

The Role of Technical and Vocational Education towards Fourth Industrial Revolution in Preparing Workforce in Malaysia

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ABSTRACT

Technical and Vocational Education (TVET) is an engine of social and economic development of the country in meeting the needs of fourth (4.0) industrial revolution. Therefore, TVET field is perceived to play a role in providing an adequate competencies workforce for the industrial revolution 4.0. This is because the industrial revolution 4.0 has become more valuable in today's world due to the economic and social benefits provided especially in the field of production. The objective of this paper is to investigate the role of technical and vocational education towards industrial revolution 4.0 in preparing workforce in Malaysia through literature review and previous study related to the topic. These inquiries provide a comprehensive understanding, establishing a robust theoretical foundation for this paper. This study used a comprehensive review of existing literature and empirical evidence. We will examine the various ways in which Technical and Vocational Education (TVET) fosters the knowledge and skills to prepare the nation workforce in industrial revolution 4.0. The literature review plays a pivotal role in this study, involving the meticulous identification and synthesis of pertinent research findings. To ensure comprehensive coverage, the researchers employed various search strategies, including leveraging search engines such as Google Scholar and accessing online journals. Key search terms such as Technical and Vocational Education, Industrial Revolution 4.0 in providing workforce in Malaysia were utilized to retrieve relevant articles and studies. A thorough analysis and comparison of established theories and models on Educational Readiness Model for Industrial Revolution 4.0 were conducted, with particular emphasis on their intersection with theories related to providing workforce. This integrative approach provided valuable insights, perspectives, and recommendations pertaining to the practical implementation and advancement of development TVET within educational institutions worldwide. In the 21st century, the success of an organization does not only depend on the products and services offered, but also on the workforce provided. This study concludes Industry 4.0 or also known as 'smart manufacturing' or 'internet industrialization'. The manufacturing industry has been transformed into a fourth revolution that is expected to affect the entire industry by changing the way goods are designed, produced, delivered, paid for and used. Therefore, education needs to pay attention, especially PTV.

Keywords: Industrial Revolution 4.0, Workforce, Technical and Vocational Education (TVET), Socioeconomics

INTRODUCTION

The concept of 'Industry 4.0' first appeared in Germany in 2011 and has become a growing value in the world due to the economic and social benefits it provides especially in the field of production. The need for industry 4.0 is becoming more important now, especially when the world is facing the era of 5.0. Industrial Revolution 4.0 refers to the transformation of the production structure into a digital system using information technology (Bilim, 2017). Tuğba Karaboğa (2022) explains the Industrial Revolution 4.0 requires a person to be closer to technology by creating a new environment where the physical, digital and biological fields are combined.

The innovative technologies that emerged from the industrial revolution have shown results from several professional groups and have led to the emergence of new branches of business. A study by Augustín Stareček,

Zdenka Gyurák Babel'ová, Natália Vraňaková, Lukáš Jurík (2023) found that in an effort to reduce operating costs and improve production quality and efficiency, production organizations in the automotive sector are trying to implement the Industry 4.0 concept that has become a phenomenon over the past two decades.

This initiative has a great impact on workers in production organizations, especially in the automotive sector. Accordingly, the needs of the labor market in the 4.0 industrial revolution are very critical. In 2020, the country expects 60% of the 1.5 million jobs to require skilled workers (Nor Aida, Suhaila, Mohammad Fakhruhlizam, and Mohamed Idrus, 2017). However, the supply of human resources for Malaysia to achieve that goal is still lacking (Nor Aida et al. 2017).

The marketability of labour resources from the production of human capital in higher education depends on the readiness of lecturers to face the development of industrial revolution 4.0. In the 21st century, the success of an organization does not only depend on the products and services offered, but also on the workforce provided (Nor Aida et al, 2017). Today's education system cannot be adapted to the rapid development of the world of work (Ali & Abdul Kadir, 2017).

According to Augustín Stareček et al. (2023), the labour market has become more complex and demands workers, due to technological innovation. Tasks are becoming more specialized and require a workforce that can do retrain multiple times throughout their career.

