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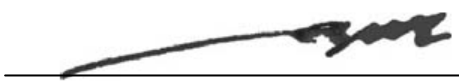

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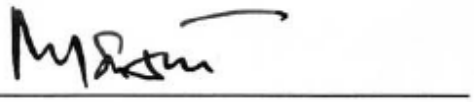
Signature : 

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INCORPORATING SUSTAINABLE CONCEPT TO IMPROVE ARCHITECTURAL DESIGN

AHMAD MAWARDI BIN MOHD ZAINAL

A project report submitted in partial fulfillment of the
requirement for the award of the degree of
Master of Science (Construction Management)

Faculty of Civil Engineering
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DEDICATION

Ya Allah,

Without your guidance,
I am none but a forgotten human
Who never satisfies what has been given…

This work is dedicated to the most sincere,
Loving and caring parent,
My beloved ‘abah’ and ‘mak’

‘Without your hope and prayer,
I am none
But a fallen leaf
On the ground ash…’

ACKNOWLEDGEMENT

In the Name of Allah, the Compassionate, the Merciful, Praise be to Allah, Lord of the Universe

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Last but not least, I dedicate my sincere appreciation to my beloved parents, my father En. Mohd. Zainal Bin Zulkifli and my mother Pn. Sawiyah Bt. Ismail for the love, patient, moral and financial support.

ABSTRACT

The world's economic and technology changes continue to grow creating an increased need for more houses, buildings and public infrastructure. Due to that matter, our government introduces the "Sustainable Concept" that we can apply to the construction industry to maintain our ecosystem and built environment as well. This project focused on the application of sustainable concept during design stage in construction process for the high rise building in Klang Valley with specific emphasis on ventilation and lighting. The methodologies adopted for the project include interview and questionnaire survey. Apart from that three case studies has been conducted on the buildings that have applied the sustainability concept. The study has identified the important elements of sustainability concept. It has also been determined that it is possible to incorporate sustainable concept at design stage particularly in ventilation as been demonstrated in the three case studies conducted.

ABSTRAK

Perkembangan pesat ekonomi dunia masa kini telah menyebabkan berlakunya peningkatan didalam projek pembinaan dan kemudahan infrastruktur. Kesan daripada ini, kerajaan telah memperkenalkan kepada kita semua “Konsep Pembinaan Tahan Lama” (sustainable construction) yang dapat diaplikasikan didalam sektor pembinaan demi manjaga ekosistem dan alam sekitar. Didalam projek ini, penekanan telah diberikan kepada aplikasi Konsep Pembinaan Tahan Lama (sustainable construction) didalam proses rekabentuk bangunan pencakar langit di sekitar Lembah Klang dan memberi tumpuan kepada sistem pengudaraan dan pengcahayaan. Methodology yang digunakan dalam kajian ini adalah temubual dan borang soal selidik yang dijalankan untuk mendapatkan maklumat yang lebih terperinci daripada individu yang berkaitan. Selain dari itu kajian kes terhadap bangunan-bangunan yang menggunakan konsep pembinaan tahan lama (sustainable construction) juga telah dijalankan. Kajian telah membuktikan kesesuaian aplikasi konsep ini didalam proses rekabentuk bangunan terutamanya dalam sistem pengudaraan dan pengcahayaan.

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LIST OF SYMBOLS

%	-	Percentage
°C	-	Celcius
CO_2	-	Carbon dioxide
Kwh/m^2	-	Kilo watt hour per meter square
m/s	-	Meter per second
M	-	Meter
MM	-	Millimeter
M^2	-	Meter square
M^3	-	Meter cube
MWh/year	-	Mega watt hour per year
O_2	-	Oxygen
Pa	-	Pascal
ppm	-	Part per million
RM	-	Ringgit Malaysia
s	-	Second

LIST OF ABBREVIATIONS

AC	-	Alternative Current
ACH	-	Air Change Rate
AHU	-	Air Handling Unit
ASHRAE	-	American Society of Heating, Refrigerating and Air conditioning Engineers
BAS	-	Building Automation System
BCS	-	Building Controlled System
BEMS	-	Building Energy Management System
CIBSE	-	Chartered Institution of Building Services Engineers
DC	-	Direct Current
DX	-	Direct Expansion
EPU	-	Economic Planning Unit
EE	-	Energy Efficiency
GFA	-	Gross Floor Area
HVAC	-	Heating, Ventilating and Air conditioning system
HVS	-	Hybrid Ventilation System
IAQ	-	Indoor Air Quality
IBS	-	Intelligent Building System
KLCC	-	Kuala Lumpur City Centre
KLIA	-	Kuala Lumpur International Airport
LEO	-	Low Energy Office
LUX	-	Lumen

