INDUSTRIAL REVOLUTION 4.0 AND ECONOMIC WELL-BEING: A SYSTEMATIC LITERATURE REVIEW

NORFAIZAH OTHMAN
Kolej Universiti Islam Antarabangsa Selangor (KUIS)
norfaizah@kuis.edu.my

FADILAH MAT NOR
Kolej Universiti Islam Antarabangsa Selangor (KUIS)
fadilahmn@kuis.edu.my

UMMI MUNIRAH SYUHADA MOHAMAD ZAN
Kolej Universiti Islam Antarabangsa Selangor (KUIS)
ummi@kuis.edu.my

ABSTRACT

The advancement and increasing usage of digital technologies due to evolution in industrial revolution 4.0 affected the economic well-being of society. Furthermore, the occurrence of COVID-19 has significantly reordered the world of work, consumption, sociability, and governance. 2.8 million of B40 households in Malaysia are low-skilled workers, low health quality and high illiteracy are unemployed. They are facing financial hardship because of increasing cost of living, expose to poverty, social discrimination and inequality subsequently unable] to achieve economic well-being. In the current literature, there is still a lack of efforts to systematically review the state of the art of this new industrial revolution wave especially focusing on the impact of economic well-being. The aim of this study is to address this gap by investigating the academic progresses in Industry 4.0 and economic well-being. A systematic literature review was carried out to analyze the academic articles within the Industry 4.0 and economic well-being topic that were published online from 2014 until the end of March 2021. The obtained result from the general data analysis of included papers such as relevant journals, their subject areas and categories, conferences, keywords and the specific data analysis corresponding to research questions are illustrated and discussed. These results not only summarize the current research activities such as main research directions, applied standards, employed software and hardware, but also indicate existing deficiencies and potential research directions through proposing a research agenda. The findings of this review can be used as the basis for future research in Industry 4.0 and related topics.

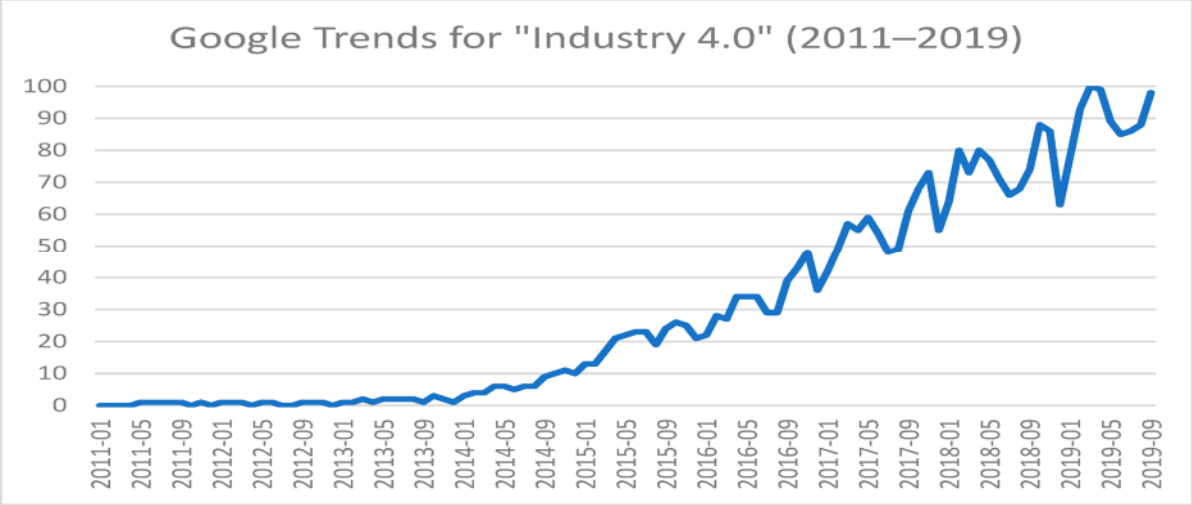
Keywords*: Industrial Revolution 4.0, Economic Well-Being, Systematic Literature Review*

INTRODUCTION

The concept of Industrial Revolution 4.0 (IR 4.0) was presented in 2011 by Henning Kagermann (former top manager of the SAP software corporation in Germany) (Paprocki, 2016). Industry 4.0, referred to as the "Fourth Industrial Revolution," is also known as "smart manufacturing,"

"industrial internet" or "integrated industry" (Hofmann & Rüsch, 2017). This several terms is increasingly becoming more popular and has been receiving attention all over the world (Liao et al., 2017; Rennung et al., 2016). According to Google Trend, the number of google searches that contained the term "Industry 4.0" and "Fourth Industrial Revolution" began in 2012 and 2015 and there has been an upward trend as of December 2018, which shows the popularity of this topic (Figure 1). This graph shows that industry 4.0 is an emerging topic and needs more research. This is a wonderful opportunity for researchers to develop their research expanse and managers to discover more about this topic and figure out how they can implement Industry 4.0 in their companies.

