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'Let's Collaborate': Malaysian TVET-Engineering Institution and Industry Partnership

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Abstract: Strategic partnerships are the most important element in the automotive industry. The interaction between two or more parties is important in pursuing the successful planning and implementation of an education and training system in producing a competent workforce. Malaysia is one country that has adopted Public Private Partnership (PPP) as a procurement technique for delivering public sector projects. PPP, taken in its broadest meaning, refers to any arrangement between the public and private sectors for the delivery of public services. However, previous studies indicated that the collaboration between training institutions and industry is still at a weak level. The major constraints were including the failure to understand the work culture of the organization, inconsistency of mission and vision of the organization, weaknesses of the governance system. Therefore, this study aims to propose a model of TVET-Engineering Governance Structure in Collaboration of Malaysian TVET-Engineering Institution and industry partnership. In this case, data were collected from 115 technologists in three different fields involved mechanical, electric and electronic and civil in Malaysia. Then, the data were analysed using the PLS-SEM 3.3.9 software via the algorithm, bootstrapping and blindfolding method. Through the PLS-SEM approach, this study focuses on the analysis of (a) convergent validity and (b) discriminant validity in which these two validities have six analyses; (i) external loading, (ii) composite reliability, (iii) average variance extracted (AVE), (iv) Fornell-Larcker, (v) cross-loading, and (vi) Heterotrait-Monotrait Ratio (HTMT). Meanwhile, the structural model testing involves the analysis of (i) Multicollinearity (Inner VIF), (ii) Path Coefficient, (iii) R square (R^2), (iv) size effect (f^2), and (v) Predictive Relevance (Q^2). At the end of the analysis, the model that has been developed is relevant to use because each phase meets the conditions that have been set in the PLS-SEM analysis. The result, the governance structure for TVET-Engineering for TVET-Engineering is important since it can contribute to intensifying the Malaysian TVET- Engineering Institution and industry partnership. TVET Institutions must play an important role in fulfilling the demands from the industry and developing innovative skills for students. Future research is suggested to test the model on a wider range of TVET respondents to see its appropriateness.

Keywords: Strategic partnership, public-private partnership, TVET institution, industry

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1. Introduction

Every year, technical education and vocational training institutions in Malaysia produce a semi-skilled manpower in multiple fields to fulfil the demands from the industry. It is one of the efforts to realize the national economic agenda and become a benchmark to be a high-income developed country (Affero et al., 2013; Mohd Jalil et al., 2015 and Norsyuhaili et al., 2016). According to the Shift Bulletin Report (2015), the Plan Department of Manpower Strategies 2016-2020 (2016), and Annual Plan Report Malaysian Education Development 2013-2025 (2013), an economic agenda outlined in the 11th Malaysia Plan (RMK-11) is expected to create 1.5 million job opportunities in various sectors with a target of 60 percent of those jobs require field -related skills technical education and vocational training through Public Private Partnership (PPP) Planning. Malaysia is one country that has adopted Public Private Partnership (PPP) as a procurement technique for delivering public sector projects. PPP, taken in its broadest meaning, refers to any arrangement between the public and private sectors for the delivery of public services. In Malaysia, the private sector has long been involved in delivering public goods and services. The Tenth Malaysia Plan 2011–2015, emphasises the desire of the government to continue supporting private sector investment in development initiatives. To aid private sector development initiatives, the government has established a facilitation fund (Usman, Yusnidah, & Arpah, 2018). This indicates that the field of technical education and vocational training are the main driving force national economy and will be the shaper of the employment dimension in Malaysia with the rapid development of technology at present. Report TalentCorp (2019) also explains that technical education and training vocational training (TVET) will be the main driver or 'game changer' through business the government produces highly skilled local skilled manpower. By as such, the targets set will be key performance indicators to all stakeholders in the technical education system and vocational training in Malaysia to produce a workforce that can meet criteria required through the planning and strategies that have been outlined.

In line with the aspiration to become an income-generating country high, in line with the rapid pace of the economy and the development of technology increasingly complex, several efforts need to be undertaken to provide energy quality skilled work and meet the needs of the industry. Among the efforts worth noting is building strategic collaboration between institutions education and training with industry (Dian Hikmah & Mohd More, 2016). The concept of collaboration between educational and training institutions with the parties industry is nothing new. Collaboration is an interaction between two one or more parties in which each party involved has a specific role in the successful planning and implementation of a management system for reach joint decisions in the interest of the development of an organization and country (Nevin 2014; Rouke et al. 2014; Scandura, 2015 Ivascu et al. 2016 and Azali, 2018). According to Norazimah (2013) collaboration is a partnership power based on the ability of knowledge and expertise possessed by an education and training institution with the industry. This clearly shows that collaboration is a network formation cooperation between educational and training institutions and the industry towards creating a balanced ecosystem in the world of employment and training.

