

Implementation Framework of Green Building for Malaysian Government Building: KKR2 Study

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Abstract. The purpose of this study is to develop the Implementation Framework of Green Building for Government Project. Implementation of Green Building Design is very important in Malaysia to conduct and execute green government project. The research intended to answer the questions about the factors involve in the development of the framework, what is the significant relationships exists between the factors involve in the Implementation Framework and whether there is significant relationship exists between the factors in implementation framework. A total 30 respondent selected between multilevel of project team KKR2 including engineers, assistants engineers, technical assistant, stake holders, contractors and consultants. In conclusion the study answered pertaining questions regarding the factors involve in development of Implementation Framework of Green Building through quantitative research and hypothesis testing.

1. Introduction

The building which we live, work and play interact with our environment, affecting storm water run off, energy and water consumption, transportation patterns, and indoor air quality. Recognition of the role that buildings have in our environment has led to significant efforts to design, build and maintain more sustainable structures (Parris, 2010). Green building practices includes environmentally responsible and resource efficient, promote building practices that conserve energy and water resources, preserve open spaces, minimise the emission of toxic substances, harmonise with the local climate, traditions, culture and the surrounding environment, sustain and improve the quality of human life, maintaining the capacity of the ecosystem at local and global levels. Benefit of green building to the environment is save energy use at 24% up to 50%, CO₂ emissions 33% up to 39%, water use save 40% and solid waste reduction of 70% for each green building (Turner, C. & Franks, M (2008). Instead of benefit to the environment, green building also contributes to the building stakeholders by enhancing health and productivity, reduced environmental impact, environmentally effective use of materials, lowering electric and water utility costs and gives long term economic return. In relation to the title, the main purpose of this study is to determine the factors involve in the development of the Implementation Framework of Green Building Design For Malaysian Government Building, significant relationships between the factors involves and is there significant relationship exists between the factors in the framework. The analysis is determines based on quantitative research and hypothesis testing.

2. Problem Identification

Prime Minister of Malaysia, Dato' Sri Haji Mohamad Najib bin Tun Haji Abdul Razak has announce Malaysia commitment in United Nations Climate Change Congress 2009 (COP 15) in Copenhagen on 17 December 2009 that during 2020 Malaysia will reduce carbon emission rate up to 40 % from the current rate on 2005. There are also major issues for Malaysia that we will become a net importer of energy by 2015. The way Malaysian building has been designed will affect the energy consumption required. There is difficulty to justify Implementation Green Building in Government projects. Existing guidelines and Code of Practise on Energy Efficiency and Renewable energy to achieve low carbon building in the market such as MS1525, Dasar Teknologi Hijau and Development and publication of EE in Buildings Guidelines does not cover the strategies or method to implement green building for government project. Besides that, in Malaysia, there is only Green Building Index which is the rating tool for Green Building and private initiatives.

Public Works Department of Malaysia is the largest implementers of Government Buildings and projects in Malaysia. Despite the excellent and best practise of project management procedures and guidelines that has implement in Public Works Department

In addition to Public Works Department initiatives and commitment to deliver outstanding Green Building Projects as mention in the Public Works Department Key Performance Indicator in the Strategic Framework 2012-2015 to produce outstanding project delivery. This Implementation Framework is a starting point and

beginning role of Public Works Department as the Implementers of Green Building Projects for Government of Malaysia.

3. Research Objectives

The Introduction and the problem statement above led to the formulation of the research aim and objectives. The broad aim of this research is to introduce/establish implementation framework of green building government building. In accordance with the research aim, the pertaining objectives of this study are: a) to determine the control factor/ critical areas to focus on the green building design. B) To assess current project team/ staff perception in implementation of green building project. C) To integrate green building factors as rating tools in existing design and project management procedure. D) To build implementation framework of green building design for government building.

4. Propose Conceptual Framework for Implementation Framework of Green Building Design for Malaysia Government Building

The suggested framework (Figure 1) is derived from the analytical literature review of the study which consists of concept process phases and also in depth review of previous study conducted from previous research. This framework consist of 5 factors involving project management procedure/ guideline/ government policies, type of project execution (design and build/) or conventional) and project staffs perceptions.

5. Pilot Test Conducted at Kompleks Kerja Raya 2 (KKR2) Project

Pilot test was conducted on 12 April 2015 to test on reliability, validity of the instrument used and Inferential Analysis Correlation Pearson to test on the hypothesis that has been developed. The pilot test were conducted upon 30 respondent selected between multilevel of project team including engineers, architects, quantity surveyor, assistants engineers, technical assistant, stake holders, contractors and consultants from Kompleks Kerja Raya 2 Project Team, Cawangan Kerja Bangunan Am', PWD Headquarters, Kuala Lumpur. All the questionnaires reviewed accordingly to ensure all the questions is answered.

