

Backward and Forward Reviews on Technical and Vocational Education and Training (TVET) in Malaysia: The Evolution and ICT-Driven Future Prospect

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Abstract This paper discusses two important aspects of Technical and Vocational Education and Training (TVET) implementation in Malaysia, namely the evolution and the role of Information and Communication Technology (ICT) in crafting the future of TVET in the Malaysian education landscape. The evolution of TVET is elaborated in seven stages, starting from the era of before the Second World War up to the present new millennium. On the other hand, the role ICT is narrated based on several contexts, such as the history behind ICT integration in TVET education, the advantages, and disadvantages, as well as the challenges and readiness to move along with rapidly shifted industrial demands. Education policies on TVET are constantly enacted and enhanced to ensure that the nation could overcome the challenges of the industrial revolution 4.0. These policies are implemented within three types of TVET institutions, which are school-based, non-school-based, and registered private entities. Therefore, this paper contributes to the existing knowledge by relating the past and the future of TVET education in Malaysia.

Keywords Technical and Vocational Education and Training, TVET, Educational Planning and Policy, Educational Administration, ICT in Education

1. Introduction

As one of the leading developing countries in South-East Asia, Malaysia ambitiously aims to be a developed nation in its own ambience by the end of 2020.

To achieve this, the highlight has been given to several aspects, particularly in promoting a balanced growth of economy, policy, society, spirit and cultures. Along with the recent Information and Communication Technology (ICT) bombardment, significant transitions and demands in every aspect of human lives happen at a rapid pace across the globe. Hence, not to be left behind, one of the strategies of the Malaysian government is to emphasize the education sector as it is recognized as an influential agent, especially by producing skilled laborers and professionals that will encourage the development of other sectors as well. Consequently, this agenda will further lead to the agile achievement of the desired status of a developed country. Furthermore, as the globalization trend continues to shape the Malaysian education system, the Technical and Vocational Education (TVET) is unexceptionally transformed along the way. Undeniably, TVET plays an essential role in the development of a country, congruent to the Malaysian aspiration to become an industrialized nation within the first 20 years of the 21st century.

Therefore, in this article, the progress of TVET implementation is discussed. Besides, the role of ICT in promoting TVET evolution is also addressed. This study uses a qualitative approach by analyzing official government documents. The review of the documents involves (i) Razak Statement, (ii) Rahman Talib Statement, (iii) Education Act 1996, (iv) Education Policy 2012, and (v) Malaysia Education Blueprint 2015-2025. These official documents are important to understand the progress that has taken place on TVET education policies in Malaysia.

2. Research Methodology

This study uses a qualitative study by analyzing official government documents. The review of the documents involves (i) Razak Statement (ii) Rahman Talib Statement (iii) Education Act 1996, (iv) Education Policy 2012 (v) Malaysia Education Blueprint 2015-2025. These official documents are important to understand the developments that have taken place on TVET education policies in Malaysia.

3. The Evolution of TVET

Tracing back through the history lane, the TVET in Malaysia was introduced in 1964 under the Technical Management Department, which is currently known as the Technical and Vocational Education Division. The main objective of TVET is to prepare students towards the real industrial environments as well as to reinforce the government's efforts to strengthen the policy of industrial-based economy. In addition, to increase the number of highly skilled manpower and to enhance the technology needed in manufacturing and industrial sectors, the Ministry of Education, Malaysia (MOE) has taken significant action in 1995 by enacting the Technical Manpower Improvement Action Plan. Therefore, based on what is stated in the above-mentioned action plan, it is important to reconsider the historical development of technical and vocational education in Malaysia. In light of this, the evolution of TVET in the country can be divided into seven stages:

- i) Before the Second World War (1900-1940)
- ii) During the Japanese occupation (1941-1945)
- iii) After the Second World War (1945-1957)
- iv) At the beginning of Independence (1957-1969)
- v) In 1970 to 1990
- vi) In 1990 to 2000
- vii) In the year 2000 to present

3.1. Before the Second World War (1900-1940)

In the early 1900s, there was no basis for technical and vocational education in Malaysia [formerly known as Malaya]. Realizing the weaknesses and shortages of the skilled and semi-skilled workforce at the time, the British government had set up a Lemon Committee in 1918. This initiative was aimed at establishing technical and industrial education for the Straits Settlements [1]. Prior to this, the Teacher Technical School was established in 1906 in Kuala Lumpur as a training institution of special technicians who worked for the Public Works and Railways Department. Later, in 1942, this technical school was upgraded to a technical college, and presently it is known as Universiti Teknologi Malaysia.

