



International Journal of Advanced Research in Future Ready Learning and Education

<https://www.akademiabaru.com/submit/index.php/frle/index>

ISSN: 2821 - 2800



Benchmarking for Industry Centre of Excellence (ICoE) at Majlis Amanah Rakyat (MARA) Technical and Vocational Education and Training (TVET) Institutions

Rozita Razali^{1,2,*}, Syuhaida Ismail¹, Abd Latif Saleh¹

¹ Razak Faculty of Technology and Informatics, Universiti Teknologi Malaysia, Kuala Lumpur, Malaysia

² Majlis Amanah Rakyat (MARA), Kuala Lumpur, Malaysia

ABSTRACT

The term “Center of Excellence” (CoE) varies by country, even though the functions and operational models are identical. Numerous organisations have established a Centre of Excellence (CoE) to accelerate technological advancement, promote research and innovation within their organisation, and increase the participation of experts in a specific focus area to conduct the centre’s special projects. CoE are accountable for demonstrating an organisation’s accomplishments and success, as well as for branding and public acceptance. Therefore, this paper will assess the suitability of benchmarking criteria based on the European Foundation for Quality Management (EFQM) excellence model for use in MARA Technical and Vocational Education and Training (TVET) institutions prior to the establishment of the Industry Centre of Excellence (ICoE). There are nine (9) top criteria and 32 sub-criteria in EFQM that ensure ICoE’s business excellence. Based on the Systematic Literature Review (SLR), it is found that top five sub-criteria in three criteria can be adopted at TVET institutions. This article discovered that while establishing an ICoE, the primary criteria for building the benchmarking for the quality matrix are people, partnership and resources, and business results. Sub-criteria include the following: business results are measured using centre-specific performance indicators; people’s knowledge and capabilities are developed; people are rewarded, recognised, and cared for; partners and suppliers are managed for long-term benefit; and finances are managed to ensure long-term success. The EFQM is found to be suitable as indicators for developing the benchmarking for quality matrix and is discussed with the parties involved in the ICoE, namely institutions and industries, to assess each benchmarking sub-criteria to be applied prior to establishing the centre.

Keywords:

Benchmarking; quality matrix; Industry
Centre of Excellence (ICoE); Technical and
Vocational Education and Training (TVET)

1. Introduction

Technical and Vocational Education and Training (TVET) has attracted interest from stakeholders and the public in Malaysia due to its ability to contribute to economic growth and offer skilled labour. TVET is a viable alternative for producing high-skilled workforce, meeting the labour market needs of the economy, and enhancing society [1,2]. TVET comprises all aspects of the educational process that include, in addition to general education, the study of technologies and related sciences, as well as the acquisition of practical skills, attitudes, understanding, and knowledge related to occupations in a range of sectors of economic and social life [3]. Based on the European Training Foundation (ETF),

* Corresponding author.

E-mail address: syuhaida.kl@utm.my

quality vocational education and training should become a foundation of economic growth and social solidarity, as well as a contributor to the reality of lifelong learning [4]. Malaysia aims to produce 35% of high-skilled workers in the labour market by 2030, according to Strategic Thrust 3 of the Shared Prosperity Vision 2030 [5]. However, according to the Pocket Stats Quarter 4 2020 report, high-skilled workers account for 30.7 percent of the workforce, while semi-skilled workers account for 59.5 percent and low-skilled workers account for 11.7 percent [6]. Thus, to attain 35% high-skilled workers by 2025 and to support the Government's Economic Transformation Programme (ETP), Malaysia must expand the intake of TVET students [2]. TVET is seen as a less attractive pathway than university education, which limits the number of students who apply for such courses, particularly high-achieving individuals. Thus, to encourage youth participation in TVET, the Malaysian Government has highlighted Quality TVET Graduates as the fourth shift in Malaysia Higher Education Blueprint, as illustrated in Figure 1.



Fig. 1. Ten Shifts in the Malaysian Education Blueprint. Reprinted from “Malaysia Education Blueprint 2015 – 2025 (Higher Education)” [2]

1.2 Institutions and Industries Strategic Collaboration

The Technical and Vocational Education and Training (TVET) education strategy aims to provide the TVET graduates with attractive career and academic progress by increasing the involvement of industry players in the TVET institutions through strategic collaborations. The partnership's strategy to enhance the potential for research and development, to develop technological skills, to fill gaps in demand and supply, and to raise graduates' employability [7,8].

TVET institutions should ensure that this collaborative effort is maintained by expanding industry involvement during the development or evaluation of curriculum. The engagement enables the industry to create an industry-led curriculum, ensuring that the syllabus remains current and relevant to link industries' current technologies. Additionally, close the skill and technology gap by equipping graduates with the necessary industrialisation skills. Eventually contributes skilled, competitive, and adaptable human capital to the dynamic labour market by adapting graduates' education to industrial needs [2].

