Development of public participation framework for environmental impact assessment

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Abstract: Public participation is essential in an environmental impact assessment (EIA) that protects and manages the environment. Current studies have shown that the application of effective public participation remains scant, especially in Malaysia. This paper aims to develop a framework for public participation in the EIA process using partial least squares (PLS). A comparative study was conducted on public participation in EIA administered in New Zealand, Canada, Hong Kong and Malaysia. Quantitative data were collected via questionnaire surveys. Analyses were administered using PLS-SEM. Three constructs form the framework: the inadequacies of the requirements for, and legislation on, public participation in EIA; barriers to public participation in EIA; and recommendations to further improve public participation in EIA. The development of the framework is expected to improve the current application of public participation in the EIA process. The framework provided in this research contributes to the further improvement of public participation in EIA.

Keywords: public participation; environmental impact assessment; EIA; Malaysian EIA process; partial least square; PLS; PLS-SEM; exploratory factor analysis; EFA; quantitative method; effective EIA; Malaysia; measurement model; structural model.

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1 Introduction

Public participation is a prominent part of an environmental impact assessment (EIA) as it has been emphasised that it is an essential component of sustainability by the United Nations Environment Programme (UNEP) (Au et al., 2000; Sharpe and Conrad, 2006). The need for public participation was internationally introduced through Principle 10 of the Rio Declaration in 1992, and further expressed through Chapter 23 of Agenda 21 (Alam, 2014; DOE, 2016). Johnson and Dagg (2003) elaborated that the 10th principle in the Rio Declaration highlighted the need to apply participation in key environmental decisions. Agenda 21 also recapitulated the importance of public participation in the decision-making process. Public participation was prominently expressed again in the Aarhus Convention in 1998, where participation in environmental decision-making was regarded as a public right in relation to sustainable development (Alam, 2014; Johnson and Dagg, 2003; Reed, 2008). Reed (2008) added that the right to public participation that is embedded in the Aarhus Convention has further strengthened the application of participation in multiple environmental interests and pressure groups.

Public participation incorporates public interests, concerns, needs, and values by way of conducting a hearing and consultation to promote quality decision-making (Aiyeola et al., 2014; Ismail and Said, 2014; Omar, 2009; Ramli et al., 2012). Two other authors added that public participation is an empowerment process that enables the involvement of local people in influencing the decision-making process (Ahmad et al., 2013; Dian and Abdullah, 2013). Furthermore, public participation is a continuous process that involves two-way communication and interaction between the community and the authorities (Creighton, 2005; Dian and Abdullah, 2013; Ismail and Said, 2014; Tazin and Yaakop, 2015; Tigawuve, 2012). Omar and Leh (2009) and Omar (2009) elaborated further on the process of public participation, which encourages the public to contribute feedback and input by conducting a dialogue with the authorities.

This integrates the public's ideas, viewpoints and preferences into the decision-making and creates a more responsive and democratic form of governance (Boyte and Kari, 1996; Dian and Abdullah, 2013; Omar, 2009; Omar and Leh, 2009). In conclusion, the definition of public participation integrates the concepts of empowerment, human rights and democracy, and involves two-way communication between the public and the authorities that generates constructive decisions, thus enhancing the decision-making process for the benefit of all parties.

The installation of public participation in an EIA not only improves the transparency of the decision-making process but also empowers communities, allowing apposite solutions and the requirements of the communities to contribute to the formation of decisions in regard to a proposed development (Fitzpatrick and Sinclair, 2003; Jiayu, 2011; O'Faircheallaigh, 2010; Pölönen et al., 2011). Additionally, three authors agreed that effective public participation will foster fair and democratic decisions that value the

opinions and views of the related community (Alam, 2014; Kanniah, 2000; Maidin, 2011). Effective public participation not only has positive impacts on the EIA process, but also coincidentally helps by reducing or avoiding public controversy, confrontation and delay (Ahmad et al., 2013; Ernsta, 2019).

Public participation in EIA in developing countries appears to be ineffective due to poor communication, poor access to information and a lack of transparency in decision-making (Hartley and Wood, 2005; Nadeem and Fischer, 2011; Shepherd and Bowler, 1997). This situation also applies to the current application of public participation in EIA in Malaysia. Public participation is the core component used in evaluating EIA in Western Australia, New Zealand and Canada (Author, 2014). Meanwhile, public participation in Malaysia is not the main component in the decision-making process for EIA in Malaysia. Yew and Zhu (2019) also highlighted that there is an absence of public participation in the EIA procedure that is administered in Malaysia. According to the Environmental Quality Act 1974, public participation is considered an 'environmental procedural right' in Malaysia (Anuar, 2012). Nonetheless, Maidin (2011) stated that there is a serious absence of the statutory rights that position public participation within the decision-making system in Malaysia. This absence of 'environmental substantive rights' provision under the Malaysian Federal Constitution has caused public participation to remain only as an 'environmental right' under Malaysian legislation (Anuar, 2012). Alam (2014) further explained that the inadequacies that arise in the EIA requirements and legislation increase the risk of the environment being affected by the negative impacts imposed by proposed developments.

