Research Title:

EFFECTIVENESS OF IMPLEMENTING GREEN BUILDING TOOLS IN FIVE ASEAN COUNTRIES

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1. Introduction

a. Background

Cities are home for more than a half of world's population. Most people live in, work in, and spend time in the city. Cities are the huge cluster of buildings and infrastructure, and these buildings and infrastructure give provide the physical spaces for people and their activities.

- There are many green building tools launched by the respective green building councils in the Association of Southeast Asian Nations (ASEAN)[1] region with the aim of reducing environmental impacts for both the construction and management phases of a building (Table 1) (Asdrubali et al. 2015). Usually, these tools cover different phases of a building's life cycle and take different environmental issues into consideration. Different tools are used to assess different buildings types (residential vs. office buildings) influencing the choice of the environmental rating tool (Haapio & Viitaniemi 2008).

Table 1 ***Green building tools using in ASEAN countries***

Country	Green Building Tool	Website
Singapore	Green Mark	https://www.bca.gov.sg
Malaysia	Green Building Index	http://www.greenbuildingindex.org
Indonesia	GREENSHIP	http://www.gbcindonesia.org/greenship
Philippines	BERDE	http://berdeonline.org
Vietnam	Lotus	http://vgbc.vn

- Cities produce and consume lots of resources, including energy, which emits lots of greenhouse gases into the atmosphere.
- Peoples spend lots of time in buildings, so it is important to make the building environmentally-friendly.

[1] ASEAN has ten country members: Brunei, Burma, Cambodia, Indonesia, Laos, Malaysia, Philippines, Thailand, Singapore, and Vietnam.

● Many of national and local governments in the ASEAN region have already introduced policies to promote green buildings, but the result of these policies is varied.

b. Objectives and Purpose:

Analyze the effectiveness of existing Green Building Tools (GBTs) in ASEAN countries.

c. Research question

Are the existing Green Building Tools in ASEAN countries effective measures of sustainability?

What are the causes that make the Green Building Tools effective (or not)?

2. Research Methodology - Quantitative Approach

In this research, quantitative analysis will be used to analyze the data. This study analyzes data which include descriptive statistics, goodness of measures, reliability analysis, validity analysis, hypothesis testing, and mediation effects testing. It investigates relationships between Awareness of Environment, Technology, Legislation, and Green Building Performance. The data collection resources (tools) are classified into two groups of primary and secondary sources or information. In the case of secondary resources, articles, books, research papers, studies, and any theses conducted in this field (collected from libraries, internet databases, and government documents available as open sources) will be used.

Primary sources of information will be collected using a field research method in the form of a questionnaire. A draft of the questionnaire will be evaluated by experts in the areas of GBTs from the respective countries. These processes will enable the researcher to develop a questionnaire with high content validity. A structured questionnaire according to a 5-point (Likert-type) scale ranging from 1 to 5 namely *Strongly Disagree, Disagree, Neither Disagree* nor *Agree, Agree and Strongly Agree* will be underlined.

The sampling technique in this research will be stratified sampling, where the researcher divides projects into separate groups. Number of samples will be decided after a general research is conducted. Then, a probability sample, often a simple random sample from a snow-balling technique is undertaken, drawing from each identified group.

The target projects stakeholders of this research will consist of project managers from construction companies identified as using GBTs and government officials (either project managers or engineers) who use GBTs.

3. Literature Review

This study will propose to compare the results from the model based on each Green Building Tool, so we will use reviewed green building projects which are granted green certificate in five countries in order to compare how these countries' green building legislation work. The priority will be to focus on the five countries that implement Green Building Tools on a national scale in the region – namely the GBI in Malaysia, Lotus in Vietnam, Green Mark in Singapore, BERDE in the Philippines, and GREENSHIP in Indonesia.

a. Malaysia - Green Building Index (GBI)

Malaysia, as a developing country realizes that the construction industry is regarded as an essential and highly visible contributor to the growth of the country. And, over the last two decades, the construction industry had been consistently contributing between three percent to five percent of the national gross domestic product (Construction Industry Development Board (CIDB) 2009).

