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The Development of Generic Competency Portfolio for Malaysian TVET-Construction Graduates

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Abstract: Construction graduates are currently in high demand by contractors in all types of construction work. The diversity of employment opportunities for construction management graduates, increase the need in having a portfolio for skills to work efficiently and effectively with other professions in the industry. Consequently, there are numerous TVET institutes that potentially produce local workforce as highly skilled workers in the construction industry. However, it is believed that, there is a persisting lack of generic competency among the construction graduates and an absence of strategic framework for Malaysian construction graduates. Therefore, this research investigates generic competencies required by construction graduates in the management scopes from the perspectives of the construction practitioners. Drawing on a construction graduates generic competencies and roles, and tasks framework, a structured questionnaire survey was used to elicit data from construction practitioners in the industry. The data was analyzed using Rasch Measurement Model with PCA, item and person reliability and item measure analysis. Result from this research indicates that industries require graduates to perform more on analytical and critical thinking in the project management phase. Moreover, in the construction management phase, it has been found that industries expect construction graduates to perform more on teamwork competency. Furthermore, this research identified that site management phase request more on problem-solving and teamwork competency from construction graduates. Therefore, it is believe that these research findings will be useful in assisting the universities and industries to improve the generic competency amongst construction students by providing valuable insight and expanding current knowledge-base of those elements and variables required by industries.

Keywords: Generic competency, construction lifecycle, construction graduates, employability

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1. Introduction

Today, Technical Vocational Education and Training (TVET) is an important field, especially in preparing developing countries for the 21st century. Malaysia is one of the developing countries that actively engaged in producing a skilled workforce to accommodate the needs of the country's workforce including in the construction industry. By 2020, up to an additional 3.3 million jobs will be created, of which 1.3 million will be TVET-related (Ismail & Abiddin, 2020). The twelve National Key Economic Area (NKEA) sectors, project a need for 1.3 million TVET graduates. Thus 1.6 million TVET graduates are required by 2020 including construction graduates. However, the involvement of students from TVET institutes, including from vocational college in the local construction industry as a highly skilled and semi-skilled worker is still low (Tun & Onn, 2017).

The changes in industry needs have further highlighted the problems of incompetence construction graduates and brought a significant change in construction education. It is believed that there are skills where graduates fell below the expectation of contracting organizations which appears when there are changes in industry requirements added with education provision in developing construction students' generic competency (Hasan, Ahamad, & Mohamed, 2011). Technical competency are proficiency in a specific kind of activity, particularly one involving methods, processes, procedures or techniques, meanwhile, generic competency can be concluded as a combination of competency which corresponds to personal behavioural, personal traits and motive (Affandi, 2015). Within the current circumstance when the industry is trying to change rapidly, much whereas in the past the focus might have been on the technical competency of the graduates and the current focus seems to be on the generic competency (Ahn, Kwon, Pearce, & Shin, 2010). Evidence to support the views of adequacy relating to the development in construction graduates finds that academia and students were having problems with proper soft skills development during teaching and learning in the university (Haryanti, Padzil, Zulhabri, & Mohd Firdaus, 2012).

The project life cycle of different industry project may vary with their size, complexity and characteristics. Each project in construction requires a manager (project manager, construction manager and site manager). Furthermore, each project life cycle may have entry-level manager (fresh graduates), managing the project. These managers practice the management function in the organization towards their project. In the case of construction, project management is handled by the developer. It means the developer owns the project. It started with a conceptual phase and finished with commissioning or hand over the project to the customer. Meanwhile, construction management is a phase which contractor will take over the project and the progress of construction will be reported to the project manager (superintendent officer/representative of developer). Also, in order to complete the project, the contractor will hire subcontractors. These subcontractors will report all the progress to the construction manager. The site management phase starts with construction and finishes with commissioning. Due to each project life cycle requires different competency from the managers. Therefore, this research aims to develop construction graduates generic competencies portfolio in the management scopes and project life cycle from the perspectives of the construction practitioners.

2. Methodology

This study employed a quantitative approach with survey method. A questionnaire survey was adopted from Affandi, (2015) which developed from construction managers' roles and task, and entry-level construction managers' generic competency framework. The questionnaire consists of three sections which are demography, roles and tasks of construction graduates and generic competencies performed by construction graduates. There are 12 constructs that consist of 48 elements of generic competencies listed in section c.

This research employs a cluster sampling technique. 2679 contractors Grade 5 to 7 in the Klang Valley registered with CIDB Malaysia are chosen as a sample in this research due to the establishment and most of the contractors employed undergraduate construction graduates rather than contractor grade 1 to 4 (Affandi, 2015). This research expects to calibrate item with ± 1 logit and 99% confidence level. Therefore the minimum sample size which has been selected for this research is 50. It is believed that this sample can represent the whole population since the construction industry has similar construction life cycle and technology no matter where the construction is held.

The data collected from this research is analyzed using the Rasch measurement model designed explicitly for survey rating scale, namely the Rasch Rating Scale Model (Andrich., 1978). This model is appropriate for Likert scale data because it relates the amount of person's latent trait (e.g., one's tendency to agree with a statement) to the probability of an item response on a single scale (Bond. & Fox., 2007). It is only when these two elements are placed on the same scale and compared those truly meaningful inferences about person and interactions can be made. Furthermore, the Rasch analysis used to test data-to-model fit (dimensionality) and data measure quality for this research.

3. Result

This section provides information on validity and reliability, item hierarchy and generic competency as performed in the project, construction and site management lifecycle.

3.1 Validity and Reliability

According to (Zikmund, 2003) validity means "the ability of a scale to measure what intended to be measured." In other words, it refers to how well the results are achieved by employing the measure fitting the theories around which the test is designed. Taking into this, construct validity has been examined in this study using principal component analysis (PCA) by Rasch Model. The PCA of residuals is used to test the unidimensional. PCA on the residuals is conducted to detect whether any dominant component remained among Rasch residual in the test, respectively.

