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# Perspectives of Malaysian academics on the preparation of fourth industrial revolution for Construction Technology Program

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**ABSTRACT**

The purpose of this study is to examine the perspective of Construction Technology academics from Malaysia vocational colleges on implementing the aspects of the industrial revolution 4.0 (IR 4.0). It was achieved by determining the degree of leadership support for vocational colleges, implementation of IR 4.0 components by academics, readiness for both generic and IR 4.0-related technical skills. This study was conducted using a survey method (cross-sectional study) where data collection and research findings were done only once during this study was conducted by applying the questionnaire method. The sample was chosen from among 408 academics from 42 vocational schools in Malaysia using Fisher's Formula. By choosing to work with a 95% confidence level, a standard deviation of 0.5, and a confidence interval (margin of error) of ± 5%, this study requires 198 samples for a better data findings and analysis. From 198 instruments distributed, only 45 instruments managed to be collected and analyzed due to limitation during global pandemic. The findings of this study were analyzed using Statistical Packages for Social Sciences (SPSS) software, version 20 by taking the mean value of each variable studied. The results of the study showed that the average mean score for each of the overall objectives of the study was at a high level which is between the mean ranges of 3.98 - 4.38. This shows that the level of implementation and readiness from the perspectives of vocational college academics in Malaysia in the field of Construction Technology is at a high level.



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## 1. INTRODUCTION

The education sector's ability to adapt to the current momentum of the fourth industrial revolution (IR 4.0) is important to ensuring that it can satisfy the industry's ever-changing needs [1]. As a result, the proper foundation is required to ensure that higher learning institutions, particularly vocational-based learning centers, are well prepared to tackle this tsunami. It also covers the teaching staff's ability to adjust to the changes that have occurred in recent years. Furthermore, technical educators must keep up with rapidly changing technological innovations and be able to adapt to 21st century learning styles [2]. In 2021, Kadir *et al.* [3] suggested that educational institutions to hold courses, workshops, guidance, facilities and develop curriculum that reflects IR 4.0. The teaching and learning approach to face IR 4.0 also needs to change to various teaching

procedures such as the use of advanced technology-based modules, simulation-based modules, prediction-based modules and others. According to Lai, Chundra, and Lee [4], the effectiveness of system reform or program implementation in education is highly dependent on the attitudes of academics including skills of academics in vocational colleges. Therefore, the leadership of the institution and the entire staff must change rapidly to meet the challenges of teaching and learning in the 21st century [5].

In light of the stated needs, this research will concentrate on a specific course of Construction Technology where no previous studies on the implementation and readiness of academics have been conducted. As a result, this article examines the level of implementation and readiness of Construction Technology academics in Malaysia vocational colleges to face the challenges of IR 4.0, including aspects such as leadership support, Construction Technology academics' application of IR 4.0 elements, generic skills readiness, and related IR4.0 technical skills readiness.

IR 4.0 marks the emergence of cyber-physical systems which fully involve the capabilities of humans, machines and new technological methods [6], [7]. Technological changes in society now also give changes to the national education system. New technologies that provide wide access from the medium of the internet can prepare these students and academics to be better prepared with IR 4.0 waves [8]. This study is a preliminary study on the readiness of academics to go through the IR 4.0. The readiness of these vocational college academics to the knowledge and challenges of tackling IR 4.0 creates comprehensive learning strategies to enhance students' knowledge and ensure the success of this wave of IR 4.0. Disciplined leaders are one of the most important components for achieving and determining an organization's success [9]. Meanwhile, any organization, according to [10], requires competent leadership. The findings of past studies on leadership in educational institutions have revealed that the various characteristics of good leadership can make it a crucial aspect that requires special attention. The importance of leadership style in enabling organizational development has been shown in previous studies [11]–[13]. According to Hertz *et al.* [14], effective support and opportunities for teachers to develop and apply their competences is crucial for maintaining both motivation and high standards in the profession. As a result, the organizational leadership style of vocational colleges is critical in contributing to Malaysia's development readiness for the industrial revolution through support, motivation, continuous reflection on accomplishments, and providing a suitable environment that is aligned with current and future educational needs.

