UNIVERSITI TEKNOLOGI MARA

DECISION MAKING FRAMEWORK ON ENERGY RETROFITTING BY STAKEHOLDERS FOR COMMERCIAL OFFICE BUILDING IN MALAYSIA

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ABSTRACT

Building sector is one of the largest sources of gas emission. The data from the USGBC and AIA shows a huge number of percentages which also gave huge negative impact on the environment. The existing buildings were not built based on green practices. Demolish the existing building is not practically viable to solve the negative impact on the environment, hence, there is one approach which is building retrofitting. The rate of response to building retrofitting is very low. The building stakeholders are the key person who can decide on the retrofitting of a building. Some research stated that the building stakeholders are less interested to retrofit the building. The reason why the building stakeholders are not likely interested in sustainable retrofitting is because there are lacks of business cases for sustainable retrofitting and it is also based on the circle of blame. Besides, lack of awareness of the building owners was also one of the reasons to the low progress in energy or sustainable retrofitting. Lack of established practises on decision making tools also one of the reason the failure for the building retrofitting on the existing building. Most of the researches were focused on the technology implementation for the building, but just few researches were focus on the aspects of decision making. It was found only little research was exploring on the decision making which consider four (4) main criteria before making a decision which are economic, technical, social and environment. From the above problem statement, three (3) objectives are created. The first objective is to identify the decision making criteria on energy retrofitting by stakeholders for commercial office building in Malaysia. The second objective is to rank the decision making criteria on energy retrofitting by stakeholders for commercial office building in Malaysia and the last objective is to develop the framework for decision making criteria on energy retrofitting for commercial office building in Malaysia. All information of the criteria will be obtained from a comprehensive literature review. The pilot study was conducted to achieve objective one. To achieve objective two, the questionnaire was distributed to the respondents and been analysed using SPSS to rank the decision making criteria on energy retrofitting by stakeholders for commercial office building. From the decision making criteria ranking, an interview with few experts was conducted for validation. Then the findings been analysed using Atlas.ti 9 software to develop the decision making criteria framework. This framework will help the stakeholders to make a better decision before retrofit the building.

ACKNOWLEDGEMENT

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CHAPTER ONE
INTRODUCTION

1.1 Background of the Research

The population in the world keep increasing from year to year and this will raise demand on the building development sector. This will also lead to demand on the energy. This situation later on will affect the environment as the carbon dioxide and greenhouse gas emissions increase. In Europe, building sector is the largest energy consumer as it consumes up to 40% of total energy generated (Hassan et. al., 2014). In 2010, data from the United State Department of Energy estimates that the building consume 74% of electricity usage and release 40% of carbon dioxide (Hassan et. al., 2014). This has supported by other author that one of the largest sources of gas emission in the world is building sector which about 30% - 40% of energy consumption (Fan & Xia, 2018). Data from American Institute of Architects (AIA), recorded almost 50% of gas emissions is produced from buildings and its constructions in which the energy consumption in the productions and transportation of the materials. In Malaysia, the data from Energy Commission Handbook (2020) shows that the commercial building consume up to 6% and the electricity consume up to 20% from the total consumption of energy in Malaysia.

The United State Green Building Council (USGBC) stated that existing building used half of the annual energy and produced gas emission which existing building recorded over 72% of electricity consumption, 39% of energy used, released 35% of carbon dioxide emission, used 40% of raw material, produce 30% of waste and 14% of water consumption (Abdullah, 2015). The data show a huge number of percentages which also gave huge negative impact on the environment (Abdullah, 2015). This also occurred in Malaysia as the number of population increase, the demand for building also increasing as well as increase in energy demand. Some research has proven that up to 40% energy consumption was from building and it release 1/3 of global contamination. Rozana (2012) as cited in Hassan et. al. (2014), stated that existing building in Malaysia and its communities has contributed to 40% of gas emission to environment. In addition, generation of electricity and consumption are expected to