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Literature Review: Technical and Vocational Education and Training (TVET) in Malaysia

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ABSTRACTS

This paper provides an overview of TVET in Malaysia by summarizing its historical development and the TVET Education System. The competency factor based on knowledge, abilities, and attitude is fully described in this chapter. The next section also discusses the definition of the competency index as well as earlier studies on the elements of TVET instructors' element competency. This section also elaborates on the fourth industrial revolution (IR4.0). Lastly, a description of Public Skills training facilities involved in IR4.0.

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1. INTRODUCTION

The 21st century, commonly referred to as the century of globalization, is a century of information revelation. Human life goes through numerous basic changes in this century, which makes it extremely different from life in the preceding century. The 21st century is characterized by the quick advancement of information technology, which is now almost entirely automated. Many repetitive or routine jobs have started to be replaced by machines, including robots and computerized production equipment. Indeed, this affects the loss of many old employment types and the start of new job types (Indarta *et al*., 2021).

This elevates technical and vocational education and training (TVET) to a position of significant importance. TVET is a learning strategy that was created by taking into account the proper aims, defined goals, competencies, and performance indicators, as well as a measurable transformation of the accomplishment of TVET's purpose and vision in the twenty-first century. The carrying capacity of the available resources in the industry was taken into consideration when developing the TVET learning strategy. A student's future in the social, economic, artistic, cultural, technological, and ecological surroundings are all impacted by good TVET education. Increasing impact rather than output is necessary for TVET in the twenty-first century. The development of a person's professional identity or area of specialty is a significant outcome of TVET learning. The formation of a person's vocational or work capacity needed by the world of work and society is the goal of TVET. The TVET learning strategy is designed to increase the real impact on students. TVET is a certified education for work-standard skills, respect for competence, development of careers, and prosperity (Shahroni & Minghat, 2021).

TVET's role, in this case, must be ready to face changes and things that are not predictable in the future. Entering the 21st century can be felt with advances in information technology, and the acceleration of digital transformation. This greatly affects various sectors of life, including the education sector. TVET must take steps to implement a curriculum that leads to 21st-century learning which is learning that combines literacy skills, knowledge and competence skills, skills and attitudes, and mastery of technology. Educators and students are also highly required to have teaching and learning skills in this 21st-century learning (Setiadi, 2019). Various challenges and opportunities must of course be a concern for TVET so as not to be left behind by the changes and developments in information technology that is so fast. The industrial revolution which began in the 18th century until now has grown rapidly from 1.0 to 4.0. It has even entered the 5.0 era known as society 5.0 (Indarta *et al*., 2021).

This essay summarizes the historical evolution of TVET in Malaysia as well as the TVET Education System. This chapter provides a detailed explanation of the competency component, which is based on knowledge, skills, and attitude. The competency index definition and past investigations into the elements of TVET instructors' element competency are covered in the following section. The fourth industrial revolution is also discussed in detail in this section (IR4.0). An explanation of the Public Skills training facilities involved in IR4.0 is provided last.

2. METHODS

This study is a literature review. We collect data from news and international articles published in journals. Detailed information on the way how to collect data is explained elsewhere (Azizah *et al*., 2021).

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3. RESULTS AND DISCUSSION

3.1. Historical Background of TVET in Malaysia

Technical and vocational education and training (TVET) had already been introduced in the period of pre-independence. The history of technical and vocational schools began with the establishment of a Trades School in Kuala Lumpur in 1926, aiming at the provision of a trade education to the youth. Trade's school is training the basics of carpentry, repairing machinery, electrical wiring, and construction building with three years of courses offered.

After independence, the government started to give an enormous concern on TVET, which is expressed from the First Malaysia Plan 1965-1970 to the Tenth Malaysia Plan 2010-2015. During the First Malaysia Plan period, several upper-secondary vocational schools were established for the first time. The main function of the vocational schools is to supply skilled technicians, craftsmen, and artisans urgently needed by the agricultural, industrial, and commercial sectors of the economy (JPM 1965).

The establishment of TVET institutions was not limited to vocational schools only. Other TVET institutions such as the Industrial Training Institutes (ITI), Polytechnics, MARA Vocational Institutes, National Youth Development Corps (NYDC), and the Center for Instructor and Advanced Skill Training (CIAST) have been expanded or established to provide technical and vocational education and skills training. In 2006, with the new enactment of the National Skills Development Act (NASDA) 652, NVTC was restructured to become the Department of Skills Development (DSD) under the Ministry of Human Resources (MoHR) with the responsibilities:

(i) to develop and continuously revise training standards, skills training, and the certification system,
(ii) to promote skills training and
(iii) to coordinate strategies and skills training programs.

