Assessing Content Validity of Enterprise Architecture Adoption Questionnaire (EAAQ) Among Content Experts

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***Abstract*— Content validity is the process to validate the measurement items from the perspective of experts. Notably, there are lack of validated items measuring the perception of intention to adopt Enterprise Architecture (EA) in the public sector organisations. This study intended to develop and assess the content validity of measurement items for EAAQ as a survey instrument to public sector organisations. Twelve academic and industrial content experts have assessed the validity of 14 identified constructs and 52 measurement items. This study was conducted through two cycles of content validation process. The written EAAQ was distributed via email or by a meeting session with the content experts for assessing the measurement items. The analysis of content experts' consensus was examined using a quantitative approach called Content Validity Ratio (CVR) and Content Validity Index (CVI). Of the 52 items, 50 were accepted, as the CVR's critical value that must be abided by 0.75 ($N = 8$) and two items were rejected. Then, the accepted items were computed to a final form using CVI. The acceptable CVI value for the final EAAQ is 0.94. Therefore, a new 50-item EAAQ was developed based on validated content and face values by the experts for public sector organisations. In future, the measurement items should be reassessed on its psychometric properties for the EAAQ reliability and internal consistency. This instrument would be useful for measuring the perception of EA adoption in organisations.**

Keywords— Content Validity, Enterprise Architecture Adoption, Measurement Items

I. INTRODUCTION

The quality of measurement items for research relies on content validity as emphasized by [1, 2]. According to them, an instrument is a tool in conducting scientific research that involves data performance, behavioural, or observational data. There are choices to obtain the instrument which include developing new instrument, locating and modifying existing instrument (adapt), or adopting the instrument entirely [2]. These choices are different from content validity process and of these choices, adapting measurement items is more commonly used in scientific research compared to developing new items [2]. When locating and modifying the items, content of the measurement items must be assessed by experts [3]. Although the process of content validity is tedious and rigorous, it is proven by the experts [4]. Experts' insights are important as they demonstrate that the measurement items are adequate, clear, appropriate and reflective to the constructs [5-10]. The consensus of experts' insights can be quantified and concluded by using CVR and CVI. These experts were identified based on their expertise in the knowledge and experience from different domains such as Information System, Enterprise Architecture, research method, statistics, and public sector. Experts also have professional qualification such as Doctor of Philosophy (PhD) and they actively conduct research in domain of research or method [11, 12]. Furthermore, the researcher should anticipate that the content experts may suggest useful feedbacks to improve the items. Content validity test does not only involve expert assessment but also statistical analysis such as reliability test, internal consistency and Exploratory Factor Analysis (EFA) to validate the questionnaire. There were some critics on the evaluation of CVR model by Lawshe [10] in quantifying of consensus of panellists and response process.

According to [8, 13], there is confusion linked to Lawshe [10] codes (1-Essential; 2-Useful but not essential; 3-Not necessary). The weighting concept proposed by Lawshe [10] is not congruent with content validity analysis method used by [8], [14], and [9]. The five-point Likert scale proposed by Allahyari, et al. [8] is a better scale compared to Lawshe's codes as five-point Likert scale provides larger range and clear phrases. To our knowledge, no validated items as yet measuring the perception of intention to adopt EA among public sector organisations. In this study context, content validity of measurement items is assessed by content experts to develop EAAQ for survey in the public sector organisations. Assessing, capturing and reporting on the content validity of measurement items are employed in this study. The structure of this paper is organized as follows; Section 2 presents the Literature Review of this study; Section 3 describes the Method; Section 4 explains the Findings; Section 5 discusses the Discussion of Findings and finally, the Conclusion and Future Works are shown in Section 6.

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II. LITERATURE REVIEW

A. Instrument Development Process

Developing and constructing measurement items involve rigorous processes in order to get the validated and reliable measurement items [2]. A new measurement items was designed following typical steps of scale development [8, 10, 15, 16] with some modifications. However, these typical steps share similarity in terms of defining the constructs and validating the content of measurement items with the experts. Construct is a variable of latent and unobservable [7]. Defining the constructs is important as it represents whether the measurement items measure the constructs adequately and clearly. Without clear definition of construct will subsequently lead to confusion, deficient or contaminated, and invalid conclusion of constructs. On the other hand, content validation process involves experts' insights on the clarity and appropriateness of items. Opinion from the experts can be measured quantitatively or qualitatively [9]. The overview of scale development steps is shown in TABLE 1.