Rapid changes in technology and the workplace have had a direct and indirect impact on technical instructors' readiness for IR 4.0 expertise. As a result of IR 4.0, changes in practice and strategy are deemed necessary. Although efforts to embed the curriculum with IR 4.0 element have been observed by the vocational-educators, it is still far reaching the demand of the future particularly in the workforce environment [15]. It was emphasized that instructors play a critical role in this situation in ensuring that kids receive relevant competencies for career and realizing the rapid changes of technology [8]. In 2018, Ilias and Ladin [16] observed that students have a moderate level of understanding about Industry Revolution 4.0 and are prepared to face the problems that come with it. In addition to accumulating knowledge about the curriculum, educators must continually prepare themselves for changes and innovations that will come [17]. Educators must also equip their students with the abilities to deal with the problems of IR 4.0 technology, which is subject to a variety of interpretations that test their thinking. Even educators who are rather behind the curve or simply cannot keep up with current technological innovations are regarded to be lest competence and inefficient in their instruction. According to previous researches [18]–[20], latest technologies such as big data analytics, artificial intelligence, augmented reality, and internet of things, cloud computing and other advancements need to be focused in order for students to learn its application.

According to Sang [21], the capacity of current technological abilities to be combined with other talents such as thinking skills, facilitation, learning skills, information technology skills, and communication skills in the teaching and learning process is critical. These soft skills sometimes refer to cognitive skills as well as generic skills [22]. Communication, problem-solving, critical thinking, teamwork, leadership, professional skills, lifelong learning, ethical and moral principles, entrepreneurial abilities, and so on are examples of soft skills [23], [24]. In most countries vocational system is part of the national system of secondary education and not only aims to provide young people with industry-specific vocational skills but also with generic skills [25], [26]. Based on those references, generic skills readiness is considered as communication, problem solving skills, self-directed learning, teamwork, lifelong learning, critical, creative and innovative thinking (entrepreneurial thinking) and information technology skills related to communication and networking.

Technical skills, according to El-Sabaa [27], relates to efficiency and comprehension in performing a certain task. A job that requires high and proper capabilities requires methods, procedures, processes, and even techniques. In 2001, El-Sabaa [27] stated that these technical skills require specific knowledge and skills related to certain fields and have the analytical ability in the use of equipment and techniques and have certain disciplines appropriate to the work of civil engineering, mechanical engineering, electrical and electronic engineering and also information system. In 2009, Nair, Patil, and Mertova [28] also stated that

skills related to basic knowledge in a specific field of engineering, proficiency in engineering subjects, engineering design skills, project management, research, development, and problem-solving skills related to the field of engineering are among the important aspects of technical skills in global competencies that need to be mastered by graduates in the field of engineering. These technical skills are also the capabilities and capacities of vocational college students in executing and implementing some basic technical skills that represent aspects of methods, procedures, and techniques in operating technical tools [29]. Furthermore, acquiring skills entails taking advantage of the opportunities provided by the digital environment, which is also required to meet the challenges of IR4.0 [30].

## 2. RESEARCH METHOD

This study was conducted using a survey method (cross-sectional study) where data collection and research findings were done by applying a quantitative approach through questionnaires. The questionnaires were developed by researchers by adopting the structure of information communications technology (ICT)-enhanced innovative pedagogy in technical-vocational education and training (TVET) by UNESCO and hence requires validity and reliability evaluations. The developed instrument was validated by two experts in Building Construction Program and the Cronbach's Alpha value for reliability is 0.96. The value of reliability was gathered from a pilot study involving 30 participants who are teaching in vocational colleges and not taking part in the real implementation of the study. The population of this study involved 408 Building Construction academics in 42 vocational colleges in Malaysia. The sample size determined by Andrew Fisher's Formula. By choosing to work with a 95% confidence level, a standard deviation of 0.5, and a confidence interval (margin of error) of ± 5%, this study requires 198 samples for a better data findings and analysis. 198 Building Constructions academics were randomly selected from the list to participate in this study. Unfortunately, form 198 instruments distributed, only 45 instruments managed to be collected and analyzed for this study due to the limitation of control movement and online data collection during the peak of COVID-19 pandemic. There are four elements of the application of industrial revolution 4.0 that are focused namely leadership support, application of IR4.0 elements, generic skills readiness and technical skills readiness as shown in Figure 1. The findings of this study were analyzed statistically using Statistical Packages for Social Sciences (SPSS) software, version 20 by taking the mean value of each variable studied.