Figure 1: Number of Google Searches Conducted between January 2011 to September 2019 by contains the Keywords "Industrie 4.0 and Industry 4.0"



Sources: Google Trends Search 2011 -2019

The Fourth industrial revolution IR4.0 radically impacted our daily lives. It is ongoing automation of traditional manufacturing and industrial practices, using modern smart technology. Both large-scale machine-to-machine communication (M2M) and the internet of things (IoT) are integrated in order to increase automation, improved communication and self-monitoring, and production of smart machines which are used to analyze and diagnose issues without the need of human intervention.

Human resource development is one of the concerns to put IR 4.0 into practice (Yong et al 2020). Skilled human resource is one of the most critical elements to fulfill in Industry 4.0 (Hassan Reza Mohammad Nurul, Sreenivasan Jayashree, Malarvizhi, 2021). Low-skilled jobs will be taken over by autonomous machines in the future, so the worker must top up with the new skills related to smart machines operation (O'Halloran and Kvochko,2015) in order to remain in the industry. The implementation of IR 4.0 is very significant to the current situation of the pandemic COVID-19. The increasing usage of digital technologies and communication requires knowledge and skills to adapt to new norms. In Malaysia, 2.8 million of the B40 households are low-skilled workers. Most of them are unemployed due to lack of skill, knowledge and education during pandemic COVID-19.In addition, the highest rate of unemployment among youth was recorded by the Bottom 40% (B40) group (Kementerian Pendidikan Malaysia (KPM), 2019). Additionally, based on the tracer study report 2019 by KPM, the first degree graduates recorded 25.3 per cent the highest unemployment rate of any other level. Unfortunately, the highest rate of unemployed or working

under academic qualifications was recorded by graduates from low income families or B40 groups with 32.2 per cent (KPM 2019). Unemployment caused B40 households to face financial hardship due to increasing cost of living, expose to poverty, social discrimination and inequality subsequently unable to achieve economic well-being.

In light of the importance of IR 4.0 on well-being, this leads to the conclusion that IR4.0 helps to improve the standard of living especially for B40 households. IR4.0 is the basis for the development of our country especially if it's combined with knowledge, skills and education. In general, well-being is the physical, social, and economic benefits that contribute to the enhancement in the quality of life and satisfaction of an individual, family, and the community. Well-being can be measured in different ways. Most of the previous studies such as Osberg and Sharpe (2002, 2005 and 2011) include per capita consumption, accumulation of stocks, intensity of poverty and income inequality, and economic security including job loss and family break-up as a component or dimensions of economic well-being. Based on the Malaysia Well-being Report, there were 14 components of well-being introduced. 68 indicators in total were used to measure each component. The components constituted under economic well-being were transport, communications, education, income and distribution, and working life. Components constituted under social well-being were housing, leisure, governance, public safety, social participation, culture, health, environment, and family.

Due to its peculiarities, IR 4.0 has become an indispensable tool in improving the well-being of humans. The usage of Internet of Things using IT (Information Technology) and OT (Operational Technology) and robotics for example can reduce the operation and production cost, and increase the firm's profit (Sreenivasan et. al,2019 and Wirtz et.al, 2021). Nevertheless, academics have only in recent years started to analyze IR4.0 in the manufacturing industry where human knowledge, skill and experience are important to achieve higher levels of operational productivity and efficiency (Peruzzini, Grandi, Pellicciari 2017). Most of previous studies highlight IR4.0 on industry healthcare (Laurenza et al., 2018)knowledge management (Mat Nor et al., 2020) work environment (Veloso et al., 2020) product and services (Harwood & Garry, 2017), and entrepreneurship (Cota et al., 2020). IR4.0 could therefore be considered as a determinant key to all those sectors since it is represented by professional experience, skills, knowledge and organizational structure.

Keeping in mind the fundamental importance that IR4.0 can have in any context, and especially improving the quality of life, it is important to conceptually consolidate the results shown by previous studies related to this topic. To do this, we have chosen to use a systematic literature review which enables us to identify the main literature gaps, which supports the identification of future research fields that could still be developed.

This work aims to contribute to the literature on IR4.0 and economic well-being, exploring the existing literature in this field, to synthesize the previous works and to identify the major areas of research and the methods used to carry out these studies. It identifies the geographical areas to which the authors are affiliated and the periods in which these studies were published. Thanks to the systematic review, evidence is obtained (Tranfield, 2003) that provides answers to the following research questions:

RQ1. What are the trends IR 4.0 based on economic well-being?

RQ2. What are the impacts IR 4.0 on economic well-being addressed on research?