TABLE 1. PROCESS IN DEVELOPING MEASUREMENT ITEMS INVOLVED IN DIFFERENT STUDIES

Steps in Developing Measurement Items	Source(s)
Planning, Construction, Quantitative Evaluation, Validation	[2]
Conceptualization, Development of Measurement, Model Specification, Scale Evaluation and Refinement, Validation, and Norm Development	[7]
Specify Domain of Construct, Generate Scale Items, Collect Data, Purify Scale, Collect New Data, Assess Validity, and Assess Reliability	[16]
Content Evaluation Panel, Validity of Judgement, Quantifying Consensus Among Panellists, Items Selection, Content Validity Index (CVI)	[10]

However, explicitly, this study involved four main steps namely: (1) define constructs; (2) develop measurement items; (3) purify and select measurement items; and (4) validate whole set of measurement items. These steps reported extensively in the finding section. A quantitative measurement model named Content Validation Ratio (CVR) is chosen to indicate expert assessment on the appropriateness, adequacy, and clarity of the inclusion items in the EAAQ. Then the CVI value is computed for the final form of EAAQ.

B. Content Validity Process

There are numbers of content validity approaches, either quantitatively or qualitatively. These approaches aim for validating the measurement items adequately and giving the confident level of clarity and appropriateness of the items from the experts' assessment. The common methods used in qualitative approach are Delphi and Q-Sort. These methods require several rounds of process with the experts and the researcher must present in the sessions. Delphi method must use same experts for every round, while Q-Sort method allows different experts. Although these methods are inexpensive and flexible, there are constraints for example dependency on the experts lead to time-consuming, and hard to find the suitable time whereby all experts can meet at the same time. Since the participation of experts is voluntary basis, these constraints lead to discontinuity in the assessment.

Alternatively, quantitative approaches such as Content Validity Ratio (CVR) [10], Content Validity Index (CVI) (Lynn, 1986), and Weighted Ratio (WR) [14] offer practicality in validating the content of items that involve statistical analysis. These techniques not only determine the decision to accept or reject the items but also aid the researcher in terms of cost and time saving. Content experts are invited to participate in the assessment at once, however in certain situations, experts are involved in the second process. Quantitative approach allows researcher to invite different experts having the same level of expertise which is different from Delphi technique. However quantitative approach has limitations for example the value of CVI may be exaggerated unexpectedly due to the four-scale used in the CVI is not universally used [9] and even-numbered scale (2,4,6) force respondents to choose either positive or negative responses [6, 8]. The inferences from above discussion include; the selection of content validation approach is determined by the type of data, objective of approaches, time, cost, and availability of content experts. Therefore, this study applies the quantitative approaches which are CVR and CVI.

III. METHOD

Different qualitative and quantitative content validity methods are used in determining the finalised measurement items. These methods are used to see whether measurement items are adequate to measure the construct and increase the confident level of appropriateness of the items. There are 14 constructs identified in this study namely: sufficient ICT infrastructure, EA complexity, top management support, organizational readiness, clear communication, normative pressure, expected benefits, good governance, organization size, external support, coercive pressure, mimetic pressure, and organization type. This study adopts the quantitative content validity approach from Lawshe [10] model with some revision from [8, 9], as Lawshe [10] on the response rating scale. The involvement of experts is vital in content validity process, therefore this study conducted two rounds of content validity process with the content experts. Two rounds of content validity process are necessary when there is modification on the items emerged after the first round conducted [9]. The study involves four main steps for developing Enterprise Architecture Adoption Questionnaire (EAAQ) as shown in Figure 1. These steps are also relatively consistent with other studies [5, 6, 9, 16].

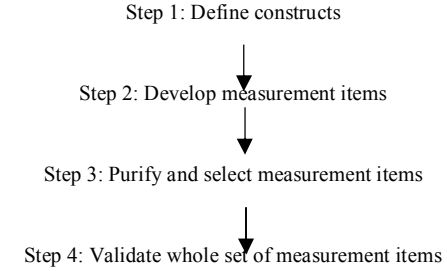

Figure 1: Steps for developing EAAQ

IV. FINDINGS

A. Define constructs

This procedure defines the construct clearly and precisely based on the literature, and proposes a new taxonomy of the construct based on the literature for this research. The operational definition of construct is as shown in TABLE 2. An instrument is a quantitative data collection tool for measuring, observing, or documenting numerical data [2]. The instrument that will be used in this study is a questionnaire. The questionnaire is designed based on previous studies. The items to be measured are adapted from the previous research that are relevant to this study. Instruments that are widely cited and frequently used by other researchers are good criteria for choosing a good instrument [2]. Therefore the content validity has been fulfilled [17]. While the reliability and accuracy of scores from instruments will be obtained through internal consistency across the items [2]. The coefficient alpha is used to test the internal consistency [18]. The items will go through the process of pre-test and pilot test. TABLE 2 shows the summary of definition construct, measurement items source of measurement items for this research method.