Meanwhile, the turning point only appeared in 1925, when a committee, The Winsted Committee on Industrial

and Technical Education, was set up to initiate vocational training. As a result, four craftsmanship schools have been set up with the primary aim of providing alternative education for underprivileged primary school students. Within three years of vocational courses in the schools, the students were expected to equip themselves before jumping into real industrial sectors. Accordingly, among the courses offered were elementary mechanical engineering, electrical engineering, and wood crafting.

3.2. During the Japanese Occupation (1941-1945)

During this phase, the country's education system was unchanged, similar to the era before the Second World War. The only difference is the domination of the Japanese army over the country's economy. Nonetheless, the technical and vocational schools continue to provide education and training to Malaysian students and workers in particular vocational fields.

3.3. After the Second World War (1945-1957)

After five years of occupation, the Japanese governance in Malaysia has come to an end and was taken back by the British government. Accordingly, the educational system was reviewed, and in 1950, an education figure from England, Barnes Oxford proposed that vocational education in Malaysia should be equipped with a Modern Vocational Secondary Curriculum whereby the priority was given to the subject of Science, Industrial Arts and Home Science [2]. Unfortunately, this proposal was abandoned before it could be implemented due to a lack of funds. In the 1955 elections, the Alliance party was elected to govern and manifested to provide a standardized education system for all citizens. Later, in 1956, the Education Committee was established as reported in Razak Report 1956 [3], in which several important changes in vocational education have been embedded into the national education system, and high priority was given to it [4].

3.4. The Beginning of Independence (1957-1969)

In this era, the Rahman Talib Report [5] has been praised as the Education Act 1961 [6]. Among the recommendations that have been made were the establishment of vocational and technical secondary schools. Furthermore, the government has opened eight carpentry schools in rural areas, which were later converted to village extension schools. However, this initiative received no support and was discarded, as it did not prepare students for the public examination. Next, the Multi-Field Education System was established in 1965 for lower secondary schools. This was followed by the establishment of three technical schools in 1968, with the aim of nurturing students' ability in engineering. Here, the academic subjects were also emphasized in addition to the

technical subjects offered. Examination-oriented education was also introduced that is the Malaysian Certificate of Education (MCE). In this case, the outstanding students would have the opportunity to pursue their studies at either the MARA Technology Institute or other technical colleges.

3.5. In 1970 to 1990

During this phase, the vision of Malaysian education has extended from solely focusing on eliminating illiteracy to an education that is driven by national economic goals. Thus, within 1970-1989, several more technical and vocational secondary schools were established. The philosophy behind this was to accommodate the demand of students who are interested in the vocational education system. In parallel, the polytechnic institutes were also growing in numbers.

3.6. In 1990 to 2000

In the 1990s, the demand for technical and vocational schools has increased. The positive consciousness among the society towards this alternative stream of education has contributed to this increment of demand, which has gone beyond academic achievements. This was proved by the statistic during this era that has demonstrated a rising number of enrollment applications, from the weak or excellent Lower Certificate of Education (LCE) graduates. Henceforth, the competition also became tougher. Moreover, two main factors have been identified to this phenomenon, which are (i) the awareness of the importance of technical and vocational education in supporting the nation's vision towards industrialization, and (ii) higher demand for employment. Therefore, the MOE has redefined their vocational education's goals so that any shortcomings would be catered. In light of this, two major divisions have been introduced by the government, namely technical education and vocational education. Technical education aimed to provide students who were keen to further studies on engineering at the upper secondary level, up to the higher education institutions. The objective of technical education was to provide a balanced mixture of mainstream as well as science and technology education. On the other hand, vocational education aimed to provide students who were interested in the vocational fields at the upper secondary level. In like manner, the courses offered allowed students to gain basic vocational knowledge and skills as a preparation to be a skilled or semi-skilled industrial workforce. Following that, in 1995, several changes were made in the vocational education system, including restructuring and rebranding 69 Vocational Secondary Schools (SVM's), which are currently known as Technical Schools (SMTs).