In 2009 at the United Nations Climate Change Conference in Copenhagen, the Prime Minister of Malaysia promised to reduce the nation's carbon emissions by 40% by the year 2020 as compared to the level in 2005. Following that, in the 2010 budget (GBI, 2010), under the Heading 'Developing Green Technology, Item fifty-six on GBI,' the Malaysian Prime Minister announced that the government will establish a fund amounting to RM1.5 billion to promote green technology in construction field.

At present, there are several sustainable projects that are being or have been constructed in Malaysia such as the *Bangunan Suruhanjaya Tenaga* which achieved a platinum GBI rating, and the *Ken Bangsar* with a gold GBI rating. This indicates that sustainable building projects in Malaysia with the concept of sustainable construction is beginning to settle within the industry. However, the development of sustainable buildings in Malaysia now is still relatively low. Projects on sustainability in buildings in Malaysia are mostly at the pioneering stage which

indicates that the Malaysian construction industry is still at its infancy level when dealing with sustainable matters (Abidin, 2010).

The Standards and Industrial Research Institute of Malaysia (SIRIM) encourages sustainable building practices. In 2009, the Green Building Index was founded in collaboration by *Pertubuhan Akitek Malaysia*/Malaysian Architect Association (PAM) and The Association of Consulting Engineers Malaysia (ACEM), propelled by the need to take care of the environment. The GBI is aimed at leading the building industry into becoming eco-friendlier in their practices. It is fortunate that the GBI also received the full support of the Malaysian Construction Industry. One of its main aims is to promote awareness on green building practices to the respective parties - especially designers, engineers, and decision makers in both the government and the private sector.

The scoring system has been largely customized in order to best suit the situations in Malaysia due to major differences with other ASEAN countries in infrastructure, transportation, resources and land. Therefore, highest scores have been allocated to energy and water saving. It is not surprising that the GBI differs from other Green Building Tools since it has been customized to Malaysia's environment, climate and resources available (GBI, 2009). There are similarities and differences regarding evaluation criteria among countries. Factors to take into consideration will include geographical landscape, energy usage, culture, climate, transportation, resources and many others. The evaluation process involved assessment on the early construction stage which led to the temporary GBI rating award. The final award will be given a year after the building has been occupied. The building will be assessed again every three years to maintain its GBI rating. **Error! Reference source not found.** shows a comparison of different criteria of Green Building Tools.

Table 2 Summary of assessment criteria for green building tools

BREEAM	LEED	CASBEE	Green Mark	GBI	Lotus
Management	Sustainable sites	Built environment quality	Energy efficiency	Energy efficiency	Energy
Health & Wellbeing	Water efficiency	Indoor environment	Water Efficiency	Indoor environmental quality	Water
Energy	Indoor environmental quality credits	Quality of service	Environmental protection	Sustainable site& management	Sustainable Purchasing

BREEAM	LEED	CASBEE	Green Mark	GBI	Lotus
Transport	Innovation in Design	Outdoor environment on site	Indoor environmental quality	Materials & resources	Ecology
Water	Regional Priority		Other green features	Water efficiency	Waster & Pollution
Materials		Built environment		Innovation	Health & Comfort
Waste		Energy			Adaptation & Mitigation
Land Use & Ecology		Resources & materials			Community
Pollution		Off-site environment			Management
					Innovation

The GBI rating is used to ensure that the building has been maintained well. These buildings will be awarded with a Platinum, Gold, or Silver category depending on the score achievement. In Malaysia, the building owners, developers, and consultants can apply for GBI assessment to GBI Sdn Bhd (GSB), a company that has been established specifically by PAM and ACEM. The applicants can also appoint GBI itself as the facilitator to provide professional assessment services. GBI provides an assessment to encourage environmental friendly building construction and maintenance within Malaysia. The rating system has integrated the best practices in environmental design and performance, and is recognized internationally (Baharuddin, et. al., 2011).