Table 1 shows respondent pilot test profile according to designation grade, age, gender, race and education. Overall, respondent for supporting staff are 6 respondents, meanwhile management staff are 3 respondents and professional staff are 21 respondents. Meanwhile for age of respondent, 3 respondents is at age 19-24 years old, 13 respondents is at 25-40 years old, 12 respondents is at 41-56 years old and 2 respondents is at 57-60 years old. Next for gender, 18 no of respondents are male and 12 no of respondents are female. For race, 27 no of respondents are Malay, 1 no respondent is Chinese and 2 respondents is Indian. Meanwhile in terms of respondent education, 1 respondent is primary school, 1 respondent is secondary school , 24 respondents are Universities Level and 3 respondents are others education level.

Table 1. Respondent demography profile

| Demography | Frequencies | Percentage |
|--------------------------|-------------|------------|
| Designation grade | | |
| Professionals | 21 | 70 |
| Management | 3 | 10 |
| Supporting Staff | 6 | 20 |
| Age | | |
| 19-24 years | 3 | 10 |
| 25-40 years | 13 | 43.3 |
| 41-56 years | 12 | 40 |
| 57-60 | 2 | 6.7 |
| Gender | | |
| Male | 18 | 60 |
| Female | 12 | 40 |
| Race | | |
| Malay | 27 | 90 |
| Chinese | 1 | 3.3 |
| Indian | 2 | 6.7 |

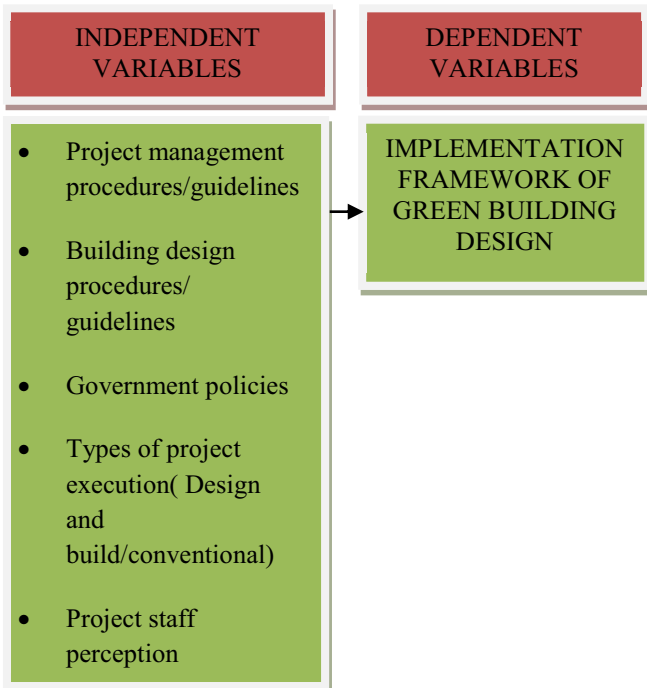


Figure 1. Conceptual Framework

Table 4. Reliability Statistic

| Cronbach's Alpha | N of Items |
|------------------|------------|
| 0.922 | 55 |

Education

| | | |
|------------------|----|-----|
| Primary School | 2 | 6.7 |
| Secondary School | 1 | 3.3 |
| Universities | 24 | 80 |
| Others | 3 | 10 |