Today, the government continuously formulates, promotes, and coordinates TVET strategies and programs which are in line with Malaysia's economic, technological, and societal needs. In the 10th Malaysia Plan 2010-2015, TVET has been chosen as a key component to achieving the country's goal as a high-income nation by the year 2020 (JPM 2010). This is to make sure that there is a constant, adequate, and timely supply of multi-skilled workers that will be able to meet the country's development.

The word technique comes from the Greek word "technikos" which means to do with art or technology. The word technique means knowledge related to the manufacture of industrial goods or methods of creating a work of art. The word technical means the implementation of work related to a particular field of technical knowledge. Technical education is education that provides strong technical knowledge related to mathematics and science. In particular from some of the meanings given it can be said that technical education is of a more theoretical nature of learning to provide a professional workforce in technical and engineering fields.

The purpose of technical education is to:

(i) Provide a balanced general academic education.
(ii) Provide basic education in science and technology to students who tend in the field.
(iii) Cultivate and maintain students' interest in technical fields.
(iv) Helping students further their studies in related fields in institutions of higher learning.

3.2. TVET Education System

TVET is education that is devoted to training students or youths to enter the job immediately after completing their studies. TVET can be described as specialized education that is designed to prepare students for entry into a specific occupation or family of

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occupations or to upgrade the skills of currently employed workers. The purpose of the TVET education system is to:

i. Provide manpower with basic skills and knowledge to meet the needs of the industrial and commercial sectors.
ii. Build strong basic knowledge and skills to provide opportunities for students to further their studies and training in technical or vocational fields.

UNESCO stated 4 objectives that are relevant to the TVET system which is that TVET enables harmonious development of personality, spirituality, and human values, understanding, decision making, critical thinking, and self-expression. TVET system prepares individuals for lifelong learning by developing mental abilities, technical and entrepreneurial skills, and attitudes. TVET helps in developing decision-making capabilities and qualities that are necessary for active and intelligent engagement, teamwork, and leadership in the workplace as well as in society. And last but not least, the TVET system enables individuals to adapt to the rapid development of information technology systems.

Some characteristics and properties of the TVET system are (i) TVET education is related to the industry, (ii) TVET education is related to employment, (iii) TVET education involves teaching and learning in the workplace and training institutions or schools, and (iv) TVET education is skills-based. Based on the characteristics of the TVET education system, it can be concluded that TVET is not only limited to the formation of psychomotor skills but goes beyond that. TVET involves all aspects namely the cognitive, affective, and psychomotor domains (Wenrish 1974; Finch & Crunkilton 1999 and Fallows & Steven 2000) so that the students can function effectively in the world of work.

3.3. Competency of TVET Instructor

Many factors cause poor production quality of TVET graduates and one of them is due to instructor's competency. Many studies stressed the significance of competencies for TVET instructors. It is noted that the TVET instructors' competencies which compass teaching, demonstrating, training, and disciplining are vital for TVET students. Despite the need for skilled manpower growth, students' discovery of their skills and attitude potential, especially when entering the work environment, must be conclusively enlightened (Omar *et al*., 2020). Therefore, before proceeding with the teaching and learning environment, the instructor must first infer all these competencies and demonstrate their relevance to students.

The competencies of TVET instructors are important as they might affect the instructors' implementation of tasks, career development, and graduates' quality. Quinn *et al.* (1999) described competency as a composure of knowledge elements (cognitive), skills (psychomotor), practical understandings, and attitudes (affective) that are shown in behavior forms when doing something. The importance of competency includes knowledge, skills, and attitudes, as a trait and personality that must be possessed by one individual to demonstrate competence in performing the assigned task.

Some researchers pointed out towards the comprised of knowledge, skills, and attitudes as core competencies. Arifin and Rasdi (2017) stated that the competencies of TVET instructors are related to skills, knowledge, attitudes, values, and appreciations that are considered critical elements for career development. TVET instructors must be competent in content delivery, skill acquisition, and classroom management. They should also be competent in handling teaching aids, accessing and evaluating students, using appropriate teaching methodology, recognizing students' learning styles, addressing students' needs in the classroom, and, most significantly, serving as a role model for students.

DOI:
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Several competency characteristics have been identified in previous research to reflect the current teaching environment. Referring to the study conducted by Omar *et al*. (2020) on 150 TVET instructors in Malaysia, found that holistic traits of instructors in knowledge, skills, and attitudes inclusively empower, their competency level of becoming effective instructors. The International Board of Standard for Training, Performance, and Instruction (2006) stated competence is the knowledge and attitude that can conduct an activity and be able to set up a set of solid skills based on one's accomplishment.

