THE ASSESSMENT OF UNIVERSITY LIBRARY FOR CERTIFIED GREEN BUILDING COMPLIANCE

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DECLARATION

I declare that this thesis entitled "THE ASSESSMENT OF UNIVERSITY LIBRARY FOR CERTIFIED GREEN BUILDING COMPLIANCE'' is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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Date : 15 JULY 2021

APPROVAL

I hereby declare that I have checked this report entitled "THE ASSESSMENT OF UNIVERSITY LIBRARY FOR CERTIFIED GREEN BUILDING COMPLIANCE'' and in my opinion, this thesis it complies the partial fulfillment for awarding the award of the degree of Bachelor of Mechanical Engineering with Honors

Signature : .....

Supervisor Name : .....

Date : .....

DEDICATION

This thesis is dedicated to my parents who sacrifices a lot for my studies in UTeM. They become one of my toughest inspiration to put my hardest effort in making this thesis complete and successful. They also helped me a lot in many basis of life where in morally, spiritually, emotionally and the most important thing is in financially. Also not forgetting my siblings and cousins who had experience in thesis writing and also engineering terms.

ABSTRACT

There are numerous demands in Malaysia to offer green technologies in the building industry. Most new developments, on the other hand, have minimal green building technology elements, which explains Malaysia's continued presence of, and growing concerns with the environment. This study aims to assess the standard of green building index compliance inside the university library. Assessment was based on three criteria of green building index which is indoor environmental quality, energy efficiency and sustainable site planning and management. Besides, this project also to propose certified measure of green building index compliance inside the library by referring to the standard of requirements GBI for Non-Residential Existing buildings . In terms of indoor environmental quality, physical parameters such as (air velocity, temperature, carbon dioxide level, light intensity, relative humidity and air flow) was measured by using IAQ meter and velocity meter and compared with Malaysian standard 1525:2019 and ASHRAE 62.1:2016.Physical parameters measured with three different time period, out of 15 items 5 items were measured and 4 parts are achieved EQ1 (minimum IAQ performance), EQ3 (Carbon dioxide monitoring and control), EQ5 (Mold prevention), and EQ15(Occupancy comfort survey) meanwhile, EQ10(Electric lightning levels) does not meet the standard requirement of MS 1525:2019, 300-400 lux.This project also involves the calculations of Building Energy Index from monthly electrical consumption of university library over the total floor gross area of library. The BEI of university library is 148.32 kwh/m^2/year even though the BEI of library does not meet the standard requirement of GBI assessment which is not more than 135 kwh/m^2/year. Hence, based on assessing the level of green building index compliance inside the library shows a low rating level when evaluated according to the GBI rating system.

ABSTRAK

Terdapat banyak tuntutan di Malaysia untuk menawarkan teknologi hijau dalam industri bangunan. Sebilangan besar perkembangan baru, sebaliknya, mempunyai elemen teknologi bangunan hijau yang minimum, yang menjelaskan keberadaan Malaysia yang terus berlanjutan, dan kebimbangan yang semakin meningkat terhadap alam sekitar. Kajian ini bertujuan untuk menilai standard pematuhan indeks bangunan hijau di dalam perpustakaan universiti. Penilaian dibuat berdasarkan tiga kriteria indeks bangunan hijau iaitu kualiti persekitaran dalaman, kecekapan tenaga dan perancangan dan pengurusan tapak lestari Selain itu, projek ini juga untuk mencadangkan ukuran kepatuhan indeks bangunan hijau yang diperakui di dalam perpustakaan dengan merujuk kepada standard keperluan bagi (GBI) untuk Bangunan Bukan Kediaman. Dari segi kualiti persekitaran dalaman, parameter fizikal seperti (halaju udara, suhu, tahap karbon dioksida, intensiti cahaya, kelembapan relatif dan aliran udara) diukur dengan menggunakan meter IAQ dan meter halaju dan dibandingkan dengan standard Malaysia 1525: 2019 dan ASHRAE 62.1: 2016. Parameter fizikal diukur dengan tiga jangka masa yang berbeza, daripada 15 item 5 item diukur dan 4 bahagian dicapai EQ1 (prestasi IAQ minimum), EQ3 (pemantauan dan kawalan karbon dioksida), EQ5 (pencegahan acuan), dan EQ15 (Sementara itu, tinjauan keselesaan hunian), EQ10 (tahap kilat elektrik) tidak memenuhi syarat standard MS 1525: 2019, 300-400 lux. Projek ini juga melibatkan pengiraan Indeks Tenaga Bangunan dari penggunaan elektrik bulanan perpustakaan universiti di seluruh tingkat kawasan perpustakaan kasar. BEI perpustakaan universiti adalah 148.32 kwh / m ^ 2 / tahun walaupun BEI perpustakaan tidak memenuhi syarat standard penilaian GBI yang tidak lebih daripada 135 kwh / m ^ 2 / tahun. Oleh itu, berdasarkan penilaian tahap pematuhan indeks bangunan hijau di dalam perpustakaan menunjukkan tahap penarafan rendah apabila dinilai mengikut sistem penarafan GBI.