The most important thing for employees is the ability to adapt and develop the necessary competencies and lifelong learning. Many employers do not have technical staff with the application skills they want. To enable adaptation to these rapid changes, especially the vocational training sector, higher education institutions need to play a role in providing a large workforce with industrial revolution 4.0.

THEORETICAL FRAMEWORK

The Role of Technical and Vocational Education Towards Industrial Revolution 4.0

In 2020, it is expected that 60% of the 1.5 million jobs will require skilled workers. However, for Malaysia to achieve its goals, skilled human resources are still lacking. Having identified this as a major issue in the education system, the government, through the 2017 Budget, has allocated a total of RM4.6 billion to focus on Technical and Vocational Education (TVET), with RM270 million allocated to upgrade TVET, while RM 360 million is allocated for Skills Development Fund Corporation. This is in line with the Education Action Plan 2050. In 2023, the Malaysian Government has allocated RM6.7 billion under seven main ministries that implement various Technical and Vocational Education and Training (TVET) initiatives, in an effort to empower TVET (Budget 2023). Among them, RM180 million is provided as a TVET Training Fund to the Skills Development Fund Corporation, to provide loans for the benefit of 12,000 trainees who are following the Malaysian Skills Certification Program. The government will also continue the National Dual Training System program with an allocation of RM20 million for the benefit of 3,000 trainees. In relation to that, RM100 million is allocated to provide industry-recognized professional certification to TVET graduates and as an incentive for the industry to collaborate with public TVET institutions.

Historically, PTVs have emerged from opposing traditions, where universities provide academic knowledge while PTVs provide skills for marketability. PTV can ensure a viable career for those who do not excel in basic academic fields (Omar, 2015). However, the value of TVET is always compared to traditional academic education. The public, and parents in particular, have the impression that the TVET program is at a standstill and fails to provide sufficient career opportunities for graduates to progress. To bring about a change in mentality, the TVET system and policy makers need to be involved in a very important role. The TVET sector is often perceived as largely serving students who have completed their formal education, rather than being recognized as an important channel for providing skilled professionals. (Samir Muhazzab Amin, Siti Shazwani Ahmad Suhaimi & Nur Shuhamin Nazuri, 2023) Previously, it has been known as in-service training, vocational education, technical education, technical-vocational education, job education, workforce education and workplace

education. Higher Technical and Vocational Training Education is a combination of both academics and skills which in the long run, increases the employability of students.

The development of higher Technical and Vocational Training Education policies in the field of education is developing all over the world including Malaysia. As stated in the Ninth Malaysia Plan, Malaysia needs 37 percent of the workforce to be "highly skilled" by 2015.

In the Eleventh (11th) Malaysia Plan (2016-2020), according to the Economic Planning Unit (EPU), labour demand especially for the PTV sector has increased with the National Key Economic Areas (NKEA). NKEA needs a workforce of up to 3.3 million by 2020 of which 1.3 million are PTV graduates. The 12th Malaysia Plan (RMK12) (2021-2025) has planned to intensify Technical Education and Vocational Training (TVET) through the National Technical Education and Vocational Training (TVET) Empowerment Agenda. The TVET Program Single Rating Initiative and a centralized platform for TVET supply and demand (TVET Collaboration Hub, TCH) were also introduced, in addition to the collaboration between industry and academia also continued to be strengthened.

Several efforts have been developed through the Graduate Employability Strategic Plan 2021 to 2025 as an effort to increase the employability of graduates with several facilities in public universities also being upgraded. In addition, the development of the Higher Education Digitization Plan which will give new life to talent development programs in higher education institutes in line with the new norms of teaching and learning implementation.

Technical and Vocational Education and Training (TVET) in this country focuses on the direction of employment and industry practices. The focus is aimed at producing a competent workforce through emphasis on practical components, psychomotor skills and exposure to industry training. It is in line with the guidelines from the United Nations Educational, Scientific and Cultural Organization (UNESCO) which gives priority to education, training and skills related to the broad field of employment, production, services and livelihood.