The European Trade Union Committee for Education (ETUCE) describes a quality instructor as equipped with the ability to integrate knowledge, handle complexity, and adapt to the needs of individual learners as well as groups. The European Reference Framework set the following eight keys of competency:

(i) communication in the mother tongue;
(ii) communication in foreign languages;
(iii) mathematical competence and basic competencies in science and technology;
(iv) digital competence;
(v) learning to learn;
(vi) social and civic competencies;
(vii) sense of initiative and entrepreneurship;
(viii) cultural awareness and expression.

Malaysian Qualification Agency defined teaching competency in COPTPA TVET Standard as a recognition of one's ability in portraying required teaching skills for a subject matter. A TVET instructor is a person who trains others to become competent and capable of contributing to the development of a country. A successful TVET instructor must meet several requirements and should possess a certain level of technical and vocational competence. The instructor's energy that flows during teaching and learning contexts helps to create a productive learning atmosphere. As a result, TVET instructors with competency characteristics are capable of delivering the TVET curriculum, which is generally divided into two key aspects that are measured in percentage form: 70% vocational skills and 30% academic knowledge.

The main components of the TVET instructors' competencies are

(i) personal traits and professionalism;
(ii) teaching, learning, and training; and
(iii) skill, technical, and innovation (Ismail *et al*., 2018).

The fundamental of TVET is the incorporation of knowledge and skills, which adheres to the holistic education philosophy. To achieve the goal of producing human capital that can function professionally and competently, educational stakeholders must coordinate a systematic transformation of the program based on the premise of strengthening the skills of TVET instructors at TVET institutions. As a result, TVET instructors' competency is crucial since they are the main entity responsible for achieving the mission's objectives.

3.3.1. Knowledge Competency

Malaysian Qualification Agency already set specific qualifications for teaching staff to carry out responsibility as TVET instructors. **Table 1** shows the knowledge competency based on the level of qualification of TVET instructors. This is a basic qualification to determine the TVET instructor's competency.

According to the Malaysian Quality Agency, Teaching Competency Certification includes a requirement for TVET instructors which can be obtained through:

(i) Vocational Training Operation (VTO),

DOI:
p- ISSN 2828-3287 e- ISSN 2828-3295

(ii) Kursus Pegawai Latihan Vokasional,
(iii) Sijil Latihan Mengajar TM 001,
(iv) IPG,
(v) Ikhtisas,
(vi) Sijil Perguruan KPLI, 7) Industry experience, and
(vii) In-service in one-month industrial attachment for every two years. When it comes to evaluating an instructor's competency, knowledge plays a big role.

Oungthong, Metha, Phadungchai Pupat, and Paitoon Pimdee (2019) listed nine items of knowledge competency as shown in **Table 2.**

Table 1. Knowledge competency is based on the level of qualification of TVET instructors.

Competency Element	Items
Knowledge	Level of qualification of TVET instructor must possess: Certificate/TVET L1 or Certificate/TVET L2 MQF Level 3 TVET Certificate in the relevant field; or MQF Level 3 Certificate in the relevant field; or MQF Level 4 TVET Diploma in the relevant field; or MQF Level 4 Diploma in the relevant field and certification of teaching competency Certificate/TVET L3 MQF Level 4 TVET Diploma in the relevant field; or MQF Level 4 Diploma in the relevant field and certification of teaching competency

Table 2. Nine items of knowledge competency.

Competency Element		Items
Knowledge	(i)	Knowledge about learner-instructor interaction principles,
	(ii)	Knowledge about how to raise a question,
	(iii)	Knowledge about how to use questions that promote deeper thinking,
	(iv)	The technique of advising to assist learners,
	(v)	Knowledge and understanding of psychology in the organization,
	(vi)	Knowledge about the theory of curriculum analysis by subjects,
	(vii)	Knowledge about the theory of curriculum evaluation by subjects,
	(viii)	Knowledge about theory of teaching methods,
	(ix)	Knowledge about principles of learning management.

TVET instructors are responsible for providing instruction in practical teaching practices in workshops, which is essential for producing skilled students. Therefore, TVET instructors should nobly be competent not just in academics but also in practical experience, ensuring that the teaching and learning process is carried out effectively. Furthermore, to ensure more TVET instructors are competent, they must master the practical pedagogical methods to encourage meaningful practical teaching and learning processes at the workshop and maintain the competency of TVET instructors at all times (Omar *et al*., 2020).