b. Vietnam - Lotus Index

In Vietnam, Solidiance and VGBC (2013) claim that the development of the Green Building market is still in its initial stages, although it has obtained increasing attention from both industry and the government. It has also become a topic of recent real estate fora and conferences (News 2015a, 2015b). After the first building was certified in 2008, Green Buildings can now be seen in large cities throughout the country, mainly in two major metropolitan areas – Hanoi and Ho Chi Minh City. In terms of organisation setting, the Vietnam Green Building Council was established in 2007 and joined World Green Building Council Network as an Associated Group. The Council has played a considerably important role in promoting Green Building practices such as engaging construction experts in developing LOTUS - a Green Building certification developed for Vietnam's conditions - and organising regular nationwide training courses about Green Buildings' solutions. Comparing Leadership

in Energy & Environmental Design (LEED) and LOTUS, industry leaders point out that LEED is considered having higher recognition while LOTUS has higher applicability and lower implementation cost (Solidiance and VGBC 2013).

Comparing the number of Green Buildings with other peer countries in the region such as Indonesia with 23 LEED projects and 105 GREENSHIP projects or the Philippines with 142 LEED projects [(Green Building Council Indonesia 2015; U.S. Green Building Council 2015) illustrates a slow progress of green building adoption in Vietnam. While Vietnam has limited programs addressing renewable energy and energy efficiency, and has yet to provide Green Building regulations at the national level, the other two countries have implemented numerous financial and advocacy incentives to encourage investment in renewable energy and Green Buildings, including feed-in-tariffs, net metering, soft loan schemes for renewable energy producers and environmentally friendly investment, and Green Building guidelines (H.-T. Nguyen 2016). It is argued that the Vietnam government needs stronger actions to promote Green Buildings, especially in light of the worsening effects of climate change in the region and all the development challenges this will entail.

c. Singapore - Green Mark

Green Mark was initiated in the year 2005 by Building and Construction Authority of Singapore. It was the first tool developed to measure Green Building construction and maintenance in the Southeast Asian region. The emergence of this tool has encouraged other countries in the region to develop their own rating tool. The objective of Green Mark is to establish criteria for the construction industry in producing a more environment-friendly building. It is also to promote sustainability in the built environment and increase environmental responsiveness among developers, designers, and builders. The benefits of using Green Mark as a tool include; facilitation of reduction in water and energy bills, reduction in potential environmental impact, improvement in indoor environmental quality for a healthy and productive workplace, and the provision of clear direction for continual improvement (Building & Construction Authority 2015).

Green Mark provides a comprehensive framework for assessing the overall environmental performance of new and existing buildings. Under the assessment framework for new buildings, developers and design teams are encouraged to design and construct green, sustainable buildings which can promote energy savings, water savings, and healthier indoor

environments. As for existing buildings, the building owners and operators are encouraged to meet their sustainable operations goals and to reduce adverse impacts of their buildings on the environment and occupant health over the entire building life cycle. The assessment criteria cover five key areas: Energy Efficiency, Water Efficiency, Environmental Protection, Indoor Environmental Quality, and Other Green Features and Innovation. The assessment identifies the specific energy efficient and environment-friendly features and practices incorporated in the projects. Points are awarded for incorporating environment-friendly features which are better than normal practice. The total number of points (190) obtained will provide an indication of the environmental friendliness of the building design and operations. Depending on the overall assessment and point scoring, the building will be certified to have met the Green Mark Platinum, GoldPlus, Gold, or Certified rating.

d. Philippines' BERDE (Building for Ecologically Responsive Design Excellence)

The BERDE Program was established by the Philippine Green Building Council (PHILGBC) in 2009 as a response to the Philippine building industry's need to proactively address the negative impacts of climate change. The program was established to develop the Philippines' own national voluntary green building rating system to facilitate green building projects in the country, inspire confidence in the industry, and build trust in the industry.