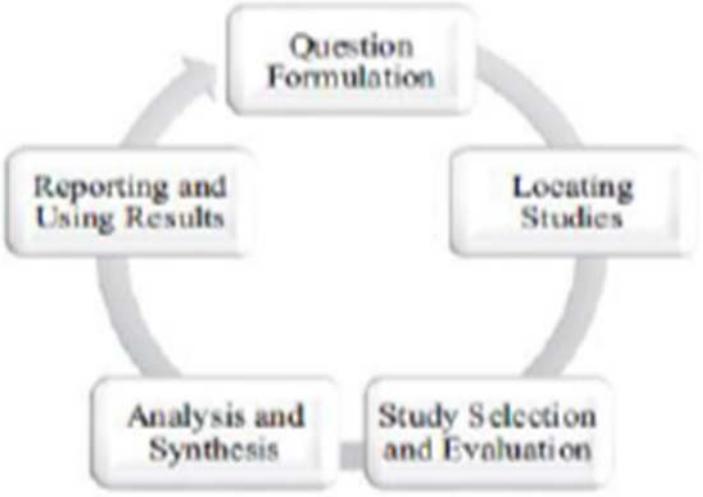
After reviewing the literature, the authors have identified the topics most analyzed by scholars over ranges in certain time periods. The authors have also identified the most-used method to carry out this research and the geographical regions from which researchers have published (RQ1). The topics most frequently addressed have been outlined (RQ2).

Therefore, the authors have achieved their predefined objectives. The paper is structured as follows. Section 2 is dedicated to explaining the methodological approach used to carry out this study; section 3, the findings of the analysis are reported. The final section in section 4, conclusions are drawn and future research directions are suggested.

METHODOLOGY

Based on the topic and existing research in this area, a systematic literature review on IR 4.0 and economic well being was implemented for this paper, a structured review methodology was adopted based on the five steps (Denyer & Tranfield, 2009) suggested for conducting systematic literature reviews: (1) question formulation, (2) locating studies, (3) study selection and evaluation, (4) analysis and synthesis, and (5) reporting and using results (Abdirad & Dossick, 2016).

Figure 2: Steps in Systematic Literature Review in Current Research



Step 1: Question Formulation

First, this paper analyzed the general trends in the literature from the standpoint of the number of studies on Industrial Revolution 4.0, economic well being and other related subjects. Secondly, this paper analyzed the findings from the existing studies by evaluating the state of the research on this subject and the pros and cons of the previous studies. From that, two main question were formulated as in Figure 3 below:

Figure 3: Question Formulated and Analysis Criteria

Question 1	: What the trends IR 4.0 based on economic well-being
Analysis	Number of studies, publication years
Criteria	Methods, databased, geographical & location
Question 2	: Impacts IR 4.0 on economic well- being addressed on research
Analysis	Content analysis based on selected papers
Criteria	Analysis based on impacts and elements of economic well-being.

Step 2: Locating Studies
The relevant research related to the particular review questions were located, selected, and appraised (Denyer & Tranfield, 2009). Four search keyword phrases: "IR 4.0 and well- being," "IR4.0 and economic well- being" and "Impact IR4.0 and economic well-being" were used to access Google Scholar first, because this search engine shows most of the results from all databases. To identify relevant papers, the title, abstract, or keywords contained were analyzed. Furthermore, it was decided to look at other major research databases. This paper just focuses on two main databases namely Emerald and Elsevier to determine whether relevant papers could be found. Keyword selection and database lists caused some limitations on finding papers in this research. Because this subject topic is still new, all review papers in this research were published from 2014 up to 2021. Furthermore, only those papers written in English were selected.

Step 3: Study Selection and Evaluation
The authors reviewed the content of each paper to evaluate the relevant studies on this topic. They selected related papers which discuss IR 4.0 impacts and economic well-being. The data of the selected and evaluated papers will be present in a descriptive chart in results and discussion part.

Step 4: Analysis and Synthesis
In this step, each paper selected was analyzed based on the question formulated in Figure 3. The first question involved a search trends including the numbers of journal, location and years of publication and the method used in each paper. The second question will specifically discuss the impacts of IR 4.0 towards economic well-being.

Step 5: Reporting and Using Results
According to the methodology, step 5 will present the results based on the evaluation of selected papers. From this section, research gaps are determined and recommendations for future research are made. At the end of this paper, a summary and conclusion are presented.

