CONTRACTORS' PERSPECTIVE ON THE MATURITY LEVEL OF GREEN BUILDING PRACTICES IN THE SARAWAK CONSTRUCTION INDUSTRY

Angela Mee Yii Ting[1]*, Shi Yee Wong[1], Precilla Anak Palis[1], Elizabeth Anak Ellie[1]

[1]Quantity Surveying Department, School of Built Environment, University of Technology Sarawak, 96000 Sibu, Sarawak, Malaysia.

Corresponding author: * angela.ting@uts.edu.my

ABSTRACT

High carbon emission alerted different stakeholders to look into sustainable practices and green building is one of the initiatives. Despite the efforts from various parties, the maturity level of green practices in Malaysia is still low compared to the developed countries. This study aims to investigate the maturity level of green building practices and factors influencing such practices in the Sarawak construction industry from contractors' perspective. Semi-structured interviews with five contractors with experiences in green building projects were conducted. Content analysis was employed to analyse the collected data. The findings revealed that the interviewees were aware on the existence and benefits of green building practices but not taking initiatives to get involved. Hence, the results indicated that the maturity level of green building practices in Sarawak construction industry is still at the low level. The results showed that the key factors that affect the maturity level are cost and limited market demand. This study could serve as a basis and provide greater insights into the adoption of green building practices in the Sarawak construction industry.

Keywords: Contractors; Construction Industry; Maturity Level; Green Building

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1. INTRODUCTION

The Malaysian construction industry plays a crucial role in contributing to the country's Gross Domestic Product (GDP) yet possess negative implications to the environment, society, and economy. Such negative implications could be due to its heavy reliance on non-renewable resources and hence generating a substantial amount of waste (Zhang et al., 2019). Studies had shown that Malaysian construction industry alone contributed to 40% of carbon dioxide (CO2) emissions (Alqadami et al., 2020). To mitigate these issues, the concept of 'green buildings' has emerged. In 2021, Sarawak contributed 9.5% to the Malaysian GDP, with its construction industry accounted for 3.4% of the RM131.2 billion contributions (Department of Statistics Malaysia, 2022). Green buildings are designed, constructed, and operated in an environmentally friendly manner, aiming to minimize negative effects on society. Moreover, the adoption of green buildings can assist in conserving natural resources and improving the overall quality of life (Oguntuase & Windapo, 2021). Hence, it is of crucial importance to ensure the adoption of green building practices into the construction industry.

Green building practices are the essential components of sustainable construction development (Al-Atesh et al., 2021). Such practices encompass practices that endorse the conservation of resources, energy, and water, as well as the reduction in the utilization of natural resources. These practices involve strategies such as water and energy conservation, along with building designs that create a healthy indoor environment for occupants. The implementation of green building practices yields numerous benefits, including a decrease in energy consumption and associated costs, preservation of non-renewable resources, reduction in the usage of building materials, and enhancement of indoor air quality, thereby improving the health and productivity of employees (Chodnekar et al., 2021). As a result, construction experts and researchers worldwide have shown significant interest in green building practices, and some of the government authorities had provided support for the adoption of green building practices, such as the Construction Industry Development Board (CIDB) (Mustaffa et al., 2021). However, despite having the Green Building Index (GBI) in place for over a decade, the current stocks of Malaysian buildings differ significantly from those in the London and Singapore, in terms of the proportion of the certified green buildings (GreenRE, 2019). Studies had shown that a general perception that green buildings are more expensive compared to the conventional, which hindered the adoption of green building (Wong et al., 2020).

Various studies had been conducted in relation to green buildings, which focusing on the barriers (Chan et al., 2018; Darko & Chan, 2017; Wong et al., 2021), benefits (Oguntona et al., 2019; Samosir et al., 2020) and strategies (Chan et al., 2017a; Cohen et al., 2017). However, little-to-none of the research specifically focused on the maturity level of green building practices of contractors solely. Contractor is one of the key stakeholders in the construction industry as this stakeholder liaised with most of the stakeholders throughout the entire construction phase of a project (Adros & Abidin, 2019). Contractors have the overall responsibility of overseeing and managing every aspect of a construction project, to ensure that a project adheres to relevant laws and regulations (Shan et al., 2020). Hence, the maturity level and non-adoption of green building practices by contractors undoubtedly affects the built-up rate of green buildings in a country.