1.3 Industry Centre of Excellence in Majlis Amanah Rakyat (MARA) Technical and Vocational Education and Training (TVET) Institutions

The ultimate objective between the TVET institutions and industries strategic collaboration is the establishment of Centre of Excellence (CoE). CoE mainly concentrated on high potential or growth areas in science and technologies, thus could leverage and generate new knowledge through the strategic collaboration between institutions and industries [9-12]. The CoE is designed to bring multiple teams under a common strategic goal and driving customer centricity, quality, and innovation [13,14]. CoE is a centre that provides a platform, where training guidelines, best practises and common strategic goals can be shared and presented with extensive challenges [15,16].

There are various terms for the CoE in various countries, although the functions and operational models are the same. For example, in Russia, the terms 'Centres of Competence' or 'Centres of Occupational Excellence and Workers' is employed, whereas the term 'Centres of Professional Excellence' is used in Ukraine. The term 'Partnerships for Quality and Relevance' is used in Moldova, and the term 'VET Competence Centres' is applied in Azerbaijan. Meanwhile, the name 'Centres of Excellence' is used in Belarus, 'Akademie' in Kosovo and 'Partnership for Excellence' in Algeria [4]. In Malaysia, the universities used 'Centre of Excellence, while in polytechnics used the term 'Centre of Technology' and in Majlis Amanah Rakyat (MARA) Technical and Vocational Education and Training (TVET) used the term 'Industry Centre of Excellence. CoE are frequently represented as institutions that reflect professional excellence.

The term used in this paper is the ICoE because the establishment of ICoE from the partnership between MARA TVET institutions and industries is mainly focusing on technologies or areas of industry expertise. Industry Centre of Excellence (ICoE) is the ultimate strategic collaboration goal between TVET institutions and industries. ICoE is an entity or shared facility that promotes high standards of conduct and success in research and development, innovation, consultation, commercialisation, or training relates to various industries' focus areas.

The establishment of ICoE ensures that lecturers and students at TVET institutions conduct research and development or innovation to assist businesses in commercialising new products or services. However, no benchmarking of the quality matrix used to establish the centre exists. As such, this paper will conduct a desk study to evaluate the quality matrix of ICoE that can be adopted in MARA TVET institutions.

1.4 Type and Level of Benchmarking

Benchmarking is becoming more common as a way of determining how to improve company performance. The practise has progressed tremendously and has become rather professional in nature. Benchmarking is the process of comparing data activities between organisations or units to enhance performance. Benchmarking demonstrates a tendency for organisational learning through comparing an organisation's internal and external actions to those of others. To appreciate the impact of the centres, each organisation must build a conceptual framework that incorporates benchmarking into organisational theory and transformation [17].

Figure 2 describes four different types of benchmarking, as well as two different levels of it. The type of comparison group of organisations or organisational units. The benchmarking level is concerned merely with finding out how other organisations "outcome", or whether the objective is to learn how the "process" by which those organisations perform is formalised. Benchmarking at the outcome level involves gathering information regarding how the focus organisation performs in some function or process as well as in similar functions or processes from other organisations or units [17].

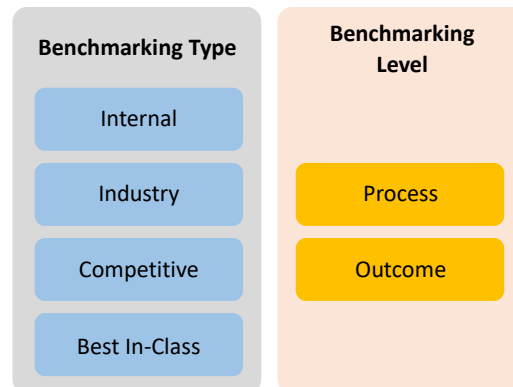


Fig. 2. Types and Level of Benchmarking [17]

Benchmarking is the process of oneself to others. As illustrated in Figure 2, organisations conduct internal benchmarking by comparing identical activities across departments in the same organisation. This benchmarking should involve a thorough analysis of all activities that can provide insight into overall performance. The second sort of benchmarking is industrial. On the other hand, comparative organisations do not have to originate from direct competitors unless their structure or standards are comparable and aid in the comparison process. The third type of benchmarking is called competition, in which comparable organisations are actual competitors for a specific product or service. For this form of benchmarking comparison, the impact of cost discrepancies and delivery time variances, for example, should be addressed. Finally, the fourth type of benchmarking is the best class, in which comparable organisations are identified less based on product or service similarities than based on the exceptional performance of a particular function or process [17].