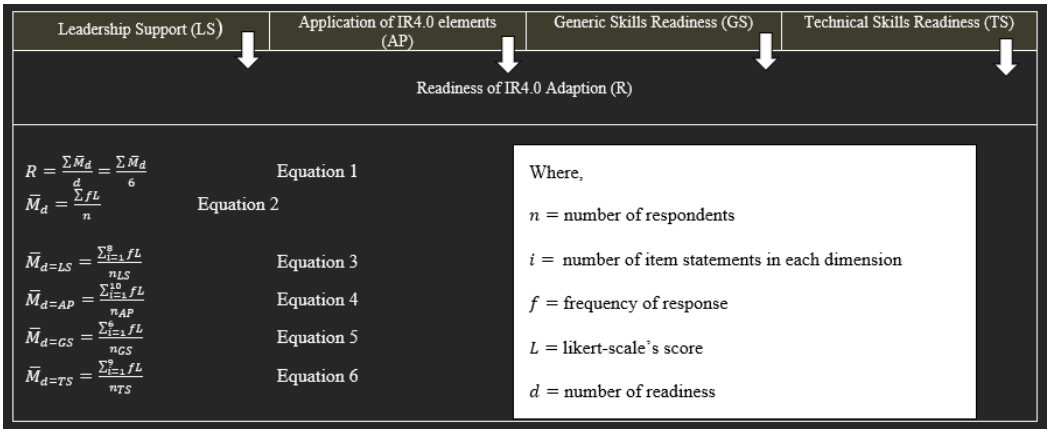


Figure 1. The measurement of readiness dimension

## 3. RESULTS AND DISCUSSION

### 3.1. Results

Table 1 summarizes each item that shows the level of leadership support according to the academics in Malaysian vocational colleges' Construction Technology Program. The element of leadership support is to answer the question of the extent of the vocational college's leadership support to Construction Technology academics towards IR 4.0-based teaching and learning. Thus, the researcher's objective for this question was achieved when the results of the study findings for this element showed a high level of interpretation (M=4.07, n=45). Meanwhile, Table 2 summaries each item that shows the application level of leadership support according to the academics in Malaysian Vocational Colleges' Construction Technology Program.

Table 1. Levels of leadership support

| Item | Min (M) | Standard deviation (SP) | Level |
|---|---|---|---|
| My institutional leadership strives to complement the development of the latest learning infrastructure in the field of construction | 4.07 | 0.84 | High |
| My institutional leadership is always reflecting on program achievement. | 4.13 | 0.79 | High |
| My institutional leadership is responsible for enhancing the learning capacity of students based on the latest technology. | 4.09 | 0.85 | High |
| My institutional leadership provides a clear process to academics to improve the curriculum in line with industry requirements. | 4.00 | 0.95 | High |
| Mean average value | 4.07 | High | |

Table 2. Application level of IR4.0 elements

| Item | Min (M) | Standard deviation (SP) | Level |
|---|---|---|---|
| There is an element of internet applications in the curriculum | 4.36 | 0.68 | High |
| There is an element of big data analysis in the curriculum | 4.09 | 1.00 | High |
| There is an element of automation in the curriculum | 3.91 | 1.02 | High |
| There is an element of artificial intelligence in the curriculum | 3.71 | 1.08 | High |
| There is an element of system integration in the curriculum | 4.11 | 0.75 | High |
| There is an element of data collection in the curriculum | 4.24 | 0.68 | High |
| There is an element of augmented reality in the curriculum | 3.84 | 1.00 | High |
| There is an element of virtual reality in the curriculum | 4.07 | 0.94 | High |
| There are cloud computing applications in the curriculum | 4.07 | 0.81 | High |
| Mean average value | 4.04 | High | |

There were two items showed values below 4.00, namely automation element (3.91) and artificial intelligence (3.71). The element of application of IR 4.0 element is to answer the question of the extent of application of IR 4.0 element by these construction technology academics in their respective vocational colleges. Thus, the researcher's objective for this question was achieved when the results of the study findings for this element showed a high level of interpretation (M=4.04, n=45). Table 3 summaries each aspect that demonstrates the amount of IR4.0 generic skills level according to academics in Malaysian Vocational Colleges' Construction Technology Program.

Table 3. IR 4.0 generic skill levels

| Item | Min (M) | Standard deviation (SP) | Level |
|---|---|---|---|
| I train students to communicate effectively | 4.44 | 0.59 | High |
| I train students to solve problems | 4.47 | 0.59 | High |
| I train students for self-directed learning | 4.44 | 0.66 | High |
| I train students to work together | 4.49 | 0.66 | High |
| I train students to make continuous improvements | 4.44 | 0.59 | High |
| I train students for optimal application practice in work | 4.29 | 0.70 | High |
| I train students to analyze risk | 4.20 | 0.76 | High |
| I train students to be creative | 4.27 | 0.69 | High |
| I train students to be innovative | 4.36 | 0.71 | High |
| I train students to use social media apps | 4.40 | 0.72 | High |
| Mean value | 4.38 | High | |

Overall, the element of IR 4.0 generic skills readiness is to answer the research question about the level of IR 4.0 generic skills readiness of construction technology academics in vocational colleges. Thus, the researcher's objective for this question was achieved when the results of the study findings for this element showed a high level of interpretation (M=4.38, n=45). Last but not least, Table 4 summarizes each part of the IR4.0 technical skills level as determined by academics at Malaysian Vocational Colleges' Construction Technology Program.

