Exploring Challenges of the Fourth Industrial Revolution

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Abstract*: Fourth industrial revolution (IR 4.0) refers to where manufacturing industries absorbed by intelligent equipment such as products and machines which able to generate intelligent systems and networks. This will help to communicate with each other autonomously. Intelligent sensing, wireless sensor networks and CPSs are fundamental technologies which Germany focusing on. IR 4.0 will include effective independent physical systems associated with each other and smart operations will be carried out by the environment. The IR 4.0 as a revolution empowered by application of advanced progresses at era level to bring unused values and organizations for clients and organization itself. Researcher believes that the outcomes of this study may contribute to the manufacturing to understand the challenges of the fourth industrial revolution that may occur and to finds out the solution in order to ensure the success of this emerging industry.

***Index Terms*: The fourth industrial revolution, Product, Challenge, Manufacturing, Operations.**

I. INTRODUCTION

Fourth industrial revolution, also known as industry 4.0 as well as IR 4.0, refers to where manufacturing industries absorbed by intelligent equipment such as products and machines which able to generate intelligent systems and networks. This will help to communicate with each other autonomously. Intelligent sensing, wireless sensor networks and CPSs are fundamental technologies which Germany focusing on.

The specialized integration of CPS into manufacturing industries and the use of the Internet of Things (IoT) and Services in industrial forms will be included in the IR 4.0 [1]. Agreeing to [2] characterize The IR 4.0 as a revolution empowered by application of advanced progresses (like information technology (IT)) at era level to bring unused values and organizations for clients and organization itself. This will additionally bring versatility and quality in production systems to fulfil requests of demand of creative business models and speedy administrations which refer to benefit situated design and organize communication at production level.

Stages that engaged in the development of manufacturing system are usually from manually efforts. It brought the move from manual work to the first manufacturing processes. A progressed excellent of life was a fundamental driver of the change. The second revolution was activated by electrification that empowered industrialization and mass production. The third industrial revolution is characterized by the digitalization with establishment of microelectronics and computerization. In manufacturing this encourages adaptable production, where assortments of products are manufactured on flexible production lines with programmable machines. Such production systems in any case still don't have flexibility concerning generation quantity.

Nowadays we are in the IR 4.0 that was activated by the improvement of Information and Communications Technologies (ICT). Advanced physical structures are decentralized control and pushed system of IoT functionalities [6]. In addition, there are several technologies for the IR 4.0 adaption in manufacturing companies such as addictive manufacturing, Artificial intelligence (AI), Big Data Analysis, Machine learning, Cybersecurity, simulation, Cloud computing, Augmented reality, IoT and Autonomous Robot [7].

II. METHODOLOGY

Very similar to the published work in 2019 [8], the main methodology of this study is a qualitative research, literature analysis. This study selects Google as the main home of databases to gather related information to analyze. So, this study explores industry 4.0 based on published articles with especial focus on the challenges.

III. RESULT AND DISCUSSION

Table 1 is listing the detailed summary of the discussed challenges to implement the IR 4.0 in nine groups, Insufficiency of infrastructures Lack of management support, Poor governmental support, Lack of network stability, Legal Issues, Data insecurity, Insufficient of integration technology platforms, Financial constraints, and Poor understanding about The IR 4.0. The challenges are listed based on reviewing the existing literature.

Table 1. Challenges of industry 4.0

Challenges		
Insufficiency of infrastructures	Lack of infrastructure and internet based networks	[3]
	Intelligent Requirements of Equipment	[4]
	Lack of technological infrastructure	[5]

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Lack of management support	Low management support and dedication	[7]
	Lack of prioritization / support by top management	[9]
	Poor skilled management team	[5]
Poor governmental support	Poor support by government	[7]
	Lack of standards, regulation, and forms of certification	[9]
Lack of network stability	Poor existing data quality	[7]
	Insufficient network stability	[9]
	Difficulties in reconfiguring	[5]
Legal Issues	Legal issues	[7]
	Unclear legal situation concerning the use of external data	[9]
Data insecurity	Data insecurity	[5]
	Unresolved questions concerning data security	[9]
	Security issues	[7]
Insufficient of integration technology	Lack of integration of technology platforms	[7]
	Too slow expansion of basic technologies	[9]
	Low maturity level of required technologies	[9]
Financial constraints	High investment	[5]
	Issues of finance	[7]
	Unclear economic benefits and excessive investments	[9]
Poor understanding about IR 4.0	Low understanding on IR 4.0 implications	[7]
	Poor research &development on IR 4.0 adoption	[7]

According to [5] insecurity of data is one of the challenges of The IR 4.0 faced by manufacturing industries. Data insecurity is referring to the non-existence of systems to guarantee sufficient information security for the manufacturing companies during the implementation of IR 4.0. This challenge is also strongly agreed by [7], the IR 4.0 able to associate one company to another company and has the ability to deliver the supply chain more productive but the supply chain systems have permanent security weakness, which are utilized by attackers. Security is the important essential to transform an industry and supply chain into effective and smatter factor. According to [9] there are some unresolved questions concerning data security.

Next, lack of polices and governmental support. Government policies and directions are very important in developing sustainable supply chain over IR 4.0. Most of the economies counting India are facing poor government support and guidelines on IR 4.0. Furthermore, governments are also doubtful on potential outcome of IR 4.0. Transforming the traditional business functions into smarter and sustainable processes have not revealed by policy analysts and government bodies. According to [7], there is still non-existence of powerful strategic plan by government to assist the usage level of The IR 4.0 in the manufacturing Industry. Moreover, lack of standards, regulation, and forms of certification, where government is still working on implementations of the IR 4.0 regulations [9].