MEWC	-	Ministry of Energy, Water and Communications
PV	-	Photovoltaic
VAV	-	Variable Air Volume

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CHAPTER 1

INTRODUCTION

1.1 Introduction

The needs for sustainable development has been recognized and popularized as a concept during the United Nations Conference on Environment and Development (UNCED), also known as Earth summit, held in 1992 in Rio de Janeiro Norman *et al*., (1995). During the conference, head of nations, pledged to take action against some perils confronting such as pollution, global warming and ozone depletion. Sustainable development is a simple idea of ensuring a better quality of life for everyone, now and for generations to come. It means achieving social, economic and environmental objectives at the same time. On the other hand, the construction industry has a huge contribution to fulfill our quality of life by changing the nature, function, and appearance of our cities.

The world's population continues to grow creating an increased need for more houses, buildings and public infrastructure. The energy consumption, waste production and water consumption continues to increase. If the resources are misused, the ability of future generations to adequately meet their needs will be significantly reduced. Hence it

is critical to find a solution to make construction project that can integrate more effectively with the environment. This concept can be implemented during the design phase. By referring to Bayer(2002) the benefits of applying sustainable concept to construction are: minimization of resource consumption; maximization of resource reuse; use renewable and recyclable resources; protect the natural environment; create a healthy and non-toxic environment and last but not least pursuing quality in creating the built environment. In brief, a number of strategies and policies had been arises in order to achieve the sustainable construction which can be defined as the way of creation responsibilities management in order to achieve a healthy built environment. It can bring the economical and social aspects together to make sure that we can maintain our construction for the future generation to make full use of it.

1.2 Study Background

The future construction industry in Malaysia seems to be bright. In construction industry a lot of thing are involve such as professionals, materials, environment and others (Fatimah and Norehan, 2001). Therefore, it is our responsibility to maintain and stabilize our future, especially in economics, socials and environments. In construction industry, the most important phase is during the design phase. Design methods changed with the changing requirements of industrializing nations. The traditional evolution of forms was no longer fast enough to keep up with the constant demand for the products (Sheron, 1999). The design process was removed from the site manufacturer to the drawing board where scale drawings were made.

Environmental considerations tend to be marginalized in the modern design process to extend that Environmental Impact Statements have been introduced around

the worlds in an effort to ensure that the environment is considered (Sharon, 1999). There are gross impacts of development to our environment. During the design phase, the environment consideration that should be considered at design stage of every product and project of what ever size such as the choice of materials, layout and implications.

1.3 Problem Statement

Since the Industrial Revolution, the world has witness incalculable technologies achievements, population growth and corresponding increases in resource use. In order to enter a new century, we are recognizing the side effect of development, such as the landfills, flood, global warming and others. All this effect happens without any proper planning during the development phase. This entire thing is straining the limits of the earth's carrying capacity, its ability to provide the resources required to sustain life while retaining the capacity to regenerate and remain viable (David, 1996). Besides that, out government pays a lot of money in built the development, but government also pays a lot of money in demolishing the old building. Building has significant impact on the environment, accounting for one-sixth of the world fresh water, one-quarter of the wood harvest and two-fifth of its material and energy flows (David, 1996).

All the resources need to create, operate and replenish, so to remain competitive and continue to expand and produce profits in the future, the built industry must address the environmental and economic consequence of its actions. Moreover, that recognition is leading to changes in the way the building owners approach the design, construction and operation of the structures. Why these things happen? It is because there is lack of knowledge about the principles of sustainable construction among the professionals that involved in construction industry. Besides that, lack information and exposure about this

principles, leads to all these problems. To overcome these problem, our country had attended a lot of seminar, either local or international, showing how important to sustain our environment, economic and social for our future generations. How our construction industry is developed, planned, designed, constructed and used will largely determine our quality of life.

A well planned and designed built environment will consider the natural environment and validate it as intrinsically important an also necessary to our well being (Macy, 1993). This study is about, application of sustainable construction principles in construction industry. By using these principles, this research will study the effectiveness and established in design phase, to ensure better quality life for the future. For the purpose of this research, we will look through many aspects such as environment, technologies, building, economics, socials and so fourth.

1.4 Aim and Objective

The aim of this study is to evaluate the application of sustainable elements in design process to improve the architecture design. To achieve this aim the following objective has determined:

a) To identify the area of possible application of sustainable elements to the process of building design.
b) To study the effectiveness of sustainable elements in building.
c) To identify how the sustainable construction can improve the architectural design.