Table 1 - Standardized residual variance (in eigenvalue units).

	-- Empirical --			Modeled
Total raw variance in observations =	84.1	100.0%		100.0%
Raw variance explained by measures =	36.1	**42.9%**		43.0%
Raw variance explained by persons =	22.4	26.6%		26.6%
Raw Variance explained by items =	13.8	16.4%		16.4%
Raw unexplained variance (total) =	48.0	57.1%	100.0%	57.0%
Unexplned variance in 1st contrast =	4.9	**5.8%**	10.2%	
Unexplned variance in 2nd contrast =	4.1	4.9%	8.6%	
Unexplned variance in 3rd contrast =	3.3	3.9%	6.8%	
Unexplned variance in 4th contrast =	3.0	3.6%	6.2%	
Unexplned variance in 5th contrast =	2.3	2.7%	4.7%	

In total, 42.9% of the Rasch dimension was explained and the unexplained variance was 5.8%. This result shows sufficient evidence for the existence of unidimensional constructs. Reliability refers to an extent to which a scale produces consistent results if it repeats the measurements which are made of the variables of concern (Malholtra, 2003). Reliability and error are related, and thus the larger the reliability, the smaller the error (Punch, 1998). Therefore, the main objective of reliability is to minimize the errors and biases in research. This research applies Item Response Theory (IRT) analysis through Rasch Model in analyzing the reliability of the research instrument where the value of item and person is identified.

Table 2 - Item and person reliability.

SUMMARY OF 156 MEASURED (EXTREME AND NON-EXTREME) PERSON

	TOTAL SCORE	COUNT	MEASURE	MODEL ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD
MEAN	192.4	48.0	2.32	.35				
S.D.	26.5	.0	2.08	.37				
MAX.	240.0	48.0	8.43	1.83				
MIN.	105.0	48.0	-1.68	.18	.03	-9.3	.03	-9.2

REAL RMSE	.53	TRUE SD	2.01	SEPARATION	3.83	PERSON RELIABILITY .94
MODEL RMSE	.51	TRUE SD	2.01	SEPARATION	3.95	PERSON RELIABILITY .94

S.E. OF PERSON MEAN = .17

PERSON RAW SCORE-TO-MEASURE CORRELATION = .92

CRONBACH ALPHA (KR-20) PERSON RAW SCORE "TEST" RELIABILITY = .98

SUMMARY OF 48 MEASURED (NON-EXTREME) ITEM

	TOTAL SCORE	COUNT	MEASURE	MODEL ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD
MEAN	625.2	156.0	.00	.14	1.00	-.1	1.00	-.1
S.D.	15.1	.0	.29	.00	.22	1.7	.26	1.9
MAX.	660.0	156.0	.57	.15	1.62	4.3	1.80	4.9
MIN.	594.0	156.0	-.69	.13	.60	-3.7	.61	-3.4

REAL RMSE	.14	TRUE SD	.25	SEPARATION	1.75	ITEM RELIABILITY .75
MODEL RMSE	.14	TRUE SD	.25	SEPARATION	1.84	ITEM RELIABILITY .77

S.E. OF ITEM MEAN = .04

The value of person reliability for contractors is excellent (.94), which can support the item value (Norlide, 2007). Moreover, the item reliability value (.75), shows that item in the instrument is fair enough to be used as an instrument for this research.

3.2 Item Hierarchy

Item hierarchy table presents a visual representation of item distributions using a hierarchy to display the item response patterns. The element that is easiest to endorse, fall towards the bottom of the hierarchy, while the element that is most difficult to endorse, are represented at the top of the item hierarchy (Bond & Fox, 2007). The distance between the items in the hierarchy illustrates how the items are functioning about one another. As explained by (Bond & Fox, 2007) the logit scale is an interval scale, meaning that the distance between the logits is of equal size. The Table 3, 4 and 5 below, shows the level of respondents' expectation and requirement measured in logit by Rasch model.

3.3 Generic Competency Performed in the Project Management Lifecycle

Project management is the application of knowledge, skills, tools, and techniques to project activities to meet project requirements (Project Management Institute, 2004). The term project management is sometimes used to describe an organizational or managerial approach to the management of the project and some ongoing operation, which can be defined as a project that is also referred to as 'management by project. In the case of construction, project management is handled by the client and developer. It means the client or developer owns the project. It started with conceptual phase and finished with commissioning or hand over the project to the customer. Table 3 below, shows the generic competency required to be performed by construction graduates in project management lifecycle.

Table 3 - Item measure for generic competency performed in the project management lifecycle.