According to Mallidou *et al*. (2018), there are four items to measure knowledge competency: (i) knowledge of specific information sources, (ii) ability to analyze, (iii) ability to grasp the meaning, and (iv) ability to share knowledge. Omar *et al*. (2020) outlined five items of knowledge competency among TVET instructors:

(i) Knowledge of demonstration teaching methods in a practical-based learning environment,

DOI:
p- ISSN 2828-3287 e- ISSN 2828-3295

(ii) Knowledge of encouraging students in a practical-based learning environment,
(iii) Knowledge of using various practical teaching and learning strategies to stimulate student interest,
(iv) Interested in learning about current and emerging technology, and
(v) Knowledge of standard operating procedures (sop) and equipment handling.

Research conducted by Ridzwan *et al*. (2017) indicates 12 items of knowledge competency of TVET instructors must acquire to be able to deliver full capacity of knowledge during the teaching and learning process as shown in **Table 3.**

Table 3. 12 Items of knowledge competency for TVET.

Competency Element	Items	
Knowledge	(i)	Major course knowledge,
	(ii)	Curriculum knowledge,
	(iii)	Co-curriculums knowledge,
	(iv)	Career knowledge,
	(v)	Teaching and learning knowledge,
	(vi)	Evaluation knowledge,
	(vii)	Application of curriculum knowledge,
	(viii)	Application of co-curriculum's knowledge,
	(ix)	Application of ict knowledge,
	(x)	Application of language knowledge,
	(xi)	Application of generic knowledge and
	(xii)	Application of moral values knowledge.

TVET systems must adapt to changes in the industry, as well as the rate at which these changes are occurring. Contemporary TVET systems will have to adopt a modern approach to vocational didactics that can be employed in all possible learning venues and economic sectors. In today's world of digitalization and automation, industries are confronted with what is known as the Industrial Revolution 4.0. Most experts believe that new technologies will eventually overtake certain occupations. As a result, the education sector is impacted because aspiring skilled workers require only qualified, highly skilled, and competent instructors. (Ismail *et al.,* 2019).

In addition, cloud technology, big data, robotics, 3-D printing, social media, modern man-machine interfaces, and the emergence of cyber-physical systems are all included in the IR 4.0 keyword. The knowledge competency of TVET instructors can be listed by eight items as shown in **Table 4.**

Table 4. Eight items of knowledge competency toward IR4.0.

Competency Element	Items	
Knowledge	(i)	knowledge in engineering and semantic technologies,
	(ii)	knowledge in IoT, Industrial Internet, and Cloud,
	(iii)	knowledge in product life cycle management,
	(iv)	knowledge in visual computing,
	(v)	knowledge in industrial automation,
	(vi)	knowledge in intelligent robotics,
	(vii)	knowledge in cybersecurity and
	(viii)	knowledge in industrial big data.

DOI:
p- ISSN 2828-3287 e- ISSN 2828-3295

3.3.2. Skill Competency

Competency is described as an individual's ability to use, apply, and demonstrate a set of related expertise and skills to complete tasks and duties, as measured by the required standards. The differences in skills needed in 2015 and 2020 due to a bigger focus on artificial intelligence and automation in the 4th Industrial Revolution as shown in **Table 5.**

Table 5. 10 Top skills needed in IR4.0.

Skills 2015	Skills 2020
1. Complex Problem Solving	1. Complex Problem Solving
2. Coordinating with Others	2. Critical Thinking
3. People Management	3. Creativity
4. Critical Thinking	4. People Management
5. Negotiation	5. Coordinating with Others
6. Quality Control	6. Emotional Intelligence
7. Service Orientation	7. Judgment and Decision Making
8. Judgment and Decision Making	8. Service Orientation
9. Active Listening	9. Negotiation
10. Creativity	10. Cognitive Flexibility

TVET instructors must acquire certain skills to ensure their skills and competency are compatible with current technology. **Table 6.** shows the TVET instructor skills development course organized by NYTSI Alor Gajah.

Table 6. TVET instructor skills development course.

Competency Elements	Items
Skills	**Module 1: Post-Pandemic Skillset**
	-Adaptability and resilient
	-Emotional intelligence
	-Cybersecurity
	Module 2: Education 4.0 and Industrial Revolution 4.0
	-Element in IR4.0 and education 4.0
	-Fundamental skills for instructor
	Module 3: Digital skills for post-pandemic
	-Top 10 skills
	-Digital skills for educator
	-UNESCO ICT Competency Framework for instructor
	-9 elements of digital citizenship
	Module 4: VR and AR in learning
	-VR vs AR
	-Learning with VR

Mallidou (2018) and Khan *et al*. (2021) emphasized that analytical thinking skill is one of the important items of skill competency needed by TVET instructors to adapt to industrial revolution 4.0 (IR4.0). Analytical thinking is the ability to identify patterns across situations that are not related and to identify key or underlying issues in complex situations.