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LIST OF SYMBOLS

SYMBOLS	DESCRIPTION
m	Metre
h	Hour
s	Seconds
˚C	Degree Celsius
%	Percentage
ft	Feet
kWh	Kilo-watt hour
PPM	Parts per million
R	Regression Analysis
CFM	Cubic Feet per minute

LIST OF ABBREVATIONS

ABBREVIATIONS	DESCRIPTION
ASHRAE	American Society of Heating, Refrigeration and Air-conditioning Engineers
ACBM	Association of Consultancy Engineering
ANNOVA	Analysis of Variance
BEI	Building Energy Index
CO_2	Carbon dioxide
CO	Carbon monoxide
EE	Energy Efficiency
GBI	Green Building Index
HVAC	Heating, ventilation and air conditioning
IAQ	Indoor Air Quality
MKR	Menara Kerja Raya
MS	Malaysian standard
RI	Relative Index
RH	Relative Humidity
UTeM	University Teknikal Malaysia Melaka

CHAPTER 1

INTRODUCTION

1.1 Background

Green building is the basis for the growth of sustainable construction. Green Building is redefining its construction approach and Malaysia is ready for early adoption in order to reconcile its possible economic and environmental benefits. Green Building focuses on maximizing performance of the utilization of energy and material resources while reducing the impact of building during the life cycle of the building on environmental and human health through improved sitting design, construction, operation and maintenance. Figure 1 shows that to reduce the cumulative effect of the developed environment on its surroundings, green buildings have to be constructed and execute (Journal & Basic, 2017).

Figure 1.1: Purpose of Green Buildings

Malaysia is one of the few countries with a defined status that does not have certain requirements in the GB standard, based on a review of the Green Building Standard by all Green Building Councils. It is important to include the management requirements in the current Malaysia Green Building index. A collection of management practices to ensure that the green building can be well handled is considered a significant attribute. Regrettably, in Malaysia, the GBI does not include the criteria which actually provide guidance on green building management..(Aghili et al., 2016).Table 1.1 shows the management criteria on other countries compared to Malaysia.

Table 1.1: Green building index against other countries.

GB Standard	BREEAM UK	LEED USA	Green Star Australia	Green Globe Canada	GBI Malaysia
Assessment Criteria	1.Management 2.Energy use 3. Health and well being 4.Pollution 5.Transport 6.Land use and ecology 7.Materials 8.Water 9.Innovation	1.Sustainable sites 2.Water efficiency 3.Energy and Atmosphere 4.Materials and Resources 5.Indoor Environmental Quality 6.Innovation & design process	1.Management 2.Indoor Environmental Quality 3.Energy 4.Transport 5.Water 6.Land use & Ecology 7.Emissions 8.Material 9.Innovation	1.Project Management 2.Site Development area 3.Energy 4.Water 5.Resource 6.Emissions, Effluents & Other Impacts 7. Indoor Environment	1.Energy Efficacy 2.Indoor Environmental Quality 3.Sustainable Site Planning & Management 4.Material & Resources 5.Water Efficiency 6.Innovation

The first detailed rating system for evaluating Malaysian environmental design and sustainable buildings based on energy efficiency, Indoor environmental quality, sustainable site planning and management, innovations and water efficiency. Based on the comprehensive rating, the green building index compliance for university library would be based on energy efficiency, indoor environmental quality and sustainable site design and management.