The maturity level could be referred as an organization reaches a state of maturity when it is functioning optimally to achieve its goals or objectives (Goh & Rowlinson, 2013). This shows that an organization is reaching the efficiency and effectiveness in the green building practices implementation through different techniques and methods. Moreover, the maturity level of green building practices could be influenced by various factors such as cost (Venkataraman & Cheng, 2018), government involvement (Sharma, 2018) and organizations' support (Low et al., 2014). However, the factors could be varied according to the focus of stakeholders and geographical location. Therefore, this research aims to identify the maturity level of green building practices and its influencing factors in the Sarawak construction industry from the viewpoint of contractors. This research is expected to serve as a foundation and offer deeper understanding on the maturity level of green building practices and its associated influencing factors in the Sarawak construction sector. This could further assist in ensuring the quality of a project while promoting sustainability.

2. LITERATURE REVIEW

Maturity could be seen as potential growth in capabilities and indicated the level of sophistication present in both the organizational processes and the consistency of green building projects throughout the organization. This could include the viewpoints of the project and risk management aspects. Maturity, in the realm of risk management, indicates the level of expertise an organization possesses in comprehending its risk portfolio,

effectively mitigating those risks, and having effective measures in place for business continuity and recovery (Goh et al., 2013).

The Capability Maturity Model (CMM), developed by Carnegie Mellon University, is derived from the Maturity Model. Its main purpose is to offer a structured framework that aids in evaluating the capability of project management or organizational management (Wei et al., 2019). Despite the original usage in the software industry in assessing the maturity level of software, CMM gained popularity in other fields like building information modeling and intelligent manufacturing projects (Wei et al., 2019; Hu & Gao, 2019). Moreover, Shen et al. (2021) utilized CMM to measure the performance of low-carbon city practice. Setiawan et al. (2019) developed green construction capability model (GCCM) based on the CMM to assess contractors' capability in adopting green construction. As CMM has been utilized in assessing the low-carbon city practice and as the based model for developing green construction practices, this research utilized CMM to examine the maturity of green building practices in the Sarawak construction industry.

The CMM consisted of five levels, namely initial, repeatable, defined, managed and optimized. In Level 1, this initial or ad hoc stage is characterized by chaotic and unstable processes (Al-Matari et al., 2021; Goh, 2014; Goh et al., 2013). Organizations could struggle to commit to proper procedures, often leading to crises. Continual success often hinges on using the same competent individuals for subsequent projects. Level 2 that signified the repeatable or planned level, is a more organized phase in project management maturity (Backlund et al., 2014). It establishes fundamental project management processes to track costs, schedules and functions, as well as to address issues. Level 2 also addresses managerial challenges, with a focus on policies to ensure the stability and repeatability of project success (Al-Matari et al., 2021; Backlund et al., 2014). The defined level (Level 3) represents advanced process maturity. It involves well-documented, standardized, and integrated processes for development and maintenance within an organization. These processes are flexible, allowing customization for different projects, and improving worker productivity (Goh, 2014; Goh et al., 2013).

The managed level (Level 4) signifies a high degree of understanding and control over processes and products. All process and product details are clearly defined and managed (Backlund et al., 2014; Goh, 2014; Goh et al., 2013). The optimized level (Level 5) represents a continuous commitment to improvement within organizations by controlling the operational process automatically (Al-Matari et al., 2021; Miklosik, 2015). The focus is continuous improvement, driven by feedback from processes to develop innovative ideas and technologies. These organizations set industry standards for project management discipline and witness increased worker productivity through continuous improvement efforts (Miklosik, 2015). The five levels of CMM are summarized in Table 1.