1.5 Scope of Research

The data collected for this study generated from Klang Valley and Putrajaya only. Building selected for the case study are only those that implements the Intelligent Building System such as ventilation system and lighting.

1.6 Brief Research Methodology

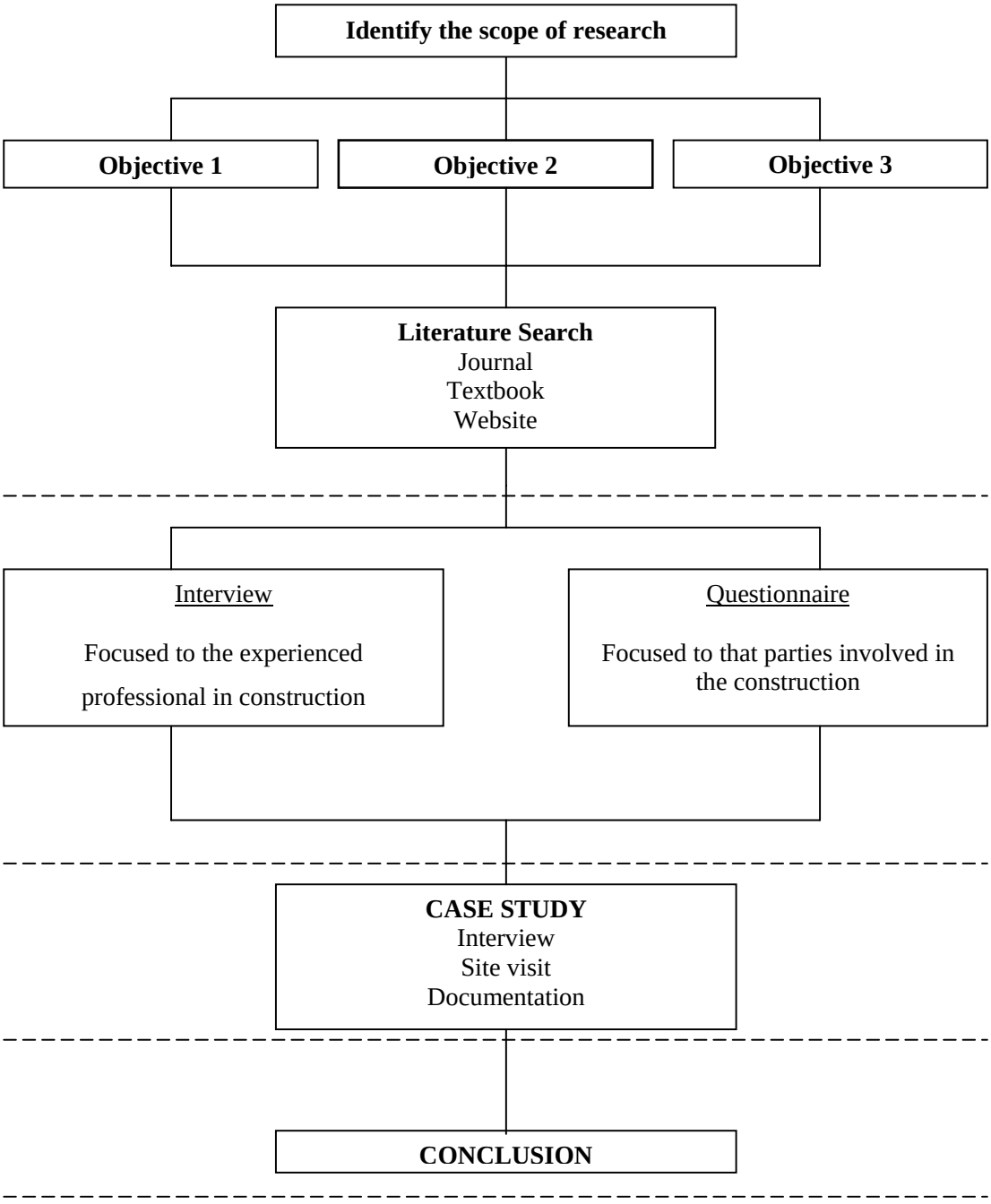

Figure 1.1 Flow Chart of Methodology

CHAPTER 2

SUSTAINABILITY CONCEPT

2.1 Introduction

According to the United Nations Bruntland commission in 1990 defined sustainability as meeting the needs of the present generation without compromising the ability of future generations to meet their own needs. For many reasons, it is difficult to meet its current needs in ways that are truly sustainable. By understanding this, it is the goal of the sustainability to reduce the use of resources and work toward the ultimate goal of sustainability. It is a simple idea of ensuring a better quality of life for everyone, now and for generations to come. The construction industry has a huge contribution to fulfill our quality of life. Construction, building materials and associated professional services together account for some 10% of Gross Domestic Product and provide employment for around 1.5 million people. Buildings and structures change the nature, function and appearance of our towns and countryside.