In fact, TVET is seen as part of an element of a lifelong learning system that includes work-based learning, continuous training and professional development leading to a certain level of qualification. In Malaysia, good practice in the implementation of TVET programs is known as the Code of Practice for TVET Program Accreditation (COPTPA). This system has been jointly developed by the Malaysian Qualifications Agency (MQA), the Skills Development Department (JPK) and TVET experts.

The content of the COPTPA, among others, covers the scope of the programme and the specific requirements of the TVET program and lists seven areas of assessment, namely program development and delivery, student assessment, student selection and support services, teaching staff, educational resources, program management, monitoring, review and continuous improvement of program quality. The COPTPA document is recommended as a reference for Higher Education Providers (PPT) that involve several stakeholders such as TVET program providers, policy makers, and assessment panels as well as MQA and JPK officials.

The transformation of PTV into higher Technical and Vocational Training Education is the re-engineering of the existing vocational education system to build a higher vocational education system; which will contribute to high-income countries, in line with the emergence of industry 4.0. Recognizing the importance of this role, the Malaysian government including companies that have ties to the government such as Majlis Amanah Rakyat (MARA) as well as private training and educational institutions take various steps to improve PTV through the provision of higher Technical and Vocational Training Education at the third level where emphasis is placed on practical practical and skill development.

The readiness of PTV to face the industrial revolution 4.0 should be noted as it will affect the readiness and readiness of students to deal with the demands of the job market that require high skills. This is because the industrial revolution 4.0 has changed the increase in employment opportunities, but graduates are not provided

with the appropriate skills in terms of psychological, sociological and technological to provide skills to students in coping with the changes in the economic industry in the 21st century.

Industrial Revolution 4.0 in Technical and Vocational Education System

Industry is a part of the economy that produces goods that require labour. Since the beginning of industrialization, an increase in the technological paradigm shift has led to the industrial revolution. Industry 4.0 is carried out comprehensively and has changed the development of new technology to the production of labor in the national economy. The technological achievements of industrial revolution 4.0 have influenced the changing teaching and learning styles of educators.

Innovation, creativity, combination will change the ecological environment of each industry and create and build a new mode of existence that will change the whole world (Ding, 2014), especially the technical and vocational education system that produces human capital for the pioneers of the country's economic progress. According to Sabrina, Mustapha, Ichsan (2018) project-based learning is identified as an effective method to develop critical thinking, creativity, innovation, and problem-solving skills among TVET students. Student motivation is also important in maintaining their interest in meeting the needs of the industry, given the community's perception of the impact of TVET graduates on student achievement motivation.

Furthermore, the provision of curriculum infrastructure including facilities for effective revision curriculum implementation is necessary (Yeap, Suhaimi & Nasir 2021). All stakeholders should provide input on all aspects of curriculum revision to meet industry needs. Vocational education is the engine of social and economic development, industrial development and enterprise growth, and its development becomes a guideline for talent in the demand of social and economic development to a certain extent (Ye Mei, 2017).

Given the effects of the industrial revolution, vocational colleges should actively develop and build in the aspects of information, cloud computing and big data to build new quality and efficiency in higher vocational teaching and management systems (Ye Mei, 2017). Technical and Vocational Education needs to provide tools to enable them to find appropriate information to meet basic skill requirements that are in line with current developments (Ali and Abdul Kadir, 2017)

Concept of Preparedness for Industrial Revolution 4.0

Readiness is a combination of an individual's ability and willingness to perform a task or profession (Baker, 2002). Educators will be seen as more prepared to carry out teaching duties (Sokal, Woloshyn & Funk-Unrau, 2013) when they have sufficient experience in preparing to build an environment that supports the teaching and learning process for all students. Therefore, educators will obtain a strong psychological and sociological readiness to face the challenges of the industrial revolution 4.0 and the economic changes of the 21st century.