2. Methodology

An analysis of the published indexed journals regarding benchmarking for quality matrix applied in other institutions in various countries has been reviewed.

This paper adopted the three basic considerations performed by applying the problem definition, scope study and search strategy, which the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) does not cover [18]. These process phases allow a systematic literature review to be quickly updated. These considerations involved:

- (a) Identification of research area and objectives
- (b) Scope study conducted a “conventional” literature review to discover related articles in the subject topic.
- (c) Search strategy by possible search phrases. This process involves identifying the databases and using the Boolean, the search options, the limiters, filters, and exclusion rules to be used as shown in Table 1.

Table 1
 The Search Strategy Adopted

Database	Journal	Search Parameters	Total of Papers
Emerald	International Journal of Quality & Reliability Management	"Benchmarking "AND "Centre of Excellence" OR "Centre of Technology" OR "Centre of Academic Excellence"	54
	Quality Assurance in Education	"Benchmarking "AND "Centre of Excellence" OR "Centre of Technology" OR "Centre of Academic Excellence"	20
	Benchmarking for Quality Management & Technology	"Centre of Excellence" OR "Centre of Technology" OR "Centre of Academic Excellence"	2
	All Journals	"Technical and Vocational Education and Training" OR "TVET" or "VET"	196
Springer	International Journal of Quality Innovation	"Benchmarking "AND "Centre of Excellence" OR "Centre of Technology" OR "Centre of Academic Excellence"	1
	Quality & Quantity	"Benchmarking "AND "Centre of Excellence" OR "Centre of Technology" OR "Centre of Academic Excellence"	5
	International Journal of System Assurance Engineering and Management	"Benchmarking "AND "Centre of Excellence" OR "Centre of Technology" OR "Centre of Academic Excellence"	3
Total Publications			281

After following Salazar-Reyna *et al.*, (2020) suggestion, the PRISMA technique is a well-known research methodology within the medical profession. It includes four distinct stages, each of which are related to one of the four categories that make up the PRISMA acronym: identification, screening, eligibility, and inclusion [19].

The literature search returned 281 publications identified through database searching and additional records identified through other sources regarding Technical and Vocational Education and Training (TVET), Centre of Excellence (CoE), Benchmarking, Quality Matrix, Systematic Literature Review (SLR) and Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) topics. Following the removal of duplications, 201 articles were relevant to the study. A systematic literature review (SLR) revealed 32 articles were screened, and seven (7) articles assessed eligibility after excluding 25 articles related to TVET, Critical Success Factors (CSFs), SLR and PRISMA topics. However, seven (7) publications included in research to discover the benchmarking of quality matrix for establishing, operating and managing the centres via desk study, as illustrated in Figure 3.

Additionally, frequency and content analysis techniques were used to identify, categorise, and organise the benchmarking in various CoE projects from various countries. The primary reason for employing SLR is to ensure the fairness and reliability of the current work's synthesis [20].

A list of main benchmarking of quality matrix that influence the Industry Centre of Excellence (ICoE) performance was found through a SLR. This paper employed frequency and content analysis to establish, describe, and categorise the benchmarking criteria covered in the selected studies. In this paper, 22 sets of sub-criteria out of 32 sub-criteria are identified through a review of seven (7) publications about CoE as shown in Table 3. These factors are ranked based on their relative importance by the literature's frequency of occurrence [20,21]. The rate of frequency of benchmarking criteria refers to the number of papers in which the relevant criteria have been discussed. All criteria for the selected literature have been tabled, from the most frequently discussed to the least frequently discussed. From the researcher's perspective, the literature criteria demonstrate the relevance of the event. Several variables, on the other hand, have a low frequency.