In 1972, Malaysia has been the reference point for the integration of development and environment issues. The third and fifth Malaysia plans are proof of our recognition

that the environment and development are inseparable. During the fifth Malaysia plan, there are some considerations that has been proposed due to the environmental policy objectives and strategies be extended, emphasized and integrated into better policies and economic objectives during the sixth plan (1990 to 1995). The policies were included the Land use policy for strict classifications and diligent implementation, forest policy for conservation and sustainable use and supply and the agriculture policy for increase of food production without destruction or overburdening the water resources (Abu Bakar Jafaar, 1990).

Besides that, another policy that has been proposed is the energy policy for an environmentally sound energy pathway with increasing emphasis on energy efficiency, minimizing of waste generation, facilitating recycling and reuses, control of hazardous chemicals and the development of institutional mechanisms to manage risk. To ensure the sustainability of our development, the population policy play an important role to integrated with another economic and social programmes, education and health care. Besides, we can minimize the pressure on the environment.

2.2 Sustainable Development

Sustainable development is development which meets the needs of the present without compromising the ability of future generation to meet their own needs (Parkin, 2000). The word development in this definition implicates two important aspects of the concept: It is omni disciplinary, it cannot be limited to a number of disciplines or areas, but it is applicable to the whole world and everyone and everything on it, now and in the future. Secondly, there is no set aim, but the continuation of development is the aim of the development. The definition is based on two concepts:

a) the concept of needs, comprising of the conditions for maintaining an acceptable life standard for all people and;
b) the concept of limits of the capacity of the environment to fulfill the needs of the present and the future, determined by the state of technology and social organization.

The needs consist firstly of basic needs such as food, clothing, housing and employment. Secondly, every individual, in every part of the world should have the opportunity to try and raise his or her life standard above this absolute minimum. The limits consist of natural limitations like finite resources, but also of declining productivity caused by over exploitation of resources, declining quality of water and shrinking of biodiversity. For our common future, it would therefore be best if needs are best fulfilled while limits are not increased, but preferably decreased. This would lead to the quite simple conclusion that all political, technical and social developments can easily be evaluated in the light of sustainable development by these two arguments. Any development should help fulfill needs and should not increase limitations. So, sustainable development can be summarized as an improvement in economic, socials and technologies in the living condition for long-term process in order to securing the natural environment.

2.3 Themes of Sustainable Development

Sustainable development comprises of the three broad themes of social, environmental and economic accountability. According to Malik *et al.* (2002) these themes were called 'triple bottom line'. The summary of this theme can be referred at Figure 2.1 below.

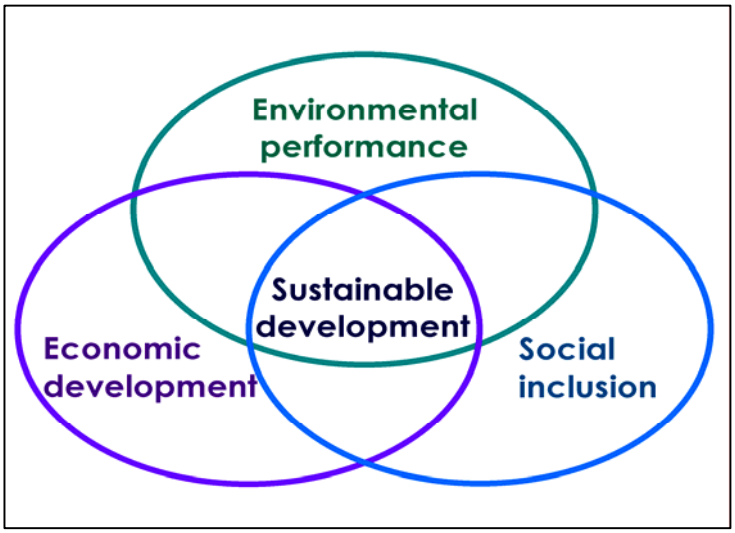

Figure 2.1 Three dimension of sustainable concept

2.4 Benefits of Sustainable Development

Sustainable is an opportunity to use natural resources efficiently while creating healthier buildings that improve human health, build a better environment and provide cost saving. A green building is a structure that is designed, built, renovated, operated or reuse in an ecological and resources efficient manner. Green building are designed to