TABLE 2. DEFINITION OF CONSTRUCTS

Constructs	Definition of Constructs
Intention to Adopt (INT)	The intention to adopt EA [19]
Technological Context	The characteristic, internal and external technologies that can foster EA adoption [20]
Sufficient ICT Infrastructure (ICT)	The degree to which the organisation has the sufficient technology infrastructure to implement EA [21]
EA Complexity (CPX)	The degree of difficulty to understand, facilitate, and implement the EA [23]
Organisational Context	The characteristics, internal pressure, and resources of the organisation [20]
Top Management Support (TMS)	Providing necessary involvement, resources, and authority in guiding and assisting the EA adoption in the organisation [25]
Organisational Readiness (OR)	Readiness from different organisational levels, adequate technical support, experienced people and EA knowledge and skill within the organisation that can provide a significant business advantage [23, 27]
Clear Communication (COMM)	The extent of communication that exists between organisational members that they can state their opinions, thoughts, and feelings without fear to gain a mutual understanding about the organisation's strategies and objectives of EA adoption [29]
Normative Pressure (NP)	Normative pressures result from the demands of professional associates, organisational culture and the extent to which the government promote the use of information technology and especially EA [30, 31]
Expected Benefits (EB)	The organisational benefits stem from adopting EA [33]
Good Governance (GVR)	The strategy and the operating model in term of defining the roles, responsibilities, and procedures used by an organisation for internal activities and EA adoption [35]
Organisation Size (OS)	The larger organisation facilitates the adoption of Enterprise Architecture [36]
Environmental Context	The sector within which the organisation operates, external pressures and opportunities that may have an influence on the EA adoption [20]
External Support (EXT)	The existence of vendors, agencies, and businesses in the external environment of the agency in order to support the adoption of EA activities [23]
Coercive Pressure (CP)	The extent of formal and informal pressures perceived by virtue of the competitive conditions, and requirements and incentives from the federal or local government and industry associations [38]
Mimetic Pressure (MP)	Mimetic pressure to conform to other organisations caused by the extent of EA adoption or by the perceived success of EA adoption by other organisations in the same industry [38]
Organisation Type (OT)	Organisation type refers to federal and state governments in Malaysia Public Sector (MPS) [40]

B. Develop measurement items

This step involves finding the scale of measurement items and content expert assessment.

1) Scale of measurement items

The measurement items were collected using a combination of deductive and inductive approaches. Multiple items were gathered in the item pool to measure different dimensions of the construct. We reviewed the literatures published in high impact journals such as MIS Quarterly, showed the empirical information such as Cronbach alpha, and widely cited and used in relevant research [2]. There were various opinions about the number of optimal measurement scales such as even-numbered (2, 4, 6, 8 or 10) or odd-numbered (3, 5, 7 or 9) scales [41]. For odd-numbered scale, numbers that were in the middle represent the choice of neutral, impartial, not sure, don't know or not applicable. On the other hand, the even-numbered scale had to choose respondents' answers as either positive or negative responses. Odd numbered scale could adapt the model accurately compared to even numbered scale [6, 8]. Therefore, this study used the five Likert-scale to show the appropriateness and clarity of the responses. Thus, this study questionnaire used scale 5 encompassing 1-strongly disagree, 2-disagree, 3-neutral 4-agree, 5-strongly agree to reflect the expert's assessment of the items.

2) Content Expert Assessment

Experts from academic and industry were invited to act as panellists for content validation process through email invitation or meeting sessions. These experts were identified

based on their expertise in different domains such as Information System, Enterprise Architecture, research method, statistics, and public sector. There were several opinions in the determination of the number of experts. Lawshe [10] suggested that the panel of experts consists of at least four people, [8] proposed 8 to 16 people, and [6] identified 9 experts. For their content validation process, Tojib and Sugianto [9] involved 6 experts in the first round and 3 experts in the second round. The number of experts chosen in Tojib and Sugianto [9] study met the minimum requirement of panellists proposed by Lynn 1987. From the 14 content experts invited, only 11 experts responded. In this study, 4 experts have been identified for the first round and 8 experts for the second round of content validation process to evaluate face and content validity of the scale. The panellists provided informed consent for participation in the study and each panellist evaluated the relevance of all measurement items of EAAQ independently. The panellists expressed their opinions on the validity of all 50 items on a five-Likert scale (1: Strongly Disagree; 2: Disagree; 3: Somewhat Agree; 4: Agree; 5: Strongly Agree). Their opinions were taken seriously for further refinement and improvement of EAAQ items.