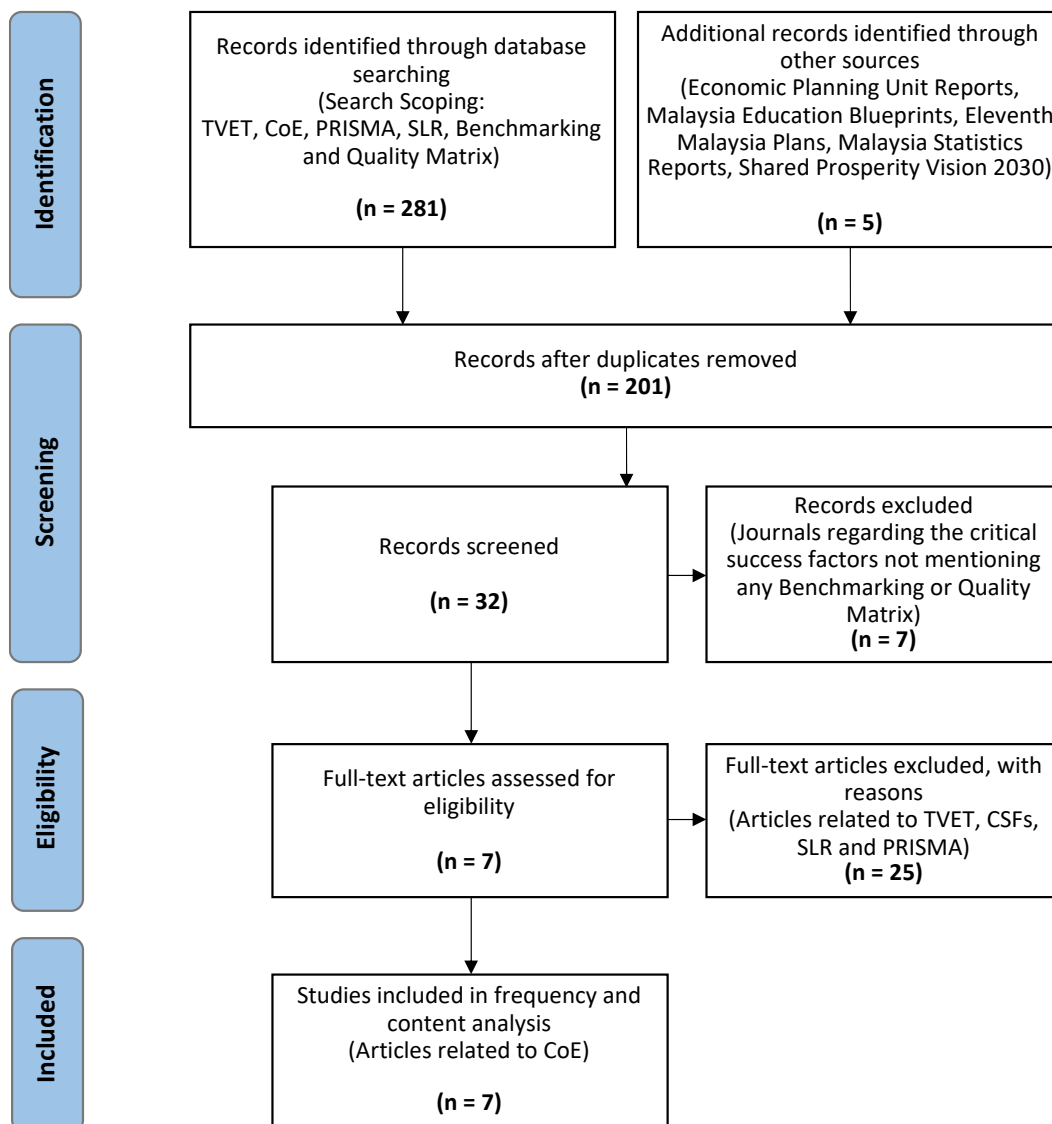


Fig. 3. PRISMA flow of systematic literature review [19]

3. Benchmarking of Industry Centre of Excellence (ICoE) Performance

Appropriate business excellence models have been developed or accepted based on area, business climate, and national economic performance; these models promote quality and excellence in the economy. A platform for learning and sharing was established in Europe in 1988, bringing together European business executives and practitioners to improve organisational performance [22]. The organisation could benchmark the European organisations’ sustainable economic growth and organisational maturity by implementing the above strategy. The excellence model developed by the European Foundation for Quality Management (EFQM) is a non-prescriptive framework that utilises nine criteria to construct a project as shown in Figure 4 [22].

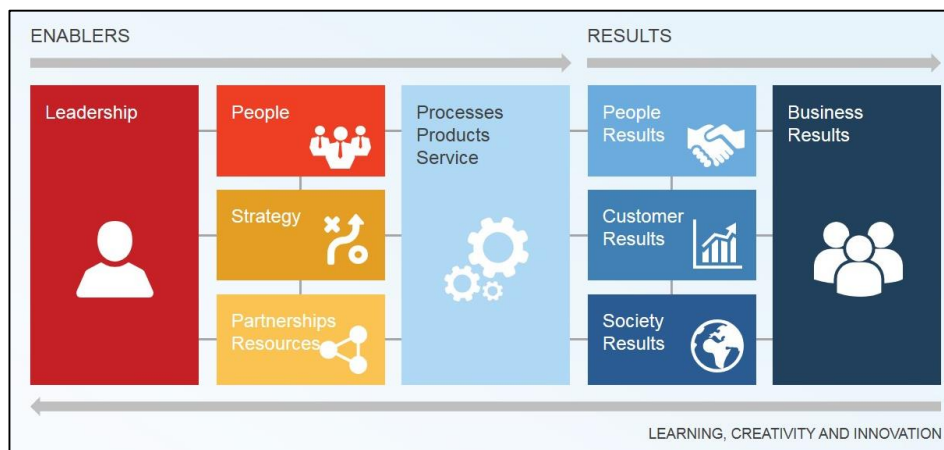


Fig. 4. The European Foundation for Quality Management (EFQM) Excellence Model [22]