The IR 4.0 technical readiness skills are to answer the research question specifically to the construction technology academics in vocational colleges on those skills. Thus, the research objective for this question was achieved when the results of the study for this element showed a high level of interpretation (M=3.98, n=45). However, items that the value below 4.00, namely exposure to programming systems, network connectivity, advanced manufacturing, operation of advanced machines/tools and data analysis still need to be given attention.

Table 4. IR4.0 technical skill level

| Item | Min (M) | Standard deviation (SP) | Level |
|---|---|---|---|
| I expose students to learning programming systems | 3.89 | 1.05 | High |
| I expose students to the network connection (network connectivity) | 3.76 | 1.11 | High |
| I expose students to advanced manufacturing processes | 3.93 | 0.86 | High |
| I expose students to cross-disciplinary disciplines | 4.11 | 0.75 | High |
| I expose students to the operation of the latest machines/tools | 3.98 | 0.81 | High |
| I expose students to the assembly of tools and components | 4.11 | 0.80 | High |
| I expose students to data reading | 4.11 | 0.71 | High |
| I expose students to data management | 4.00 | 0.80 | High |
| I expose students to data analysis methods | 3.93 | 0.89 | High |
| Mean average value | 3.98 | High | |

### 3.2. Discussion

The level of readiness of vocational college construction technology academics towards IR 4.0 is high and considered satisfactory. A disciplined leader is also one of the most important elements so that the success of an organization can be determined [9]. Meanwhile every organization needs effective leadership [10]. Leadership is a key aspect to influence, push and motivate others by enhancing their abilities and capabilities in performing and completing a task in lined with previous studies [11]–[13]. A strong and supportive leadership team, as well as strong financial and technical support from stakeholders, may assist to boost the influence not just on academics and outcomes, but also on individual well-being [31].

Furthermore, the amount of readiness of Construction Technology academics at vocational colleges to apply IR 4.0 through teaching and learning is a determining factor in the implementation of the IR 4.0 element. In the era of IR 4.0, new technologies including as big data, artificial intelligence (AI), system integration, augmented reality, virtual reality, cloud technology (cloud computing), and others are being used. Despite the fact that the application of IR4.0 elements in the field of construction technology has been measured at a high level, attention should be paid to the elements of automation and artificial intelligence in order to maximize the application of IR4.0 elements in the field of construction technology.

The generic skills also provide quality assurance in the institution, ensuring that future graduates have competitive technical and practical skills, technical thinking management skills, communication skills, professional and information management skills, as well as a commitment to lifelong learning. This study's findings demonstrate a reasonably high degree of performance for generic skills, which is in lined with practices of vocational providers around the globe [26].

Technical skills are the talents and competences of vocational college students in performing and implementing some basic technical skills that represent characteristics of methods, procedures, and techniques in using technical tools [29]. In addition to the importance of technical skills [28], academics in the subject of Construction Technology at Malaysian vocational colleges have attained a reasonably high level. However, factors such as exposure to programming systems, network connectivity, modern manufacturing, operation of the latest machines/tools and data analysis skills can still be strengthened as it is also important in current competitive digital world [15], [30].

According to Ahmad *et al.* [32], characteristics of education sector preparedness in IR 4.0 are critical to ensuring that it can satisfy the industry's expectations and evolving demands. As a result, the proper foundation is required to assure their preparedness to adjust to the changes that occur. This study shows that Building Construction academics with their supportive organizations trying their best to keep up with the rapid advancement of technology and be hence capable of adapting to 21st century education. With some quality needed for improvement, it is suggested the institution to offer a course, workshops, counselling, facilities, and curriculum development relevant to IR 4.0 [3].

## 4. CONCLUSION

The average mean score for each overall objective of the study was found to be at a high level of interpretation between the mean that ranged from 3.98 to 4.38, according to the findings of the study on the survey of the level of implementation of industrial revolution 4.0 elements for vocational college Construction Technology academics in Malaysia. This clearly demonstrates that academics in Malaysian vocational colleges are confronted with the challenges of the industrial revolution, particularly in the field of Construction Technology at certain sub components. The overall readiness, on the other hand, is satisfactory. The teaching and learning approach to IR 4.0, as well as the adaptation to diverse instructional techniques such as the use of new technologies, has been favorably received. It is hoped that determining the level of preparation will help to influence the reform efficacy of future program execution. The elements employed in this study could be used as a model for academics as well as curriculum development in other domains.

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