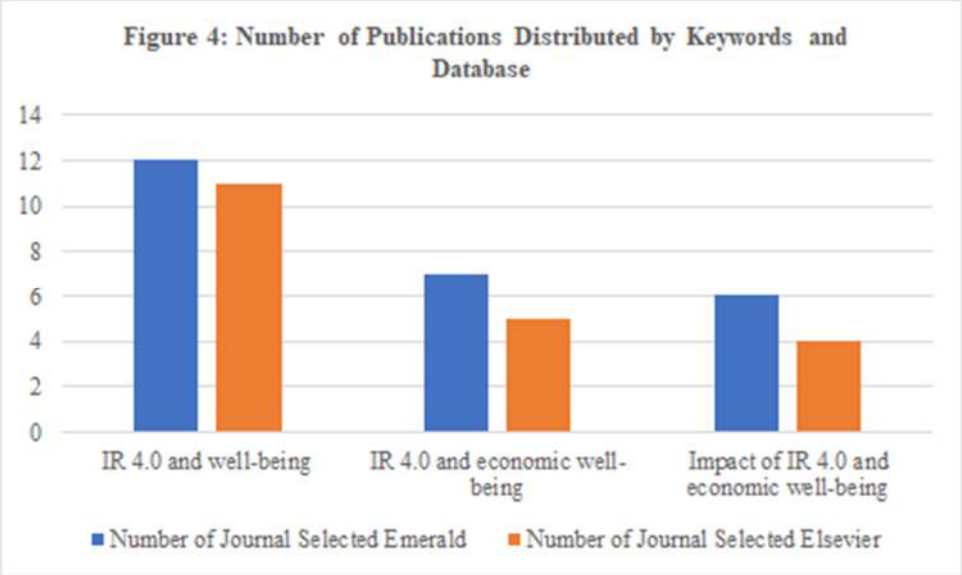
RESULTS

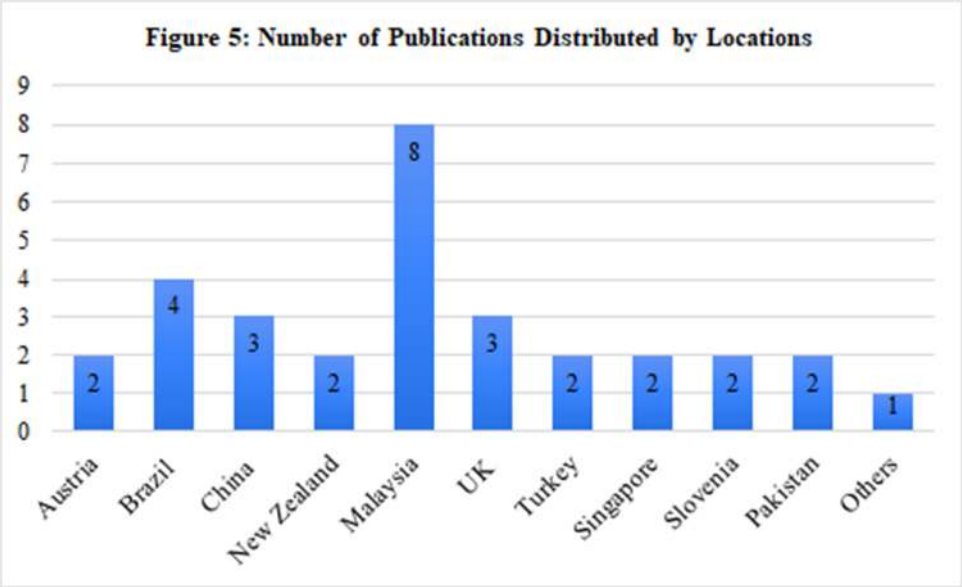
The discussion section started with Table 1 and Figure 4 that represents the number of publications distributed by keywords and Database referred. From the table and figure below presents the

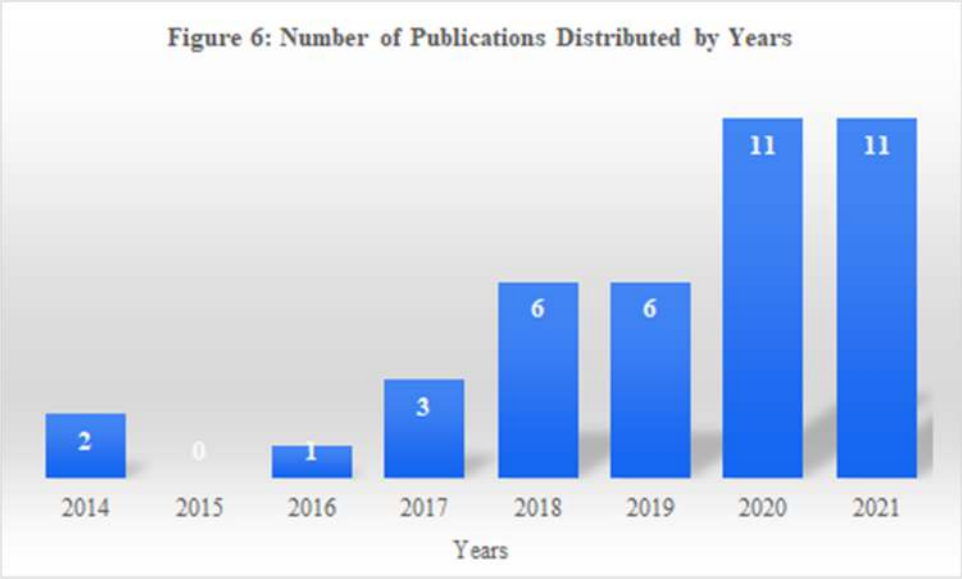
number of reviewed and selected articles in each database. A total of 41 out of 295 publications were selected and included in the analysis.

