Students' Readiness In Facing Industrial Revolution 4.0 Among Students Of Technical Teacher's Education

Ismail, A., Wan Hassan. W. A. S., Ahmad, F., Affan. Z., Harun, M. I.

Abstract: The emergence of a new wave of technology known as 'The Fourth Industrial Revolution' or IR 4.0 led to the current development of technology that predicted 50 billion electronic devices would interact with each other. Meeting the challenges of IR 4.0, all students in Higher Educational Institutions need to get out of their comfort zone and be prepared for this new era. The Industrial Revolution 4.0 can also address dependency on energy sources that will significantly change the future of the working world. In this regard, a study was conducted on 136 Vocational Education Bachelor students in seven (7) fields of study at the one of Malaysian Technical University. This study aims to identify the knowledge, attitudes, interests and students' readiness to face the challenges of Industry Revolution 4.0. This descriptive study uses questionnaires based on Likert Scale. The data obtained were processed and analysed using the Statistical Package for the Social Sciences (SPSS) software. The findings showed that the students' knowledge on IR 4.0 was weak. The study also found that students' interest and attitudes were high and students' readiness to deal with IR 4.0 was high. Researchers recommend that more effort need to be put such as organizing seminars, courses and forums related to challenges of IR 4.0 to students. To encourage students to improve their skills in information technology and knowledge of IR4.0, it is recommended that all the students choose their IR4.0 related topic for their final year project..

Index Terms: interest and attitudes, Industrial Revolution 4.0, IR4.0, knowledge, student satisfaction.

1. INTRODUCTION

THE The recent emergence of the concept of Industrial Revolution 4.0 (IR 4.0) has given a new impetus to the thinking on TVET transformation. Lately, there has been initiatives to drive TVET institutions to respond to the needs of IR 4.0. The skill sets predicted to be required by IR 4.0 are putting new demands on TVET providers. There are also major needs to increase the number of TVET-educated workforce and establish greater opportunities for job creation. Re-skilling and upskilling programmes that are knowledge-intensive are required to accommodate the transformational needs of I4.0. It is also imperative to cultivate creative human resources that could prime innovation in order to sustain growth and generate new value. Thus, several efforts are being highlighted by the educational institutions in order to respond to TVET needs of IR 4.0. The Industrial Revolution (IR) is a form of advancement or change in human civilization [1]. The development of science and technology has changed the world as the first-generation revolution gave birth to history when creating machines to replace human and animal labour. Furthermore, in the second-generation industrial revolution it is characterized by the emergence of electrical energy and the combustion engine [2].

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Later, the industrial revolution continues to evolve with the advent of digital technology and the internet in the third generation. In the fourth-generation industry revolution, this revolution has developed with the emergence of supercomputers, smart robots, unmanned vehicles, genetic modification and neurotechnology developments that allow humans to optimize brain functioning [3]. Therefore, in the fourth-generation industrial revolution, all human daily affairs will be shared with specially-designed robots to optimize human needs and comfort [4]. Dzulkifli [5] described the IR to cause humanitarian elements to be eroded as a result of full dependence on the transhumanism concept in which the value of the human spirit is being side-lined. Economic experts see that the IR, especially IR 4.0, will have a significant impact, particularly in terms of income and wealth gaps between residents across continents, status, gender and employment, in addition to the erosion of humanitarian and justice values. However, there is no view from the other side that IR 4.0 is capable of opening up space for more problem-solving methods such as the inadequacy of resources and energy faced by the present world [6]. According to Daricin [7], the Industrial Revolution 4.0 focusing on the construction of virtual reality technology without much use of manpower definitely affects many aspects of life. One of them is the field of higher education where the field of education is an important field and also has an impact on the development of IR 4.0. The existence of Higher Learning Institutions (IPT), especially the Public Higher Learning Institution (IPTA) throughout the country generally generates quality human capital to fill future vacancies. The current big challenge is to increase the productivity of the adult generation to use technology compared to the middle generation [8]. This research is focusing on the student's readiness on facing IR4.0. The readiness of knowledge and challenge to take the IR 4.0 allows lecturers to set up a comprehensive learning strategy to enhance students' knowledge as well as to ensure the success of IR 4.0. Therefore, appropriate frameworks are needed to identify students' readiness in understanding the concept to ensure their readiness towards IR 4.0 in using technology, understanding pedagogy and integrating the

knowledge of the technology in their learning process.