Several studies state that collaboration between educational institutions and training with industry is very important and much needed to achieve the objective of producing a competent workforce (Miller et. al. 2009; Heinemann et al., 2009; Ramli, 2011; Mohtadi et al., 2014; Shamsudin et al. to 2015; Abdul Wahid, 2015 Belyaeva et. al. 2017 and Azali, 2018). Hence, strategic collaboration between educational and training institutions with the industry needs to be considered as an important strategy to increase a skilled workforce that meet the industry's needs. In addition, the rapid development of technology has also been creating a need for cooperation between educational and training institutions with industry in providing skills and information on the latest technologies for producing a skilled and quality workforce (Siti Hamisah et al. 2010; Ramli, 2011; Ankrah et al., 2015; Roese 2015; Sarai, 2016 and Widforss et al., 2017)

Therefore, to achieve the status of an income-generating country high, all parties especially the government, institutions and industry need to plan an effective strategic collaboration so that the workforce generated can be spurred the economic growth of the country. Hence, TVET-Engineering Governance Structure in collaboration between institutions with the industry needs to be promoted and implemented with an appropriate approach so that negative perceptions in efforts to realize such collaboration did not take place.

1.1 Public-Private Partnership in TVET

The TVET Engineering Governance Structure has three sub-constructs that represent itself namely Government Administration and Management in the development of Malaysian TVET, the Role of TVET Institutions in the development of Malaysian TVET, and Industry Involvement in the development of TVET- Engineering. The first is that Government Administration and Management in the development of Malaysian TVET has can be broken down into three parts namely Malaysian TVET Management, role of the government in the development of Malaysian TVET, and policy. The second is the Role of TVET Institutions in the development of Malaysian TVET which is only focused on Institutional Management in TVET- Engineering only. Lastly, Industry Involvement in the development of TVET-Engineering has two parts, namely Awareness of TVET-Engineering and Industry readiness in TVET development.

The governance structure in the Malaysian education system comprises two levels, which are macro and micro level. TVET institution director falls into the micro governance and practices high management level. The standard practices in Malaysia are TVET institution directors promoted to the managerial position after showing themselves to be

technically competent. Even though the TVET institution director possesses a high management skill level in the micromanagement governance level, these directors must have technical skills because these skills allow the manager to train, direct, and evaluate subordinates performing specialised tasks (Peterson & Van Fleet, 2004). Therefore, the authority to perform tasks should be delegated to subordinates, and also special attention should be paid to the division of labour to enjoy more effectiveness in tasks (Al-Jammal, Akif, & Hammadat, 20-15). Being a manager in an educational setting can act as an effective leader and problem-solver in many complex and straightforward situations (Ibay & Pa-alisbo, 2020).

The lack of industry input in curriculum design has resulted in the mismatch of skills required by industry and the skills attained by TVET graduates (Yaakob, 2017). A study done by Yaakob (2017) identify that there is a weakness in the Malaysian TVET curriculum, which is TVET curriculum, and methods do not meet the requirements of the labour market. Thus, involvement in curriculum development by encouraging the industry to use multiple and innovative approaches in teaching and learning and organise regular committee meeting to discuss industry needs in curriculum development and upgrade the content of curriculum development matching with the latest technology (Ex robotics, bionics, mechatronics etc) (Sohimi et al., 2019). Furthermore, the factors such as society, industry, and the role of government needs to be a concern while developing a curriculum (Khan & Law, 2015).

Strategic partnerships with industries/agencies/companies are expected to increase the chances of graduates getting a job. Technical and vocational education training must be responsive to the rapidly changing student and workforce needs (Poirier & Remsen, 2017). However, the difference between working practices and expectations by both industry and TVET institutions becomes one of the barriers to accomplishing the collaboration.

