Acceptance of the Low Carbon Initiatives in the Local Government Project Implementation in Malaysia

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It is known that one of the leading cause of climate change is greenhouse gas (GHG) emissions. There are multiple contributors to the rise of GHG emissions worldwide, including the project development sector after the energy and transportation sector. A strategic approach is needed to ensure the acceptance of low-carbon initiatives (LCI) in the project development and construction sectors, especially with the local government in Malaysia. The acceptance of the LCI has been evaluated based on four (4) influencing factors identified in this research. A survey questionnaire was developed based on the acceptance measurement model built on those identified factors. The 163 responses were collected from the survey and analysed via simulation in SmartPLS 3.0 to determine the validity and reliability of the model. The analysis has found that three (3) out of four (4) factors identified were significant towards the acceptance of LCI in local government project implementation: "Awareness", "Knowledge", and "Financial Concern".

1. Introduction

Malaysia needs to prepare itself for the climate change phenomenon. Project developments and constructions have been known as one of the main contributors to greenhouse gas (GHG) emissions after energy and transportation. In 2020, the construction industry has been accounted for 35 % of the world's total energy consumption and 38 % of the world's process-related carbon dioxide (CO_2) emissions. In other words, the infrastructure developments in developed and developing countries contribute to 33 % of global GHG emissions and 40 % of global energy consumption (Wang et al., 2021). Various policies outlined to reduce GHG emissions by 2050 across all levels of society and sectors, including project development and the construction sector. However, accepting of the means of understanding and implementing the policies remains questionable because it necessitates a collaborative effort from all stakeholders, particularly in project development implementation. As the third-tier government responsible for local affairs under the Local Government Act of 1976, local governments play an important role in the low-carbon agenda. In the National Low Carbon City Masterplan (NLCCM) 2021, 33 local governments were selected as "target cities." Based on the 3M approach, consists of measurement of GHG emissions, management of low-carbon development, and mitigation of GHG emissions through the execution of programs and projects. Local governments can conduct performance evaluations on existing low-carbon programs and initiatives at the local level to support the federal and state governments' ambitions. In the traditional project implementation management approach, little emphasis is placed on the sustainability-related attributes required for managing and leading projects. Human, political, knowledge-and-information, market, and cost-and-risk hurdles hinder project development acceptance of low-carbon initiatives (LCI). Questions were raised regarding the degree of perception by the local governments towards the LCI implementation, especially in the project development and construction sector, among the small, undersized local governments. Hence, determining the possible elements that might influence the acceptance of LCI in the actual operations at the local government in the sector. Therefore, the objective of the research is to determine the acceptance factors and determine the significance of factors influencing LCI in local government project implementation through the constructed acceptance measurement model.

2. Factors influencing the acceptance

Studies shown that project managers' awareness of low-carbon goals for project development remained low in Malaysia (Chan et al., 2022). The existing environmental concern is believed to be insufficient to raise awareness as per study in China (Zhou et al., 2020) and authorities must exert institutional pressure such as regulatory pressure. The mentality of 'business-as-usual' is not practical anymore. However, awareness alone is not sufficient to move forward in this. Knowledge is one of four (4) significant barriers to the implementation of LCI in Malaysia (Klufallah et al., 2018), which can be attributed to standards, education, or a lack of skills. It is critical for the stakeholders to have a solid understanding of GHG emissions reduction and LCI. Effective implementation of carbon-related policies can increase policymakers' and other stakeholders' awareness and support for LCI. For instance, the government has facilitated the harmonisation of existing relevant national policies, such as waste management, energy, and development plans, such as the National Physical Plan, through the NLCCM 2021. However, gaps remained in the alignment of federal, state, and local government policies. Low 'buy-in' and support at the state level, as well as working in silos without incorporating federal macro policies at the local government level, are among the problems. Most project development will eventually run into financial difficulties, whether due to anticipated or unanticipated circumstances. Allocation of financial resources, lack of capital for green-objective projects, high cost of low CO_2 emission projects, and ambiguous cost solutions for sustainable designs were the financial elements that impeded the implementation of the LCI in project development in Malaysia (Klufallah et al., 2018).