This is because readiness is an important element in determining success and failure in implementing a change (Habib Mat Som, 2005). Educator readiness has to do with familiarizing oneself or being willing to undergo training and be ready to perform the tasks given (Asrofi, 2013). There are several aspects that influence individual readiness for change, namely commitment, encouragement from the organization, loyalty and employee participation (Madsen, Miller, & John, 2005), demographic factors such as educational background and position (Devos, Buelens & Bouckennooghe, 2007), trust, support, and a conducive organizational environment (Huy, 2008), employee knowledge and skills, interpersonal relationships at work, organizational culture, relationships with management and leaders (Hanpachern, Morgan & Griego, 1998), change content, context, process and individual characteristics (Holt, Armenakis, Feild & Haris, 2007) significantly have a relationship with individual readiness for change.

Professional tasks that are carried out effectively through knowledge, understanding and planning for self-control and re-action will help psychological readiness to act (Klimov, 2002). This shows that the availability of lecturers in coping with Industry 4.0.

EDUCATIONAL READINESS MODEL FOR INDUSTRIAL REVOLUTION 4.0

Darab dan Montazer (2011)

Figure 1 shows a framework that has been adapted and modified from Darab and Montazer (2011) for educators' readiness for industrial revolution 4.0. Factors that affect the readiness of educators are policies, networks, equipment, management, standards, content, regulations, financial resources, human resources, culture and security. In this model, aspects of equipment, security and network can be classified against the technology used for the readiness of educators in facing industrial revolution 4.0. Policies and standards are needed to enable any system or operation to run smoothly (Asma, Mohd. Naz'ri & Roslina, 2016).

Management involves the regulation and design involvement of systematic system management. While the network can access technology effectively can be achieved because a suitable network allows educators to deliver lessons well and motivate students in the learning process. Culture needs educators, students to understand the importance of the advantages of industry 4.0 and accept those advantages of the industry. Equipment is very important to provide systematic work results.