The EFQM was initially utilised by corporations before being adopted by academics. It was made of nine (9) components that were adapted for use in an educational setting: leadership, policy or strategy, people, partnerships and resources, processes, outcomes for individuals, outcomes for customers, outcomes for society, and significant outcomes for business or organisation [23]. The first five factors are referred to as facilitators, while the other term refers to results. An enabler takes on the duty of conveying ways and means to attain greatness within an organisation. Results criteria include the variables that a company may influence with enablers. “Results” are influenced by “Enablers”, and “Enablers” can be enhanced utilising metrics and new insights that are garnered from the results. The arrows make it clear that these models are dynamic because they promote learning, creativity, and innovation, with the goal of better enabling [22,23].

In several service contexts especially in the higher education sector EFQM excellence model has quickly become more popular and is being implemented to assist organisation in responding to several challenges, mainly for institutions aimed at achieving or consolidating their position as centres. Many authors have stressed that the model is non-prescription, since it does not prescribe the implementation in companies of quality management methods related to the many criteria which make it suitable for services. However, many companies can benefit from the use of such a self-assessment tool to monitor and evaluate the state of their improvement operations by acknowledging their strengths and potential for progress and by focusing on essential ongoing improvements. Tari [24] supported the implementation of the EFQM model for excellence as a suitable framework to guide the management controls of education organisations [24,25]. The EFQM model of excellence was the best model to compare many businesses improvement approaches for the institutions [25].

4. Benchmarking Criteria

This paper compared six (6) indexed journals with one most prominent indexed journal that conducted empirical classification research at 58 different organisations to examine the interlinkages of the European Foundation for Quality Management’s (EFQM) model’s sub-criteria impacts the organisations.

The EFQM results in Table 2 comprise 32 sub-criteria, consisting of 24 for enabled criterias and eight (8) for results in the EFQM. The criteria and the findings are related [22]. This requires a change in one or more criteria in order to achieve business excellence. The poor results emphasise the importance of criterion revisions, and the outcomes demonstrate the success of the revised criteria following adjustments. Due to the fact that beneficial outcomes derive from the proper execution of enablers, facilitators must be understood and improved through the maintenance and development

of their enabling components. On the other hand, ineffective execution of a facilitator or enabler that is insufficient to improve the output results cause negative outcomes. These facilitators need to be recognised, developed and redeployed [22,25].

Table 2

The Criteria and Sub-Criteria for European Foundation for Quality Management’s (EFQM) Model

		Criteria	Sub-Criteria	
Enablers	1	Leadership	1	Leadership develop the mission, vision, values and ethics and act as role model
			2	Leaders define, monitor, review and drive the improvement of the organisation's management system and performance
			3	Leaders engage with external stakeholders
			4	Leaders reinforce a culture of excellence with the organisation's people
			5	Leaders ensure that the organisation is flexible and manages change effectively
	2	Strategy	6	Strategy is based on understanding the needs and expectations of both stakeholders and the external environment
			7	Strategy is based on understanding internal performance and capabilities
			8	Strategy and supporting policies are developed, reviewed and updated.
			9	Strategy and supporting policies are communicated, implemented and monitored.
	3	People	10	People plans support the organisation's strategy
			11	People's knowledge and capabilities are developed
			12	People are aligned, involved and empowered
			13	People communicate effectively throughout the organisation
			14	People are rewarded, recognized and cared for.
	4	Partnership and Resource	15	Partners and suppliers are managed for sustainable benefit
			16	Finances are managed to secure sustained success
			17	Buildings, equipment, materials and natural resources are managed in a sustainable way
			18	Technology is managed to support the delivery of strategy
			19	Information and knowledge are managed to support effective decision making and to build the organisational capability
	5	Processes, Product & Services	20	Procoesses are designed and managed to optimize stakeholder value.
			21	Products and services are developed to create optimum value for customers
			22	Products and services are effectively promoted and marketed
			23	Products and services are produced delivered and managed.
			24	Customer relationships are managed and enhanced.
Results	6	Customer Results	25	Customer results - Perceptions
			26	Customer results - Performance Indicators
	7	People Results	27	People results - Perceptions
			28	People results - Performance Indicators
	8	Society Results	29	Society results - Perceptions
			30	Society results - Performance Indicators
	9	Business Results	31	Business results - Perceptions
			32	Business results - Performance Indicators

Several benchmarking criteria of Centre of Excellence (CoE) in the various areas and countries have been identified together with the suggested practical recommendations for adoption at Majlis Amanah Rakyat (MARA) Technical and Vocational Education and Training (TVET) institutions. Table 3

illustrates the benchmarking criteria of CoE identified across six (6) publications with EFQM model's sub-criteria.