Thus, this paper aims to contribute to the body of literature by developing a framework for public participation practice relating to EIAs in Malaysia. Even though public participation is said to be present in EIA evaluations in Malaysia, evidence concerning the effective application of public participation in EIA is barely adequate. The framework focuses on the requirements and legislation in terms of EIA public participation practice, the barriers regarding EIA public participation practice and the recommendations to alleviate the barriers to EIA public participation practice in Malaysia. Furthermore, this paper reports on quantitative data analyses using PLS-SEM that form the framework. This paper presents quantitative data collected from EIA consultants and environmental non-governmental organisations (NGOs) that are active in the EIA field in Malaysia. The results are discussed, and the framework is represented at the end of the paper.

1.1 Comparative study on public participation in EIA

The National Environmental Policy Act (NEPA) was the first form of legislation that incorporated the EIA as the main environmental assessment tool in 1969 (Agrawala et al., 2010; Bhatia and Wernham, 2008; Bond et al., 2020; 2021; Markham, 1983; Morgan, 2012; Ogola, 2007; Yang, 2019). In analysing the EIA system adapted in developing countries, Abaza et al. (2004) has stated that Malaysia has been one of few developing countries that have established their own EIA systems since the late 1970s. Abaza et al. (2004) added that the effect of globalisation in developing countries has led to accelerated economic growth, while heightened environmental deterioration has demanded the utilisation and development of an EIA system. On the contrary, Wood (2003) contended that Asian countries, such as Hong Kong, have followed other western countries, such as Canada, on the path to establishing EIA legislation after many years of

EIA practice. Nevertheless, Abdul-Sattar (2007) indicated that public involvement in the EIA process is different in every country. The differences in the application of public participation in the EIA process are most apparent when developed and developing countries are compared (Abdul-Sattar, 2007; Boyle, 1998; Wood, 2003). Therefore, a review comparing the EIA systems in developed countries, such as New Zealand, Canada and Hong Kong, with the EIA system in Malaysia is provided in this paper.

1.1.1 EIA legislative framework and enforcement agents

Table 1 summarises the respective legislative framework and enforcement agents for New Zealand, Canada, Hong Kong and Malaysia. The Resource Management Act (RMA) came into force on 1 October 1991 and is the principal form of environmental legislation in New Zealand (Baba, 2003; Makmor and Ismail, 2014; MfE, 2006). According to BCITO (2018), the enforcement agent for the RMA is the Ministry for the Environment (MfE). Nevertheless, the MfE is not the authority responsible for administering the EIA or AEE in New Zealand. Scott and Ngoran (2003) said that the RMA only provides the proper guidelines for the EIA or AEE processes in New Zealand. The entities that are responsible for administering the implementation of the EIA or AEE in New Zealand are the regional councils, district councils and city councils (BCITO, 2018; Makmor and Ismail, 2014; MfE, 2006; Scott and Ngoran, 2003).

Table 1 Comparison on EIA legislative framework

Countries / *EIA framework*	*New Zealand*	*Canada*	*Hong Kong*	*Malaysia*
EIA law/ regulations	The RMA	IA)	EIAO	EQA
Year of implementation	1991	2019	1998	1974
Enforcement agency	MfE	IAAC	EPD	DOE
Segregation of EIA legislation	Not applicable	The EIA legislation is segregated between one federal, ten provincial and three territorial governments	Not applicable	The EIA jurisdiction differs between the Peninsular Malaysia and the state of Sabah and Sarawak

The Canadian Environmental Assessment Act (CEAA) was introduced and officially promulgated in January 1995 by the Canadian Parliament (CIDA, 1996; Makmor and Ismail, 2014; Paci et al., 2002; Powell, 2014). Larkin et al. (2019) added that the CEAA was amended in 2012 and reintroduced as CEAA2012, which was utilised by Canada until 2019. The Government of Canada launched a review of its regulatory and environmental processes in 2016, and the CEAA2012 was replaced with the Impact Assessment Act (IAA) (Canada, 2019; Hunsberger et al., 2020; Larkin et al., 2019; Vypovska et al., 2020). The IAA is a new Act that protects the environment, fish and waterways, respects Indigenous rights and rebuilds public trust in decision-making over

resource development (Canada, 2018; IAA, 2020; Vypovska et al., 2020). The enforcement agents for EIA in Canada were also changed from the Canadian Environmental Assessment Agency to the Impact Assessment Agency of Canada (IAAC) which is referred to as 'the Agency' (Canada, 2018, 2019; Vypovska et al., 2020). Larkin et al. (2019) stated that the IAAC is a single government impact assessment that is in charge of leading assessments and coordinating crown consultations with indigenous people.

The EIA process was inaugurated in Hong Kong through an administrative application from 1979 to 1986 and a systematic application from 1986 to 1991 (Au, 1998; Au and Hui, 2004; Wood and Coppell, 1999). Hong Kong's EIA directive was revised in 1992 to formalise the environmental monitoring and audit requirements. Since then, it has been

applied to all major developments in both the public and private sectors (Au, 1998). The Technical Memorandum was published in 1997 (Au, 1998; Au and Hui, 2004; Wood and Coppell, 1999). The environmental impact assessment ordinance (EIAO) was formally enacted in 1997 and went into effect in 1998 (Au, 1998; Au and Hui, 2004; Hui and Ho, 2008; Tang et al., 2016; Wood and Coppell, 1999). The designated enforcement agency responsible for the EIA Ordinance in Hong Kong is the Environmental Protection Department (EPD) (Tang et al., 2016).