3. Methodology

To measure the acceptance of the LCI in the local government project implementation, the research conceptual model development has been developed. The LCI acceptance factors determined based on the review of the previous studies forming the research conceptual model. The factors have been translated into the latent variables and measured by the sets of indicators which are called measured variables. The conceptual model was interpreted as the acceptance measurement model, was converted into a set of hypotheses, and tested using the SmartPLS 3.0 Software. The acceptance measurement model shown as in Figure 1. Table 1 below showed the related latent variables and their indicators. Four (4) hypotheses that were developed for this research are: "Awareness", "Knowledge", "Policy Understanding and Appreciation", and "Financial Concern" have positive influence on the acceptance of LCI in project development and construction.
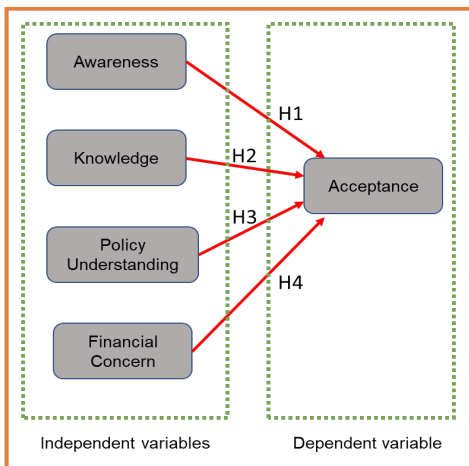

Figure 1: The acceptance measurement model

Then, the survey questionnaire based on the acceptance measurement model and also the list of indicators listed in Table 1, was developed. The model was analyzed based on the response data collected from the survey questionnaire distribution. The significance of factors influencing the acceptance of low carbon initiatives in local government project implementation was determined using the partial least square structural equation modeling (PLS-SEM). This PLS-SEM was simulated using the SmartPLS 3.0 software. The analysis of the data collected has two (2) phases: evaluating the measurement model and evaluating the structural model.

4. Data survey findings

The 40 questions survey questionnaire was distributed to all local governments via Google Forms. The questionnaires were answered by a total of 163 local government employees involved in project development and construction. Table 2 shows that most respondents from district and city councils had moderate knowledge of GHG and LCI with 82 and 85 respondents.

Table 3 shown some sample items applied in the survey and the summary of responses. Under the "Awareness", "Knowledge", and "Financial Concern" factor, the majority of the local government employees agreed on the reality that project development contributes towards GHG emissions. Most of them also knew the importance of GHG inventory for LCI implementation. They agreed on the need for extra budgeting and finance to implement LCI in local government project implementation. However, for the policy understanding factor, the local government's opinion was mainly neutral in understanding the existing LCI policies.

Table 1: Lists of latent variables and their indicators

Latent Variables	Indicators
Awareness on the Issue	The impact of GHG emissions
	The cause of GHG emissions
	Project development is one of the largest contributors to the GHG emissions
	The need to mitigate the GHG emissions issue in project construction
	The roles of the LCI
	The scenario of the existing LCI
Knowledge in Low Carbon Initiatives	The elements and components of GHG
	Understanding of carbon footprint in project development
	Understand the purpose of LCI in the construction sectors
	Anything related to the LCI's know-how including the technology needed and other relevant tools
	The perceived idea of the implementation of LCI
Policy Understanding and Appreciation of the Low Carbon Initiatives	Aware of the existing policies related to the LCI
	Understanding of the low-carbon initiatives outlined by the government
	Understanding the hierarchy of policies management related to the low carbon initiatives
	Importance of the top to bottom and holistic support by the government at all levels, policy-wise to implement the low carbon initiatives
Financial Concern on Low Carbon Initiatives	LCI will incur more costs in the project development budget and finance
	Lack of incentives in implementing the LCI

Table 2: Knowledge of local governments in GHG and LCI

Categories of Local Government	Experienced		Little		Moderate		None	
	GHG	LCI	GHG	LCI	GHG	LCI	GHG	LCI
City Council	4	4	27	26	40	42	3	2
District Council	3	4	36	33	43	42	5	8
Others	0	0	0	0	2	2	0	0

Table 3: Summary of the collected data survey

Responses	Factor 1: Awareness Project development contributes towards GHG emissions	Factor 2: Knowledge Acknowledge the importance of GHG inventory for LCI implementation	Factor 3: Policy Understand the existing LCI policies	Factor 4: Financial Additional budget needed for LCI implementation in project development
Strongly disagree	0%	0%	6%	0%
Disagree	5%	3%	10%	1%
Neutral	27%	20%	**37%**	20%
Agree	**42%**	**44%**	29%	**44%**
Strongly agree	26%	34%	18%	35%

5. Validating the acceptance model

The acceptance measurement model analysis has been divided into two (2) parts as mentioned earlier. The measurement model analysis and the structural model analysis. The measurement model analysis which comprises two (2) phases examines the relationship between latent variables and their measured variables or indicators. Table 4 shows the results of the convergent validity tests for the first phase of the measurement model analysis. The composite reliability of all latent variables in the measurement model is greater than 0.7. Thus, it has the reliable value of internal consistency. Next, the average variance extracted (AVE) value should be 0.5 or higher, and based on the simulation, the AVE values for all latent variables are more than 0.50 as shown in Table 4. Table 6 shows the results of the discriminant validity tests as the second phase of the measurement model analysis.