1.2 Problem Statement

This project focusing on university library is also known as the hub of knowledge, where students can avoid loud roommates and technical disruptions, students can search for an alternative position in a constructive atmosphere for research and get their job done. A well-constructed green building can enhance the occupants and environmental health, which also takes an advantage on the light pollution reduction, insulation, airflow and aesthetic appeal inside the university library. The indoor environmental quality of university library should be integral to the green building concept as the environmental toxins and the emission of carbon dioxide gas CO_2 , ensuring an adequate air flow, air temperature and air quality. The cost saving opportunities from the energy consuming technologies could be reduced by having a green building compliance in university library. Energy initiatives include innovations and designs that optimize the efficiency of buildings to gain more with less input. These include technologies and design that improve library's performance such as high-efficiency glazing, passive heating and cooling, high efficiency lighting, solar and other renewable energy.

Figure 1.2: Level 1 Laman Hikmah Library UTeM.

1.3 Objective of the projectcs

1) To conduct an assessment on University Library according to Green Building Index criteria.
2) To propose measures for certified Green Building Index compliance of university library.
3) To suggest ways to improve the settings of Green Building Index compliances for university library.

1.4 Scopes

1) The indoor environmental quality of university library should be integral to the green building concept as negative environmental impact could be reduced.
2) University library has the potential of implementing green building criteria for the whole building management.
3) Potential to improve university library's energy efficiency.
4) Study on the design and sustainable management that meets the objective of Green Building index criteria of university library.

1.5 General Methodology

Based on the project given, the problem statement, objective, significance of study, and the scope of study were analyzed and structured based on the title of the project. To achieve the project's objective, relevant literature from the journals, published thesis, articles, blogs and any materials on Green Building concepts. Through this, the justification of the relation of previous studies carried out, with the title of this project are studied and explained. The general methodology follows as:

a) The data on physical quantities which has been measured in the University Library and evaluated for the study purpose. Data on minimum energy efficiency performance on the use of air-conditioning and carbon dioxide gas CO_2 emission inside the library atmosphere.
b) Besides, analyzed the use of lightings used in the library that complies with the Green Building compliance.
c) Questionnaire will be prepared for the University library occupant on the Indoor Air Quality and IAQ meter.
d) Analysis on performed data will be recorded for the study purpose and for the project's report.

Improved indoor environment improves occupant wellbeing and productivity, this may reduce the sick building syndrome, absenteeism and presenteeism in the library. Perform the study on the design of the university library that meets the criteria of Green building index, on the ventilation system and the renewable energy. Lastly, a complete report on the assessment of university library on the Green building index that meets its criteria that is complied with its standard. Figure 1.3, shows the general methodology flow chart.