ENTRY NUMBER	TOTAL SCORE	TOTAL COUNT	MEASURE	MODEL S.E.	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD	PT-MEASURE CORR.	PT-MEASURE EXP.	EXACT MATCH OBS%	EXACT MATCH EXP%	ITEM
33	145	47	1.32	.40	.20	-3.7	.15	-3.2	.84	.71	97.7	83.8	SECCN1
34	145	47	1.32	.40	.77	-.7	.61	-.9	.72	.71	88.4	83.8	SECCN2
4	146	47	1.16	.40	.45	-2.1	.38	-1.8	.78	.70	90.7	83.5	SECCRB1
3	148	47	.83	.40	.95	-.1	.92	-.1	.64	.70	79.1	82.3	SECCLL1
15	148	47	.83	.40	1.23	.8	.80	-.4	.72	.70	79.1	82.3	SECCTW11
12	149	47	.67	.40	1.20	.7	1.32	.9	.60	.69	79.1	82.0	SECCTW8
17	149	47	.67	.40	.78	-.7	.70	-.7	.70	.69	79.1	82.0	SECCPS2
37	149	47	.67	.40	.81	-.6	.91	-.1	.70	.69	83.7	82.0	SECCBC1
10	150	47	.51	.40	.72	-.9	.52	-1.3	.69	.68	81.4	81.6	SECCTW6
36	150	47	.51	.40	.52	-1.9	.53	-1.3	.73	.68	90.7	81.6	SECCN4
39	150	47	.51	.40	1.26	.9	1.27	.8	.60	.68	72.1	81.6	SECCBC3
30	151	47	.35	.40	.56	-1.7	.38	-2.0	.80	.68	88.4	80.9	SECCE5
35	151	47	.35	.40	.67	-1.2	.46	-1.6	.71	.68	79.1	80.9	SECCN3
38	151	47	.35	.40	.69	-1.1	.48	-1.5	.70	.68	79.1	80.9	SECCBC2
41	151	47	.35	.40	.87	-.4	1.00	.1	.66	.68	83.7	80.9	SECCF2
48	151	47	.35	.40	1.48	1.6	1.15	.5	.67	.68	81.4	80.9	SECCEN2
13	152	47	.19	.40	.73	-1.0	.62	-1.0	.76	.67	86.0	81.5	SECCTW9
16	152	47	.19	.40	.87	-.4	.83	-.3	.64	.67	86.0	81.5	SECCPS1
19	152	47	.19	.40	1.00	.1	.95	.0	.73	.67	76.7	81.5	SECCPS4
31	152	47	.19	.40	1.70	2.2	1.10	.4	.74	.67	72.1	81.5	SECCE6
32	152	47	.19	.40	1.31	1.1	1.20	.6	.69	.67	72.1	81.5	SECCE7
20	153	47	.03	.39	.64	-1.4	.46	-1.7	.79	.66	83.7	80.8	SECCPS5
28	153	47	.03	.39	.86	-.5	.93	.0	.67	.66	88.4	80.8	SECCE3
40	153	47	.03	.39	.81	-.7	.90	-.1	.65	.66	83.7	80.8	SECCF1
47	153	47	.03	.39	1.44	1.5	1.12	.4	.58	.66	81.4	80.8	SECCEN1
42	**154**	**47**	**-.12**	**.39**	**.77**	**-.9**	**.83**	**-.4**	**.69**	**.66**	**90.7**	**80.2**	**SECCF3**
46	**154**	**47**	**-.12**	**.39**	**.79**	**-.8**	**.84**	**-.3**	**.66**	**.66**	**86.0**	**80.2**	**SECCL4**
8	**155**	**47**	**-.27**	**.39**	**1.42**	**1.6**	**1.37**	**1.1**	**.53**	**.65**	**65.1**	**79.5**	**SECCTW4**
9	**155**	**47**	**-.27**	**.39**	**.88**	**-.4**	**.76**	**-.6**	**.76**	**.65**	**79.1**	**79.5**	**SECCTW5**
14	**155**	**47**	**-.27**	**.39**	**.93**	**-.2**	**.83**	**-.4**	**.62**	**.65**	**79.1**	**79.5**	**SECCTW10**
29	**155**	**47**	**-.27**	**.39**	**.82**	**-.7**	**.68**	**-.9**	**.66**	**.65**	**79.1**	**79.5**	**SECCE4**
45	**155**	**47**	**-.27**	**.39**	**1.02**	**.2**	**.93**	**-.1**	**.70**	**.65**	**74.4**	**79.5**	**SECCL3**
5	**156**	**47**	**-.42**	**.38**	**.82**	**-.7**	**.67**	**-.9**	**.66**	**.64**	**79.1**	**78.7**	**SECCTW1**
6	**156**	**47**	**-.42**	**.38**	**.88**	**-.5**	**.70**	**-.9**	**.65**	**.64**	**74.4**	**78.7**	**SECCTW2**
11	**156**	**47**	**-.42**	**.38**	**1.06**	**.3**	**.85**	**-.3**	**.70**	**.64**	**74.4**	**78.7**	**SECCTW7**
18	**156**	**47**	**-.42**	**.38**	**.62**	**-1.8**	**.47**	**-1.8**	**.71**	**.64**	**83.7**	**78.7**	**SECCPS3**
22	**156**	**47**	**-.42**	**.38**	**.97**	**-.1**	**.78**	**-.6**	**.72**	**.64**	**79.1**	**78.7**	**SECCACT2**
25	**156**	**47**	**-.42**	**.38**	**2.29**	**4.1**	**1.94**	**2.3**	**.46**	**.64**	**72.1**	**78.7**	**SECCACT5**
43	**156**	**47**	**-.42**	**.38**	**1.24**	**1.0**	**1.08**	**.4**	**.67**	**.64**	**74.4**	**78.7**	**SECCL1**
1	**157**	**47**	**-.57**	**.38**	**1.50**	**2.0**	**1.51**	**1.4**	**.63**	**.63**	**65.1**	**77.9**	**SECCC1**
24	**157**	**47**	**-.57**	**.38**	**1.52**	**2.0**	**1.35**	**1.1**	**.53**	**.63**	**69.8**	**77.9**	**SECCACT4**
7	**158**	**47**	**-.71**	**.38**	**1.23**	**1.1**	**1.11**	**.4**	**.54**	**.62**	**60.5**	**77.2**	**SECCTW3**
26	**158**	**47**	**-.71**	**.38**	**.87**	**-.5**	**.69**	**-1.0**	**.74**	**.62**	**74.4**	**77.2**	**SECCE1**
23	**159**	**47**	**-.85**	**.37**	**1.58**	**2.4**	**1.31**	**1.0**	**.62**	**.62**	**60.5**	**76.5**	**SECCACT3**
27	**159**	**47**	**-.85**	**.37**	**.98**	**.0**	**.84**	**-.4**	**.54**	**.62**	**83.7**	**76.5**	**SECCE2**
44	**159**	**47**	**-.85**	**.37**	**.97**	**-.1**	**1.04**	**.2**	**.64**	**.62**	**79.1**	**76.5**	**SECCL2**
21	**160**	**47**	**-.99**	**.37**	**.96**	**-.1**	**.76**	**-.7**	**.61**	**.61**	**76.7**	**75.7**	**SECCACT1**
2	**161**	**47**	**-1.13**	**.37**	**1.18**	**.9**	**1.04**	**.2**	**.54**	**.60**	**62.8**	**75.1**	**SECCC2**