As for the Heterotrait-Monotrait (HTMT) ratio test which signifies a measure of similarity between latent variables. Table 5 shows the value of the HTMT ratio test that is closest to one (1) is the "Policy Understanding" latent variable with the value of 0.846, which is considered acceptable. If the HTMT value is below the threshold of 0.90, the discriminant validity has been met (Henseler et al., 2015).

Table 4: The results of convergent validity tests

Latent Variables	Composite Reliability	Average Variance Extracted (AVE)
Acceptance	0.822	0.538
Awareness	0.891	0.505
Financial Concern	0.930	0.768
Knowledge	0.925	0.607
Policy Understanding	0.937	0.680

Table 5: The results of the HTMT ratio test

Latent Variables	Acceptance	Awareness	Financial Concern	Knowledge	Policy Understanding
Acceptance					
Awareness	0.685				
Financial Concern	0.742	0.703			
Knowledge	0.761	0.786	0.759		
Policy Understanding	**0.846**	0.567	0.628	0.740	

The structural model analysis involved testing the relationship between latent variables, the accuracy, and the relevance of the research model. Table 6 below shows the results of collinearity, the goodness of fit, and the effect size tests of the structural model analysis. VIF values are all less than five (5) which shows there was no collinearity issue between latent variables which means this research independent latent variables are genuinely "independent". The effect size (F^2) test evaluates the change effect of the dependent variable when the specified independent variable is expelled from the measurement model (Hair et al., 2014). An F^2 value higher than 0.02 represents a small effect size, while higher or equal to 0.15 represents a medium effect size, and an F^2 value higher or equal to 0.35 represents a large effect size of the independent variables towards the dependent variable. Therefore, Table 7 below shows that three latent variables have a weak effect size while one has a medium effect size. Meanwhile, the goodness of fit, R^2 is a measure of the measurement model's predictive accuracy, and it represents the independent variables' combined effect on the dependent variables. A rule of thumb regarding an acceptable R^2, with 0.75 as substantial, 0.50 as moderate, and 0.25 as weak levels of predictive accuracy must be applied (Hair et al., 2011). The R^2 for this research is 0.563 or 56.3%.

Table 6: The collinearity, effect size, and goodness of fit test results

Latent Variables	VIF	F^2	R^2
Awareness of the Low Carbon Initiatives	2.126	0.025	
Knowledge in Low Carbon Initiatives	2.963	0.004	56.3%
Policy Understanding Related to the Low Carbon Initiatives	1.932	0.238	
Financial Concern on the Low Carbon Initiatives	2.135	0.055	

6. Proving the significance of the acceptance factors

Based on the simulation results, the acceptance measurement model has been validated and the reliability has been proved. The final test is the bootstrapping test, and the results are shown in Table 7. It has proven the significance of factors of three (3) independent variables which are "Awareness", "Policy Understanding", and "Financial Concern" with "Acceptance" as a dependent variable. Unlike the fourth independent variable, "Knowledge" did not significantly affect the dependent variable. From the result table, "Awareness" had a t-value of 2.083 (more than 1.65) at the significance level (p-value) of 0.038, "Policy Understanding" had a t-value of 5.827 (more than 2.57) at the significance level (p-value) of 0.000, and "Financial Concern" had a t-value of 2.173 (more than 1.65) at the significance level (p-value) of 0.030. Besides demonstrating the significant relationship between variables, the test also validates the hypotheses made for this research.

Table 7: The results bootstrapping test

Hypothesis	Latent Variables Relations	T Statistics	P Values	Outcome
H1	Awareness of the Low Carbon Initiatives -> Acceptance to Implement the Low Carbon Initiatives	2.083	0.038	Significant
H2	**Knowledge in Low Carbon Initiatives -> Acceptance to Implement the Low Carbon Initiatives**	**0.636**	**0.525**	**Insignificant**
H3	Policy Understanding Related to the Low Carbon Initiatives -> Acceptance to Implement the Low Carbon Initiatives	5.827	0.000	Significant
H4	Financial Concern on the Low Carbon Initiatives -> Acceptance to Implement the Low Carbon Initiatives	2.173	0.030	Significant