The Government of Malaysia enacted a legal statute in 1974 to prevent, reduce and regulate the pollution levels, thus improving the environment in Malaysia (Makmor and Ismail, 2016; Memon, 2000; Mustafa, 2011; Rahman, 2011). The Environment Quality Act 1974 (EQA) is a federal environmental statute that enhances the quality of the environment by utilising regulations and licensing, as well as liaising over information related to the community with regards to the environment (Briffet et al., 2004; Emang, 2006; Mustafa, 2011; Said et al., 2008). The governing body for EIA in Malaysia is the Department of Environment (DOE), which is currently situated within the Ministry of Natural Resources and Environment (NRE). The DOE plays a vital role in monitoring and administering the policies related to environmental management, including all the provisions under the EQA 1974 (Briffet et al., 2004; Makmor and Ismail, 2014; Mustafa, 2011).

Canada is one of the countries that have segregated jurisdictions on EIA at the federal and state level (UNEP, 2018). Such countries distribute the power within the country in accordance with the level of decentralisation, which in this case is the authority related to EIA, which is shared through different levels of government (UNEP, 2018). UNEP (2018) and Vypovska et al. (2020) explained that the power of law-making in Canada is distributed and shared between one federal, ten provincial and three territorial governments. Vypovska et al. (2020) added that the environmental regulations in Canada at the federal and provincial level may overlap, and the project proponents are required to comply with both provincial and federal regulations on EIA. However, the scope of the EIA requirements might differ between the federal and provincial jurisdictions, and specific regulations at both levels are issued to facilitate the delegation of powers (Vypovska et al., 2020).

A similar segregation of powers was adapted in the EIA system in Malaysia (Memon, 2000). The delegation of powers on EIA jurisdiction was differentiated between Peninsular Malaysia and the states of Sabah and Sarawak (DOE, 2015, 2016; Makmor and Ismail, 2014). Memon (2000) explained that the delegation of powers is administrated due to the vast coverage of forests and natural resources in both states, which needed protection from the adverse impacts of development. The EIA legislation and requirements of Sabah and Sarawak differed from those of Peninsular Malaysia as they have additional EIA legislation and requirements that are specifically designed for the conditions of their states (DOE, 2015, 2016; Makmor and Ismail, 2014).

1.1.2 Public participation in EIA process

Table 2 provides a compilation of levels of public participation in EIA administered in New Zealand, Canada, Hong Kong and Malaysia. From Table 2, it is evident that the EIA process, as administered in New Zealand, Canada and Hong Kong, provides more opportunities for the public to participate throughout the EIA process. The level of transparency in these three countries is higher compared to Malaysia, as the three countries provide easy access for the public to view information related to the EIA process. The Malaysian EIA process provides opportunities for the public to participate only in the preparation and review stages of the EIA, while limited participation is administered in the scoping stage. New Zealand and Malaysia do not provide any opportunities for participation in the follow-up process. On the contrary, Canada and Hong Kong provide public participation opportunities at the follow-up stages of the EIA. Moreover, the three countries have special policies or provisions, whereby New Zealand and Canada have provisions for the participation of Indigenous people, and Hong Kong has a special policy on follow-up policies, such as the continuous public involvement (CPI). In conclusion, the EIA process administered in Malaysia is observed to be deficient compared to that administered in New Zealand, Canada and Hong Kong.

2 Research method

This study started with a review of selected literature on the topic of public participation in an EIA. The main data collection was administered using questionnaire surveys with two groups of respondents. The quantitative findings were then analysed and contextualised to form the framework for public participation practice in terms of EIAs in Malaysia.

In this study, purposive sampling was applied, whereby the sampling subjects were targeted based on their involvement in the process of public participation in EIA in Malaysia. The sampling subjects were chosen to represent the two sides of the parties involved in a public participation process. The EIA consultants were the subjects for the organiser, while the environmental NGOs were the subjects for the participants, in regards to the public participation process.