The collaboration between industry in developing TVET will facilitate the formation of knowledge with the support of experts and experienced persons in the industry that can give a right direction to make enthusiastic, intelligent students and make them experts of future (Dhamdhere, 2015). However, limited accessibility due to the lack of information, promotion, and industry involvement has contributed to the declining interest among youth to continue their study in TVET (ILMIA, 2018). Moreover, the engagement between TVET institutions and industries in reskilling and upskilling trainer, help in making sure that TVET students received up to date technical knowledge. Furthermore, limited coordination and fragmented TVET system contributed to the lack of standardized performance data among TVET institutions. Moreover, the lack of recognition from the Malaysian government contributed to collaboration hesitant from the industries in the TVET system. Therefore, it is important to identify the indicator to ensure the successful of collaboration between TVET-Engineering institutions and industries.

In the current situation of public-private partnership among TVET institution in Malaysia were mediate or moderate by several predictors, namely Malaysian TVET Management: the role of the government in the development of Malaysian TVET, Policy, Institutional Management in TVET-Engineering, Awareness of TVET-Engineering, and Industry readiness in TVET development. All this variable developed from Final Report for Regional PPP New Models (2017), Dadang Hidayat Martawijaya (2012), Hadromi (2018), Wiriadidjaja et al. (2019), Sutopo (2017) and Seel & Phuong (2020), European Union (2014), Phalasoon (2017), Bui Van Hong & Nguyen Thi Luong (2018), Europian Union (2018), Choy et al. (2004), Ferns (2019), Haukka (2007), Euler (2013), Manuela Epure (2017), Thomas Deissinger (2015), Huynh Chau Duy (2019), European Union (2017), and Littooij Siep & Todd Davey (2016). This previous research can be a guideline for TVET-Engineering Institution, Industry Based Association, and Industry in collaborating for TVET-Engineering system improvement.

2. Methodology

This study involved personnel from engineering technology and who were registered under the Malaysia Board of Technologists (MBOT). The sample size was determined based on the Krejcie and Morgan's (1970); the minimum number of respondents is 113 persons. Thus, a random sampled of 115 technologists from three different fields namely, mechanical, electric and electronic and civil have been involved in this study. The random sampling method was used to prevent a possibility of biasness in the sampling since everyone in the population has equal chances (Creswell, 2012).

2.1 Instrument

The development of the questionnaire is based on a literature review in which the researcher has adapted the questionnaire items of the previous study to the new study. he set of questionnaire items for this study refers to previous studies, namely; Final Report for Regional PPP New Models (2017), Dadang Hidayat Martawijaya (2012), Hadromi (2018), Wiriadidjaja et al. (2019), Sutopo (2017) and Seel & Phuong (2020), Final Report, Luxembourg: Publications Office of the European Union (2014), Phalasoon (2017), Bui Van Hong & Nguyen Thi Luong (2018), Europian Union (2018), Choy et al. (2004), Ferns (2019), Haukka (2007), Euler (2013), Manuela Epure (2017), Thomas Deissinger (2015), Huynh Chau Duy (2019), European Union (2017), and Littooij Siep & Todd Davey (2016).

The questionnaire that has been constructed and verified finally has two parts, namely (i) Part A is related to the Demographics of the respondents, (ii) Part B is related to the Development of the Cooperation Model of TVET-Engineering and Industry Institutions. Many opinions from past researchers' state that the selection of a five-point likert scale is the most appropriate for social science studies (Beglar & Nemoto, 2014). Therefore, a five-point likert scale has

been used in this questionnaire where respondents are given answers that have been determined based on being rated from one (strongly disagree) to five (strongly agree).

2.2 Pilot Study

The questionnaire was developed and adapted from previous studies and was verified by four experts in the field of mechanical, electric and electronic, and civil and have been tested for validity. Therefore, a pilot study was conducted to strengthen and refine the content of language use and the meaning of items. This pilot study involved 32 respondents to test a total of 210 items. There are two types of item reliability that were conducted, namely the instrument reliability index and the respondent reliability index.

i. Person Reliability Index

Table 1 shows person reliability values and individual isolation values.