Negotiating skill is the skills needed in the 21st-century industry. Negotiating involves the ability to work towards win-win outcomes. At lower levels, this competency assumes an understanding of one's counterparts and how to respond to them during negotiations. At the higher levels, the competency reflects a focus to achieve value-added results.

DOI:
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3.3.3. Attitude Competency

TVET instructor support programs, also known as instructor induction programs, have been carried out over the years. The objective of this program is to enhance their motivation to teach and build a positive attitude among TVET instructors. It is proven that such programs can improve teaching staff's performance rates. In another context, the induction program can help instructors apply the positive attitude acquired in their teaching preparation program to the complexity of real-life teaching.

Ismail and Kamsiah (2019) stated that management work is an important task that makes a great contribution and can be used by all parties such as students, instructors, and institutions as well as the profession and able to assess the competence of an instructor. Six items could indicate the attitude competency of the instructor as shown in **Table 7.** The attitude competency of TVET instructors is shown in **Table 8.**

Table 7. Six items of attitude competency.

Competency elements	Items
Attitude	(i) Professionalism, (ii) Collaborative, (iii) Student management, (iv) Teaching preparation, (v) Activity and program management, and (vi) Documentation and reporting.

Table 8. Four items of attitude competency according to Omar *et al*. (2020).

Competency elements	Items
Attitude	(i) Positive attitude, (ii) Managing students' disciplinary issues, (iii) Encouraging students to participate in a practical-based learning environment, and (iv) Safety practices at the workshop.

3.4. Competency Index

Developing competency index is already in various literature. Tanloet and Tuamsuk (2011) worked on developing a core competencies index for information professionals of teaching staff. They investigated the roles of teaching staff and information professionals in the next decade, and from the collected data, the core competencies index was developed by using the Delphi technique. Delphi technique is a predictive method for obtaining consensus among a group of experts often used as a means of problem-solving, decision making, and/ or forecasting.

The competency Index defines a set of assertions of knowledge, skills, and attitudes. Over the past two years, the LD4PE project funded by the Institute of Museum and Library Services brought together experts from the fields of information science, computer engineering, Semantic Web technologies, and education to develop a competency index of the knowledge, skills, and attitudes required for professional practice. They investigated the roles of their work and from the collected data, the competency index was developed by using the Delphi technique.

This Competency Index can be used to measure an individual's readiness to perform general functions or specific tasks; to assess the education and training needs of TVET

DOI:
p- ISSN 2828-3287 e- ISSN 2828-3295

instructors; and evaluate the impact of education and training programs on the competency of TVET instructors and to monitor the performance of TVET instructor so that it parallels with the revolution of IR4.0.

3.5. Industry Revolution 4.0 (IR4.0)

The industry has fully overridden three previous revolutions, each of which had a significant impact on its activities and productivity. During the 19th century, steam power was the transforming force, electricity emerged more in the 20th century and significant digitalization began the third major shift in the early 21st. In the 21st century, the industry will accomplish the IR 4.0 era with intellect as its essential. IR 4.0 is described as a fusion of skills that is blurring the lines between the physical, digital, and biological fields.

The key concepts of IR 4.0 were issued for the first time in 2011, as shown in **Figure 1.** Despite the excessive attention to the perception of IR 4.0, there is no one official description for it. However, it can be defined as "the integration of complex physical machinery and devices with networked sensors and software, used to predict, control, and plan for better business and societal outcomes", or "a new level of value chain organization and management across the lifecycle of products". The nine main pillars of IR 4.0 are automation, data exchanges, cloud computing, cyber-physical systems, robots, big data, artificial intelligence (AI), the internet of things (IoT), and semi-autonomous industrial techniques.