Table 1: Number of Publications Distributed by Keywords and Database

Keywords	Number of Journal		Number of Journal Selected	
	Elsevier	Emerald	Elsevier	Emerald
IR 4.0 and well-being	45	62	11	12
IR 4.0 and economic well-being	41	55	5	5
Impact of IR 4.0 and economic well-being"	38	54	4	4







While, Figure 5 and Figure 6 above used to answer the first question in step 2 (RQ1). Which involved a search for the trends of existing research in IR 4.0 and economic well-being for example number of articles, publications location and the years articles were published. Regarding the data, 8 out of 41 publications on the topic of IR 4.0 and economic well being were published from Malaysia, followed by Brazil with 4 publications, United Kingdom and China with 3 publications. While, other countries listed with 1 paper published namely Denmark, Finland, India, Krea, Norway, Tunisia, Italy, Vietnam, Portugal and Argentina. Furthermore, Figure 6 also shows the chronological distribution of publications from 2014 to half year of 2021. The first paper related to IR 4.0 based on well-being generally was published in 2014 and there is significant growth in the number of studies on this topic even in the half of 2021 with 11 papers.

To answer the second question (RQ2) mentioned in step 2 and to find research key topics and areas, this papers performed content analysis based on the findings by keywords as presented in the Table 2 below:

Table 2: Findings by Keyword

Keyword	**Dimension in economic well-being**	**Database**	
		Elsevier	**Emerald**
Impact of IR 4.0 and economic well-being	transport	**-**	**-**
	communications		1. Internet of Things, robotics, artificial intelligence and big data in all industries and social activities provide goods and services that address manifold needs in more responsible ways (Potočan et al., 2021) 2. The use of AI enables the interactions between health professionals and care seekers at a distant (Wong & Sa'aid Hazley, 2020)
	education	1. technology providers should also pay more attention to knowledge transfer and value and thus address the needs of SMEs more specifically (Fei Yiu 2020)	1. The viability of Open Source Hardware (OSH) and technological innovation in the academic sphere, provide great potential in the areas of health and education (Cota et. al 2020)
	income and distribution	1. Digital use in IR 4.0 shows that it has a positive and statistically significant	1. Big data dan digital transformation help to improve firm

	impact on household income and expenditure. Digital use significantly contributes to the improvement of the economic well-being of rural households, (Haiying et al 2021)	performance, achieve better environment,social and economic benefits (Del Giudice et al., 2020)
working life	1. IR 4.0 shows a significant relationship between economic well-being and workers performance. (Maziana Zakaria et.al 2014) 2. IR 4.0 investments will reduce the employment of low-level labour force while increasing the employment of qualified labour force in areas such as design and information technology. (Hasan et. al 2019)	

LITERATURE FINDINGS

In the following section, the results obtained from the literature review are presented based on the economic well-being dimension which are transport, communications, education, income and distribution, and working life.

Communication

The Industry 4.0, now assumed as the fourth industrial revolution IR 4.0 has been brought into the world by the German government in 2011 (Alcacer and Cruz-Machado 2019; Wagner, Herrmann and Thiede 2017; Grieco, Caricato, Gianfreda, Pesce, Rigon, Tregnaghi and Voglino, 2017; Motyl, Baronio, Uberti, Speranza and Filippi 2017). Industry 4.0 is defined as the digital transformation involving manufacturing and technology platforms; Big Data/Analytics, (Industrial) Internet of Things using IT (Information Technology) and OT (Operational Technology), robotics, cybersecurity, cloud, simulation, additive manufacturing (3D), and augmented reality. The aim of IR 4.0 is to work with a higher level of automatization to achieve a higher level of operational productivity and efficiency (Peruzzini, Grandi, Pellicciari 2017) besides connecting the physical to the virtual world (Leyh, Martin, Schaffer 2017). This relevant revolution is expected to bring a good development for the industrial scenario focusing on creating smart products, smart processes, and smart procedures (Baena, Guarin, Mora, Sauza, Retat 2017). The firms in the economic sectors are expected to increase the level of digitalization, working together in digital ecosystems with customers and suppliers (Tupa, Simota, Steiner 2017). Internet of Things, robotics, artificial

intelligence (AI) and big data in all industries and social activities provide goods and services that address manifold needs in more responsible ways (Potocan et.al , 2021). Furthermore, the usage of AI enables the interactions between health professionals and care seekers at a distance (Wong & Sa'aid Hazley, 2020).

Education

The viability of Open Source Hardware (OSH) and technological innovation in the academic sphere, provide great potential in the areas of health and education (Cota et. al 2020). Besides,technology providers should also pay more attention to knowledge transfer and value and thus address the needs of SMEs more specifically (Fei Yiu 2020). It is important to ensure SMEs are in line with the IR4.0. In Malaysia, pandemic affected various sectors including services, manufacturing, mining, agriculture, and construction. Bank Negara Malaysia reported a GDP growth of 0.7 percent for the first quarter of 2020, as compared to 4.5 percent for the first quarter of 2019 due to movement control order. Overall it affected 2.8 million of B40 households in Malaysia. Furthermore, the highest rate of unemployment among youth was recorded by the Bottom 40% (B40) according to a group (Kementerian Pendidikan Malaysia (KPM), 2019). Additionally, based on the tracer study by KPM, the first-degree graduates recorded 25.3 per cent the highest unemployment rate of any other level. Unfortunately, the highest rate of unemployed or working under academic qualifications was recorded by graduates from low-income families or B40 groups with 32.2 % (KPM 2019). More than 1.5 billion students have been affected by the closure of educational institutions, reported by the United Nations Educational Scientific and Cultural Organization (UNESCO, 2020).