The third challenge of the IR 4.0 for Manufacturing Industries is, nonexistence of infrastructure and internet based networks. Information technology based on infrastructure and technologies are important in productive adoption of The IR 4.0 concepts. It can be clearly seen that poor internet connectivity is a vital challenge to The IR 4.0 implementation [7]. Further, in urban and rural areas which is in Indian context, internet based technologies which can increase the business growth are could not recognized. This challenges are also strongly agreed by [9] said that lack of infrastructure and internet based networks is not helping many other manufacturing industries to adopt the IR 4.0. Insufficient network stability stated by [9] in his article.

The next challenge is poor integration of technology platforms. According to a study [7], integration of technology is very essential in productive communication and higher efficiency. Nowadays businesses are confronting challenges in planning an adaptable interface to coordinated different heterogeneous components. Cyber physical networks have numerous diverse components, which must be coordinates and backed for compelling information trade and investigation in manufacturing environment. Therefore, it is important to develop a platform to add technology for developing an operative The IR 4.0 propels sustainable supply chain. According to [9] said in his article that there is too slow expansion of basic technologies, where manufacturing industries are still having difficulties in learning on how to use, or how to operate and handle technological machines in order to develop a sustainable industry.

Intelligent requirements of equipment are needed said by [4]. Due to the establishment of underlying equipment, it is significant to monitor and control the basic manufacturing asset for reconfiguration of production line, energetic planning, and information fusion in smart factory. Hence, it is vital to make improve the intelligence level of manufacturing equipment. The configurable controller and self-reconfigurable robots can give potential arrangements to operate expansion of manufacturing units. In the focus on hybrid production, the coordination and data interaction between the multi-module manufacturing units ought to be investigated. The optimized combination of programs ought to be made to improve the workshop efficiency. The intelligent equipment ought to be able to gather production information, give consistent data interface, and support communication protocol. In addition, the equipment may perceive manufacturing environment and collaborate with other equipment in

smart factory. Flexible manufacturing is a representative feature of smart factory, but there are still many problems such as strong proprietary of production line, dynamic scheduling, and tight coupling between functions and devices. This challenge also supported by [7], in term of lack of technological facilities to assist the manufacturing companies in adopting of The IR 4.0.

Moreover, financial constraints said by [5] in their articles. In The IR 4.0, financial constraints are measured to be a really vital challenge among trade organizations for creating their capabilities in terms of progressed hardware and machines, facilities and feasible process developments. This challenge also stated [7] in a different way which is the manufacturers need to invest more on adopt the IR 4.0 in their industries. The writer also explained the requirement of huge capital investment for the IR 4.0 inventiveness in the manufacturing industry [9].

Poor management support and commitment is also one of the challenges of the IR 4.0, [7] Management support and commitment to accept the changes is very important in order to develop a productive The IR 4.0 concept. Most appropriate management practices should be established as The IR 4.0 calls for a groundbreaking alteration in business processes and activities. Improving employee ability in terms of development and training, programs based on knowledge management in order for The IR 4.0 propel sustainability in business. According to [9] there is lack of prioritization or support by top management, the writer explained that effective the IR 4.0 is not possible without management support and commitment. Lack of skilled management team also supported by [5] as lack of competence management team to implement the new and creative business models in The IR 4.0.

Following challenge that needs to focus is, low accepting on The IR 4.0 implications. Here is really poor enlightenment on The IR 4.0 implications among both the researchers and practitioners. Industrial and practicing managers do really understand the significant of The IR 4.0 adoption in manufacturing environment though, they are still unsure on its exact connection on fulfilling sustainability objectives in supply chains, [7]. In other hand, [7] defined the challenge as poor research & development (R&D) on The IR 4.0 adoption. The writer then explained that the IR 4.0 has been concluded by different practicing managers in their own understanding. In order to adopt The IR 4.0 effectively, business organizations are facing difficulties mostly in taking accurate decision during the business transformation. The main reason behind this is a non-existence of research on pointing the numerous aspects of The IR 4.0 adoption.

The last challenge of the IR 4.0 for manufacturing industries that need to take a deep look is legal issues. Machines, facilities, sensors, and humans are connected to the internet and exchanges information with each other so this may tend to develop a cyber-physical network. This cyber physical network may appear with complex legal issues. In order to industries, legal subjects must be considering while adopting advanced technological system. In developing propel sustainable business models of The IR 4.0, data privacy and security matters needs to be reflected said by [7] in his article. According to a study [9], it is stated about unclear legal situation concerning the use of external data. Although rare, a cyber-attack could be devastating to organization's standing and bottom line. Whether it's ransomware or a targeted, zero-day attack, these incidents can be noticed and banned with the right strategy in place.

IV. CONCLUSION

This study was able to verify the significant challenges for industries to implement the IR 4.0. It believes that this study gives benefits to the following parties such as researcher, government and industry. Results of the study will prove helpful to industries, organization and people that want to expand their business and manage their business efficiency. It will be a useful reference for related works if future studies who are invited to complete the characterization of the IR 4.0.

Contribution Note: The initial idea of the work was with T.S.T., however, the work is part of a degree final-year project by H.S.; S.S was supervising the project. Drafting of the article was with H.S, and T.S.T have edited and improved it. Corrections and response to the reviewers was with T.S.T. Financial support for this publication was with T.S.T. All authors agreed on the last version of the work.

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