3.7. In the Year 2000 to Present

Since the beginning of the new millennium, vocational education has undergone constant changes in terms of its structure and curriculum. This is in line with the vision of MOE to provide up-to-date training that meets the needs of skilled human resources in Malaysia. As for TVET students, the importance of mastering skills in a specific area is unquestionable. Recognizing this, the transformation of the vocational education curriculum is carried out to provide greater opportunities for students who are inclined and capable in the technical field to pursue higher education. Coherent to the current demands, the Technical Education Department has revised the vocational curriculum. The review takes into account the current industrial needs, which is vital to equip vocational education graduates with proper skills, whether in the field of engineering, economy, agriculture, or service sectors.

To cope with the rapid transformation of the country's industrial orientation that has shifted from 'labor-intensive' to 'capital-intensive', the use of technology is unavoidable. This leads to the greater requirement of skilled, scientifically trained, and technically knowledgeable manpower to embark on the operation. In the meantime, the vocational education transformation to TVET was fully implemented since 2013, which makes this stream no longer considered a second-class education. Instead, it is now generally accepted as an alternative with an equal prospect as mainstream education. This has been positively accepted, resulting in an accretion number of admissions, year by year. Today, TVET continues to receive serious attention from the government through the 11th Malaysian Plan (RMK-11) that will secure the possibility of Malaysia to become a high-income nation [7]. Furthermore, this agenda is supported in the Malaysian Education Blueprint 2015-2025 (Higher Education) that emphasizes the foundation of TVET to achieve sustainable industrial-based job opportunities and boost-up the country's economy [8].

4. The Development of TVET

The development and implementation of TVET in Malaysia occur in three different landscapes, as discussed below.

4.1. School-based TVET

There are two types of school-based TVET. First, the TVET is implemented as insertions or additions to the core subjects in comprehensive and mainstream secondary schools. The vocational subjects are offered as elective subjects that require students to choose them according to their interests and abilities. Additionally, some optional vocational subjects are offered primarily for those who

have no tendency towards the academic subjects. Second, TVET is also implemented comprehensively through special vocational and technical schools. These secondary schools are established as special academic schools, focusing on TVET. Presently, the vocational schools have been rebranded to Vocational College.

4.2. Non-School-Based TVET

Besides the school-based TVET, several other institutions and centers are operated by multiple ministries and agencies such as MARA, Ministry of Youth and Sports, Ministry of Human Resources, and Ministry of Higher Education, especially for youths who have partly or fully completed secondary education. In light of this, the implementation can vary in terms of duration, modules, and courses, whereby these criteria will determine its implementation mode, whether as short or long courses that take up to three years to complete. At the end of the training, the graduates will be awarded the TVET certificates by their respective institutions.

5. The Importance of TVET

In this article, five main importance of TVET in shaping Malaysian educational landscape has been highlighted, as follows. First, TVET has been proved to increase the nation's productivity. In this sense, it can be assumed that the skills acquired during TVET training will facilitate the workers to quickly adapt themselves to the industrial environment. Consequently, with that capability, less time would be consumed for industrial training, and thus, the workers would be more productive and able to produce more with comparatively limited efforts. Productivity also relies on the level of teamwork. This is the part where the advantages of TVET graduates become visible as they are trained to effectively and efficiently work in a team. Second, TVET also contributes to human capital. A higher level of human capital is required to efficiently operate sophisticated machinery that will increase the rate of return of investment [9]. Investing in physical equipment and machinery is definitely an important growth determinant. Nevertheless, highly skilled workers who can quickly master the technology are equally vital to ensure sustainable production in certain industries. Third, TVET addresses technological challenges. The recent Industrial Revolution 4.0 has changed the way of technology utilization in industrial sectors. As a result, the industrial players nowadays are more towards demanding highly skilled workers to complement their advanced technology. This is making sense as technological changes would bring no competitive advantage if it is not properly operated by highly skilled workers to reap most of the returns from the technological advances [10].

Fourth, TVET deals with changes in work organization. The effective use of skills within the industry depends on the way that work is organized [10]. Organizational changes and work practices in high-performance industries are closely related to how human capital is managed. For instance, self-managed work teams, multi-skilling, job rotations, cross-training, and dissemination of decisions are among the usual circumstances that can occur in any organization. In such a manner, the technical skills could be the treasure value-added of an employee, besides those that are normally required in traditional organizations [9]. Finally, TVET addresses trade openness, competition and Direct Foreign Investment (DFI). In the era of globalization, skills and non-regional-based resources determine industrial competitiveness [10]. Globalization creates capital flows, generates turn, and establishes demands of skilled laborers. As a consequence, the lack of highly skilled laborers could impede the flow of DFI to certain countries.