Table 1. Five levels of CMM

Maturity Level	Description
Level 1 – Initial	Chaotic and unstable stage (Al-Matari et al., 2021; Goh, 2014; Goh et al., 2013)
Level 2 – Repeatable	More organized phase with repeatability of project (Al-Matari et al., 2021; Backlund et al., 2014)
Level 3 – Defined	Allow standardization and customization for projects (Goh, 2014; Goh et al., 2013)
Level 4 – Managed	Defined and managed process and products clearly (Backlund et al., 2014; Goh, 2014; Goh et al., 2013)
Level 5 – Optimized	Continuous commitment to improvement within organizations (Miklosik, 2015)

However, the maturity levels are affected by various factors. The list of factors that derived from literature review is shown in Table 2.

Table 2: Factors derived from the literature review

Factors	References
Research and Development	
Technology (Innovation)	Chan et al. (2017b), Hwang et al. (2018)
Research and Development	Chan et al. (2017b), Darko et al. (2017)

Table 2: Factors derived from the literature review (continued)

Factors	References
Culture	
Market Demand for Green Building	Chan et al. (2017b), Hwang et al. (2018)
Motivation	Zhang et al. (2019), Darko et al. (2017)
Education on Green Building	Chan et al. (2017b), Wimala et al. (2016)
Awareness of Green Building	Chan et al. (2017b), Wimala et al. (2016)
Management Capability and Capacity	
Training	Sharma (2018), Wimala et al. (2016)
Knowledge of Green Building	Wimala et al. (2016), Wang et al. (2018)
Expertise (Skilled Labor)	Wang et al. (2018), Awang and Iranmanesh (2017)
Organizational Support	Zhang et al. (2019), Wimala et al. (2016), Wang et al. (2018)
Cost of Green Building	Venkataraman and Cheng (2018), Sharma (2018)
Performance	
Government Regulatory and Legislation	Sharma (2018), Awang and Iranmanesh (2017)
Government Support (Incentives)	Sharma (2018), Wimala et al. (2016), Awang and Iranmanesh (2017)
Stakeholders Involvement	Zhang et al. (2019), Sharma (2018)

These factors were classified under the four categories, namely research and development, culture, management capability and capacity, and performance. Research and development focused on the research and innovation in the context of green building, consisting technological innovation and research and development (Chan et al., 2017b; Darko et al., 2017; Hwang et al., 2018). The culture category emphasized the cultural factors affecting the development and implementation of GB practices. It includes market demand for green building, awareness, education and motivation, which are vital in promoting and implementing green building practices successfully within a community and society (Chan et al., 2017b; Darko et al., 2017; Hwang et al., 2018; Wimala et al., 2016; Zhang et al., 2019). Management capability and capacity involved organizational support, expertise, knowledge of green building, and training, which contributing to the success of the green building practices when addressed adequately (Awang & Iranmanesh, 2017; Sharma, 2018; Wang et al., 2018; Wimala et al., 2016; Zhang et al., 2019). The category of performance considered importance of stakeholder collaborations, including government incentives, regulatory guidance and the associated cost in shaping for green building practices maturity (Awang & Iranmanesh, 2017; Sharma, 2018; Wimala et al., 2016; Zhang et al., 2019).

The Sarawak construction industry is lagged in terms of green building adoption (Ohueri et al., 2020). A survey with the Sarawak contractors revealed that the contractors possessed limited expertise and knowledge on green technology leadings to their refrainment of incorporating green technology into the projects (Sa'adi & Zainordin, 2019). This seems to indicate on the low level of maturity in Sarawak construction industry. However, there is notable gap in the empirical evidence in showing its maturity level and associated factors.

3. METHODOLOGY

As this research requires the selection of a less rigid method to support the researcher's intention for the multi-perspective understanding of green building practices in the Sarawak construction industry, semi-structured interview was adopted. Semi-structured interview is a suitable data collection technique for managing data generated through interaction between researcher and interviewees, especially in understanding meaning and exchanging views through interaction (Mahat-Shamir et al., 2021).

Contractor was identified as the targeted interviewees as contractor is the key contact person throughout the entire construction phase of a project (Adros & Abidin, 2019). Purposive and snowball sampling methods were adopted to identify the targeted interviewees. The interviewees shall have experience with green building projects with at least five years' experience as a contractor in the Sarawak construction industry. Moreover, the interviewees shall be working in the Grade 7 construction companies. Grade 7 companies were selected as the companies having unlimited construction projects coverage which leads to a high tendency to be involved in the green building projects. The contractors could have a higher chance of being exposed to green building trainings and hence equipped with a better level of knowledge of green building. As a result, five contractors in Sarawak that are involved with green building projects were recruited as interviewees of this research. The interviewees were being asked on a few key aspects, such as their years of experience in Sarawak construction industry,

involvement in green building project, position in the company, as well as the maturity level and its influencing factors of green building practices in Sarawak.