C. Purify and Select Measurement Items

The process of quantifying the consensus among panels for every item is analysed using CVR and Mean. Retention of items is based on items that meet the minimum CVR value and via versa.

1) Content Validity and Mean

The measurement model used for individual scale items in this study is CVR based on Lawshe [10] model. The model is reasonable as the number of panellists involved in the study is less than 10 [42]. This step involves statistical analysis based on CVR and CVI [8, 10]. There were some critics on the evaluation of CVR model by Lawshe [10] in quantifying of consensus of panellists and response process. According to [8, 13], there is confusion linked to Lawshe [10] codes (1-Essential; 2-Useful but not essential, 3-Not necessary). The weighting concept proposed by Lawshe [10] is not congruent with content validity analysis method used by [8], [14], and [9]. The argument is consideration for both logical and empirical evidence for content validity analysis. Therefore this study used a different 5-point Likert scale and employed judgements mean used in Allahyari, et al. [8] study to fill these gaps. This study involved two rounds of content validity process with different content experts with the same level of expertise. Two rounds process of content validity are required in this study because we believe that it is necessary when there is modification and refinement items based on first round process. This shows the rigorous process of assessment employed by this study to increase the confident level and content validity of measurement items. This is consistent with Tojib and Sugianto [9] said that there is limited study implicating measures during this step or development stage. The formula is shown as follows:

$$CVR = (Ne - N/2)/(N/2) \quad (1)$$

where
Ne = the proportion of experts who rated the item as a 4 or 5 on a 5-point scale
N = the total number of experts.

For the eight panellists in the second round content validation process reported, the cut-off point for excellent CVR was set at ≥0.75. Interpretation of the CVR value of judgments on components is given in TABLE 3.

TABLE 3. MINIMUM CVR VALUE [10]

Numbers of panellists	Minimum acceptable CVR value
5	0.99
6	0.99
7	0.99
8	**0.75**
9	0.78
10	0.62
11	0.59
12	0.56
13	0.54
14	0.51
15	0.49
20	0.42
25	0.37
30	0.33
35	0.31
40	0.29

For purpose of calculating the mean for each item, the following conversion was done for the values reflected in the questionnaire [8]:

Strongly Agree (5) or Agree (4) - was replaced by 2
No Idea (3) - was replaced by 1
Strongly Disagree (1) or Disagree (2) - was replaced by 0

According to [10] only those components and links with CVR values and meeting the minimum values were retained in the final form. An item is accepted for final items if its mean value of experts assessment is higher than 1.5. This signals that the mean is closer to the "Strongly Agree" or "Agree" rather than the value of the expert assessment "0" or "No Idea". On the other hand, if the mean value of expert assessment is lower than 1.5, the item would be rejected as the expert assessment showed that the item is not appropriate to measure the construct. However, the items would accept CVR equal or higher than 1.5. The summary of criteria used to finalise the measures are as shown in

TABLE *4*.

TABLE 4. SUMMARY OF CRITERIA FOR FINALISING THE ITEMS

Status	Criteria
Accept	If CVR ≥ 0.75. Only for the panellist = 8
Accept	0 ≥ CVR ≤ 0.75 AND Mean > 1.5
Reject	If CVR ≤ 0 AND Mean < 1.5

Therefore two items were rejected and only 50 items remain. The result for CVR and Mean for this study is shown in

TABLE *5*.

D. Validate whole set of measurement items

1) Content Validity Index (CVI)

To quantify and interpret the content validity of final questionnaire, Content Validity Index (CVI) was used in this study. CVI was computed for the whole set of item remained in the content validated process. Only the inclusions of item where the mean of the CVR values of retained items were analysed. The formula as shown in CVI = $\overline{\sum_{n}^{1} \boldsymbol{CVR}}$ / Retained items *(2)* used in this study by Lawshe [10] seeing that the value of CVI showed the unity of experts' assessment concerning the validity, adequacy, and clarity of questionnaire. A CVI value close to 0.99 indicates that the overall content validity of the measurement items would be higher [10]. The CVI value for this study was 0.94 which is close to 0.99, indicating that the validity for EAAQ is high.

$$\text{CVI} = \overline{\sum_{n}^{1} \boldsymbol{CVR}} \,/\, \textit{Retained items} \qquad (2)$$