Table 3 - (Continue)

ENTRY NUMBER	TOTAL SCORE	TOTAL COUNT	MEASURE	MODEL S.E.	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD	PT-MEASURE CORR.	PT-MEASURE EXP.	EXACT MATCH OBS%	EXACT MATCH EXP%	ITEM
MEAN	153.3	47.0	.00	.39	1.00	.0	.88	-.3			78.9	80.0	
S.D.	3.8	.0	.59	.01	.37	1.4	.33	1.0			8.0	2.1	

Table 3 shows that, from the total of 12 constructs that consist of 48 elements of generic competencies for construction graduates, only 23 generic competencies required by the industries from construction graduates. Based on the item hierarchy table, 23 generic competencies are the easiest endorse item by construction practitioners (below logit 0). The most important generic competency requires by the industries is communication competency (Make a clear presentation, logit -1.13) and on the other hand is negotiation competency (Collects and analyses all available information and develops option to achieve agreement, logit 1.32).

3.4 Generic Competency Performed in the Construction Management Lifecycle

Construction management lifecycle starts with tendering and finishes with the hand over the project. Construction management involves in coordinate and supervision of the construction process including planning the sequences of works, administration of construction site, materials delivery, making sure all works being done accordingly on-site, decision making which pertaining works on site and so forth, from the tendering awarded stage through final construction, making sure that the project gets done on time and within budget (Mat Isa, 2007). Construction management is a phase where the contractor will take over the project and the progress of construction will be reported to the superintendent officer or representative of the developer. Table 4 below shows the generic competency required to be performed by construction graduates in construction management lifecycle.

Table 4 - Item measure for generic competency performed in the construction management lifecycle.

ENTRY NUMBER	TOTAL SCORE	TOTAL COUNT	MEASURE	MODEL S.E.	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD	PT-MEASURE CORR.	PT-MEASURE EXP.	EXACT MATCH OBS%	EXACT MATCH EXP%	ITEM
35	204	65	.94	.32	.75	-.8	.75	-.7	.73	.71	83.3	82.7	SECCN3
23	205	65	.84	.32	.76	-.8	.67	-1.0	.79	.71	83.3	82.7	SECCACT3
17	207	65	.63	.32	.90	-.3	.91	-.2	.75	.70	81.7	82.5	SECCPS2
22	207	65	.63	.32	1.25	.9	1.17	.6	.72	.70	71.7	82.5	SECCACT2
36	207	65	.63	.32	.65	-1.3	.67	-1.0	.76	.70	88.3	82.5	SECCN4
25	208	65	.53	.32	1.19	.7	1.15	.5	.67	.70	80.0	82.3	SECCACT5
34	208	65	.53	.32	.66	-1.3	.56	-1.5	.76	.70	83.3	82.3	SECCN2
40	208	65	.53	.32	.57	-1.7	.47	-1.9	.76	.70	86.7	82.3	SECCF1
46	208	65	.53	.32	.84	-.5	1.02	.2	.73	.70	83.3	82.3	SECCL4
18	209	65	.42	.32	1.76	2.4	2.01	2.5	.57	.69	78.3	82.0	SECCPS3
30	209	65	.42	.32	1.38	1.4	1.19	.7	.69	.69	75.0	82.0	SECCE5
33	209	65	.42	.32	1.05	.3	1.33	1.0	.58	.69	80.0	82.0	SECCN1
2	210	65	.32	.32	.94	-.1	.95	.0	.71	.69	85.0	82.1	SECCC2
21	210	65	.32	.32	.85	-.5	.75	-.7	.70	.69	85.0	82.1	SECCACT1
38	210	65	.32	.32	.90	-.3	1.00	.1	.69	.69	81.7	82.1	SECCBC2
42	210	65	.32	.32	1.17	.7	1.37	1.1	.65	.69	78.3	82.1	SECCF3
31	211	65	.21	.32	1.23	.9	1.20	.7	.69	.68	76.7	81.6	SECCE6
41	211	65	.21	.32	.99	.1	.86	-.3	.69	.68	80.0	81.6	SECCF2
3	212	65	.11	.32	1.45	1.7	1.56	1.6	.60	.68	71.7	81.1	SECCLL1
10	212	65	.11	.32	1.32	1.3	1.14	.5	.69	.68	76.7	81.1	SECCTW6
16	212	65	.11	.32	.95	-.1	.78	-.6	.69	.68	81.7	81.1	SECCPS1
19	212	65	.11	.32	1.18	.8	1.21	.7	.63	.68	75.0	81.1	SECCPS4
27	212	65	.11	.32	.99	.1	.87	-.3	.72	.68	78.3	81.1	SECCE2
28	212	65	.11	.32	.52	-2.3	.40	-2.3	.80	.68	88.3	81.1	SECCE3
43	212	65	.11	.32	.55	-2.1	.44	-2.1	.77	.68	88.3	81.1	SECCL1
1	213	65	.01	.32	1.51	1.9	1.67	1.8	.59	.67	78.3	80.4	SECCC1
29	213	65	.01	.32	.49	-2.6	.42	-2.2	.78	.67	90.0	80.4	SECCE4
39	213	65	.01	.32	1.00	.1	.90	-.2	.68	.67	80.0	80.4	SECCBC3
4	**214**	**65**	**-.10**	**.32**	**.84**	**-.6**	**.78**	**-.6**	**.69**	**.66**	**81.7**	**79.7**	**SECCRB1**
15	**214**	**65**	**-.10**	**.32**	**.92**	**-.3**	**.89**	**-.3**	**.61**	**.66**	**85.0**	**79.7**	**SECCTW11**
24	**214**	**65**	**-.10**	**.32**	**.61**	**-1.9**	**.58**	**-1.4**	**.74**	**.66**	**88.3**	**79.7**	**SECCACT4**
44	**214**	**65**	**-.10**	**.32**	**1.34**	**1.4**	**1.24**	**.8**	**.64**	**.66**	**71.7**	**79.7**	**SECCL2**
47	**215**	**65**	**-.20**	**.32**	**1.66**	**2.6**	**1.77**	**2.1**	**.57**	**.66**	**70.0**	**78.8**	**SECCEN1**
12	**216**	**65**	**-.30**	**.31**	**.91**	**-.4**	**.84**	**-.4**	**.66**	**.65**	**78.3**	**78.0**	**SECCTW8**
37	**216**	**65**	**-.30**	**.31**	**.84**	**-.7**	**.79**	**-.6**	**.68**	**.65**	**81.7**	**78.0**	**SECCBC1**
32	**217**	**65**	**-.39**	**.31**	**.57**	**-2.4**	**.42**	**-2.2**	**.74**	**.64**	**83.3**	**77.2**	**SECCE7**
48	**217**	**65**	**-.39**	**.31**	**1.95**	**3.7**	**3.14**	**4.5**	**.49**	**.64**	**66.7**	**77.2**	**SECCEN2**
6	**218**	**65**	**-.49**	**.31**	**.67**	**-1.8**	**.59**	**-1.4**	**.70**	**.63**	**81.7**	**76.3**	**SECCTW2**
13	**218**	**65**	**-.49**	**.31**	**.82**	**-.9**	**.83**	**-.4**	**.64**	**.63**	**81.7**	**76.3**	**SECCTW9**