2 PROBLEM STATEMENT

The students' knowledge of the Industrial Revolution 4.0 and their readiness towards Industrial Revolution 4.0 challenge is at an alarming level [9]. Therefore, this study is important for University of Tun Hussien Onn Malaysia (UTHM) to see students' knowledge on the Industrial Revolution 4.0 and their readiness in facing the Industry Revolution 4.0. Competent, knowledgeable and skilled students are the main agenda of the national education system in order to contribute to the skilled workforce. The current challenge is to ensure that new employees in the Industrial Revolution 4.0 era to have skills in automation, digital and information technology without forgetting the soft skills to manage and utilize smart system requirements. According to Kergroach [10], emerging technological developments are likely to bring widespread automation and irreversible shifts in the structure of jobs, raising major challenges on labor markets and for policymakers responsible for promoting the necessary skills and employment. Hence, the situation becomes alarming when more employees will lose their jobs in the economic challenges and adaptation of new technologies. Among the sectors predicted to be affected including banking, insurance, construction and manufacturing industries. As of September 2016, almost 40,000 workers have been retrenched, while 44,000 and 25,917 in 2015 and 2014 respectively [9]. Hence, students need to be exposed to IR 4.0 so that these problems can be treated from the beginning. However, for students to understand IR 4.0, teachers need to know the students' level of readiness of the IR 4.0. Therefore, this study is aimed at looking at the level of knowledge and readiness of students of the IR 4.0.

3 RESEARCH OBJECTIVES

This study is conducted to fulfil several objectives which are: -

a) To identify the students' level of knowledge on Industrial Revolution 4.0.

b) To identify the students' level of readiness in facing the challenge of Industry Revolution 4.0.

4 RESEARCH QUESTIONS

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5 CITATIONS

In 2016, the Fourth Industrial Revolution (Industry 4.0) comes as the third version of the emergence continuation of automation, Internet and other physical processes and a cyber-physical system. Industry 4.0 is about the discovery of new technologies. According to Cordes & Stacey (2017), there are nine thrusts in Industry 4.0 which are autonomous robots, simulation, horizontal and vertical system integration, the Industrial Internet of Things (IOT), cyber security, the cloud, additive manufacturing, augmented reality and big data and analytics [11]. According to Muhammad Nizam (2018), based on the core of industry 4.0 industry, it can dominate the economy nowadays due to new technology [12]. Even changes in digital transformation can also remain competitive and spur the progress of the modern world landscape. According to Klaus Schwab [13], Industry 4.0 changes the way we work and live. This change is driven by three major technology domains which are physical, digital and biological. Furthermore, the internet is becoming a new necessity such as clothing, food and shelter in today's world as most of the business and business affairs are messed up when it is down or problems occurred in the internet technology system. According to Benesova & Tupa [14], the industrial revolution can have a big impact on education, especially in educational institutions. Even from the revolutionary of industry 4.0, it has also made substantial changes to the country, community and so on. The benefit of the industry 4.0 is it can sharpen the skills in problem solving. According to Tapper [15], in order to enter a professional workplace in the industry, employers will find graduates who can transfer critical thinking skills to workplaces. Therefore, the critical thinking that leads to problem solving is very important. Furthermore, in order to improve graduates, it is necessary to have links between universities and industry to strengthen the vision of the Industry Revolutionary (IR) such as creating "Smart Factories" in order to further enhanced the skills and qualifications of the workforce which is key to the success of innovative industries. According to Renganathan, Ambri, Abdul & Li [16], in order to combine the experience and knowledge of students to deal with Industry 4.0 related to employment in formal education at a university, they should be involved in the real estate work section to improve because skills will change according to the purpose of today's industry needs. This statement is also supported byLasi et al., [17], All these industrial revolutions did not influence only the production itself, but also the labor market and the educational system as well. Furthermore, the world faces many uncertainties that make things become more difficult to predict in three major domains including political, economic and social and also encompass variety of difficult challenges. Polemics of graduates' weaknesses such as lack of knowledge, skills, challenges in communication, having negative attitudes, lack of knowledge and low general knowledge are among those that can be listed. Not to mention adding young graduates who are said to be 'very urgent' in terms of starting salary rather than skills. The situation is increasingly alarming as recent media reported that more workers will be dismissed, due to economic challenges other than the adaptation of new technologies. According to the Malaysian Employers Federation (MEF), among the sectors predicted to be affected including the banking, insurance, construction and manufacturing industries. Hence, students at HEIs today should not be sitting comfortably in their arms or still in the air in the immersive world of their own - spending hours indefinitely in cyberspace - internet and computer or college leisure is merely 'uninterrupted' aimlessly. They must prepare a powerful weapon to face the increasingly uncertain career world. If more people are being retrenched as reported and students do not achieve the desired competency, there will be an issue on how would they be able to penetrate the job market later. Thus, a study has been conducted to identify the level of knowledge and readiness to the Industrial Revolution 4.0.