Income and Distribution

Malaysia acknowledges the drivers of Industry 4.0 to the global economic order, technology advancement, knowledge and skill, global supply chain, competitiveness, regulations, and customer behavior. Since the IR 4.0 boom, the research community has experienced different approaches to IR 4.0 implementations and impacts. In Malaysia, IR 4.0 has been a serious and exclusive discussion since it was launched by 8th Prime Minister Tun Dr. Mahadir Muhammad on Oct 31, 2018. In conjunction with the launch, Malaysia has taken the initiative by formulating a policy namely Industry 4WRD under the Ministry of International Trade and Industry (MITI). The Industry 4WRD policy is believed to encourage the development of Malaysian products and services using innovative manufacturing capabilities based on technology (MITI, 2018). The existing technological transformation proposes new hopes and prospects which can lead to remarkable changes not only in the way of creating new products and making profit but also in the entire financial structure (Rifkin, 2014). For example, a large number of SMEs can reduce the operation and production cost, product price and services might be lower, and increase the firm's profit (Sreenivasan et. al,2019). In addition, big data and digital transformation may also help to improve firm performance, achieve better environment,social and economic benefits (Del Giudice et al., 2020). Big data acts as a moderating role in making decisions for a circular economy supply chain. Digital use in IR 4.0 shows that it has a positive and statistically significant impact on household income and expenditure. Digital use significantly contributes to the improvement of the economic well-being of rural households (Haiying et al 2021).

Working life

IR 4.0 shows a significant relationship between economic well-being and workers performance (Maziana Zakaria et al 2014). However, IR 4.0 on another side, may reduce the workforce in technology upgraded industries. Human resource development is one of the concerns to put IR 4.0 into practice (Yong et al 2019). Low-skilled jobs will be taken over by autonomous machines in the future, so the worker must top up with the new skills related to smart machines operation (O'Halloran and Kvochko,2015). Skilled human resource is one of the most critical elements to fulfill in Industry 4.0 (Hassan Reza Mohammad Nurul, Sreenivasan Jayashree, Malarvizhi, 2021). Thus, this evidence proves that a skilled, knowledge and education and diverse workforce with a high degree of wage is imperative by upgrading the current workforce and fascinating and improving potential talent in the industrial sector including in Malaysia (MITI 2018). The implementation of IR 4.0 is very significant to the current situation of the pandemic Covid 19.

Coronavirus disease also termed COVID-19 is the fifth pandemic to have occurred after the Spanish Flu pandemic back in the year 1918. COVID-19 spreads from China to other countries by human-human transmission (Chin-Liu, Kin-Kuo, and Ru- Shih, 2020) and mainly hits the respiratory system. Coronavirus disease has spread to 215 countries affecting a wide range of people. Most countries are implementing temporary mobility restrictions, social distancing, and large-scale gathering cancelation. These strategies have shown their effectiveness in slowing the transmission speed of SARS-CoV-2, however, they also have side effects on many aspects of citizen's lives (UNDP, 2014).

A pandemic can cause economic disruption in different ways (Madhav, Oppenheim, Gallivan, Mulembakani, Rubin, and Wolfe 2017). The drastic changes in the world of work, consumption, sociability, and governance caused a high rate of unemployment in the world. The International Labor Organization estimates that 195 million jobs could be lost in the second quarter of 2020 as a result of COVID-19 (International Labour Organization, 2020). Due to widespread business closures, especially in lower-income populations, national economies are expected to contract, leading to a dramatic rise in unemployment and poverty rates. A report from the World Bank estimated that 11 million people could fall into poverty across East Asia and the Pacific (World Bank 2020). People living in poverty, the elderly, youth, and indigenous persons are among the most vulnerable populations in terms of suffering detrimental effects from the SARS-CoV-2 virus (UNDESA, 2020).They are facing financial hardship due to increasing cost of living, expose to poverty, social discrimination and inequality finally unable to achieve economic well-being.