Table 4 - (Continue)

ENTRY NUMBER	TOTAL SCORE	TOTAL COUNT	MEASURE	MODEL S.E.	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD	PT-MEASURE CORR.	PT-MEASURE EXP.	EXACT MATCH OBS%	EXACT MATCH EXP%	ITEM
13	**218**	**65**	**-.49**	**.31**	**.82**	**-.9**	**.83**	**-.4**	**.64**	**.63**	**81.7**	**76.3**	**SECCTW9**
26	**218**	**65**	**-.49**	**.31**	**.68**	**-1.8**	**.53**	**-1.7**	**.72**	**.63**	**78.3**	**76.3**	**SECCE1**
9	**219**	**65**	**-.59**	**.31**	**.83**	**-.9**	**.66**	**-1.1**	**.65**	**.62**	**78.3**	**76.0**	**SECCTW5**
20	**219**	**65**	**-.59**	**.31**	**2.02**	**4.2**	**2.18**	**2.9**	**.52**	**.62**	**65.0**	**76.0**	**SECCPS5**
45	**219**	**65**	**-.59**	**.31**	**.83**	**-.8**	**.75**	**-.7**	**.67**	**.62**	**81.7**	**76.0**	**SECCL3**
11	**220**	**65**	**-.68**	**.31**	**.77**	**-1.3**	**.61**	**-1.3**	**.67**	**.62**	**80.0**	**75.1**	**SECCTW7**
14	**220**	**65**	**-.68**	**.31**	**.83**	**-.9**	**.74**	**-.7**	**.62**	**.62**	**80.0**	**75.1**	**SECCTW10**
8	**221**	**65**	**-.78**	**.31**	**.97**	**-.1**	**.85**	**-.4**	**.63**	**.61**	**70.0**	**74.5**	**SECCTW4**
5	**224**	**65**	**-1.05**	**.30**	**.95**	**-.3**	**.84**	**-.3**	**.58**	**.58**	**71.7**	**72.7**	**SECCTW1**
7	**225**	**65**	**-1.14**	**.30**	**1.34**	**2.0**	**1.23**	**.7**	**.48**	**.58**	**61.7**	**72.4**	**SECCTW3**
MEAN	213.2	65.0	.00	.32	1.00	-.1	.99	-.1			79.3	79.7	
S.D.	4.8	.0	.48	.01	.36	1.5	.51	1.4			6.2	2.9	

Table 4 shows the item hierarchy result for generic competency required by the industry for the construction management phase from construction graduates. Based on the item hierarchy result, 20 generic competencies are the easiest to endorse items by contractors (below logit 0). It is believed that industries require graduates to perform teamwork competency (Manages the requirements of the various team members and the circumstances and interests of individuals throughout the project, logit -1.14) rather than negotiation competency (Considers practical options and prioritizes those presenting the optimal solution for the project, logit 0.94).

3.5 Generic Competency Performed in the Site Management Lifecycle

Normally, site management phase will be managed by subcontractors. These subcontractors will report all the progress to the construction manager. The site management phase starts with construction and finishes with commissioning. Table 5 below shows the generic competency needs to be performed by construction graduates in site management lifecycle.

Table 5 - Item measure for generic competency performed in the site management lifecycle.