6. The Stimulating Role of ICT in TVET Implementation

Over the past few decades, the world has seen a stunning transformation on the way education was disseminated. Along with the advancement of technology, face-to-face and physical gatherings are no longer becoming a requirement for teaching and learning to happen. As in the case of Malaysia, distance learning has started to take place since 1980; with the preferred mode of delivery was paper-based due to very limited access to the Internet at that moment. Approximately ten years later, the demand for Web-based learning has increased dramatically, caused by difficulties of public universities in handling the escalation of student enrollment [11]. Ironically, this has marked the beginning of the era of ICT in the Malaysian education system, which was also boosted by the increasing availability of Internet access across the nation. The phenomenon has correspondently impacted TVET implementation worldwide. Since the past decade, ICT and computer-based literacies have been recognized as vital elements that are desperately needed in TVET education during this digital age [12], [13]. In fact, ICT integration has been identified by UNESCO as one of the emphasized initiatives to be applied to improve the quality of teaching and learning in TVET education [14], [15]. Past researchers agree that ICT could be a powerful tool to support teaching and learning in TVET education, especially when it is combined with proper pedagogical foundations [11], [12], [16]. Indeed, the vital role of ICT in TVET implementation has been evidenced as a critical key to global competitiveness around the world [17], [18].

In the case of Malaysia, the literature from the past ten years has shown that ICT was widely applied for a long

time ago in delivering TVET education [12]. However, this positive progress is yet to attain the equivalence of the Malaysian general education sector [19]. Moreover, TVET educators' ICT competencies were found to be at a moderate level, although their attitudes toward ICT were positive [20]. On the other hand, despite this finding, ICT integration into TVET education is theoretically promising and advantageous. Congruent to a rapid expansion of ICT tools and trends, the TVET sectors in Malaysia are expected to obtain fruitful long-term benefits from this assimilation [11]. ICT is useful in both aspects of TVET, namely education management as well as teaching and learning [15]. In terms of education management, ICT is perceived as a tool to remain competitive but, at the same time, cost-effective [11], [16]. Be that as it may, the real bounty of ICT in TVET education lies in its capability to enhance the quality of teaching and learning. This medium allows dynamicity, flexibility, together with fast deliverance of education, and therefore, improves the quality of TVET's learning outcomes [16], [21]. Moreover, high-end computer technologies, coupled with innovative pedagogical approaches, will enable the teaching and learning of TVET to take place in more satisfactory and engaging ways [12]. For example, using ICT, multiple modes of education is possible to be implemented, such as distance learning or blended learning, which is more student-centered and conveniently instilling high order thinking skills to students [11]. This has been empirically proved by a recent study, which revealed that ICT-based open learning systems facilitated attractive TVET teaching and learning activities through an online learning environment [16]. Additionally, in certain risky cases such as when teaching on power plant safety, using a computerized simulator is comparatively a safer option to be implemented. Similarly, in certain TVET subjects that involve expensive machinery and equipment, the use of ICT tools could provide a cheaper but equally effective teaching method for students. Both of these examples demonstrated how ICT could save time, reduce costs and risks while at the same time retaining the motivation of TVET students. The preceding discussion has confirmed that the implementation of ICT has made TVET education more meaningful, while it enables students and educators to explore the world of industry with ease [20]. The effective ICT integration could help TVET students to perform better by building substantial skills and knowledge in a constant process while preparing them for the natural industrial ecosystems [16]. Meanwhile, along with its speedy advancement, ICT tools are becoming cheaper, accessible, easy to use and interactive, whereby their application in TVET education is expected to produce creative, innovative and industrial-oriented graduates [15], [22]. With all things being considered, it can be inferred that the process of producing quality students will also prepare educators in the new

information age and add value to TVET education systems in general [12], [17], [21], [23].

Turning now to the possibility of improving the adaptability of TVET graduates, it is equally important to note that ICT and technology's growth will continue to challenge the current practices in TVET education [24]. The requirement to master at least basic ICT skills regardless of the industry or the position has appeared since long ago [15]. However, it is expected that within these recent years, this requirement might no longer be valid. In the era of constant technological, economic and social transitions, sticking to a single skill is not a sustainable approach for workers because skills and knowledge could become quickly outdated [11], [23]. Likewise, real industrial ecosystems run significantly parallel to the fast progress of ICT. For instance, the advanced tools such as e-commerce, e-account, and mobile technology have been applied for decades, and recently, the technological trends like the Internet of Things (IoT), data science and cloud computing have taken over to support industrial revolution 4.0 [15]. To cope with the current industrial workforce demand, the TVET syllabus and course contents should not be left behind. In the same way, TVET education should be able to generate industrial-ready, ICT-capable, and skilled-based manpower while at the same time move progressively side-by-side with the evolution of technology [25]–[27]. Unless MOE adopts this, the good reputation of TVET will not be attained, indicating the crucial role of ICT application that should not be under-emphasized during the current digital era [23], [25].