The BERDE Green Building Rating System was developed under the BERDE Program. BERDE is a tool to assess, measure, monitor, and certify the performance of green building projects above and beyond existing national and local building and environmental laws, regulations, and mandatory standards. BERDE is recognized by the Philippine government, through the Department of Energy (DOE), as the National Voluntary Green Building Rating System (BERDE Online, 2018).

The BERDE Green Building Rating System focuses on the following categories as part of its framework:

Management: Management focuses on the environmental performance of a building, from its pre-construction or design phase to the construction, post-construction, commissioning and operation. This category incorporates commitment to the compliance of national and local laws, establishment of teams and commissioning

teams, conducting a stakeholder consultation and formation of design charrettes, all constituting the design and construction phase to properly address different environmental issues.

Land Use and Ecology: Land Use and Ecology tackles different issues on the condition and the development of the site during the certification period. This category includes the promotion of the integrated design process for pollution control from construction activities, utilizing lands previously developed, protection of ecological features and biodiversity, and reduction of environmental impacts through encouraging environment-resilient site development.

Water: Water mainly addresses the reduction of potable water consumption and wastewater discharge. The category covers effluent monitoring to manage the sewage discharging and minimize effluent discharge, providing a water meter to create management efficiency, and the reduction of potable water for landscape irrigation.

Energy: Energy mainly focuses on the reduction of energy consumption. Aspects affecting energy efficiency of the building is an integral part of the category. The category encompasses monitoring of energy consumption, energy efficiency improvement, improvement of operation and maintenance, integration of sustainable design, use of improving technologies and energy efficient equipment, energy simulation, and use of automation.

Transportation: Transportation focuses on lessening transport circulation and encouraging the use of alternative transportation, thus lowering emission and use of energy. This category covers the use of alternative and greener mode of transportation and providing enough parking to encourage use of alternative transportation, and reduce emissions, congestion, and hardscapes. The category also deals with the proximity of key establishments, public access, and transport amenities to further reduce extended travels.

Indoor Environment Quality: Indoor Environment Quality deals with human comfort, lighting, thermal levels, acoustics, and views. The category includes

lighting design to acquire good lighting levels, control the illumination and prevent glare, thermal levels, and indoor acoustics.

Materials: Materials generally deals with hazardous substances, measures of recycled content, and the building materials' reduction of CO2 emissions. This category covers different engineering disciplines specifically civil works, electrical works, and architectural finishes.

Emissions: Emissions deals with the building's emissions and ways to measure and prevent further emissions. This category includes carbon inventory, prevention of refrigerant leak through providing measures to monitor it, and controlling emissions from equipment which involve combustion and burning.

Waste: Waste deals with the management of waste in the building from the design to the construction, operation and deconstruction stage. This category includes formulating an overall waste management plan and recycling plan, looking over waste management during construction, and the establishment of a materials recovery facility.

Heritage Conservation: Heritage Conservation deals with the conservation of Philippine historic and heritage sites and preservation of the country's culture. The category includes conservation assessment, protection of significant features of a heritage building, and promotion of heritage features.

Innovation: Innovation focuses on encouraging the industry to go above and beyond the rating scheme, and to recognize and reward those who innovate new technology, design, and processes that will impact the environmental performance of the building. The category provides additional recognition for initiatives that innovate in the field of sustainability.

BERDE supports the sustainable development plans and programs of the Philippine government. Increasing priority for green buildings in particular and sustainable development in general by the government requires the clients be knowledgeable with current laws and regulations at both the national and local levels. At the national level, as the tool recognized as

the National Voluntary Green Building Rating System by the Philippine Government, several national agencies have been using BERDE as a guide in developing policies and programs for green buildings and sustainability for the building sector. At the local level, several local Governments within the Philippines have incorporated BERDE as part of environmental performance of projects within their jurisdictions. BERDE recognizes performance beyond existing environmental and building laws, regulations and standards. As a compliance tool, it supports the clients in complying with building and environmental laws and regulations.