ENTRY NUMBER	TOTAL SCORE	TOTAL COUNT	MEASURE	MODEL S.E.	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD	PT-MEASURE CORR.	PT-MEASURE EXP.	EXACT MATCH OBS%	EXACT MATCH EXP%	ITEM
25	132	44	.85	.37	2.10	3.1	2.63	3.0	.39	.58	59.1	79.9	SECCACT5
40	133	44	.72	.37	.86	-.5	.77	-.5	.58	.58	81.8	79.4	SECCF1
23	134	44	.58	.37	1.08	.4	1.02	.2	.63	.57	79.5	78.9	SECCACT3
27	134	44	.58	.37	.54	-2.0	.44	-1.7	.63	.57	88.6	78.9	SECCE2
29	134	44	.58	.37	1.00	.1	.72	-.7	.55	.57	79.5	78.9	SECCE4
41	134	44	.58	.37	.37	-3.1	.27	-2.6	.62	.57	88.6	78.9	SECCF2
47	134	44	.58	.37	1.02	.2	1.11	.4	.53	.57	75.0	78.9	SECCEN1
48	134	44	.58	.37	1.19	.8	1.16	.5	.39	.57	75.0	78.9	SECCEN2
4	135	44	.45	.37	1.02	.2	1.14	.5	.73	.57	72.7	78.3	SECCRB1
16	135	44	.45	.37	.95	-.1	.68	-.8	.72	.57	81.8	78.3	SECCPS1
21	135	44	.45	.37	.66	-1.4	.74	-.6	.60	.57	90.9	78.3	SECCACT1
26	135	44	.45	.37	.67	-1.4	.49	-1.5	.72	.57	77.3	78.3	SECCE1
3	136	44	.31	.37	.77	-.9	.96	.0	.46	.57	81.8	78.5	SECCLL1
30	136	44	.31	.37	.57	-1.9	.36	-2.2	.41	.57	86.4	78.5	SECCE5
35	136	44	.31	.37	.76	-.9	.74	-.6	.60	.57	81.8	78.5	SECCN3
36	136	44	.31	.37	.57	-1.9	.49	-1.5	.69	.57	90.9	78.5	SECCN4
45	136	44	.31	.37	1.90	2.9	1.66	1.6	.84	.57	70.5	78.5	SECCL3
9	137	44	.18	.37	.98	.0	.99	.1	.74	.56	79.5	78.3	SECCTW5
15	137	44	.18	.37	.71	-1.2	.59	-1.1	.50	.56	84.1	78.3	SECCTW11
24	137	44	.18	.37	1.13	.6	1.00	.1	.60	.56	79.5	78.3	SECCACT4
28	137	44	.18	.37	.77	-.9	.67	-.9	.26	.56	84.1	78.3	SECCE3
32	137	44	.18	.37	.60	-1.8	.57	-1.2	.57	.56	88.6	78.3	SECCE7
39	137	44	.18	.37	1.35	1.3	.98	.1	.76	.56	75.0	78.3	SECCBC3
42	137	44	.18	.37	1.27	1.1	1.47	1.2	.57	.56	70.5	78.3	SECCF3
31	138	44	.04	.37	.62	-1.7	.53	-1.4	.67	.56	86.4	77.9	SECCE6
33	138	44	.04	.37	1.02	.2	.97	.1	.50	.56	77.3	77.9	SECCN1
46	138	44	.04	.37	2.00	3.2	1.95	2.1	.65	.56	70.5	77.9	SECCL4
10	**139**	**44**	**-.09**	**.37**	**.74**	**-1.1**	**.69**	**-.8**	**.54**	**.56**	**79.5**	**77.4**	**SECCTW6**
13	**139**	**44**	**-.09**	**.37**	**.67**	**-1.5**	**.50**	**-1.5**	**.46**	**.56**	**84.1**	**77.4**	**SECCTW9**
18	**139**	**44**	**-.09**	**.37**	**.87**	**-.5**	**.78**	**-.5**	**.57**	**.56**	**79.5**	**77.4**	**SECCPS3**
22	**139**	**44**	**-.09**	**.37**	**.60**	**-1.9**	**.42**	**-1.9**	**.50**	**.56**	**84.1**	**77.4**	**SECCACT2**
14	**140**	**44**	**-.23**	**.37**	**.72**	**-1.2**	**.56**	**-1.3**	**.67**	**.57**	**84.1**	**76.9**	**SECCTW10**
34	**140**	**44**	**-.23**	**.37**	**1.25**	**1.1**	**.78**	**-.5**	**.10**	**.57**	**84.1**	**76.9**	**SECCN2**
5	**141**	**44**	**-.36**	**.37**	**1.47**	**1.8**	**1.03**	**.2**	**.69**	**.57**	**75.0**	**77.5**	**SECCTW1**

Table 5 - (Continue)

ENTRY NUMBER	TOTAL SCORE	TOTAL COUNT	MEASURE	MODEL S.E.	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD	PT-MEASURE CORR.	PT-MEASURE EXP.	EXACT MATCH OBS%	EXACT MATCH EXP%	ITEM
11	141	44	-.36	.37	.86	-.5	.72	-.7	.64	.57	79.5	77.5	SECCTW7
17	141	44	-.36	.37	1.24	1.0	1.30	.9	.68	.57	70.5	77.5	SECCPS2
20	141	44	-.36	.37	1.36	1.5	1.57	1.5	.43	.57	65.9	77.5	SECCPS5
12	142	44	-.50	.37	.93	-.2	.96	.0	.39	.57	79.5	77.2	SECCTW8
19	142	44	-.50	.37	.95	-.2	.78	-.6	.54	.57	75.0	77.2	SECCPS4
37	142	44	-.50	.37	1.07	.4	1.17	.6	.45	.57	75.0	77.2	SECCBC1
38	142	44	-.50	.37	.92	-.3	.73	-.7	.56	.57	75.0	77.2	SECCBC2
2	143	44	-.63	.37	1.06	.4	1.14	.5	.48	.58	75.0	76.9	SECCC2
6	143	44	-.63	.37	.85	-.6	.88	-.2	.48	.58	79.5	76.9	SECCTW2
7	143	44	-.63	.37	.87	-.5	.86	-.3	.68	.58	84.1	76.9	SECCTW3
8	144	44	-.77	.37	.90	-.4	.75	-.7	.50	.58	77.3	76.6	SECCTW4
1	145	44	-.90	.37	1.26	1.2	1.38	1.1	.52	.59	75.0	76.4	SECCC1
44	145	44	-.90	.37	1.00	.1	1.08	.3	.75	.59	79.5	76.4	SECCL2
43	146	44	-1.04	.37	1.21	1.0	1.22	.7	.62	.59	65.9	76.1	SECCL1
MEAN	138.3	44.0	.00	.37	.98	-.1	.93	-.2			78.8	77.9	
S.D.	3.5	.0	.48	.00	.36	1.4	.43	1.1			6.6	.8	

Table 5 shows 21 generic competency required by the industries from construction graduates in performing site management roles and tasks. Industries require construction graduates to focus more on Leadership (Create an environment which encourages high performance and enables team members to reach their full potential, logit -1.04) rather than analytical and critical thinking competency (Think beyond the limits, logit 0.85).