All interview sessions were conducted physically, ranging from 25 to 40 minutes per session. Each interview session was recorded, and notes were taken to ensure an effective transcript. The consent was obtained from the interviewee prior to the recording session. The interview transcripts were analyzed by using content analysis method. To ensure research reliability, the interview transcripts were sent to the respective interviewees for final confirmation on the content being transcribed.

4. RESULTS AND DISCUSSION

4.1 Demographic Details

Five interviewees participated in this study with a minimum five years' experience. The interviewees deal with green building projects and work in Grade 7 construction companies which handling larger scale construction projects in Sarawak. All five interviewees were based in Sibu or Kuching (refer to Table 3). Hence, the interviewees provide insight based on their involvement in one of the three GBI certified construction projects in Sarawak, which are University College of Technology Sarawak (I2 and I5), Sarawak Museum (I1 and I4) and Toyota 3S Centre (I3). The involvement of all interviewees in one of the green building projects in Sarawak, indicating their experience and relevancy in providing responses towards green building maturity level. Moreover, the interviewees aware of and applied green building features into the project during the construction phase.

Table 3: Details of interviewees

Code	*Year of Experiences*	*Location*	*Position*
I1	More than 10 years	Kuching	Construction Manager
I2	More than 25 years	Sibu	Senior Project Manager
I3	More than 15 years	Kuching	Project Manager
I4	More than 20 years	Kuching	Project Manager
I5	More than 5 years	Sibu	Assistant Project Manager

4.2 Maturity Level of Green Building Practices Adoption

The interviewees were given the CMM to assess the maturity of green building practices in Sarawak. The interviewees were informed of the five levels of maturity of this model, with 1 as initial level, 2 as repeatable level, 3 as defined level, 4 as managed level and 5 as optimized level. The interviewees had varying opinions on the maturity levels, with some considering it to be at Levels 1 or 2, and others perceiving it as Level 3 (refer to Table 4).

Table 4: Interviewees' responses on green building maturity level

Maturity Level	*Interviewee*	*Total number of Interviewees*
Level 1	I1	1
Level 2	I1, I4, I5	3
Level 3	I2, I3	2
Level 4	None	0
Level 5	None	0

Low maturity levels (Level 1 and/or 2). Three interviewees suggested lower maturity levels and pointed out challenges such as extra costs, lack of awareness, demand, expertise, and government support. For instance, interviewees 1 and 2 mentioned that:

> *Sarawak is still at Level 1 or maybe Level 2… I do not know if all Jabatan Kerja Raya projects compulsory to have GBI, but for Sarawak Museum, we are practicing the GBI. (I1)*

I think we are still at Level 2. Sarawak is left behind compared to others. Green building projects involved cost and we do not [consider] green building project unless it is public project or involving the government. (I4)

In the context of maturity level of 1 or 2 maturity, the contractors may lack of knowledge on green building concepts due to the use of conventional construction methods. This lack of awareness and resistance to adopting green building practices could possibly place Sarawak lagging behind other countries in terms of green building adoption. This is in line with the literature that Malaysia is having a lower number of certified green buildings compared to other countries (GreenRE, 2019).

Higher maturity level (Level 3). Two interviewees (I2 and I3) who believed in a higher maturity level emphasized factors like government incentives and client support as key contributors. The interviewees mentioned that:

I believe the most is Level 3. We were being paid by Sarawak government or client for [using] the system here. (I2)

I think Sarawak is in Level 3… not many are expert on green building projects… to prevent this, all parties need to play their roles. (I3)

The contractors could receive extensive training and knowledge about green building practices, enabling them to apply these practices in their projects and advocate for green building concepts.