Table 2 Comparison on public participation in EIA process

EIA categories	*New Zealand*	*Canada*	*Hong Kong*	*Malaysia*
Screening	Written consents from affected communities are required. Affected communities have the right to appeal (if issues present) to the planning tribunal.	Public participation with the affected communities and Indigenous people led by the Agency.	The public and the ACE are able to comment on Project Profile (Statutory EIA). Public is able to review related information and comment in the screening and scoping process (CPI)	No public participation element is included at this stage.
Scoping	Consultations with related authority in the AEE system and affected communities (AEE preparation). Identify and notify affected parties (Resource Consent).	Public participation with the affected communities and Indigenous people led by the Agency.		Limited public participation is included in the review of the TOR by the EIA Technical Review Committee (EIATRC) where Appointed Individuals (AIs) from Non-Governmental Organizations (NGOs).
EIA Report	Additional participation is allowed if required (AEE preparation). Public notification is required in accordance to full notification or limited notification (Resource Consent).	Include information from engagements with Indigenous people and the public. The Agency post a notice notifying the public on the commencement of the review of the IA.	Public is able to review related information and comment in the screening and scoping process (CPI)	Public participation element exists through public engagement by EIA consultants on behalf of the project proponent. Only required for Schedule 2 activities.
EIA review	Pre-hearing meeting and public hearings are organised.	Public engagement sessions with public and indigenous people led by the Agency.	The public and the ACE are able to comment on Project Profile (Statutory EIA). Public is able to review related information and comment in the screening and scoping process (CPI)	Public participation element exists through EIA display to collect comments from public for Schedule 2 activities
EIA decision	No public participation element is included at this stage.	The Agency is responsible to publicise the Decision Statement including reasons for the decision, explanation of how report and the public interest factors were considered on the Agency's website	Public is able to review related information and comment in the screening and scoping process (CPI)	No public participation element is included at this stage.
EIA follow-up	No public participation element is included at this stage.	Indigenous People and other communities are able to participate in Monitoring Committees and inform the Agencies of potential non-compliance by the proponent	Involves Environmental Team (ET) and Independent Environmental Checker (IEC) to ensure compliance with the follow-up requirements. Follow-up results are posted on website hosted by the EPD (web-based EIA follow-up)	No public participation element is included at this stage.
Indigenous participation	Provisions for Maori communities as indigenous consultations are included in each public consultation.	Indigenous Engagement and Partnership plan is utilised in almost every stages of the EIA process.	Not Applicable	Not Applicable
Additional policy	Not Applicable	Not Applicable	CPI where the public is informed and invited to participate in all stages from the environmental planning, EIA and Environmental Monitoring and Audit (EM&A) processes	Not Applicable

3 Data collection

The invitations for participation were sent to 75 registered EIA consultants and 17 environmental NGOs via email. A period of 30 days was allocated for the targeted respondents to participate in the online questionnaire survey using Google forms. After 60 days of administering the questionnaire survey, a process of filtration of the completed questionnaires was administered, to scrutinise the questionnaires used and form the database for the final data analysis. A total of 28 out of 75 EIA consultants and seven out of 16 environmental NGOs completed the questionnaire survey online and offline. The response rates of 37% and 44% were identified as appropriate to be used in the final data analyses.

4 Data processing

The main data analyses utilised PLS-SEM software as this can work efficiently with small sample sizes and makes practically no assumptions about the underlying data. This study identified 75 registered EIA consultants and 17 environmental NGOs. A hierarchical model was applied in this study due to the multiple indicators under each construct, which formed two layers of component models. Thus, the application of PLS-SEM was the most appropriate method of analysing the collected data in this study.