TABLE 5. CVR AND MEAN RESULTS FOR THIS STUDY

Measurement items	CVR	Mean	Result
ICT1	0.75	1.9	ACCEPT
ICT2	1.0	2	ACCEPT
ICT3	0.75	1.9	ACCEPT
ICT4	0.5	1.38	REJECT
ICT5	0.5	1.38	REJECT
CPX1	1.0	2	ACCEPT
CPX2	0.75	1.9	ACCEPT
CPX3	1.0	2	ACCEPT
CPX4	1.0	2	ACCEPT
TMS1	1.0	2	ACCEPT
TMS2	1.0	2	ACCEPT
TMS3	1.0	2	ACCEPT
TMS4	1.0	2	ACCEPT
OR1	1	2	ACCEPT
OR2	1	2	ACCEPT
OR3	1	2	ACCEPT
OR4	1	2	ACCEPT
COMM1	1	2	ACCEPT
COMM2	1	2	ACCEPT
COMM3	0.75	1.9	ACCEPT
COMM4	0.75	1.9	ACCEPT
COMM5	1	2	ACCEPT
COMM6	1	2	ACCEPT
NP1	0.75	1.9	ACCEPT
NP2	0.75	1.9	ACCEPT
NP3	0.75	1.9	ACCEPT
NP4	0.75	1.9	ACCEPT
EB1	0.75	1.9	ACCEPT
EB2	0.75	1.9	ACCEPT
EB3	0.75	1.9	ACCEPT
EB4	0.75	1.9	ACCEPT
EB5	0.75	1.9	ACCEPT
GVR1	0.75	1.9	ACCEPT
GVR2	0.75	1.9	ACCEPT
GVR3	0.75	1.9	ACCEPT
GVR4	0.75	1.9	ACCEPT
GVR5	0.75	1.9	ACCEPT
GVR6	0.75	1.9	ACCEPT
OS1	1.0	2	ACCEPT
EXT1	1.0	2	ACCEPT
EXT2	1.0	2	ACCEPT
EXT3	1.0	2	ACCEPT
EXT4	1.0	2	ACCEPT
EXT5	1.0	2	ACCEPT
MP1	1.0	2	ACCEPT
MP2	1.0	2	ACCEPT
MP3	1.0	2	ACCEPT
CP1	1.0	2	ACCEPT
CP2	1.0	2	ACCEPT
CP3	1.0	2	ACCEPT
OT1	1.0	2	ACCEPT
INT1	1.0	2	ACCEPT
INT2	1.0	2	ACCEPT
INT3	1.0	2	ACCEPT

V. DISCUSSION

The main purpose of content validity assessment conducted in our study is to develop and validate the measurement items for EAAQ. The quality of EAAQ developed in this study is adequate, appropriate to, and demonstrative of, the construct. Therefore, the involvement of content experts is important to assess the measurement items. We conducted two-round process with different content experts having the same level of expertise. Two-rounds of content validity process is necessary when there is modification on the items emerged after the first round conducted [9]. First round was exhaustive because the content experts assessed the instrument thoroughly and modifications were done for example deleting, refining, or adding items. The researcher had to accommodate these comments and do inductive study such as literature review. Bear in mind, in defining and generating items, researcher did extensive literature reviews. To choose a good instrument for this study, the researcher followed the suggestion from Creswell [2] such as reliability and validity are visible in the previous study, widely cited, frequently used, and accepted measurement scale. In the second round, the process to quantify the consensus form content experts are done suitably. Consequently, the confident level of clarity and appropriateness of EAAQ is higher for the researcher.

Overall, this study contributes to the existing research on EAAQ measures by defining the constructs of EAAQ, conducting two-round process with experts, analysing the measurement items rigorously, purifying and constructing final items for each of the constructs. Furthermore, since there is lacking contribution that involve CV in Information System (IS) study especially measurement items in EAAQ, this study try to complement and expand the literature by conducting two-rounds process of CV quantitatively as shown in

TABLE *5*. Nevertheless, our study has limitation. EAAQ needs to test its reliability by conducting pre-test and pilot test as suggested by [1, 2]. Prior to that, Exploratory Factor Analysis (EFA) can be used to test data from the pilot test. This is one of the methods used to refine and evaluate tests, scales and measure. Furthermore, EFA is considered method for interpreting self-reporting questionnaires.

VI. CONCLUSION

In conclusion, a total of only 50 items from 52 items remain after content validation process. This indicates that the items were constructed through rigorous process. The first and foremost process is defining the good constructs and finding good instruments to measure the constructs. Then, the CVR is prominent measurement model to quantify the content experts' consensus using statistical analysis. Decision for the inclusion and exclusion of items were made clearly and adequately. The researcher suggests that all 50 validated items to undergo a pre-test and pilot test using real respondents. Therefore, the EAAQ is proven tested and reliable instruments. Through the empirical analysis, the reliable and validity item selected after some anticipated consideration such as internal consistency and correlation coefficient in order to fulfil the validity test.

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