CONCLUSION

Industrial revolution 4.0 is an emerging topic and needs more research. This is a wonderful opportunity for researchers to develop their research expanse and managers to discover more about this topic and figure out how they can implement Industry 4.0 in their companies.The IR4.0 radically impacted our daily lives. The implementation of IR4.0 might not only affect the performance of the companies but it also affect the economic well-being of humans. As mentioned in this paper, it is clear that IR, as an industrial revolution, is increasingly taken into consideration and therefore analyzed. The authors have knowingly chosen the keywords "industrial revolution" and "economic well-being" and categorized them into five major components of IR: transport, communications, education, income and distribution, and working life. This has enabled them to understand which of these areas have already been treated and discussed and which, instead, have remained unexplored. After a careful reading of the documents allocated to each category, it is

possible to state that the trend is increasing from 2011-2021. Most of the previous research was conducted in Malaysia and most of them focus on the impact of IR 4.0 in communication, education, income and distribution, and working life. Again, the use of technology in the digital age could be analyzed, this time with reference to human capital. It also seems interesting to analyze how the use of IT effects, influences and modifies the know-how, skills, abilities and experiences of the members of organizations. On the other hand, it should be interesting to consider human capital in conjunction with technology to understand how these two factors can affect the development process of human which cover both material and spiritual aspects.

References

Alcacer, V. Cruz-Machado. (2019). Scanning the Industry 4.0: A Literature Review on Technologies for Manufacturing Systems. *Engineering Science and Technology, an International Journal*. 22(3), 899-919.

Baena, A. Guarin, J. Mora, J. Sauza, S. Retat. 2017. Learning Factory: The Path to Industry 4.0, *Procedia Manufacturing*. 9, 73-80. https://doi/org/10.1016/j.promfg.2017.04.022.

Chin Liu, Y., Lin Kuo, R., Ru Shih, S. 2020. COVID-19: The first documented coronavirus pandemic in history. *Biomedical Journal*. 43, 328-333. https://doi.org/10.1016/j.bj.2020.04.007.

Cota, V. R., Lopes Aguiar, C., Souza Neto, B. de, & Benegas, M. (2020). Open-source hardware as a model of technological innovation and academic entrepreneurship. *Innovation & Management Review*, 17(2), 177-195. https://doi.org/10.1108/inmr-06-2018-0036.

Del Giudice, M., Chierici, R., Mazzucchelli, A., & Fiano, F. (2020). Supply chain management in the era of circular economy: the moderating effect of big data. *International Journal of Logistics Management*, 32(2), 337-356. https://doi.org/10.1108/IJLM-03-2020-0119.

Denyer, D, & Tranfield, D. (2009). Producing a systematic review. In D. A. Buchanan & A. Bryman (Eds.), The sage handbook of organizational research methods (pp. 671– 689). Sage Publications Ltd. https://psycnet.apa.org/record/2010-00924-039.

Fei Yu, Tim Schweisfurth. (2020). Industry 4.0 Technology Implementation in SMEs: A Surveyin the Danish-German Border Region. *International Journal of Innovation Studies*. 4, 76-84.

Grieco, A.,Caricato, Gianfreda,D.,Pesce,M., Rigon,V., Tregnaghi,L.,Voglino, A. (2017). An Industry 4.0 Case Study in Fashion Manufacturing. *Procedia Manuf.* 11, 871-877.

Haiying Lin a, Ruihua Li a, Shuxia Hou a, Wenlong Li b. (2021). Influencing factors and empowering mechanism of participation in e-commerce: An empirical analysis on poor households from Inner Mongolia, China. *Alexandria Engineering Journal*. 60, 95-105.

Harwood, T., & Garry, T. (2017). Internet of Things: understanding trust in techno-service systems. *Journal of Service Management*. 28(3), 442-475. https://doi.org/10.1108/JOSM-11-2016-0299.

Hasan Çebi BAL, Çisil ERKAN. (2019). Industry 4.0 and Competitiveness. Karadeniz Technical University, Turkey. 3rd World Conference on Technology, Innovation and Entrepreneurship (WOCTINE). *Procedia Computer Science 158*. 625-631.

Hassan Reza Mohammad Nurul, Sreenivasan Jayashree. C. A. Malarvizhi. (2021). Industry 4.0 and Sustainability - A study on Malaysian MSC Status Companies. Book Chapter - Exploring Information Systems Research Boundaries (EISRB) - Series http://Assets.Teradata.Com/Resources/Ebooks/EB6982.

Hofmann, E., & Rüsch, M. (2017). Industry 4.0 and the current status as well as future prospects on logistics. Computers in Industry. 89, 23-34. https://doi.org/10.1016/j. compind.2017.04.002.

Laurenza, E., Quintano, M., Schiavone, F., & Vrontis, D. (2018). The effect of digital technologies adoption in healthcare industry: a case based analysis. *Business Process Management Journal*. 24(5), 1124-1144. https://doi.org/10.1108/BPMJ-04-2017-0084.

Leyh, S. Martin, T. Schäffer.2017.Industry 4.0 and Lean Production – A Matching Relationship? An analysis of selected Industry 4.0 models, Federal Conference on Computer Science and Informatics Systems (FedCSIS) Prague 11, 989-993.

Liao, Y., Deschamps, F., de Freitas Rocha Loures, E., & Felipe Pierin Ramos, L. (2017). Past, present and future of Industry 4.0—A systematic literature review and research agenda proposal. *International Journal of Production Research*. 55(12), 3609-3629. https://doi.org/10.1080/00207543.2017.