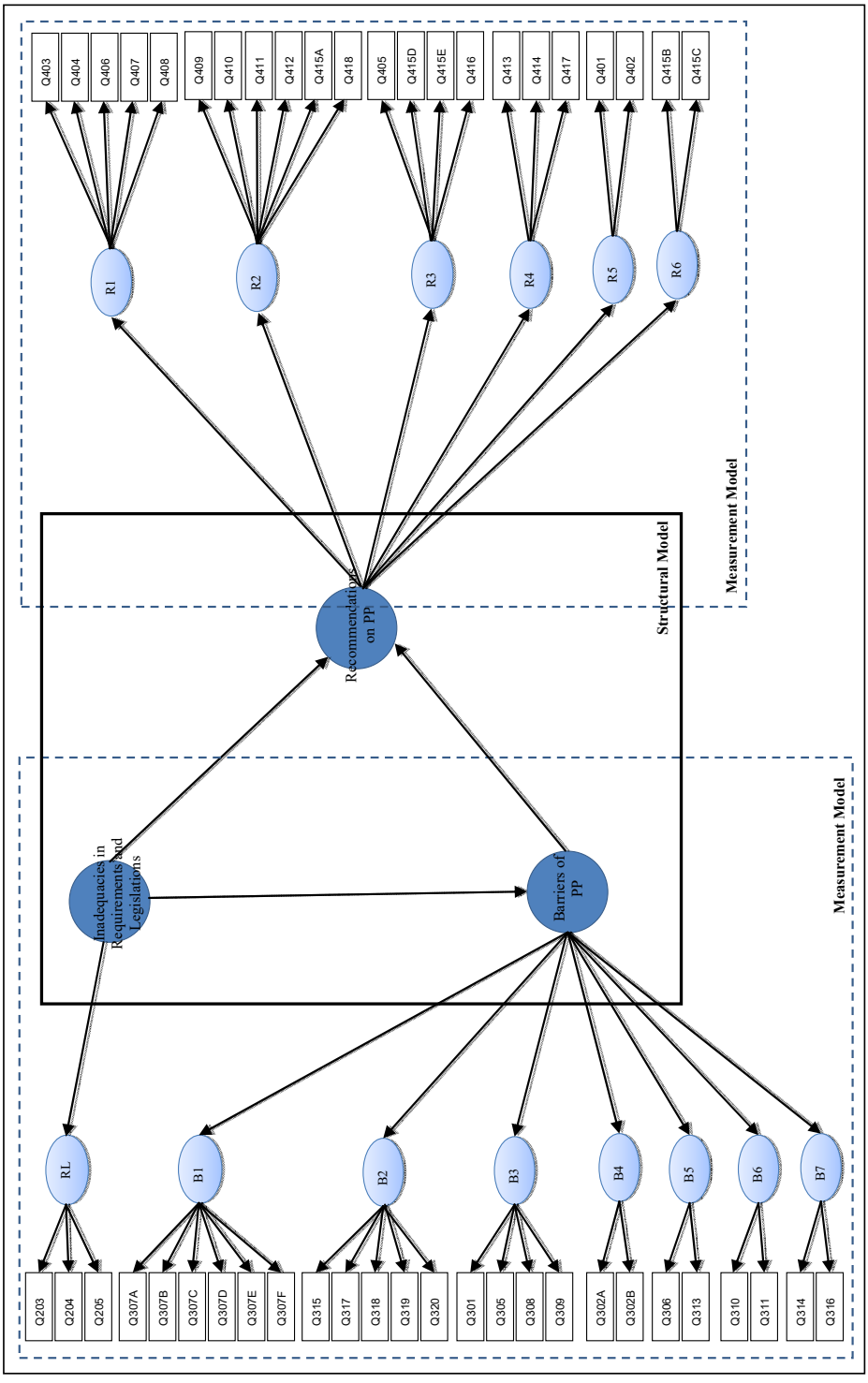
5 Results

5.1 Partial least square (evaluation of measurement model)

Figure 1 presents the reflective measurement and structural model evaluated using PLS-SEM. A measurement model describes the relationship between a construct and its items. The assessments in the reflective measurement model included composite reliability and Cronbach's alpha to evaluate the internal consistency, indicator's outer loadings for indicator reliability, and average variance extracted (AVE) to evaluate the convergent validity. In addition, the discriminant validity was evaluated using three methods, which were the Fornell-Larcker criterion, cross-loadings and heterotrait-monotrait ratio (HTMT) (Hair et al., 2014a).

The first assessment of a measurement model is to determine the indicator reliability, which refers to outer loadings. The preferable value for outer loadings is 0.70 or higher (Hair et al., 2014a, 2014b; Henseler et al., 2009). The items that have outer loadings of below 0.70 were evaluated before the removal of the said items. Hair et al. (2014a) elaborated that the effects of the item removal on the composite reliability and the construct's content validity are to be examined. Basically, the items with outer loadings from 0.40 to 0.70 should be considered for removal if the removal of the said items leads to an increase in the composite reliability (or the AVE) above the threshold value (Hair et al., 2014a). Hair et al. (2014a) and Henseler et al. (2009) both agreed that the items with outer loadings below 0.40 should be removed without any considerations. After the assessment of outer loadings, six items from the total of 54 items were removed.

Figure 1 Reflective measurement and structural model (see online version for colours)



The next assessments to be evaluated were the internal consistency reliability, which consists of composite reliability, and the convergent validity, which refers to the AVE. The internal consistency reliability values for composite reliability ranged from 0 to 1. Values more than 0.60 are considered acceptable, values above 0.70 are deemed preferable, and values more than 0.95 are not desirable (Andres, 2010; Hair et al., 2014a; Hamid et al., 2017) Hamid et al. (2017) defined convergent validity as an assessment to measure the level of correlation of multiple indicators in the same construct. An AVE value of 0.50 indicates that the construct is able to explain more than half of the variance of its indicators (Hair et al., 2014a, 2014b; Henseler et al., 2009). Conversely, Hair et al. (2014a) mentioned that an AVE value of less than 0.50 indicates that the indicator contains more errors in the average rather than in the variance explained by the construct.

Discriminant validity is defined as the extent to which a construct is truly empirically different from other constructs (Hair et al., 2014a, 2014b; Hamid et al., 2017; Henseler et al., 2009). Firstly, the Fornell-Larcker Criterion is a measure of discriminant validity that compares the square root of each construct's AVE and its correlations with all other constructs in the model (Hair et al., 2014a; Henseler et al., 2009). The value of the square root of each construct's AVE should be greater than the squared correlations with other constructs. Analysis of the Fornell-Larcker Criterion showed that the square root of the AVEs for each construct was higher than the correlation of these constructs with the other latent variables in the path model.

Cross-loading was the second test to verify the discriminant validity for the measurement model. Cross-loadings evaluate the indicator's outer loadings to be greater than the outer loadings of the other constructs, with a threshold of outer loadings of more than 0.70 (Hair et al., 2014a, 2014b; Hamid et al., 2017; Henseler et al., 2009). In this study, the results for the cross-loadings showed that all the indicator's loadings on a construct were higher than all of its cross-loadings with another construct.

Table 3 Summary of results of the assessments on the reflective measurement model

Construct	*Items*	*Outer loadings (> 0.70)*	*Indicator reliability (outer loadings²)*	*Composite reliability (0.70–0.95)*	*AVE (> 0.50)*	*Discriminant validity (Fornell-Larcker criterion, cross loading and HTMT)*
RL2	Q 203	0.914	0.835	0.918	0.789	Yes
	Q 204	0.929	0.863			
	Q 205	0.817	0.667			
B1	Q 307A	0.867	0.752	0.943	0.736	Yes
	Q 307B	0.775	0.601			
	Q 307C	0.937	0.878			
	Q 307D	0.920	0.846			
	Q 307E	0.770	0.593			
	Q 307F	0.861	0.741			
B2	Q 315	0.627	0.393	0.876	0.589	Yes
	Q 317	0.771	0.594			
	Q 318	0.877	0.769			
	Q 319	0.770	0.593			
	Q 320	0.770	0.593			

Note: The number 2 stands for squared symbol (outer loadings squared).