Table 3
 Comparison of Benchmarking for Quality Matrix of Seven (7) Main Articles

CRITERIA		SUB-CRITERIA	[26]	[11]	[27]	[28]	[4]	[29]	TOTAL	%
1	Leadership	1	√						1	17%
		2								
		3								
		4	√						1	17%
		5								
2	Strategy	6		√				√	2	33%
		7								
		8					√		1	17%
		9	√						1	17%
3	People	10					√		1	17%
		11	√	√	√		√		4	67%
		12	√						1	17%
		13								
		14	√			√	√		3	50%
4	Partnership and Resource	15	√				√	√	3	50%
		16		√		√	√		3	50%
		17			√				1	17%
		18								
		19								
5	Processes, Product, and Services	20					√		1	17%
		21								
		22								
		23		√					1	17%
		24								
6	Customer Results	25	√				√		2	33%
		26	√						1	17%
7	People Results	27	√						1	17%
		28					√		1	17%
8	Society Results	29		√	√				2	33%
		30	√				√		2	33%
9	Business Results	31		√					1	17%
		32	√	√	√	√		√	5	83%
TOTAL			12	7	4	3	10	3	39	

5. Discussion

The top five benchmarking criteria are selected based on the percentage of frequency of occurrence that is equal and more than 50% [21]. This paper discovered that while establishing an Industry Center of Excellence (ICoE), the primary criteria for building the benchmarking for the quality matrix are strategy, people, partnership, and resources and business. The sub-criteria include measurements of business results using performance indicators of the centres; the development of people in the centres' knowledge and capabilities; people are rewarded, recognised, and cared for; partners and suppliers are managed for long-term benefit; and finances are managed to ensure long-term success.

Business results based on the performance indicators are one of the top sub-criteria to establish benchmarking for the centres. One of the key business issues is establishing and maintaining competitive advantages and achieving business excellence through success and exceptionality. Companies have a vital role to play in all their actions to achieve extraordinary achievements. Other criteria, such as value creation for all key stakeholders, including customers, workers, partners, and the community, are interrelated to ensure the results focus of the organisations. Achieving balance among these critical stakeholders is an essential aspect of the effective development of business performance indicators [26]. The business results of ICoE should be innovation and technological development, where numerous resources that have strategic and applications-oriented expertise are brought together in support of the industrial application [11].

On the other hand, for the Chinese Academy Sciences, high technology institutes of research and development activities stated that the number of scientific citation index (SCI) papers published in publications with a high impact factor, the number of patents created in the year observed, and the number of patents issued in the year observed are the performance indicators for the centres. The institutions are financed primarily by the government. Their performance is improved, and substantial innovative outputs are under pressure from the government [28].

The business performance indicators must be Specific, Measurable, Acceptable, Relevant And Time-Rated (SMART). Performance indicators and benchmarking statistics are should exchange among organisations so that all related parties can identify areas where they might improve their performance relative to others. It is suggested to have all the data collection and central system where all benchmarking participants can use a secure web-based application or reporting tool to access the central database anytime they want [29].

The second benchmarking sub-criteria is the subject matter experts in the focus area to achieve the extraordinary achievements of the centres. ICoE experts or specialists have vast technical skills and valuable professional experiences to tackle highly complex problems in the focus area. They are the talented and competent experts who can execute and coordinate all ICoE's activities, recognise problems in the focus area, and suggest realistic solutions. The experts also provide advisory support for project technological enhancements and advisory services to the institutions and industries.

The sub-criteria for people knowledge and rewarded, recognised are cared for are interrelated. A vital part of an excellent strategy is stimulating individual and organisational learning, creativity, and development through the effective sharing of knowledge and information. Without knowledge, skills, creativity, and motivation, an organisation cannot succeed. Through common beliefs, trust, and empowerment, the organisations can maximise the expert's potential. Valuing individuals is an important component of a methodology that promotes greatness [26]. Strengthening human resources: giving the training, skills, information, and expertise needed to help actors perform well [11,28].