6 RESEARCH METHODOLOGY

6.1 Research Design

The study was a descriptive research using survey instrument. Questionnaires were used to obtain feedback from

respondents to identify the level of knowledge and readiness towards Industrial Revolution 4.0. The data obtained from this random sample are then analysed and the results were analysed using statistical tests to come out with the conclusion to the objectives. In this study, the population targeted by the researcher is comprised of students of Bachelor of Vocational Education in a Malaysian Technical University. The total number of samples involved is 200 students, covering 7 fields of study namely Catering, Electrical and Electronics, Building Buildings, Creative Multimedia, General Machines, Welding and Air Conditioning. According to Krejcie & Morgan (1970) in Chua [18] the sampling setting of the study sample is based on the total population. The sample of the study is a number of respondents in a study population. For this study, the population was 200 and the sample needed was 136 students with reference to the sample size determination of Krejcie & Morgan [18]. The questionnaire has two (2) parts: part A and B. Part A contains four (4) items related to student demographics. Part B contains eighteen (18) items that include questions related to knowledge, attitude and interest and students' readiness towards IR 4.0. The answer choices for the questions in this section are designed using a nominal scale of which respondents are required to fill in the blank space and indicate (/) in the box provided. The findings from the questionnaire will be analysed using SPSS software. Content distribution in the set of questionnaires can be clearly shown in Table 1 below:

TABLE 1
SURVEY QUESTIONNAIRE CONTENT

Section		Item
A	Demographics of respondents	4
	Student Knowledge of IR 4.0	6
B	Students' Attitude towards IR 4.0	6
	Students' Skill towards IR 4.0	6

Each item of questionnaire uses the five-level Likert Scale to see the level of respondent's consent to the items starting from 1 as highly disagree to 5 as strongly agree. The Likert rating scale is shown in Table 2.

TABLE 2
LIKERT RATING SCALE

Score	Option
1	Strongly disagree
2	Disagree
3	Less agree
4	Agree
5	Strongly agree

7 FINDINGS

This quantitative data was obtained through a survey disseminate to the respondents to get the response on the revolutionary industry 4.0.

7.1 Research Design

Table 3 shows the distribution of frequency and percentage of respondents who answered the questionnaire according to gender. Based on the table, the number of male respondents were 12 (40%) and female were 18 (60%).

TABLE 3
DISTRIBUTION ANALYSIS OF RESPONDENTS BY GENDER

Gender	Frequency	Percent (%)
Male	80	58.8
Female	56	41.2
Total	136	100

Table 4 shows the distribution of frequency and percentage of respondents who answered on the readiness of students in facing the industrial revolution 4.0 at the Technical and Vocational Faculty by specialization areas. Based on the analysis of the findings, the number of respondents who answered the questionnaire was from Machining n=21, (15.4%), Building and Constructions n=21, (15.4%), Catering n=23, (16.9%), Welding and Metal Fabrication n=6, (4.4%), Electric and Electronic n= 30, 22.17%. Multimedia creative n=15, (11.0%), and Air Conditioning and Refrigeration n=20, (14.7%).

TABLE 4
ANALYSIS OF RESPONDENTS DISTRIBUTION BASED ON STUDY PROGRAM

Specialized Area	Frequency	Percent (%)
Machining	21	15.4
Building and Constructions	21	15.4
Catering	23	16.9
Welding and Metal Fabrication	6	4.4
Electric and Electronic	30	22.17
Multimedia Creative	15	11.0
Air Conditioning and Refrigeration	20	14.7
Total	136	100

7.2 Students' Readiness towards Industrial Revolution 4.0 (IR 4.0)

Table 5 shows the mean score of the student's readiness factor based on knowledge factor. The highest mean is 4.15 indicating they can expand the science knowledge by knowing elements of IR4.0.

TABLE 5
THE READINESS OF STUDENTS FROM KNOWLEDGE FACTOR

Specialized Area	Frequency	Percent (%)
Machining	21	15.4
Building and Constructions	21	15.4
Catering	23	16.9
Welding and Metal Fabrication	6	4.4
Electric and Electronic	30	22.17
Multimedia Creative	15	11.0
Air Conditioning and Refrigeration	20	14.7
Total	136	100

Table 6 explains the students' readiness in terms of attitude. The highest mean is μ=4.53 which is the students interested in the technology system in the Industrial Revolution 4.0. The second highest mean score is μ=4.51 indicating that students feel good when accessing IR4.0 technology environment and easy to communicate with contacts using IR4.0 technology.

TABLE 6
THE READINESS OF STUDENTS FROM ATTITUDE FACTOR

No	Item Question	Min Score	SD	Level
1	I am interested in a new technology system in the era of Industrial Revolution 4.0 (IR 4.0).	4.53	0.76	High
2	IR 4.0 technology encourages me to think.	4.43	0.76	High
3	IR 4.0 technology affects my daily life.	4.48	0.77	High
4	I am motivated to study about IR technology	4.47	0.75	High
5	I feel satisfied when accessing IR 4.0 technology environment.	4.51	0.67	High
6	I am happy to communicate with contacts using IR 4.0 technology.	4.51	0.68	High

Table 7 shows the readiness in terms of skill. The highest mean score is the student should be ready to face the challenge of IR 4.0 (μ=4.29). Furthermore, all item in readiness in terms of skill factor are high.