Table 3 Summary of results of the assessments on the reflective measurement model (continued)

Construct	*Items*	*Outer loadings (> 0.70)*	*Indicator reliability (outer loadings²)*	*Composite reliability (0.70–0.95)*	*AVE (> 0.50)*	*Discriminant validity (Fornell-Larcker criterion, cross loading and HTMT)*
B3	Q 301	0.836	0.699	0.887	0.663	Yes
	Q 305	0.831	0.691			
	Q 308	0.834	0.696			
	Q 309	0.751	0.564			
B4	Q 302A	0.995	0.990	0.900	0.819	Yes
	Q 302B	0.796	0.634			
B5	Q 306	0.960	0.922	0.883	0.792	Yes
	Q 313	0.816	0.666			
B6	Q 310	0.834	0.696	0.842	0.727	Yes
	Q 311	0.871	0.759			
B7	Q 314	0.819	0.671	0.820	0.695	Yes
	Q 316	0.773	0.598			
R1	Q 403	0.844	0.712	0.895	0.630	Yes
	Q 404	0.816	0.666			
	Q 406	0.747	0.558			
	Q 407	0.788	0.621			
	Q 408	0.768	0.590			
R2	Q 409	0.748	0.560	0.935	0.705	Yes
	Q 410	0.917	0.841			
	Q 411	0.853	0.728			
	Q 412	0.848	0.719			
	Q 415A	0.722	0.521			
	Q 418	0.887	0.787			
R3	Q 405	0.809	0.654	0.917	0.734	Yes
	Q 415D	0.882	0.778			
	Q 415E	0.886	0.785			
	Q 416	0.847	0.717			
R4	Q 413	0.908	0.824	0.891	0.733	Yes
	Q 414	0.779	0.607			
	Q 417	0.876	0.767			
R5	Q 401	0.951	0.904	0.928	0.867	Yes
	Q 402	0.911	0.830			
R6	Q 415B	0.871	0.759	0.891	0.804	Yes
	Q 415C	0.920	0.846			

Note: The number 2 stands for squared symbol (outer loadings squared).

Lastly, the final test conducted for the analysis of the discriminant validity for the reflective measurement model was the HTMT. The value of HTMT ranges from 0 to 1, and high discriminant validity is yielded when the ratio is closer to 0. The HTMT ratio values of each construct were below the maximum threshold value of 0.90, which is acceptable. Conclusively, the constructs in this measurement model yielded high discriminant validity as shown by the analysis of the three tests, which were the Fornell-Larcker Criterion, cross-loading analysis and HTMT. Table 3 summarises the results of the reflective measurement models assessment (rounded to three decimal places). The Indicator Reliability is the square of a standardised indicator's outer loadings. It represents the variation in an item explained by the construct and is referred to as the variance extracted from the item. As shown in Table 3, all the model evaluation criteria have been met, providing support for the measurement's reliability and validity.

5.2 Partial least square (evaluation of structural model)

According to Henseler et al. (2009) and Hair et al. (2014b), reliable and valid outer models (measurement models) allow the evaluation of the inner model (structural model) estimates. The evaluation of the inner model involved examining the model's predictive capabilities and the relationships between the constructs. PLS-SEM assesses the quality of a model based on its ability to predict the endogenous constructs (Hair et al., 2014a).

Hair et al. (2014a, 2014b) agreed that there are five key criteria for assessing an inner model (structural model) in PLS-SEM, which are the collinearity issues, the significance path coefficients, the level of R^2 values, the f^2 effect size and the predictive relevance (Q^2).

Table 4 Summary of results of the assessments on the reflective measurement model

Results		*Tolerance level*	*VIF values 0.20–5.00)*	*R^2 values (0.0–1.0)*	*Q^2 values (>0.00)*
Constructs	Inadequacies of the regulations and legislation on public participation	0.861	1.162	-	-
	Barriers of public participation	0.861	1.162	0.139	0.026
	Recommendations on public participation	-	-	0.266	0.088
Results		*Path coefficients (-–.0 to +1.0)*	*t values*	*p values*	*f^2 values*
Relationships	Inadequacies of the regulations and legislation on public participation → barriers of public participation	0.373	2.031	0.04	0.162
	Inadequacies of the regulations and legislation on public participation → recommendations for public participation	0.252	1.542	0.12	0.075
	Barriers of public participation → recommendations for public participation	0.366	2.434	0.02	0.157

The first assessment to be conducted of a structural model was the collinearity assessment, which examined each set of exogenous latent variables in the structural

model for potential collinearity problems. This was to determine if any of the variables should be eliminated, merged into one or simply mean a higher-order latent variable should be developed (Wong, 2013). This assessment evaluates the tolerance level and the Variance Inflation Factor (VIF) values, whereby the acceptable values should be more than 0.20 and less than 5.00, respectively (Wong, 2013; Hair et al., 2014a). Table 4 shows the results of the collinearity assessment. It can be concluded that the independent variables are not highly correlated and there are no collinearity issues between the constructs in the structural model.