Table 1 - Person reliability

SUMMARY OF 32 MEASURED PERSON

	TOTAL SCORE	COUNT	MEASURE	MODEL ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD
MEAN	673.6	205.0	-37.87	.13	1.96	1.1	4.27	4.7
S.D.	63.7	.0	2.72	.02	2.61	4.9	4.10	5.0
MAX.	806.0	205.0	-27.86	.17	9.90	9.9	9.90	9.9
MIN.	536.0	205.0	-40.19	.09	.35	-7.7	.50	-5.7

REAL RMSE	.19	TRUE SD	2.71	SEPARATION 14.52	PERSON RELIABILITY 1.00
MODEL RMSE	.13	TRUE SD	2.71	SEPARATION 20.75	PERSON RELIABILITY 1.00
S.E. OF PERSON MEAN = .49					

Referring to table 1, the individual reliability value is 1.00. This value means that the probability of repeating individual response results when the same test is performed is excellent (Fisher, 2007; Aziz, 2015). In addition, the individual isolation index recorded 14.52. This means that the item creates a large person separation and can separate the person classification studied, the isolation index recorded was 6 (Aziz, 2015).

ii. Item Reliability Index

The reliability of the instrument is aimed at seeing how well the instrument measures what it is supposed to measure accurately then the instrument.

Table 2 - Item reliability

SUMMARY OF 205 MEASURED ITEM

	TOTAL SCORE	COUNT	MEASURE	MODEL ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD
MEAN	105.1	32.0	.00	.34	1.24	.7	2.78	2.1
S.D.	9.9	.0	2.38	.06	.71	1.2	3.47	3.9
MAX.	160.0	32.0	1.81	.52	9.90	4.7	9.90	9.9
MIN.	86.0	32.0	-30.99	.07	.46	-2.3	.43	-2.5

REAL RMSE	.40	TRUE SD	2.35	SEPARATION	5.93	ITEM RELIABILITY	.97
MODEL RMSE	.35	TRUE SD	2.36	SEPARATION	6.76	ITEM RELIABILITY	.98
S.E. OF ITEM MEAN = .17							

Table 2 also shows the item reliability value is 0.97. This means that the adequacy of the item to measure what it wants to measure is good (Fisher, 2007; Aziz, 2015). In addition, the item isolation index recorded 5.93. This means that the adequacy of the items to measure what is to be measured is good (Aziz, 2015).

2.3 Analyse Data

The data were analysed using the PLS-SEM 3.3.9 software via the algorithm, bootstrapping and blindfolding method. The measurement model is conducted to determine how far those items are measuring what should be measured, its

accuracy in representing a construct and fulfilling the standards of validity and reliability (Ummu Sakinah, Ridzwan, Ramlee, & Zaliza, 2020).

There are six variables involved in this study, namely Malaysian TVET Management: the role of the government in the development of Malaysian TVET, Policy, Institutional Management in TVET-Engineering, Awareness of TVET-Engineering, and Industry readiness in TVET development. All these variables were tested to see the relationship and influence of the variables in the TVET-Engineering Governance Structure model. This testing was done using PLS-SEM analysis.

The main focuses are the analysis on the (a) convergent validity and (b) discriminant validity in which these two validities have six analyses; (i) external loading, (ii) composite reliability, (iii) average variance extracted (AVE), (iv) Fornell-Larcker, (v) cross-loading, and (vi) Heterotrait-Monotrait Ratio (HTMT). Meanwhile, the structural model testing involves the analysis of (i) Multicollinearity (Inner VIF), (ii) Path Coefficient, (iii) R square (R^2), (iv) size effect (f^2), and (v) Predictive Relevance (Q^2).

3. Results

The results of the analysis are explained according to the process of model formation. Two main steps is measurement model and the structural model that must be discussed in order for this model to be formed. (Henseler & Fassott, 2009). Testing the measurement model involves internal consistency, which is convergent validity and discriminant validity. While the evaluation of the structural model has five values that directly form the model is to evaluate the structural model.

3.1 Convergent Validity

The aspect of convergence validity can be seen at the value of (i) outer loading, (ii) composite reliability, and (iii) average variance extracted (AVE).

External load or outer loading is the standard load that connects the factor to the indicator variable. Any load values within the range of 0.50 to 0.70 should be considered if the value of AVE is >0.50 (Hair et al., 2016). While composite reliability is an alternative to Cronbach's alpha as a convergent validity test in a reflective model. The composite reliability should be >0.70 for a model aimed at authentication (Hair et al., 2016). Lastly, the AVE can also be used as a test of convergent and differentiated legitimacy. It reflects the average community for every latent factor in a reflective model. In a reproductive model, the AVE should be >0.50 (Hair et al., 2016). This means that the factor should explain at least half of the variation of each indicator. AVE that is <0.50 means that the error variance is beyond the variation described.