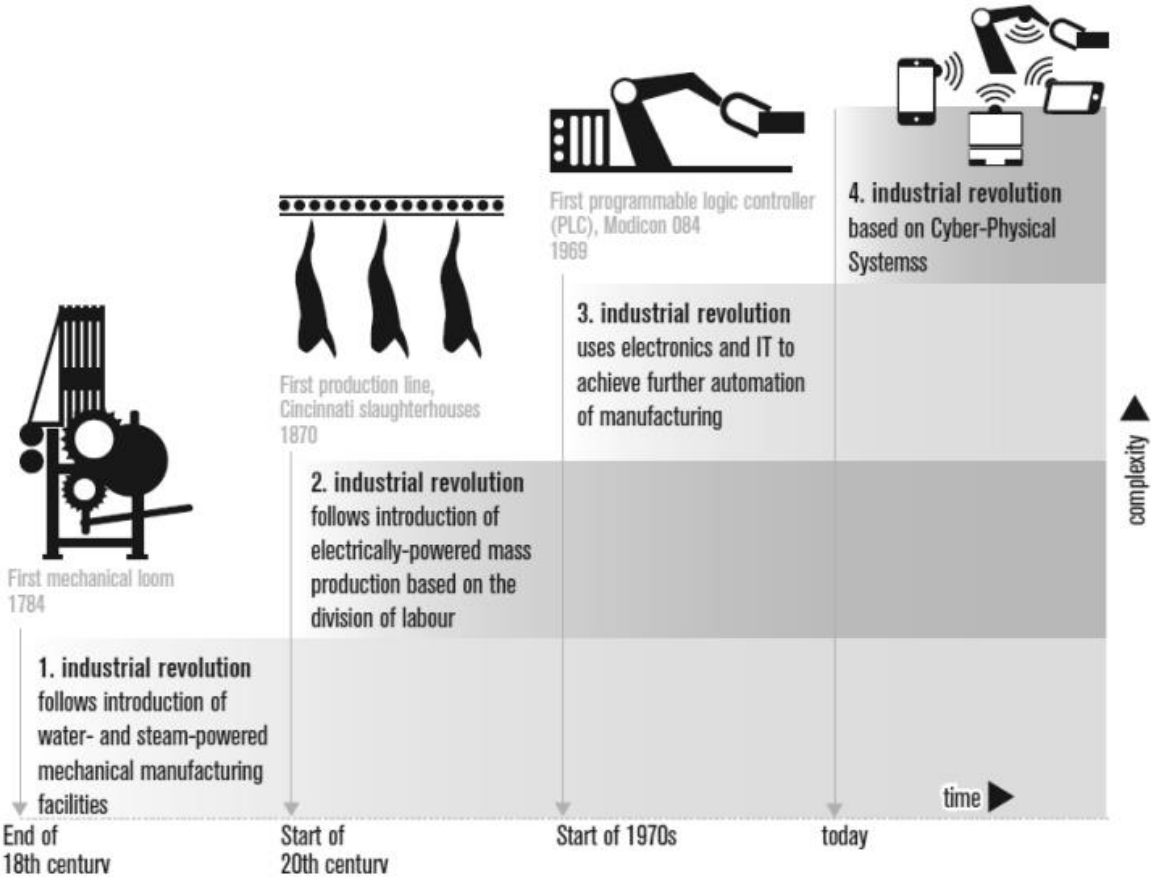

Figure 1. The four stages of the industrial revolution.

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3.6. Public Skills Training Institution under ILKBS that Relates to IR4.0

Public Skills Training Institution provides different skills training and education under different agencies. Ministry of Youth and Sport offers courses under three agencies: NYSI, NYTSI, and GYSA. NYSI (National Youth Skills Institute), NYTSI (National Youth TECHNOLOGY Skills Institute), and Golf Youth Skills Academy (GYSA) have been merged into one name which is Youth and Sports Skills Training Institute (YSSTI) under the Ministry of Youth and Sport. In line with the National Industrial Master Plan, the Institute was established objectively to provide intensive training in the field of metalworking, machining, equipment and molds, maintenance, and electronics following the National Skills Standard curriculum for Malaysian Skills Certification. The Institute also prepares and conducts a Diploma in Technology Program in fields related to the cooperation of local/foreign institutions of higher learning to provide opportunities for higher skills and career advancement to trainees in the skills stream.

NYSI and NYTSI are established to create skilled manpower in relevant fields to meet some of the needs of skilled manpower in related industries. It provides short-term specialization training in the form of `customized 'or` modular' in related fields for staff, and technicians sponsored by the private/public for skills upgrading. The Institute provides services in the form of advisory services and work bookings to external parties according to the ability and capability of the institute and provides long-term training for SKM certification and Diploma in Technology and short-term training in metalworking, electronics, and maintenance for youths and private employees. The Institute will ensure that at least 80% of the trainees complete the course in the fields undertaken. It also provides support services throughout the year to improve organizational performance. In addition, consultation and follow-up services, as well as effective advisory services during and after training, will be provided. NYSI and NYTSI have collaborated with established industries to provide guidance and career options appropriate to industry needs. And it provides advisory services and workshop services for small and medium industries to gain exposure and transfer the latest technology.