Although there were varying opinions with regards to the maturity level of green building practices in Sarawak construction industry, none of the interviewees suggested Sarawak achieving Level 4 or 5. This seems to indicate that the green building practices in Sarawak construction industry is still at the early stage of development. Ohueri et al. (2020) emphasized the low development of green building projects in Sarawak.

4.3 Factors influencing the Maturity Level of Green Building Practices

The interviewees identified high costs associated with green building practices, limited market demand, training and incentives, and government support as the factors that influencing GB practices' maturity.

4.3.1 High cost

Four interviewees (I1-4) noted the significant influence of budget or cost on maturity levels due to the higher costs associated with green building practices. One of the interviewees mentioned that:

The materials and processes used during the construction of green building are different from conventional building, which incurred higher cost. (I3)

Such finding is tally with Venkataraman and Cheng (2018) that cost of green building technologies and materials influencing the adoption of green building practices. Ohueri et al. (2020) supported that the high cost of green building technologies could hinder its adoption in Malaysia and proposed a framework that suggested market-based incentives and government's co-funding for improving green building development.

4.3.2 Limited market demand

Three of the interviewees (I2, I3, I4) reckoned that there was limited market demand for green building practices unless incentivized by tax deductions. Interviewee 3 mentioned that:

…not really a demand in Sarawak unless there is tax deduction as we only [received] good reputation from involving in green building projects. (I3)

This seems to indicate that financial incentives or tax deductions could offset the challenges faced by the contractor in green building practices adoption. However, the lack of market demand limited the contractors from adopting green building practices. Chan et al. (2017b) and Hwang et al. (2018) supported that lack of market demand is one of the factors that affecting green building adoption.

4.3.3 Training and Incentives

Three interviewees (I2, I3 and I5) emphasized the need for training and government incentives.

> *The incentives and training are the encouragement for us to adopt green building practices. Without the encouragement and training, we are afraid to venture into new practices as the rate of return of our investment is unable to be assured. (I5)*

This seems to imply that the hesitation in adopting green building practices could affect the maturity. Hence, the training and incentives could increase the confidence of contractors in adopting green building practices. Moreover, the training could allow contractors to be more aware on the selection of green building technologies and methods, which in turn, in the future could allow contractors to suggest those technologies to their potential clients. Wimala et al. (2016) suggested that training could allow appropriate skills for green building practices. This could further foster the collaboration between government, developers and other construction stakeholders in the adoption of green building practices (Sharma, 2018).

4.3.4 Government support

All of the interviewees opined the essential role of government support in promoting the adoption of GB practices in Sarawak. For instance, an interviewee mentioned that:

> *Government is playing the key role to mandate the green building construction enforcement and adoption rate. Those financial and non-financial provisions could assist its implementation. (I5)*

Such finding is in line with Yang and Yang (2015) that stakeholders shall collaborate to ensure efficient sustainable buildings implementation, with the support of government. The mandatory requirement of green building from government undoubtedly assists green building practices maturity level. For instance, Australia is mandating for a minimum of six start rating based on Australian National Construction Code, for developers and contractors to include 'green' features into the new building construction (Commonwealth of Australia, 2019). This seems to indicate that with mandatory requirement from the government, the contractors will be made compulsory to learn and improve their knowledge for the green building practices. Similar approach may be applicable to Malaysia for improving the green building practices and its maturity level.

5. CONCLUSION

This research examined the maturity level of green building practices in Sarawak through the viewpoints of contractors who worked in large scale construction companies. The findings indicated that green building practices are still at the early stage of development and adoption in Sarawak construction industry. To increase the level of green building practices maturity, the interviewees suggested contractors to attend green building-related training, and government to provide incentives as well as mandating the incorporation of green building practices for new building construction. Support can be provided in the form of incentives and promoting GB practices through advertising and campaigns. This research could contribute to the Sarawak construction industry as an indication on the current status of the maturity level of green building practices and provide some guidance to the contractors and / or government on the possible strategies to adopt to foster the uptake of green buildings.

As this research only focused on Sarawak, hence the results may not be able to generalize to the entire Malaysia. Future research can expand to cover the entire Malaysia and use different research methods, such as quantitative or mixed methods, for comprehensive understanding of green building practices and the maturity levels.

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