It is an opportunity to improve by partnering with industry actors to achieve excellence and innovation through networking. The partnership is the strategies to create opportunities for the technical institutions' students to learn about the current technologies and provide professional development for centre specialists to develop their networking with industries. A survey reveals that basic collaboration includes firms providing positions for students, such as apprenticeships and expertise sharing progress towards innovation and industries incubator initiatives. In terms of transferring knowledge and resources, two-way exchanges have the greatest potential for benefiting both parties. A key characteristic of the instances is that an institution must cooperate with industry players to succeed [4,26]. In the near term, these relationships seem to be beneficial to both sides. A range of outside partners including customers, suppliers, and education groups must be supported by all businesses, for the long-term development of mutually beneficial collaborations.

The business performance indicators and people development stated above are support by funding and assessment procedures, governance and organisational solutions, and several impacts and capacities, including research capacity [11]. With proper funding arrangements, the ICoE can deepen their research, technological development, people development and enhance their innovation activities.

Nevertheless, the ICoE funding is difficult and challenging. The majority of the centres have to rely on government budget funding, except a handful that also uses private finance or sponsorship by the industries itself. For the European Training Foundation (ETF), it is important to have the funding assessment. The ETF points out the critical role of governance and funding in the conceptualisation and formulation of the centres. Greater finance, greater autonomy, better cooperation with businesses, more accountability, better leadership and better national planning are all possible causes of greater achievement of the centres. An issue for the centres at European countries are development is the prioritisation of expenditure in restricted numbers of institutions to obtain a visible transformation, leverage foreign aid, or gain support from the business community. By building up alternative financial channels like public-private partnerships or dedicated funding agencies, centres allow governments to find alternate avenues for financing. Funding mechanisms and obligations should be seen as having long-term benefits, and a social partner or stakeholder should be consulted in setting them up [4].

6. Conclusion

In conclusion, benchmarking criteria are critical factors to consider when establishing an Industry Center of Excellence (ICoE). The European Foundation for Quality Management's (EFQM) model include nine (9) major criteria and 32 sub-criteria that can be implemented at Majelis Amanah Rakyat (MARA) Technical Vocational Education and Training (TVET) institutions through the Industry Centre of Excellence (ICoE). Thus, the EFQM can be used as indicators to develop the quality benchmarking matrix and discussed with the ICoE's stakeholders, namely institutions and industries, in order to assess each benchmarking sub-criteria.

Finding articles relating to the Centre of Excellence (CoE) at Technical and Vocational institutions proved to be quite difficult during the literature review and analysis of the indexed journals. This is because the majority of articles reflect the standards of excellence established by higher education institutions. The sub-criteria, however, may still can be adopted and applied at TVET institutions. Throughout the analysis processes, significant sub-criteria were identified but only 50% of the requirements stated in the methodology section were met, such as leadership role to drive the centres, the strategic orientation and supporting policies to support the centres' achievements, the

centres' resources involved buildings, materials and natural resources and also the customers, people and social perceptions of the centres.

Benchmarking is a continuous quality improvement strategy that every organisation should implement. Although the majority of benchmark initiatives begin with the stated goal of improving quality or performance, actual (measurable) quality or performance gains are not required for the initiative to succeed. The data gathered here enables the identification of critical criteria for developing ICoE benchmarking. The information gathered in this paper contributes significantly to the benchmarking process's accumulation of operational, tactical, and strategic knowledge. Organisational learning has a greater benefit for the organisation as a whole or for management. Benchmarking is an effective strategy for enhancing performance, sharing ideas, and initiating new development for the centres.