3.6.1. Courses offered in NYSI and NYTSI that related to IR4.0

NYSI and NYTSI offered 14 areas of specialization including automation technology, marine technology, mechanical technology, civil technology, electronic technology, electric technology, textile technology, personal technology, photography technology, information technology, sports technology, oil and gas, and hospitality. Among 14 areas offered by ILKBS, there are only a few fields that are related to IR4.0. **Table 9.** lists the department that involves with IR4.0.

3.7. Public Skills Training Institution under ILKBS that Relates to IR4.0

Previous research about Competency Index was conducted by Linked Data for Professional Educator (LD4PE) Project team presented in 2017 at iConference, Wuhan, China. The Competency Index was developed based on the Achievement Standard Network (ASN) website which is a provider of machine-readable representation of learning objectives. Figure 2.2 shows the structure of the Competency Index. According to LD4PE, there are four elements to construct a Competency Index:

(i) Topic cluster
(ii) Topic
(iii) Competency
(iv) Benchmark

DOI:
p- ISSN 2828-3287 e- ISSN 2828-3295

Table 9. List of departments that involves with IR4.0.

ILKBS	DEPARTMENT
NYTSI SEPANG	Mechanical Technology Department
	Electronic Technology Department
NYTSI BUKIT MERTAJAM	Electric Technology Department
	Electronic Technology Department
	Mechanical Technology Department
NYTSI DUSUN TUA	Electronic Technology Department
	Electric Technology Department
NYTSI PAGOH	Mechanical Technology Department
NYTSI BACHOK	Civil Technology Department
	Automation Technology Department
NYTSI CHEMBONG	Automation Technology Department
	Civil Technology Department
NYTSI ALOR GAJAH	Electric Technology Department
NYSI JITRA	Electric Technology Department
NYSI KINARUT	Electric Technology Department
NYSI WAKAF TAPAI	Electric Technology Department
NYSI NAKA	Electric Technology Department
NYSI SERI ISKANDAR	Electric Technology Department
	Electronic Technology Department

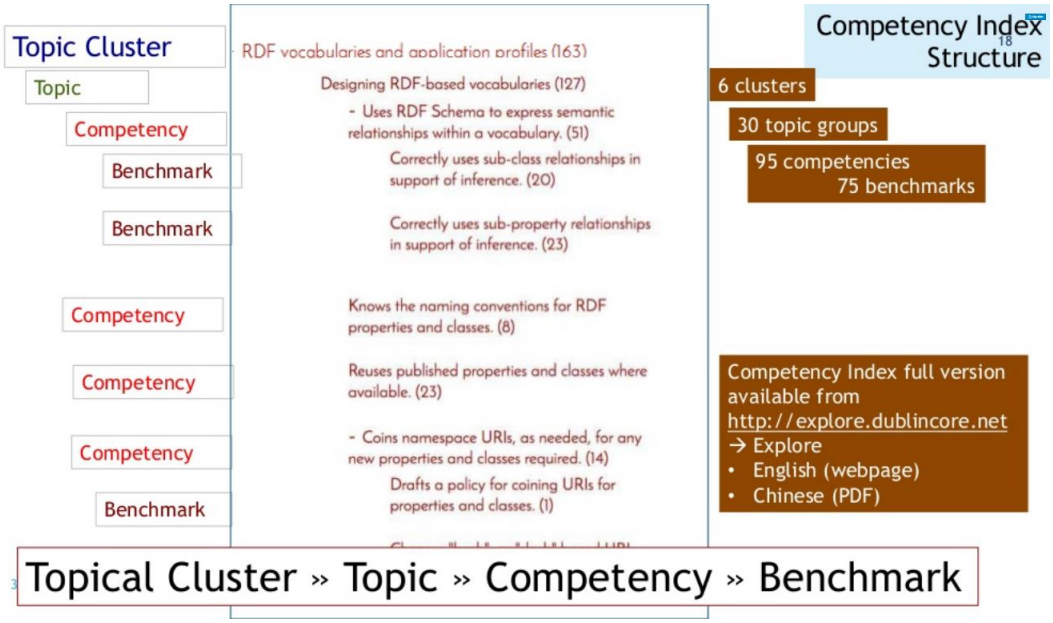

Figure 2. Structure of competency index by LD4PE

Developed Competency Index to assess the knowledge, skills, and abilities of clinical workers in the United States (US), Canada, Latin America, Europe, Asia/Pacific, Middle East, and Africa. The Competency Index is used as an instrument to evaluate an individual's readiness to perform general and advanced tasks; to assess the education and training needed by workers, and evaluate the impact of education and training programs on the worker. **Figure 3.** shows the structure of the Competency Index.