Table 1 shows that all external loading values, composite reliability and AVE for each construct have fulfilled the required conditions of the load value >0.50, composite reliability >0.70 and AVE >0.50.

Table 1 - Outer loading value, Composite Reliability (CR) and AVE

No.	Sub- Construct	Item	Outer loading	Composite Reliability	AVE
1.	*Malaysian TVET Management	SPP1	0.938	0.967	0.856
		SPP2	0.973		
		SPP3	0.863		
		SPP4	0.924		
		SPP5	0.923		
2.	*The role of the government in the development of Malaysian TVET	SPerananKerajaan1	0.762	0.953	0.804
		SPerananKerajaan2	0.963		
		SPerananKerajaan3	0.959		
		SPerananKerajaan4	0.883		
		SPerananKerajaan5	0.903		
3.	Policy	SPolisi1	0.941	0.984	0.939
		SPolisi2	0.98		
		SPolisi3	0.969		
		SPolisi4	0.986		
4.	*Institutional Management in TVET- Engineering	SPerananInstitusi1	0.863	0.982	0.918
		SPerananInstitusi2	0.972		

		SPerananInstitusi3	0.988		
		SPerananInstitusi4	0.986		
		SPerananInstitusi5	0.974		
5.	*Awareness of TVET-Engineering	SKesedaranIndustri1	0.987	0.985	0.944
		SKesedaranIndustri2	0.978		
		SKesedaranIndustri3	0.977		
		SKesedaranIndustri4	0.944		
6.	*Industry readiness in TVET development	SKesediaanIndustri1	0.725	0.977	0.754
		SKesediaanIndustri10	0.912		
		SKesediaanIndustri11	0.924		
		SKesediaanIndustri2	0.705		
		SKesediaanIndustri3	0.909		
		SKesediaanIndustri4	0.856		
		SKesediaanIndustri5	0.959		
		SKesediaanIndustri6	0.959		
		SKesediaanIndustri7	0.924		
		SKesediaanIndustri8	0.953		
		SKesediaanIndustri9	0.94		

* Short form writing in future table:
i. Malaysian TVET Management will be written as Management.
ii. The role of the government in the development of Malaysian TVET will be written as Role.
iii. Institutional Management in TVET- Engineering will be written as Institutional.
iv. Awareness of TVET-Engineering will be written as Awareness.
v. Industry readiness in TVET development will be written as Readiness.

4.2 Discriminant Validity

Measuring the discriminant validity is based on the; (i) Fornell-Larcker, (ii) cross-loading, and (iii) Heterotrait-Monotrait (HTMT)

i. Fornell-Larcker

This analysis compares the square root value of AVE with the construct correlation value indicating the highest value in any column or row compared to the highest correlation value for any other construct (Hair et al., 2016). This method is based on the view that the latent variable should explain better for the item variant itself than the variant for other latent variables. Table 2 shows the higher square root values of AVE compared to the correlation values for each of the other constructs.

Table 2 - Fornell Larcker

Sub-Construct	Awareness	Institutional	Management	Policy	Readiness	Role
Awareness of TVET-Engineering	**0.972**					
Institutional Management in TVET- Engineering	0.849	**0.958**				
Malaysian TVET Management	0.787	0.719	**0.925**			
Policy	0.651	0.858	0.848	**0.969**		
Industry readiness in TVET development	0.767	0.838	0.597	0.66	**0.89**	
The role of the government in the development of Malaysian TVET	0.745	0.694	0.829	0.763	0.684	**0.897**

ii. Cross-Loading

Cross-loading or crosslinking is a good loading indicator for the intended factors and other factors that are not intended to be clearly measured. The loading value of the construct must be greater than all loadings values on the other constructs (Hair et al., 2016). Table 3 shows the cross-loading values for each item that can be observed crosswise with each

construct where the cross-loading values for items on a particular construct are found to be greater than the loading values for other constructs. These findings have also directly answered the research question by showing cross-loading values that provide evidence of validity for the measurement model construct.