Madhav, N., Oppenheim, B., Gallivan, M., Mulembakani, P., Rubin, E., and Wolfe, N. (2017). "Pandemics: risks, impacts, and mitigation," in Disease Control Priorities: Improving Health and Reducing Poverty, 3rd Edn. https://doi/org/10.1596/978-1-4648-0527-1_ch17.

Mat Nor, N., Mat Khairi, S. M., Rosnan, H., Maskun, R., & Johar, E. R. (2020). Establishing a knowledge-based organisation. *Innovation & Management Review*. 17(3), 235-249. https://doi.org/10.1108/inmr-05-2019-0065.

Maziana Zakaria, Nik Kamaruzaman Abdulatiff, Norli Ali. (2014). The role of wellbeing on performance in services sector. Procedia - Social and Behavioral Sciences 164. 358-365.

Motyl, G. Baronio, S. Uberti, D. Speranza, S. Filippi.(2017). How will Change the Future Engineer's Skills in the Industry 4.0 Framework? A questionnaire Survey. *Procedia Manuf*. 11 (2017), 1501-1509.

O'Halloran, D., and Kvochko, E. (2015). Industrial Internet of Things : Unleashing the Potential of Connected. WEFUSA Industrial Internet Report 2015.pdf.

Osberg, Lars, and Andrew Sharpe. (2002). An Index of Economic Well-being for Selected OECD Countries, Review of Income and Wealth. 48(1), 291-316.

Osberg, Lars and Andrew Sharpe.(2005). How Should We Measure the 'Economic' Aspects of WellBeing?, Review of Income and Wealth. 51(2), 311-336.

Osberg, Lars, and Andrew Sharpe. (2011). Moving from a GDP-based to a Well-being Based Metric of Economic Performance and Social Progress: Results of the Index of Economic Well-Being for OECD Countries, 1980-2009, Paper presented to the International Statistical Institute Conference, Dublin, Ireland.

Paprocki, W. (2016). How transport and logistics operators can implement the solutions of "Industry 4.0." In M. Suchanek (Ed.), Sustainable Transport Development, Innovation and Technology. TranSopot 2016. Springer Proceedings in Business and Economics, Cham. Springer. https://doi.org/10.1007/978-3-319-51427-7_16.

Peruzzini, F. Grandi, M. Pellicciari. (2017). Benchmarking of Tools for User Experience Analysis in Industry 4.0. *Procedia Manuf*. 11, 806-813.

Potočan, V., Mulej, M., & Nedelko, Z. (2021). Society 5.0: balancing of Industry 4.0, economic advancement and social problems. *Kybernetes*. 50(3), 794-811. https://doi.org/10.1108/K-12-2019-0858.

Rennung, F., Luminosu, C. T., & Draghici, A. (2016). Service provision in the framework of Industry 4.0. Procedia - Social and Behavioral Sciences 221, 372-377. https://doi. org/10.1016/J.SBSPRO.2016.05.127.

Rifkin, J. (2014). The Zero Marginal Cost Society, The Internet Of Things, The Collaborative Commons, And The Eclipse Of Capitalism. Palgrave Macmillan, Basingstoke. St. Martin's Press LLC, 175 Fifth Avenue, New York.

Sreenivasan Jayashree. C.A Malarvizhi, Mohammad Nurul Hassan Reza. (2019). The Impact of Organizational Readiness on IR 4.0 and Sustainability: A Conceptual Framework for SMEs in Malaysia. Eurasian Journal of Analytical Chemistry ISSN: 1306-3057.

Tranfield, D. (2003). Toward a methodology for developing evidence-informed management knowledge by means of systematic review. *British Journal of Management*. 14, 207-222. https://doi.org/10.1016/j.intman.2013.03.011.

Tupa, J. Simota, F. Steiner. 2017. Aspects of Risk Management Implementation for Industry 4.0, Procedia Manuf. 11, 1223-1230.

Veloso, E., Silva, R. C. da, Trevisan, L., & Dutra, J. (2020). Technological innovations in the work environment and the career of the millennium generation. *Innovation & Management Review*. 17(4), 379-394. https://doi.org/10.1108/inmr-05-2019-0070.

Wong, B. K. M., & Sa'aid Hazley, S. A. (2020). The future of health tourism in the industrial revolution 4.0 era. *Journal of Tourism Futures*. https://doi.org/10.1108/JTF-01-2020-0006.

Wagner, C. Herrmann, S. Thiede.(2017). Industry 4.0 Impacts on Lean Production Systems. *Procedia CIRP* 63 (2017), 125-131. https://doi/org/10.1016/j.procir.2017.02.041.

Yong Man Ling, Nor Aziati binti Abdul Hamid, Lee Te Chuan. (2020). Is Malaysia ready for Industry 4.0? Issues and Challenges in Manufacturing Industry. *IJIE The International Journal of Integrated Engineering* UTHM Publisher. ISSN: 2229-838X e-ISSN: 2600-7916.