3.6 Construction Graduates Generic Competency Portfolio

Table 6 below, represent the generic competency required by the industry from the construction graduates in performing each construction lifecycle. This portfolio was developed based on item hierarchy analysis for each construction lifecycle. The most difficult items for principal to express agreement with, are the item at the top of the table (positive logit). The least difficult item for principals to express agreement with, were item at the bottom of the table (negative logit) (refer to table 3,4 and 5).

Therefore, this research identified that, in performing project management phase, industries require graduates to perform communication, analytical and critical thinking, leadership, ethics, teamwork and problem-solving competency. Furthermore, in performing construction management phase, industries required graduates to master teamwork, leadership, problem-solving, ethics, entrepreneurship, behavior characteristic, analytical and critical thinking and relationship building competency. Moreover, industries needs students to perform leadership, communication, teamwork, behavior characteristic, problem-solving, negotiation and analytical and critical thinking competency in site management phase.

Table 6 - Construction graduates generic competency portfolio based on construction lifecycle.

Construction Lifecycle		
Project Management	**Construction Management**	**Site Management**
Communication: Make a clear presentation	**Teamwork:** Manages the requirements of the various team members and the circumstances and interests of individuals throughout the project.	**Leadership**: Create an environment which encourages high performance and enables team members to reach their full potential.
Communication: Deliver ideas clearly and effectively, orally and in writing	**Teamwork:** Builds and maintains an effective project team throughout the project lifecycle. In doing so is aware of the different stages of team development and the different models that can be applied	**Leadership:** Gains the trust, confidence, and commitment of others and utility collaboration throughout the lifecycle to ensure the continued momentum of the project
Analytical and Critical Thinking: Makes appropriate plans or analysis, systematically breaking down a complex problem or process into parts. Uses several techniques to break apart complex problems to reach a solution, or makes long chains of causal connections.	**Teamwork:** Takes pride in the project and the team's achievement, provide regular feedback to the team, and recognizes and acknowledges contributions from individual team members.	**Communication:** Deliver ideas clearly and effectively, orally and in writing

Table 6 - (Continue)

Construction Lifecycle		
Project Management	**Construction Management**	**Site Management**
Analytical and Critical Thinking: Provides the framework so that solutions to problems or concerns involving the immediate project team are addressed.	**Teamwork:** Contribute to the planning and coordinating team effort	**Communication:** Make a clear presentation
Analytical and Critical Thinking: Expand and improve thinking skills	**Teamwork:** Contribute positively to address problems and devises solution with the team	**Teamwork**: Manages the requirements of the various team members and the circumstances and interests of individuals throughout the project.
Analytical and Critical Thinking: Think beyond the limits	**Teamwork:** Communicates regularly with the project team and wider networks.	**Teamwork**: Develops the team objectives and agrees on ways of working with the team.
Analytical and Critical Thinking: Understands how actions taken on the project may impact other areas of the project, other projects in the organization or other organizational operations.	**Teamwork:** Respect others	**Teamwork:** Takes pride in the project and the team's achievement, provide regular feedback to the team, and recognizes and acknowledges contributions from individual team members.
Teamwork: Manages the requirements of the various team members and the circumstances and interests of individuals throughout the project.	**Teamwork:** Develops the team objectives and agrees on ways of working with the team.	**Teamwork:** Show respect for others' intelligence by appealing to reasons.
Teamwork: Contribute positively to address problems and devises solution with the team	**Teamwork:** Show respect for others' intelligence by appealing to reasons	**Teamwork**: Contribute positively to address problems and devises solution with the team
Teamwork: Develops the team objectives and agrees on ways of working with the team.	**Teamwork:** Responsible for the team result	**Teamwork**: Builds and maintains an effective project team throughout the project life cycle. In doing so is aware of the different stages of team development and the different models that can be applied
Teamwork: Builds and maintains an effective project team throughout the project life cycle. In doing so is aware of the different stages of team development and the different models that can be applied	**Leadership:** Agrees on SMART performance objective for the team and individuals which are regularly reviewed and monitored to provide prompt and constructive feedback	**Teamwork:** Contribute to the planning and coordinating team effort
Teamwork: Contribute to the planning and coordinating team effort	**Leadership:** Gains the trust, confidence, and commitment of others and utility collaboration throughout the lifecycle to ensure the continued momentum of the project	**Teamwork**: Respect others
Teamwork: Communicates regularly with the project team and wider networks.	**Ethics:** Practice ethical behavior	**Teamwork:** Ask for support and offers assistance as appropriate
Teamwork: Takes pride in the project and the team's achievement, provide regular feedback to the team, and recognizes and acknowledges contributions from individual team members.	**Ethics:** Honestly represent self at the appropriate level of competence which can be evidenced by appropriate continuing professional development, qualifications, knowledge and experience.	**Behavior characteristic:** Identifies and adopts sensible, effective, straightforward solutions
Problem Solving: Identified the root causes rather than the symptoms of the conflict and is creative in seeking a path to resolution	**Problem Solving:** Find new ideas and alternative solutions	**Behavior characteristic:** Have an open, positive, and 'can-do' attitude which build confidence and credibility both within the team and stakeholders.