References

- [1] Petnuchova, Jana, Roman Hrmo, Veronika Hornakova, Martin Podaril, Milan Stur, Zuzana Ridzonova, and Marian Novota. "Vocational education and training in OECD countries." In *2012 15th International Conference on Interactive Collaborative Learning (ICL)*, pp. 1-6. IEEE, 2012.
- [2] Ministry of Higher Education Malaysia 2015 Malaysia Education Blueprint 2015-2025 (Higher Education).
- [3] United Nations Educational Scientific and Cultural Organization 2015 Proposal for the Revision of the 2001 Revised Recommendation concerning Technical and Vocational Education 38th General Conference. 16
- [4] European Training Foundation 2020 Centres of Vocational Excellence an Engine for Vocational Education and Training Development an International Study.
- [5] Ministry of Economic Affairs 2019 Summary Shared Prosperity Vision 2030
- [6] Malaysia Department of Statistics 2020 Pocket Stats Q4 2020 Stats Malaysia
- [7] Kamaliah, Sharifah, Samsilah Roslan, Ab Rahim Bakar, and Zeinab Ghiami. "The effect of supervised work experience on the acquisition of employability skills among Malaysian students." *Higher Education, Skills and Work-Based Learning* (2018).
- [8] Raihan, Abu. "Collaboration between TVET institutions and industries in Bangladesh to enhance employability skills." *International Journal of Engineering and Technical Research (IJETR)* 2, no. 10 (2014): 50-55.
- [9] Adenfelt, Maria, and Katarina Lagerström. "Knowledge development and sharing in multinational corporations: The case of a centre of excellence and a transnational team." *International Business Review* 15, no. 4 (2006): 381-400.
- [10] Ghazinoory, S., F. Ameri, and S. Farnoodi. "An application of the text mining approach to select technology centers of excellence." *Technological Forecasting and Social Change* 80, no. 5 (2013): 918-931.
- [11] Hellström, Tomas. "Centres of excellence and capacity building: from strategy to impact." *Science and Public Policy* 45, no. 4 (2018): 543-552.
- [12] Palaiologk, Anna, Bastian Koller, and Andreas Wierse. "Centre of excellence for HPC and engineering: Concept development." In *eChallenges e-2015 Conference*, pp. 1-10. IEEE, 2015.
- [13] S. Hogan and E. Volini 2011 GlobalizationToday International Association of Outsourcing Professionals (IAOP). 26-30
- [14] Marciniak, Robert. "Center of Excellence as a next step for shared service center." *Journal of International Scientific Publication: Economy & Business, ISSN* (2012): 1313-2555.
- [15] Dahm, Johann P., David F. Richards, Aaron Black, Adam D. Bertsch, Leopold Grinberg, Ian Karlin, S. Kokkila-Schumacher et al. "Sierra center of excellence: Lessons learned." *IBM Journal of Research and Development* 64, no. 3/4 (2019): 2-1.
- [16] Larsen, Katarina. "Managing the complexity of centres of excellence: accommodating diversity in institutional logics." *Tertiary Education and Management* 26, no. 3 (2020): 295-310.
- [17] Fedor, Donald B., Charles K. Parsons, and Christina E. Shalley. "Organizational comparison processes: Investigating the adoption and impact of benchmarking-related activities." *Journal of Quality Management* 1, no. 2 (1996): 161-192.
- [18] Salazar-Reyna, Roberto, Fernando Gonzalez-Aleu, Edgar MA Granda-Gutierrez, Jenny Diaz-Ramirez, Jose Arturo Garza-Reyes, and Anil Kumar. "A systematic literature review of data science, data analytics and machine learning applied to healthcare engineering systems." *Management Decision* (2020).
- [19] D. Moher, A. Liberati, J. Tetzlaff, D. G. Altman, and T. P. Group 2009 Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement PLoS Medicine. 6(7)

- [20] Ayat, Muhammad, Muhammad Imran, Azmat Ullah, and Chang Wook Kang. "Current trends analysis and prioritization of success factors: a systematic literature review of ICT projects." *International Journal of Managing Projects in Business* (2020).
- [21] Nasir, Mohd Hairul Nizam, and Shamsul Sahibuddin. "Critical success factors for software projects: A comparative study." *Scientific research and essays* 6, no. 10 (2011): 2174-2186.
- [22] Murthy, Narasimha, Kuldip Singh Sangwan, and Nuggenahalli S. Narahari. "Empirical classification of European Foundation for Quality Management (EFQM) model enabler sub-criteria using a quadrant matrix." *International Journal of Quality & Reliability Management* (2021).
- [23] Díez, F., A. Villa, A. L. Lopez, and I. Iraurgi. "Impact of quality management systems in the performance of educational centers: educational policies and management processes." *Heliyon* 6, no. 4 (2020): e03824.
- [24] Tarí, Juan José. "An EFQM model self-assessment exercise at a Spanish university." *Journal of Educational Administration* (2006).
- [25] Laurett, Rozelia, and Luis Mendes. "EFQM model's application in the context of higher education: A systematic review of the literature and agenda for future research." *International Journal of Quality & Reliability Management* (2019).
- [26] Vartiak, Lukas, and Miriam Jankalova. "The business excellence assessment." *Procedia engineering* 192 (2017): 917-922.
- [27] Kamat, Vivek B., and Jayant K. Kittur. "Quantifying the quality of higher and technical education: salient perspectives." *International Journal of System Assurance Engineering and Management* 8, no. 2 (2017): 515-527.
- [28] Xiong, Xi, Guo-liang Yang, and Zhong-cheng Guan. "Estimating the multi-period efficiency of high-tech research institutes of the Chinese Academy of Sciences: A dynamic slacks-based measure." *Socio-Economic Planning Sciences* 71 (2020): 100855.
- [29] van Veen-Berkx, Elizabeth, Dirk F. de Korne, Olivier S. Olivier, Roland A. Bal, and Geert Kazemier. "Benchmarking operating room departments in the Netherlands: evaluation of a benchmarking collaborative between eight university medical centres." *Benchmarking: An International Journal* (2016).