TABLE 7
THE READINESS OF STUDENTS FROM SKILL FACTOR

No	Item Question	Min Score	SD	Level
1	I understand the challenges of Industrial Revolution 4.0 (IR 4.0)	4.22	0.96	High
2	I should be ready to face the challenge in the IR 4.0.	4.29	0.84	High
3	Strengthening oral and written communication skills can expand student's employability.	4.26	0.85	High
4	Sharpen complex problem-solving skills is important for IR4.0	4.26	0.88	High
5	Enrich emotional intelligence to be able to control in terms of awareness, networking and emotional control.	4.26	0.89	High
6	Improve teamwork skills with technological know-how, charisma and innovative leadership.	4.21	0.90	High

8 FINDINGS

The overall findings show that the level of students' readiness in terms of knowledge, attitude and skill in facing IR 4.0 showed that the students had a relatively weak knowledge level on the Industrial Revolution 4.0 (IR 4.0). The findings are consistent with the findings of Sharita et al. [9] where they identified that students' knowledge is weak. This due to the likelihood of students not being accustomed to the use of IR 4.0 technology during the teaching and learning session (T&L) in class or in everyday life. However, the study also found that students have high levels of enthusiasm and attitudes and willingness to face the challenges of IR 4.0. Teachers need to play a significant role engaging the students in class [19]. This element is a very important element in nurturing and guiding students in learning and using IR 4.0 technology in everyday life because students with deep interest and are ready to use IR 4.0 technology, are easy to be nurtured in comparison to those who have no interest. The Industrial Revolution 4.0 (IR 4.0) is not only changing the industrial landscape, but also altering the knowledge and skills requirement demanded by various industrial sectors. In order to response to the new challenges triggered by IR 4.0, Educational Institutions are required to review and restructure the existing programmes' curriculum with the aim to produce graduates who are more knowledgeable, competent and familiar with the technology related to IR 4.0. On top of that, it is also a must for the academicians, especially the senior one, to be reskilled and upskilled in the aspects of knowledge and skills related to IR 4.0, such as Internet of Things (IoT), big data and cloud technology. Senior academicians are different compared to the younger ones in many aspects, such as motivation level and technology adaptability level. In addition, many existing training programmes related to IR 4.0 did not put the focus on senior academicians. The change is driven by three key technology domains, namely physical, digital and biological across nine Industry 4.0 pillars, including simulation and virtual reality, vertical and horizontal system integration, Internet of Things (IoT) industry, cyber security, cloud computing, add-on manufacturing, supply chain, data analysis and robot automation [20]. Industrial Revolution 4.0 has created a new

industrial landscape which incorporates automation, cloud technology, Internet of Thing (IoT), big data, and augmented reality into manufacturing process. This new form of industry revolution has required manpower who are knowledgeable and capable of dealing with big data, cloud technology, IoT and so on. This requirement has brought about a great challenge to the higher learning institutions. In order to cater for the needs of the industrial sectors that are moving toward IR 4.0, Educational Institutions have to redesign and restructure their programmes by embedding IR 4.0 elements (such as big data analysis, cloud technology and IoT) into the curriculum [21]. This strategy is seen as the effort by the educational institutions to produce more fresh graduates who are familiar with IR 4.0. However, if we look a little bit deeper into the issues related to IR 4.0, the main challenge of IR 4.0 is not only pertaining to producing fresh graduate skilled workers [22], but also to upgrade the knowledge and enhance the skills related to IR 4.0 among the academicians in order to allow them to teach effectively and relevant to the contemporary industrial development.

9 CONCLUSION

In conclusion, the Educational Institution is not only the place where the students get knowledge and skills but also as a field to equip the students to complement the era of Industrial Revolution 4.0 (IR 4.0). This is where they are developed to become professionals [23]. Therefore, the educational institutions should devise various initiatives of exposure activity to these changes such as courses, seminars and forums to enhance student awareness and dedication. The selection of the Bachelor Degree Project must be directed towards IR 4.0. Students should be exposed to the design principles of IR 4.0 in example operational, virtualization, decentralization, real-time capabilities, service orientation and modularity. The IR 4.0 will serve us on cutting edge robots and autonomous transport, artificial intelligence, biotechnology and "genome" which involves automation, simulation, system integration, Internet of Things (IoT), cyber security, cloud computing, additional, virtual reality world, large data analysis, and vertical and horizontal system integration. Many experts see that human duty will be replaced by robotic energy, millions of people lose their jobs especially in the manufacturing sector. Hence, all parties need to be prepared to equip themselves with adequate skills and competency to contribute to the country in facing the challenges in IR4.0.

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