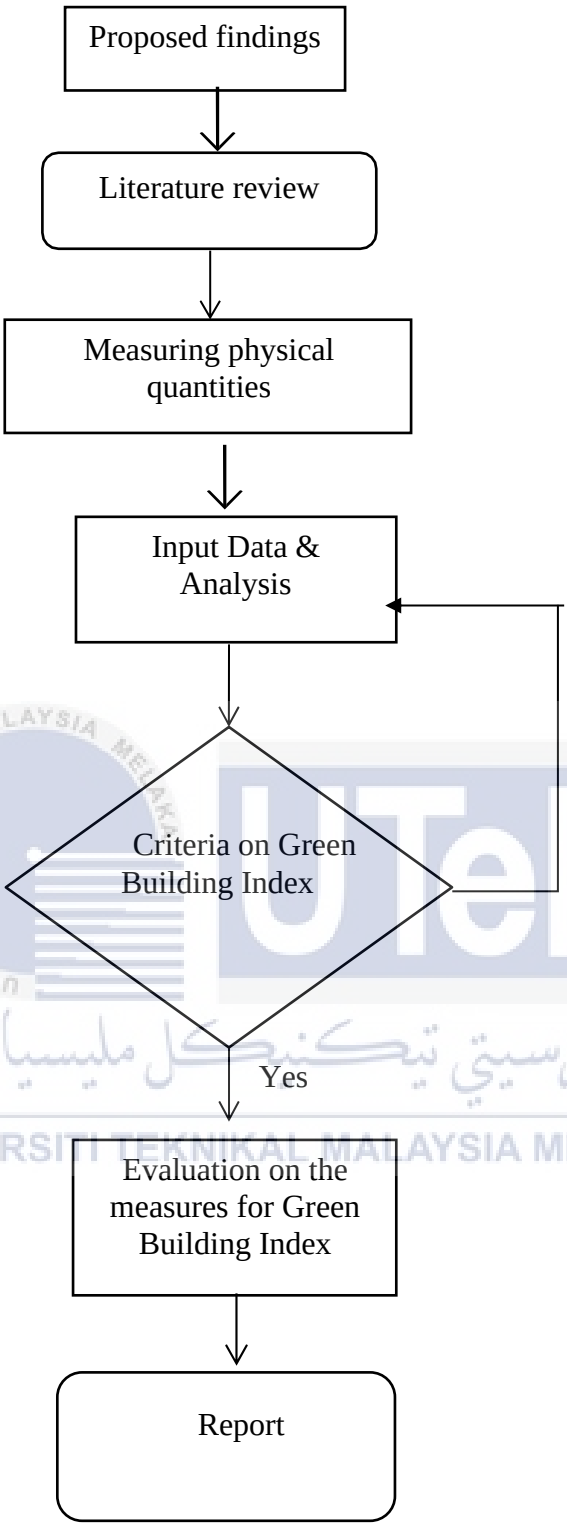

Figure 1.3: Flowchart of general methodology

1.6 Importance of Research

The significance of this project would be essentials to the occupants of the university library in terms of health and conducive condition surrounding it. Green Building index was developed to save energy and resources, that eventually can reduce the electrical consumption in library and preserve the tenant on the utility billings. Besides, going green means the library is away from harmful contamination and having the occupants have the potential to breathe in healthy and fresh air. Getting a healthy indoor environment preserves the health of the occupants and increases their quality of life by preventing serious illness caused by harmful substances being inhaled. The value of green construction reaches well beyond the ecosystem's finances and benefits occupants on a social level. Occupants would be healthier and could enjoy an enhanced standard of living.

CHAPTER 2

LITERATURE REVIEW

In Malaysia, the “Green Building Index (GBI)” is the acknowledged “Rating Tool” for green buildings. This promotes built-environment sustainability and raises knowledge of these issues among associated stakeholders, such as developers, contractors, and architects.
as well as architects. The “GBI Rating Tool” uses six key factors to evaluate residential and commercial properties: “Indoor Environment Quality (EQ), Sustainable site planning & management (SM), Materials and Resources (MR), Energy Efficiency (EE), Innovation (IN), and Water Efficiency (WE).” Buildings are also classified into the following categories: “Non-Residential New Construction (NRNC)” and “Residential New Construction (RNC)”.

2.1 Sustainable development in construction

Sustainable building, also referred to as Green Building, is a style that satisfies existing criteria by not compromising future generations potential to fulfill their own requirements. Besides, sustainable development will reduce level of energy and resources use and waste reproduction in order not to damage the natural systems on which future generations will rely to provide them with resources, ingest their waste and provide safe and healthy living conditions.

Economically, Malaysia is one of the world's fastest growing construction industries. Holding away from further environmental degradation is the fundamental balance between the systems of the financial and ecological system. Sustainable construction of university library refers to the ways of how the developers design, develop, build and control a project that make as little negative impacts on the environment and occupants as possible.

2.1.1 Importance of sustainability in green building construction

Sustainable development is very important for saving to ensure that future generations may benefit from benefits close to those of the present generation., capable of persuading