BERDE was developed in line with the Quality Assurance for Green Building Rating Tools (WorldGBC, 2013), the International Framework for Socio-Economic Factors for Green Building Rating Tools in Developing Countries (WorldGBC & GBCSA, 2013), and other best practices from international standards for standards development. Tools and documents under the BERDE are drafted by the BERDE Committee, with support from the BERDE Program Secretariat, input from the PHILGBC General Membership, and final approval by the PHILGBC Board of Trustees. Interested external parties were provided opportunities to comment and provide their insight on the drafting of the BERDE GBRS as part of the development process. The BERDE GBRS is administered by the PHILGBC under the BERDE Program.

The development of BERDE is guided by internationally-recognized methodologies for developing standards and by the Quality Assurance for Green Building Rating Tools (WorldGBC, 2013). Under the Quality Assurance for Green Building Rating Tools (WorldGBC, 2013), national green building councils are guided by the WorldGBC to test rating tools through pilot projects to establish and evaluate whether credits, processes, and procedures are appropriate and effective in delivering rating activities for green buildings.

e. GREENSHIP - a green home assessment tool in Indonesia

GREENSHIP Home is a rating system initiated by GBCI used to measure the green performance of construction projects in Indonesia. The tool will be used by projects' stakeholders such as project developers, architects, M&E professionals, landscape designers, etc.

There are 6 categories taken into consideration for this type of assessment, constituting appropriate site development, energy efficiency and conservation, water conservation, material resources and cycle, indoor health and comfort, as well as Building and Environment Management (BEM).

GREENSHIP needs a proper availability of basic green area as well as the combination of infrastructure and community accessibility. The compliance of this certification also seeks for energy use mitigation and a more efficient power consumption, which involve the application of electrical metering, heat reduction material, energy-efficient artificial lighting, maximum utilization of renewable resources through water heater, etc.

f. Summary

These GBTs will be analyzed based on their implementation of sustainable design and maintenance in terms of similarities and differences. From the analysis, this proposal aims to develop a model to assess buildings' life cycle cost, GHG emissions, and energy consumption that can be used throughout the region.

4. Results and limitations

a. Expected Outcomes

- A Provide a comparative review and assessment on the Green Building Tools (GBT) in five ASEAN member countries - Indonesia, Malaysia, Vietnam, the Philippines, and Singapore.
- Create a tool than can measure building demand, but indicate practices that can mitigate the negative impacts of the construction industry in following building demand and its connected development problems within the initiated five ASEAN member countries.
- Create a tool that can evaluate effectiveness in and indicate improvements for long-lasting infrastructure products through an assessment of the existing initiated ASEAN member countries – Indonesia, Malaysia, Vietnam, the Philippines, and Singapore.
- Increasing effectiveness of the existing green building tools of 5 ASEAN countries through an assessment of the implementation of these GBTs towards sustainable development.

b. Limitation

The scope and limitations of the sustainable assessment scheme are critical. These could be considered in three dimensions of sustainable assessment, which are Criteria, Time and Scale.

i. Criteria (Indicators):

- Direct indicators: The performance criteria, which can be considered as quantifiable factors, are defined and assessed and can be illustrated as solid lines, such as energy use, water use, etc.
- Indirect impacts: Other performance indicators that can be described qualitatively can be met with a more detailed clarification

ii. Time

- One of the most important factors in assessing sustainable development is Time scale. This is because of the changing nature of the direct indicators and the appearance of new ones over a period.

iii. Scale

- Scale is obviously the critical dimension in relation to building environmental performance within the context of sustainable development and urban planning.

4. Timeline

Project component	Month 2018	April	May	June	July	Aug	Sept	Oct
Literature Review								
Data collection								
Data analysis								
Write up report								

5. References

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