In spite of this, one should take into account that every opportunity comes with challenges. One of the challenges faced by TVET educators is the difficulty of integrating ICT into teaching and learning activities that are not just fun and engaging, but also effective to improve students' performance [12]. Perhaps, this situation occurs due to the nature of Malaysian education that is still examination-oriented. Although TVET has shifted a bit from this path, students are still required to pass academic subjects in addition to the acquired technical and vocational skills. Additionally, as for stakeholders and MOE, challenges that possibly hinder the successful ICT integration can be grouped into a few categories [11], [15]. Firstly, Malaysia, as a developing country, is still facing technological obstacles, especially in providing proper physical facilities and equipment to support ICT integration in TVET education. Secondly, the administration's readiness also includes lack of funds as well as inadequate technical and administrative staff. And finally, Malaysia is also having difficulty in terms of educators' readiness. This includes negative attitudes toward ICT, change resistance, lack of ICT knowledge and skills, as well as lack of moral value implementation.

Challenges that are not well addressed will lead to total failure. This notion applies to all areas, including TVET

education. Therefore, past literature has highlighted several strategies and factors to consider for a successful ICT integration into TVET such as; (i) strategic readiness, (ii) organizational readiness, (iii) pedagogical readiness, and (iv) technical readiness [15], [19], [28]. In terms of strategic and organizational readiness, the example can be related to the aforementioned issue of student performance on general academic subjects. In this sense, the ICT-enabled TVET institutions and courses need to be mainstreamed [29]. This means that the syllabus, course content, and assessment methods should also be transformed from examination-oriented to skill-based assessments. Similarly, any TVET institutions should equip themselves with an adequate fund, technical staff, and administrative staff to support their ICT integration. On the other hand, there are at least two aspects to consider regarding the pedagogical readiness. First, TVET educators as the sources of knowledge should prepare themselves with positive attitudes, knowledge, and skills to ensure the effectiveness of ICT-based content delivery [11], [26]. For example, TVET education is different in some features. Unlike teachers in general education, TVET educator, especially those who are teaching engineering subjects, requires special skills and knowledge on certain ICT tools such as Engineering Computer Aided Drawing and Design (CAD). Similarly, different situations will demand different tools as well as different set knowledge and skills [20]. Meanwhile, the second aspect of pedagogical readiness is teaching preparation. In light of this, a few concerns should be acknowledged by TVET educators, namely consideration of the target group, learning domain, deciding on ICT integration mode, learning theories and instructional design [19]. Last but not least, in terms of technological readiness, Malaysia, as a developing country, is still facing obstacles to providing proper, adequate, and hi-end ICT physical facilities [30]. Nonetheless, this is an important issue for the future survival of TVET education, and thus should be given decent attention. Indeed, to secure the sustainability of TVET education in Malaysia, additional special efforts will be needed from the stakeholders and MOE in providing the best ICT solutions to catch up with the needs of industrial revolution 4.0.

7. Conclusions

TVET education in Malaysia has its own unique challenges that determine the sustainability and future direction of the implementation. Therefore, the current and future challenges need to be addressed properly so that no taxpayers' money would come into a waste. Moreover, with the rapid pace of technological advancement that happens globally, the direction of TVET is certainly not straight and smooth. However, with proper plans and strategies, any upcoming hindrances could be

catered. In today's digital era, the impact of ICT is unavoidable. Therefore, by hook or by crook, TVET education has to catch-up the pace and move along with the requirement of the industrial revolution 4.0. This is to ensure that TVET institutions remain relevant and competitive in supplying skillful, competent, and ICT-literate human resources to the industry. Accordingly, any obstacles, challenges, or hindrances that slow down the momentum should be progressively dealt with. This is the only solution to securing the vision of Malaysia toward achieving the success of every planned education policy. From a philosophical perspective, the past plays an important portrayal of the future. Thus, this paper theoretically contributes to the existing knowledge by relating the past to the future, in contemplation of tailoring the robust TVET prospect in Malaysia.

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