Table 3 - Cross-loading

Item	Awareness	Institutional	Management	Policy	Readiness	Role
SKesedaranIndustri1	**0.987**	0.851	0.766	0.643	0.754	0.745
SKesedaranIndustri2	**0.978**	0.843	0.751	0.647	0.766	0.734
SKesedaranIndustri3	**0.978**	0.825	0.752	0.622	0.726	0.726
SKesedaranIndustri4	**0.943**	0.78	0.791	0.617	0.733	0.689
SKesediaanIndustri1	0.442	0.487	0.36	0.343	**0.751**	0.418
SKesediaanIndustri10	0.682	0.719	0.571	0.597	**0.873**	0.633
SKesediaanIndustri11	0.682	0.72	0.588	0.608	**0.888**	0.615
SKesediaanIndustri2	0.572	0.597	0.539	0.455	**0.711**	0.363
SKesediaanIndustri3	0.666	0.718	0.527	0.547	**0.934**	0.59
SKesediaanIndustri4	0.686	0.735	0.468	0.557	**0.868**	0.606
SKesediaanIndustri5	0.764	0.846	0.568	0.679	**0.958**	0.699
SKesediaanIndustri6	0.743	0.827	0.561	0.668	**0.958**	0.682
SKesediaanIndustri7	0.702	0.738	0.595	0.618	**0.887**	0.631
SKesediaanIndustri8	0.769	0.859	0.58	0.679	**0.958**	0.714
SKesediaanIndustri9	0.739	0.828	0.566	0.665	**0.945**	0.694
SPP1	0.792	0.75	**0.938**	0.86	0.588	0.861
SPP2	0.763	0.689	**0.973**	0.822	0.58	0.84
SPP3	0.629	0.522	**0.863**	0.707	0.605	0.868
SPP4	0.714	0.667	**0.924**	0.754	0.474	0.615
SPP5	0.734	0.69	**0.923**	0.771	0.504	0.62
SPerananInstitusi1	0.646	**0.863**	0.811	0.777	0.643	0.775
SPerananInstitusi2	0.842	**0.972**	0.651	0.791	0.836	0.642
SPerananInstitusi3	0.848	**0.988**	0.665	0.795	0.828	0.651
SPerananInstitusi4	0.851	**0.986**	0.657	0.798	0.837	0.642
SPerananInstitusi5	0.867	**0.974**	0.679	0.771	0.854	0.629
SPerananKerajaan1	0.851	0.763	0.654	0.57	0.645	**0.762**
SPerananKerajaan2	0.638	0.603	0.768	0.727	0.623	**0.963**
SPerananKerajaan3	0.644	0.61	0.781	0.726	0.591	**0.959**
SPerananKerajaan4	0.625	0.629	0.669	0.673	0.636	**0.883**
SPerananKerajaan5	0.621	0.541	0.831	0.712	0.589	**0.903**
SPolisi1	0.595	0.769	0.862	**0.941**	0.596	0.711
SPolisi2	0.647	0.853	0.805	**0.98**	0.674	0.727
SPolisi3	0.633	0.846	0.804	**0.969**	0.637	0.773
SPolisi4	0.647	0.857	0.817	**0.986**	0.651	0.747

iii. Heterotrait-Monotrait (HTMT)

In the appropriate model, the Heterotrait correlation should be smaller than the Monotrait correlation where the HTMT ratio should be <1.00 (Hair et al., 2016). Hence, the Heterotrait-Monotrait (HTMT) ratio in this study has been achieved with all values being <1.00 as illustrated in table 4.

Table 4 - Heterotrait-Monotrait (HTMT)

Sub-Construct	Awareness	Institutional	Management	Policy	Readiness	Role
Awareness of TVET-Engineering						
Institutional Management in TVET- Engineering	0.865					
Malaysian TVET Management	0.812	0.747				
Policy	0.664	0.884	0.875			
Industry readiness in TVET development	0.784	0.854	0.62	0.672		
The role of the government in the development of Malaysian TVET	0.788	0.739	0.868	0.796	0.717	

4.3 Structural Model Testing

Structural model testing involves the analysis of; i) internal VIF or Multicollinearity (Inner VIF), (ii) structural model coefficient (β), (iii) determination coefficient (R square, R^2), (iv) size effect (f^2), and (v) predictive relevance, Q^2.

i. Internal VIF or Multicollinearity (Inner VIF)

Multicollinearity test is conducted to determine whether the independent variables are redundant to one another. Collinearity is said to exist in the case of VIF <5.00 (Hair et al., 2016). The results of multicollinearity analysis in this study are presented in table 5 which shows that all VIF test values are <5.00. Therefore, each variable has met the appropriate VIF criteria.