The next step was to evaluate the structural model path coefficients, whereby the standardised values of the path coefficients (β) were between -1 to +1. Hair et al. (2014a, 2014b) stated that if the path coefficients are closer to +1, this indicates a strong positive relationship (and vice versa for the negative values), one which is always statistically significant. Nevertheless, the significance of a coefficient depends on the standard error that can be obtained using bootstrapping (Hair et al., 2014a, 2014b). Hair et al. (2014a) added that the bootstrap standard error estimates the empirical t-value, which should be more than the commonly used critical values. In this study, a two-tailed test was used. The given critical values were 1.65 (significance level = 10%), 1.96 (significance level = 5%) and 2.57 (significance level = 1%). Table 4 presents the values for the structural model path coefficients.

As shown in Table 4, the inadequacies of the regulations and legislation on public participation have 0.373 effects on the barriers to public participation, the inadequacies of the regulations and legislation on public participation have 0.252 effects on the recommendations for public participation and the barriers to public participation have 0.366 effects on the recommendations for public participation. Overall, the relationship between the inadequacies of the regulations and legislation on public participation, and the barriers to public participation, has the highest path coefficients, compared to the two other relationships. On the contrary, the relationship between the inadequacies of the regulations and legislation on public participation, and the recommendations for public participation, has the lowest path coefficients compared to the two other relationships. The three path coefficients collected show positive relationships that bind the three constructs in the path modelling. Although the path coefficients for all three relationships are quite low, the significance of the relationship is within the range of the given significance level.

The third step was to measure the coefficient of determination (R^2 values), which is a measure of the model's predictive accuracy using the squared correlation between a specific endogenous construct's actual and predicted values (Hair et al., 2014a, 2014b). According to Hair et al. (2014b), the R^2 values represent the exogenous variable's combined effect on the endogenous variable. Henseler et al. (2009) and Chin (2003) described the range of the R^2 values from 0 to 1; as a rough rule of thumb, 0.67, 0.33 and 0.19 in the partial least square (PLS) path model are seen as substantial, moderate and weak. Nevertheless, a few exogenous variables that explain an endogenous latent variable might cause the R^2 values to be lower (Henseler et al., 2009). However, relying on only R^2 values to explain the significance of the model is not a good approach.

Table 4 shows the R^2 values for the assessment of the coefficient of determination for the structural model. The inadequacies in the regulations and legislation on public participation, and the barriers to public participation, explain 26.60% of the total variance in the recommendations on public participation. Meanwhile, the inadequacies in the

regulations and legislation on public participation explain 13.90% of the total variance in the barriers to public participation.