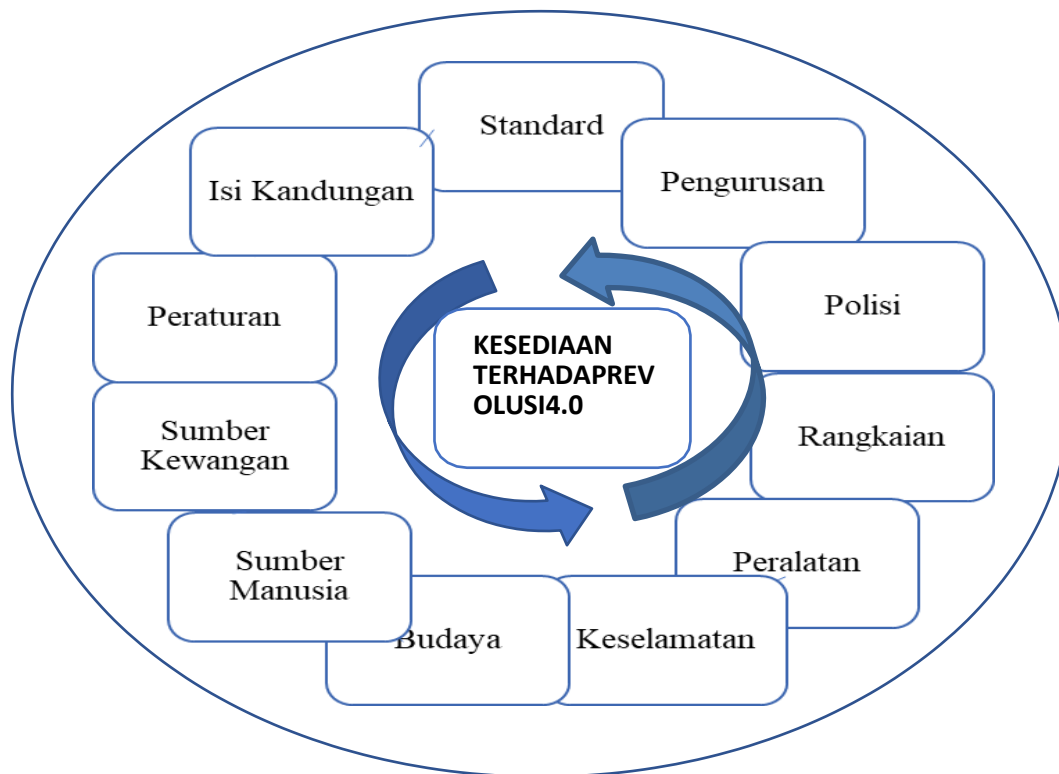


Figure 1: Framework of Readiness for Industrial Revolution 4.0 (Adapted and modified from Darab & Montazer, 2011)

Standard – management – policy – network – tools – security – culture – human resource – financial resource – rules – content

AKASLAN AND LAW MODEL (2011)

Akaslan and Law (2011) identified several factors that influence readiness for e-learning in developing countries. Educational institutions are taking steps to change from traditional learning mode to e-learning mode. The e-learning factor is based on two beliefs that e-learning will reduce the ability required by teachers and at the same time increase the level of education, and training is required for students and teachers to change from traditional learning modes to e-learning learning modes. This belief affects the perception of related entities. According to

Ford, Ford, and D` Amelio (2008), when change is implemented, it faces some issues and obstacles but will be accepted later. This process is illustrated in Akaslan and Law's model based on figure 2.

In the first phase of readiness, it is important to consider four aspects namely individuals, technology, content, and institutions. Obstacles are expected from individuals who are concerned with the implementation of e-learning in line with the institution as it embeds e-learning in its activities.

The technological aspects of this model are hardware, software, and internet stability. Hardware refers to the physical components, and software refers to the information aspect of technology. This requires access to the internet with the use of a personal computer or laptop as hardware along with a web browser such as Internet Explorer or Firefox as software.

Technology is a fundamental factor because apart from e-learning and other critical elements, it is fundamentally based on computers and the internet. The availability of these two things needs to be examined for learning due to the implementation of e-learning using the environment open web-based virtual learning (VLE) can be widely used. This prompts to examine access to the Internet at home and at university because e-learning transcends temporal and locational constraints. In addition, the ease and flexibility of access is important to know the convenience.

Individual readiness is another important component to measure readiness as e-learning implemented by individuals. The individual readiness factor deals with the characteristics of individuals serving in higher education institutions. It is clear that individuals who are more skilled at working in larger institutions may have learning that is successfully implemented. Therefore, self-efficacy, experience, confidence and expectation to mobilize various ICTs for various purposes become important factors.

The level of skills, experience, relevant beliefs, and attitudes of the people concerned, i.e. researchers, lecturers, administrators and strategists towards learning may have an impact on the integration of e-learning. The readiness of individuals at the institution was analyzed considering their own experiences and beliefs in the use of various ICTs and their attitudes towards e-learning. Individual use of innovation is closely related to users of the same technology function (Park, Roman, Lee & Chung, 2009). The use of the system is significantly influenced by the experience of other systems.

Individuals' confidence to use ICT can be classified as the level of e-learning readiness because generally there is a linear relationship between internet and software skills and confidence about e-learning (Agboola, 2006). Scheir and Carver (1993) also emphasized that individuals who have optimistic beliefs about something continue to work towards the desired result even though their progress is slow, but they still strive to achieve it. A positive attitude towards e-learning can be an important factor influencing readiness for e-learning.

Content is related to the existing availability of content, format, level of interactivity, feasibility, and interoperability (Lopes, 2007). It is almost impossible to inculcate all these aspects because the curriculum currently used in HEIs linked to the subject of electricity is very large. Willingness to address the suitability of e-learning to improve the quality of learning and teaching electricity broadly - theoretically and practically - rather than at a subtle level.

An institution is an environment that can be replicated as a university with its faculties and departments (Clarke, 2004). Institutions need to support e-learning by offering good infrastructure, cultural support, incentives, models and resources. By examining the current strategy, curriculum, facilities and personnel managed by the institution, it makes it easier to identify the suitability for e-learning.