Table 5 - Internal VIF or multicollinearity (Inner VIF)

Construct	*Structure
Institutional Role	4.920
Involvement	4.902
Management & Administration	2.963

*Structure is short form for TVET-Engineering Governance Structure and it will be rewritten in future table writing.

ii. Path Coefficient (β),

The β value of each route in the hypothesis model is calculated; the greater the value of β, the more significant the impact on endogenous latent construction. However, the β values need to be verified for their significance through the *T*-statistical tests where *T* value should exceed 1.645 for one tailed study (Hair et al., 2016). In order to test the importance of path coefficients and *T*-statistics, a bootstrapping procedure is performed. Table 6 shows that the Involvement construct has the highest path coefficient of $\beta = 0.431$ as compared to other extracts.

Table 6 - Path coefficient (β),

Construct	Mean (M) / Beta (β)	Standard Deviation (STDEV)	*T* Statistics (|O/STDEV|)	*P* Values
Institutional Role >Structure	0.179	0.014	12.786	0.00
Involvement >Structure	0.431	0.015	28.733	0.00
Management & Administration >Structure	0.235	0.01	23.494	0.00

Meanwhile, the predicted hypotheses of this study are H_1: The Institutional Role, Involvement, and Management and Administration factor has significant relationship in affecting TVET-Engineering Governance Structure with $p = 0.00 < 0.05$

iii. R Square (R^2),

The contribution value of all variables can be seen through the R square (R^2) values. The value of $R^2 > 0.67$ is strong, $R^2 > 0.33$ is moderate and $R^2 > 0.19$ is weak (Hair et al., 2016). The result shows that the model of this study has a strong predictive power value of $R^2 = 0.996$ where the value of free extract contribution is high as illustrated in Table 7. This means that the R^2 value suggests that 99.6% variants can be explained by the independent constructs towards the dependent construct of the research.

Table 7 - R square (R^2),

Variable	Structure
TVET-Engineering Governance Structure	0.996

iv. Size Effect (f^2)

The size effects can also be evaluated in three sizes, where $0.00 \leq f^2 < 0.15$ is small, $0.15 \leq f^2 < 0.35$ is moderate and $f^2 \geq 0.35$ is large (Hair et al., 2016). Therefore, the analysis result in Table 8 shows that involvement has a moderate impact, with the value of $f^2 = 0.25$. Meanwhile, Institutional Role and Management and Administration have a strong effect of $f^2 = 11$ and $f^2 = 8.5$.

Table 8 - Size effect (f2)

Construct (exogenous)	Endogenous	R^2 included	R^2 excluded	f^2
Institutional Role	Structure	0.996	0.952	11
Involvement	Structure	0.996	0.995	0.25
Management & Administration	Structure	0.996	0.962	8.5

v. Predictive Relevance, (Q^2)

The measured Q^2 value must be greater than zero for specific endogenous latent construction (Hair et al., 2016). Therefore, the blindfolding analysis result in Table 9 shows that $Q^2 = 0.669$ and this value meets the Q^2 criteria of $Q^2 > 0$. Such value proves that the built model has a predictive relevance. Figure 1 shows the structural model of the TVET-Engineering Governance Structure model that has been developed.

Table 9 - Predictive relevance, (Q^2)