7. Discussion

Based on the acceptance model evaluation result, three out of four factors have been proven significant in influencing the acceptance of low-carbon initiatives in local government project implementation. The three (3) significant factors were "Awareness", "Policy Understanding", and "Financial Concern". Awareness is a paradigm shift as from having the conventional mindset to more ′out-of-the-box′ kind of thinking. The increase in awareness usually stemmed from the environmental pressure created by the stakeholders towards local governments thus posing significant urgency to work on the low-carbon agenda in their project implementation. This could begin with low-carbon practices in the project planning phase as in design stage such as focusing on renewable energy technology, like passive solar space or water heating, photovoltaics, triple glazing, and high levels of insulation, energy-efficient condensing boilers, natural-friendly building façade etc. Local governments could make these compulsory in the development permit approval. Normalising the Environmental Impact Assessment (EIA) or Social Impact Assessment (SIA) procedures regardless of the project size, could be seen as initiatives due to the increased awareness, as those should be applied in the early part of the project development stage. Awareness that begins from the local government could help create a low-carbon society in the context of project development. For example, as mentioned in a study by Basri et al. (2022), the Green Mentoring programs as part of the low-carbon agenda, organised under the LA21KL by the Kuala Lumpur City Hall (DBKL) should be promoted to spread environmental awareness among the community. Lack of awareness in local government on the implementation of low-carbon initiatives in project development could limit the capacity improvement among the local government employees and parties that support them. The study made by Chan et al. (2022) proves that almost half of the research respondents in Malaysia's construction professionals do not know pulverised fuel ash (PFA). PFA has the advantages of being highly inexpensive, environmentally friendly, and having microscopic particles that make the concrete dense and minimise its permeability. From the perspective of policy understanding, the local government needs to understand the National Green Technology Policy (NGTP) 2009, the NLCCM 2021, the Green Procurement Guideline (GGP) and other related policies in place for low-carbon agenda implementation. As an authoritative body at the ground level, the local government must make the low-carbon agenda compulsory in any development plan permit application by incorporating those policies. This way will boost the ′buy-in′ of the stakeholders, thus making them understand what low-carbon initiatives are all about. Local government should strengthen the roles of its multiple steering and working committee platform where any policy-related concerns could be raised and discussed as all relevant stakeholders will participate in the event. Sarker (2018) in his study also mentioned that the good establishment of carbon-related policies could increase the positive behaviours of policymakers and other related stakeholders towards low-carbon initiatives. Currently, there are some local governments that are guided by the local or international low-carbon initiatives framework, such as the Local Government for Sustainability

(ICLEI) and the Global Covenant of Mayors (GCOM). However, the mandate for low-carbon agenda implementation from the state government down to local governments is still weak. Therefore, awareness, together with policy understanding and appreciation, is crucial. Financial has always been a massive concern in project development. Project developers often juggle to have a financial balance among material supplies, labour costs, and day-to-day operational expenses in construction. Moreover, the rising of raw materials price worldwide has made things more difficult for industry players. Therefore, financial concern in applying low-carbon initiatives in project implementation has its foundation. According to the Green Building Index (GBI), the incremental construction cost of going green, including material and technological costs, ranges from 0.7% to 11%, besides the administration fees. NLCCM 2021 also addressed the lack of source of funding and financing as one of the barriers executing the low-carbon agenda. Local governments must find ways to diversify their source of income to fund more low-carbon initiative-oriented development projects.

8. Conclusion

The factors that influenced LCI acceptance in project implementation were determined. "Awareness", "Knowledge", "Policy Understanding", and "Financial Concern" comprised the factors. The acceptance measurement model was developed, and the survey questionnaire based on the acceptance measurement model was constructed to evaluate the acceptance of LCI in the local government project implementation. The PLS-SEM technique was used in SmartPLS 3.0 software to analyse the survey responses to evaluate the acceptance model's validity and reliability. Based on the evaluation, the acceptance measurement model was found to be valid and reliable. In the end, "Awareness", "Policy Understanding", and "Financial Concern" were found to be significant factors influencing LCI in local government project implementation. As a result, the Malaysian government could take a more constructive and organised approach to address local governments' perspectives on GHG emission threats and low-carbon agendas. This research will provide the Malaysian government with a framework for studying the feasibility of LCI not only in the project development sector but possibly across all sectors. For future studies, the sample of respondents could be expanded. In addition, the study could be extended to include local government support agencies such as the Public Works and Water Works departments. The life cycle assessment (LCA) of any project development and construction could also be investigated. The information gathered could determine whether the local government has sufficient awareness and knowledge to indicate their acceptance and willingness towards LCI. This research is in line with the 13th SDG, "Climate Action," as the outcome of the study will provide insights for the authorities to take measures in dealing with GHG emissions to tackle climate change issues. The 11th SDG, "Sustainable Cities and Communities", and the 9th SDG, "Industry, Innovation, and Infrastructure," aim to ensure the resiliency and sustainability of infrastructure. The findings of this research should provide comprehensive insights into the acceptance or readiness of authorities, as in this research context. These local governments will steer the nation's aspirations towards achieving those SDGs.

Acknowledgement

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