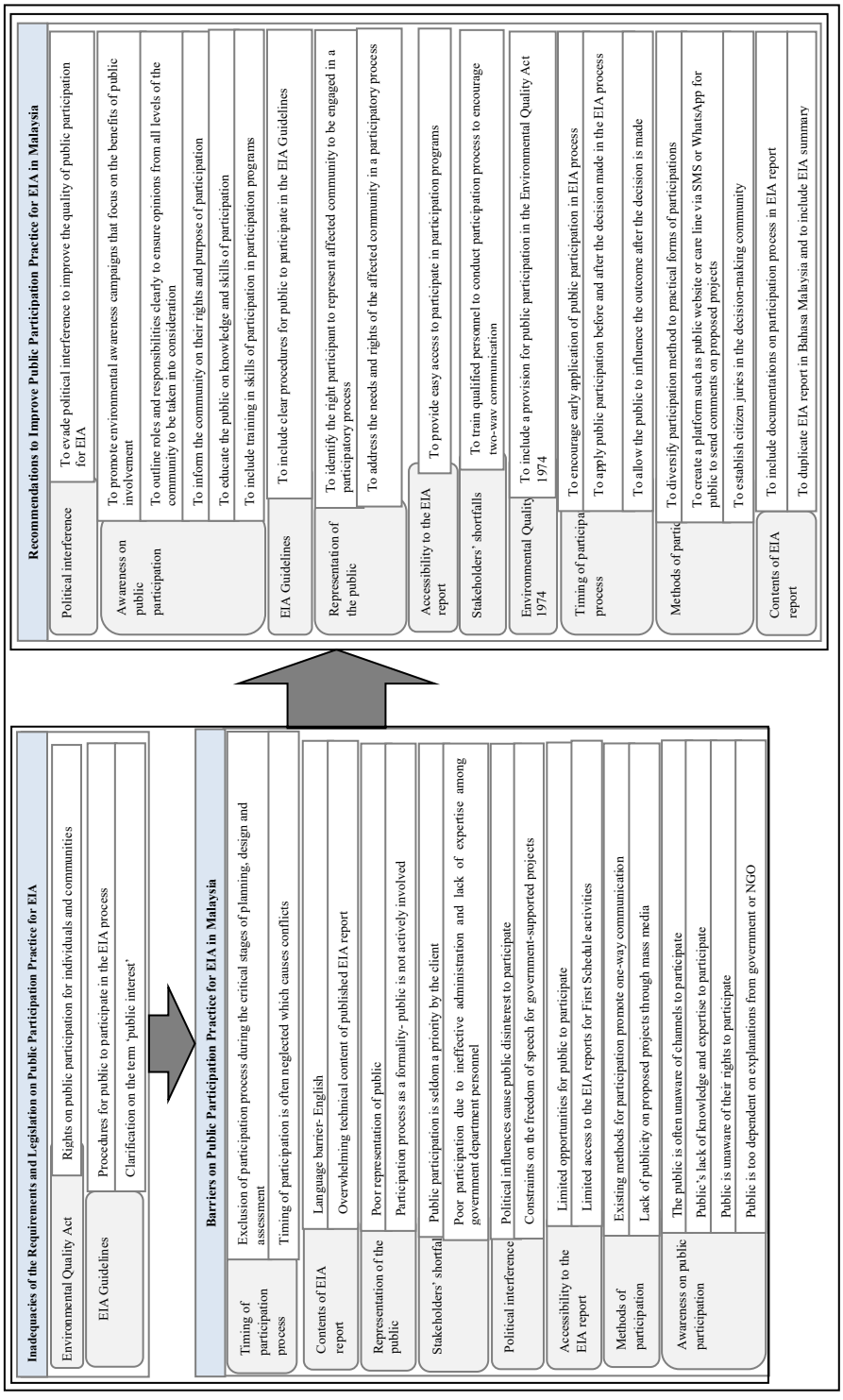
The fourth assessment to be conducted was the effect size f^2. The effect size is another test to assess the exogenous constructs' contributions to the endogenous latent variables (Wong, 2013; Ahmad and Afthanorhan, 2014). Wong (2013) added that the effect size assessment is important as it examines the magnitude or strength of the relationship between the latent variables, and determines the overall contribution of a study. The effect size utilises the calculation of Cohen's f^2. The f^2 values given are 0.02, 0.15 and 0.35, which indicate small, medium and large effects, respectively (Hair et al., 2014a, 2014b; Henseler et al., 2009). Table 4 shows the results of the effect size, from which it can be concluded that the strength of two relationships (the inadequacies of the regulations and legislation on public participation → barriers to public participation and barriers to public participation → recommendations for public participation) have medium effects. Meanwhile, the relationship between the inadequacies of the regulations and legislation on public participation → recommendations for public participation have a small effect, according to the Cohen's f^2 calculated using PLS-SEM.

The last aspect to be explored for the structural model assessment was the predictive relevance (Q^2), which is the assessment of the model's capability to predict. Wong (2013) and Henseler et al. (2009) both stated that the predictive relevance for the structural model can be measured using a blindfolding procedure, which is a sample re-use technique that omits every d^{th} data point in the endogenous construct's indicators and estimates the parameters with the remaining data points. The omission distance of D = 9 was chosen for this procedure in this study. A value of Q^2 that is larger than 0 for a particular endogenous construct indicates the path model's predictive relevance. Nonetheless, it should be noted that the Q^2 value to 0 is indicative of whether an endogenous construct can be predicted, but it does not examine the quality of the prediction (Hair et al., 2014b). Table 4 shows the results of the predictive relevance Q^2 for this structural model assessment. The predictive relevance Q^2 of the barriers to public participation is 0.026, while the Q^2 value for the recommendations for public participation is 0.088. In conclusion, the values of the Q^2 for both barriers to public participation and recommendations for public participation are above 0, which support the model's predictive relevance to the endogenous latent variables.

6 Discussion

The data gathered from the quantitative data collection were analysed and contextualised via SPSS and PLS-SEM software to propose a framework to further improve the practice of public participation for EIA in Malaysia. The data collected resulted in a final three items, involving the inadequacies of the requirements and legislation on public participation practice in terms of EIA; 28 items under the barriers regarding public participation practice in terms of EIA; and 25 items under the recommendations to alleviate the barriers to public participation practice in terms of EIA. The final variables under these three constructs are illustrated in Figure 2, and form the framework for public participation in the EIA process in Malaysia. The framework produced in this study bridges the gap in numerous researches produced on the topic of public participation in EIA that focuses on the Malaysian context.

Figure 2 Framework for public participation for EIA in Malaysia (see online version for colours)



7 Conclusions

The PLS-SEM path model confirmed the framework for public participation in EIA in Malaysia by analysing the relationship between the inadequacies of the requirements and legislation on public participation practice in terms of EIA, the barriers to public participation practice in EIA, and recommendations to improve public participation practice in terms of EIA. This study incorporated an alternative method of analysis for the data collected for the topic of public participation in EIA. Nonetheless, this study is limited to the application of public participation in EIA in Peninsular Malaysia, and does not include the state of Sabah and Sarawak. This is due to the different EIA legislation and requirements that are specially designed for the two states. This framework should induce multiple efforts by the Malaysian government to improve public engagement, and encourage sustainable development and environmental protection awareness among local communities. This study provides a more holistic approach by proposing a framework that can be applied to multiple types of project under EIA. The framework for public participation in EIA in Malaysia produced in this study will be validated to further determine the practicality of the framework for public participation in EIA in Malaysia, a framework that could be applied in the environmental assessment world.

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