Variable	SSO	SSE	Q^2 (=1-SSE/SSO)
Structure	3808	1260.896	0.669

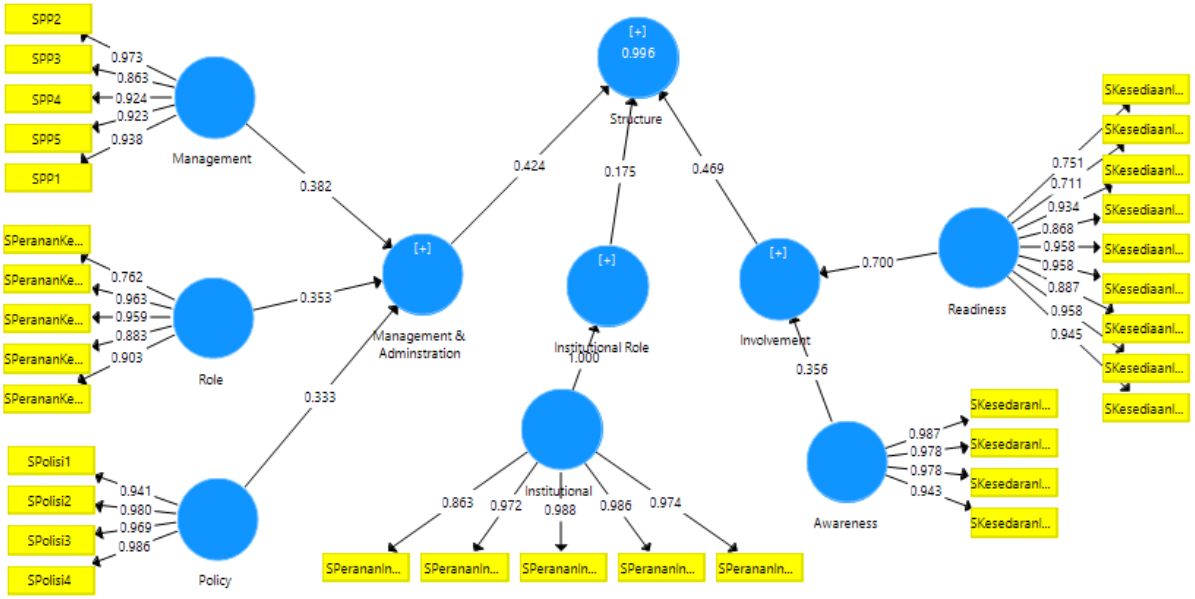

Fig. 1 - TVET-Engineering governance structure model

4. Discussion and Conclusion

The development of the TVET-Engineering Governance Structure model for technologists from mechanical, electric, and electronic and civil field indicates that this model has a predictive viability. This study finds that The Institutional Role, Involvement, and Management and Administration have significant relationships in influencing TVET-Engineering Governance Structure. The transformation of TVET systems in Malaysia require the strong involvement and commitment of parties which is government, institution, and industry. Each parties play a different but crucial role to ensure the

successful of TVET system in Malaysia. This supported previous studies which report that The Institutional Role, Involvement, and Management and Administration affects TVET-Engineering Governance Structure among technologies (Afshari et al., 2013); Peterson & Van Fleet, 2014; ILMIA, 2018). The TVET institution need to play an important role to meet the current requirements from the industry and develop its student innovation skills to supply skilled workers to the industry (Ministry of Education Malaysia, 2021). Thus, TVET institution director need to involve and play the role in managing the partnership or collaboration between institution and industry. Furthermore, Brennan (2014) states that leaders in TVET are expected to gear the transformation in which the dynamic, relevant, and accessible system can be created. At the end of the analysis, two models, namely the measurement model and the structural model were developed after they met the conditions set in the PLS-SEM analysis.

In the current situation of public-private partnership among TVET institution in Malaysia were mediate or moderate by several predictors, namely Malaysian TVET Management: the role of the government in the development of Malaysian TVET, Policy, Institutional Management in TVET-Engineering, Awareness of TVET-Engineering, and Industry readiness in TVET development.

The partnership among TVET institutions and industry in Malaysia was driven by several predictors which are Malaysian TVET Management: the role of the government in the development of Malaysian TVET, Policy, Institutional Management in TVET-Engineering, Awareness of TVET-Engineering, and Industry readiness in TVET development. However, the most importance predictors to ensure the successful partnership between TVET institutions and industry was the role of the government in the development of Malaysian TVET. The government has an important role to engage all the TVET players to play their part in micro system and determine program direction and provide advice to the government (Ministry of Education Malaysia, 2021). Furthermore, it is importance for the government continuously formulates, promotes and coordinates TVET strategies and programs which are in line with Malaysia's economic, technological, and societal needs (Rasul, 2015). Besides, one of indicators that important in Malaysian TVET-Engineering institution and industry partnership model which are governance structure for TVET-Engineering. The governance structure for TVET-Engineering is important because for the time being, 95% of Public TVET institutions revenue is derived from uncontested government funding. Furthermore, public institutions' budgets are based on actual costs and do not incentivize intended outcomes. Therefore, the contribution from the industries, especially in sharing infrastructure or assets with TVET institutions, involved with on-the-job training and dual national training scheme and sponsoring TVET students for an apprenticeship in their company is much help in improving the TVET system.

Overall, it can be concluded that the constructs of Institutional Role, and Management and Administration have a strong effect in forming the TVET-Engineering Governance Structure model. The model that is formed also shows that the model path prediction for all constructs is relevant for the construction of this model. Finally, proving the constructed model has predictive relevance. The researcher suggested that the items that were formed could be tested to a wider scope of respondents in the TVET field so that the appropriateness of the items used would be clearer.

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