Table 6 - (Continue)

Construction Lifecycle		
Project Management	**Construction Management**	**Site Management**
Leadership: Gains the trust, confidence, and commitment of others and utility collaboration throughout the lifecycle to ensure the continued momentum of the project	**Entrepreneurship:** Plan a business	**Negotiation**: Set out a negotiation strategy, understanding the motivation, wants and needs of all parties
Leadership: Create an environment which encourages high performance and enables team members to reach their full potential.	**Entrepreneurship:** Develop, explore and seize business opportunities	**Analytical and critical thinking**: Understands how actions taken on the project may impact other areas of the project, other projects in the organization or other organizational operations.
Leadership: Agrees on SMART performance objective for the team and individuals which are regularly reviewed and monitored to provide prompt and constructive feedback	**Analytical and Critical Thinking:** Expand and improve thinking skills	**Problem Solving:** Find new ideas and alternative solutions
Leadership: Basic knowledge of leadership theory	**Behaviour Characteristic:** Have an open, positive, and 'can-do' attitude which build confidence and credibility both within the team and stakeholders.	**Problem-solving**: Identify and analyze problems in complex situations
Ethics: Honestly represent self at the appropriate level of competence which can be evidenced by appropriate continuing professional development, qualifications, knowledge and experience.	**Relationship Building:** Navigates quickly through network to gain support to move project forward	**Problem-solving**: Anticipates and prepares for potential conflict situations that may have an impact on the project.
Ethics: Adopts a morally, legally and socially appropriate manner behavior and working with all members of the project teams and stakeholders.		**Problem-solving**: Identified the root causes rather than the symptoms of the conflict and is creative in seeking a path to resolution
Ethics: Encourages a culture of openness and honesty within the project.		
Flexibility: Changes quickly when necessary.		

4. Discussion and Conclusion

It is common knowledge that the nature of occupations served by the TVET sector has been evolving progressively in recent decades into one demanding more intellectual and higher-order skills commonly associated with traditional professions (Ab. Rahim Bakar, 2011). In accomplishing higher-order skill worker, each graduate needs to be well prepared with technical and generic skills. In the 21st century, generic competency is the most required skill besides technical knowledge in an attempt to compete for employment and sustain job at the global industrial market (Joynes et al., 2019)

From the result of generic competency portfolio, it can be concluded that industries require graduates to perform more on analytical and critical thinking in the project management phase. It is believed that, when the graduates are employed as an entry level in the top management position, this position requires more conceptual skill involving thinking skill in performing project management roles and task (refer to figure 1). This is because the working environment and culture of a construction project is unique compared to most working condition. The worker must deal with the nature of constructions which are unpredictable nature, non-linear relationship, short term task, working environment, volume, size, multiple feedback possesses and physical boundaries (Gould & Joyce, 2009; Mat Isa, 2007 and Hassan, 2005). Therefore, in dealing with this kind of situation, construction graduates need to acquire analytical and critical thinking skill.

Moreover, in the construction management phase, it has been found that industries require construction graduates to perform more on teamwork competency. Industries require less conceptual skill which involves thinking and problem-solving skills. This is because construction management involves coordinate and supervision of the construction process. Graduates must work as a team within the whole organizations entirely, but each has a specific function to deliver specific sub-objectives and their performances are usually measured in terms of the achievement of the organizational goals (Mat Isa, 2007). Furthermore, construction is a group work and consist of people from various backgrounds. Therefore,

construction graduates need to be part of it and able to work within the group. Teamwork is a key requirement in most occupations and an essential part of workplace success therefore, employers are seeking to recruit individuals who pay due attention to relations with peers and superiors (Suarta et al., 2018) .

Meanwhile, for the site management phase, it is believed that the site manager will perform more on technical skill rather than conceptual skill (refer to figure 1). The result from table 5 identified that site management phase requires more on problem-solving and teamwork competency. Capability to solve problems and make suitable choices is critical, individuals with this skill are able to effectively plan and organize their team and are probable to get the job completed appropriately in the first time (Keow Ngang Tang, 2019). It can be concluded that the problem-solving competency is implemented in solving any problems in the technical competency.

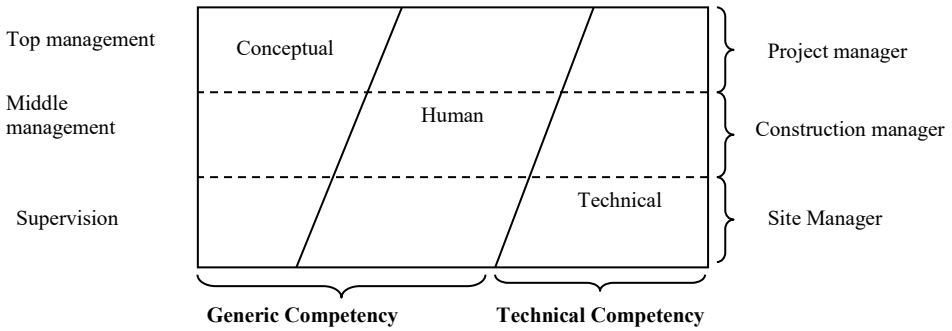

Fig. 1 - Competency in management scope.

Therefore, it is believed that the construction curriculum shall include all generic importance competencies demand by the industries. This will make sure that, TVET-construction graduates can adapt to the working environment in every phase of the project lifecycle. These research findings will be useful in assisting the universities and industries to improve the generic competency amongst construction management students by providing valuable insight and expanding current knowledge-base of those elements and variables required by industries. Since the Ministry of Higher Education (MOHE) hasn't proposed any generic competency focusing on construction programs, this portfolio can be a significant basis for assessing the current soft skills model adapting in their curriculum. Moreover, this research will offer options and strategies to improve existing curriculum, training and needs and contribute to the opportunity to enhance the construction graduates generic competency.

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