In the second phase, when users identify the benefits of e-learning, they accept the mode of e-learning and think it will be useful. In the third phase, training is given to fully adapt to the e-learning mode. Students, teachers, facility managers (managers of university facilities relevant to e-learning) and other personnel (employees who have a role in e-learning) are included in this training.

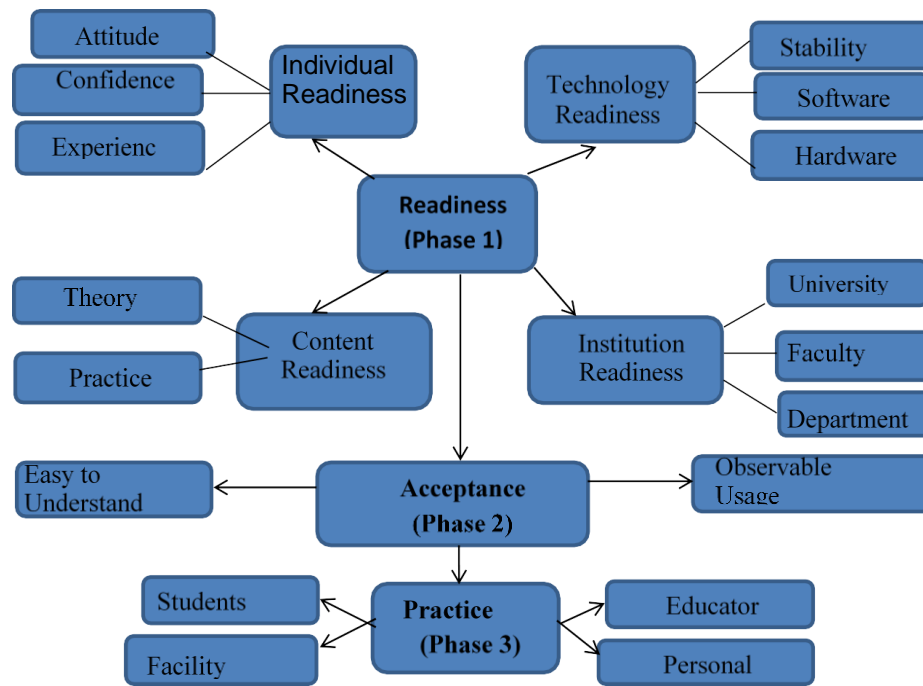


Figure 2 : Model Adapted from Akaslan & Law (2011)

METHODOLOGY

This study used a comprehensive review of existing literature and empirical evidence. We will examine the various ways in which Technical and Vocational Education (TVET) fosters the knowledge and skills to prepare the nation workforce in industrial revolution 4.0.

The literature review plays a pivotal role in this study, involving the meticulous identification and synthesis of pertinent research findings. To ensure comprehensive coverage, the researchers employed various search strategies, including leveraging search engines such as Google Scholar and accessing online journals. Key search terms such as Technical and Vocational Education, Industrial Revolution 4.0 in providing workforce in Malaysia were utilized to retrieve relevant articles and studies. Additionally, the researchers consulted authoritative books and reputable websites to enrich their data collection process.

A thorough analysis and comparison of established theories and models on Educational Readiness Model for Industrial Revolution 4.0 were conducted, with particular emphasis on their intersection with theories related to providing workforce. This integrative approach provided valuable insights, perspectives, and recommendations pertaining to the practical implementation and advancement of development TVET within educational institutions worldwide.

CONCLUSION

Industry 4.0 or also known as 'smart manufacturing' or 'internet industrialization'. The manufacturing industry has been transformed into a fourth revolution that is expected to affect the entire industry by changing the way goods are designed, produced, delivered, paid for and used. Therefore, education needs to pay attention, especially PTV. This is because PTV is the main key to support Industry 4.0 in providing the necessary labor force. Therefore, PTV needs to be prepared to play a key role in line with the country's needs in dealing with the 4.0 industrial revolution, especially in providing a skilled workforce.

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