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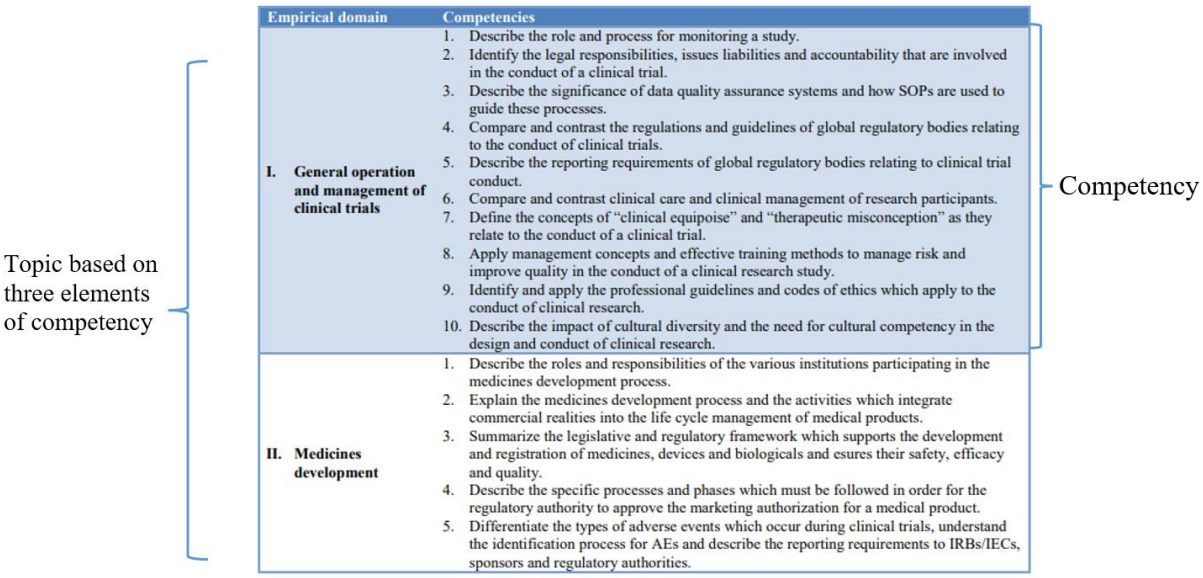
p- ISSN 2828-3287 e- ISSN 2828-3295



Empirical domain	Competencies
I. General operation and management of clinical trials	1. Describe the role and process for monitoring a study. 2. Identify the legal responsibilities, issues liabilities and accountability that are involved in the conduct of a clinical trial. 3. Describe the significance of data quality assurance systems and how SOPs are used to guide these processes. 4. Compare and contrast the regulations and guidelines of global regulatory bodies relating to the conduct of clinical trials. 5. Describe the reporting requirements of global regulatory bodies relating to clinical trial conduct. 6. Compare and contrast clinical care and clinical management of research participants. 7. Define the concepts of "clinical equipoise" and "therapeutic misconception" as they relate to the conduct of a clinical trial. 8. Apply management concepts and effective training methods to manage risk and improve quality in the conduct of a clinical research study. 9. Identify and apply the professional guidelines and codes of ethics which apply to the conduct of clinical research. 10. Describe the impact of cultural diversity and the need for cultural competency in the design and conduct of clinical research.
II. Medicines development	1. Describe the roles and responsibilities of the various institutions participating in the medicines development process. 2. Explain the medicines development process and the activities which integrate commercial realities into the life cycle management of medical products. 3. Summarize the legislative and regulatory framework which supports the development and registration of medicines, devices and biologicals and esures their safety, efficacy and quality. 4. Describe the specific processes and phases which must be followed in order for the regulatory authority to approve the marketing authorization for a medical product. 5. Differentiate the types of adverse events which occur during clinical trials, understand the identification process for AEs and describe the reporting requirements to IRBs/IECs, sponsors and regulatory authorities.

Figure 3. Structure of competency index.

4. CONCLUSION

This paper summarizes the historical background of TVET in Malaysia and the TVET Education System to give an overview of TVET in Malaysia. This chapter gives a full description of the competency element based on knowledge, skills, and attitude. Then, the section also reviews the previous research about items of element competency of TVET instructors and the definition of the competency index. Also, this section elaborates on industrial revolution 4.0 (IR4.0). Finally, an overview of Public Skills training institutions that involve in IR4.0.

5. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. The authors confirmed that the paper was free of plagiarism.

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