant issue against the adoption of Industry 4.0. In addition, they were also similar in view in the case of the installation of technologies to gain the benefits of Industry 4.0, which is very expensive; therefore, the companies do not like to apply them in the factory sector, being another challenge for the application of Industry 4.0. However, all the participants have added that the industries of Bangladesh, such as the RMG industry, leather industry, and tourism industry, can take the benefits of Industry 4.0 because automation reduces the unit costs, improves communication efficiency, minimises the risks of accidents and contributes to creating a sustainable economy.

ANALYSIS AND IMPLICATIONS

According to the findings from the semi-structured interviews, it has been identified that Bangladesh is far behind the facilities of Industry 4.0. However, it would not be difficult for the country if it concentrated on the technological integration and infrastructure development, since there is the availability of technology imports and setting up in new locations (Gilchrist, 2016; Gilboy, 2016; Walcott, 2017). The key issues found in this study are consistent with the previous research results of Rößmann et al. (2015); Schläpfer et al. (2015); Hofmann & Rüschi (2017); Witkowski (2017); Jones & Pimdee (2017), where they have also found that lack of knowledge regarding Industry 4.0, poor infrastructure, lack of government support, the availability of cheap labour, and expensive technological installations are the main barriers for many countries. In this respect, it is highly feasible to recommend to the Bangladesh government that they increase the support for the integration of Industry 4.0. If the government cannot do so, the country will not be a part of the fourth industry revolution, which could accelerate its present economic progress and would contribute to building a stronger economy in South Asia.

This study highlights that Industry 4.0 has not been popular in Bangladesh, but it is crucial to meet the future complicated work environment and meet with international standards. This is also consistent with the previous studies explored in this paper, which indicates that the integration of Industry 4.0 will not only reduce the cost of production but will increase production efficiency leading to increased unit production. Moreover, it will also reduce human

dependency in the manufacturing environment where health and safety is a serious issue. Therefore, to gain tremendous benefits from Industry 4.0, it is time for the Bangladesh Government and the decision makers of private organisations to take action so that Industry 4.0 can be adapted and implemented in the manufacturing and service industry. Since the preparation and establishment of the technological set up is on-going in Bangladesh the process of applying Industry 4.0 elements should be integrated into the establishment processes, which is occurring in other developing and emerging countries, such as China, India, Sri Lanka, Vietnam, Malaysia and Thailand (Buhr, 2015; Bahrin et al., 2016; Li, 2017; Jones & Pimdee, 2017).

CONCLUSION

Overall, this study presents that Bangladesh is far behind the fourth industrial revolution that is Industry 4.0. The study has presented some significant challenges such as *poor infrastructure, availability of cheaper labour, expensive installation of technologies, lack of government supports and lack of knowledge*. Therefore, it is very much challenging for the country to get the immense benefits from Industry 4.0. Moreover, the results highlight that the establishment of the manufacturing settings with the elements of Industry 4.0 is indispensable not only to increase the production of units, but also to reduce the production costs. The study also presents that integrating and establishing Industry 4.0 is not only complicated, but also expensive, while other challenges already exist in Bangladesh. Therefore, it is crucial for the key decision makers of the country from the highest level of government to adapt to Industry 4.0 rapidly so that the country can utilise and maximise on the benefits it has to offer.

LIMITATIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH

The study included results from only 10 interviews that contribute to the limitation of the study, hence it cannot be generalised. Therefore, the future research could increase number of interviews so that stronger generalisation could be produced. Furthermore, the future studies can be done through the use of quantitative methods taking challenges as the variable.

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