Table 5. Item-Total Statistic

| | Scale Mean if Item Deleted | Scale Variance if Item Deleted | Corrected Item-Total Correlation | Cronbach's Alpha if Item Deleted |
|--------------|----------------------------|--------------------------------|----------------------------------|----------------------------------|
| Age | 113.8667 | 502.257 | .341 | .921 |
| Gender | 114.9000 | 504.093 | .463 | .921 |
| Race | 115.1333 | 517.430 | -.125 | .923 |
| Education | 113.3667 | 509.068 | .181 | .922 |
| Design Grade | 114.8000 | 525.269 | -.299 | .926 |
| Q7 | 114.3333 | 491.609 | .411 | .921 |
| Q9 | 114.7000 | 489.321 | .687 | .919 |
| Q10 | 114.9333 | 492.064 | .613 | .919 |
| Q11 | 114.7000 | 492.769 | .558 | .920 |
| Q12 | 114.3667 | 487.482 | .607 | .919 |
| Q13 | 114.6000 | 482.248 | .786 | .918 |
| Q14 | 113.4333 | 484.599 | .230 | .929 |
| Q15 | 114.6000 | 491.559 | .605 | .919 |
| Q16 | 114.5000 | 485.638 | .724 | .918 |
| Q17 | 113.6000 | 510.248 | .106 | .923 |
| Q18 | 114.0000 | 495.586 | .556 | .920 |
| Q19 | 113.8000 | 502.717 | .210 | .923 |
| Q20 | 113.6333 | 507.689 | .148 | .923 |
| Q21 | 113.6667 | 513.057 | .021 | .924 |
| Q22 | 114.4667 | 489.775 | .596 | .919 |
| Q23 | 114.4333 | 479.771 | .718 | .918 |
| Q24 | 114.4000 | 481.628 | .709 | .918 |
| Q25 | 113.8333 | 496.557 | .396 | .921 |
| Q26 | 113.9333 | 494.133 | .397 | .921 |
| Q27 | 114.4000 | 496.938 | .508 | .920 |
| Q28 | 114.0333 | 496.102 | .389 | .921 |
| Q29 | 113.8000 | 501.200 | .301 | .922 |
| Q30 | 113.6000 | 507.283 | .127 | .923 |
| Q31 | 113.4000 | 517.352 | -.078 | .925 |
| Q32 | 113.4000 | 510.731 | .043 | .925 |
| Q33 | 114.5333 | 489.085 | .690 | .919 |
| Q34 | 114.3000 | 494.010 | .542 | .920 |
| Q35 | 114.2667 | 497.651 | .608 | .920 |
| Q36 | 114.4000 | 500.731 | .457 | .921 |
| Q37 | 114.3667 | 490.033 | .692 | .919 |
| Q38 | 114.4667 | 508.740 | .210 | .922 |
| Q39 | 114.5333 | 491.085 | .716 | .919 |
| Q40 | 114.2333 | 502.668 | .306 | .921 |
| Q41 | 113.8000 | 504.648 | .208 | .922 |
| Q42 | 114.0000 | 499.931 | .376 | .921 |
| Q43 | 114.2333 | 496.668 | .530 | .920 |
| Q44 | 114.3000 | 485.528 | .678 | .918 |
| Q45 | 113.9667 | 488.447 | .518 | .920 |
| Q46 | 114.2000 | 484.993 | .710 | .918 |
| Q47 | 113.9000 | 501.472 | .310 | .921 |
| Q48 | 113.9667 | 495.895 | .437 | .920 |
| Q49 | 114.2333 | 495.564 | .530 | .920 |
| Q50 | 114.5333 | 489.568 | .642 | .919 |
| Q51 | 114.3667 | 497.206 | .482 | .920 |
| Q52 | 114.3333 | 503.471 | .393 | .921 |

6. Pilot Test Data Analysis

For this pilot test, the data will be analyze using "Statistical Package For Sosial Science" (SPSS). Analyzing technique that will be used is descriptive analysis and inferential analysis. Descriptive analysis consists of percentage and frequencies respondent feedback and the strength for every variables. Inferential Analysis will used correlation Pearson Techniques. Besides that, coding process and recoding the data is essential before the data analysis is done Statistical test conducted to test hypothesis is Pearson Correlation.

6.1 Reliability test analysis for the KKR2 project pilot test

After the data is collected and reviewed accordingly, next the goodness data collected should be tested. Reliability for the data happened when the test to measure the same element repeatedly and the result is the same (Salkind, 2006 in Mohd Khairul Nizam, 2007). If the second measure, third, etc. have the same result, this means the research has high reliability (Chua, 2006). In addition, reliability test has been conducted to measure the stability of the instrument used. For This research Cronbach alpha near to 1, the highest reliability the instrument used will be. Rule of thumbs for Cronbach alpha value by Hair et. al.(2007) will be used as guidelines to show the strength for every test and measures.as shown in table 2.

Table 2.

| Alpha | Relationship strength |
|-------------|-----------------------|
| < 0.6 | Strong |
| 0.6 - < 0.7 | Medium |
| 0.7 - < 0.8 | Good |
| 0.9 - < 0.9 | Very Good |
| 0.9 | Excellent |

The reliability test result conducted at KKR2 Project shows:-

Table 3. Case processing summary

| | N | % |
|--------------|----|-----|
| Cases Valid | 30 | 100 |
| Excluded (a) | 0 | 0 |
| Total | 30 | 100 |

a Listwise deletion based on all variables in the procedure.

| | | | | |
|-----|----------|---------|------|------|
| Q53 | 114.3000 | 496.838 | .523 | .920 |
| Q54 | 114.0667 | 484.961 | .648 | .919 |
| Q55 | 113.9333 | 482.271 | .628 | .919 |
| Q56 | 114.1333 | 489.499 | .535 | .920 |
| Q57 | 114.2000 | 500.717 | .292 | .922 |

6.2 Hypothesis Testing for KKR2 Project Pilot Test Study

There are 5 main Hypothesis develop to answers all the pertaining relationship between all the independent variables and dependent variables in the theoretical Framework. The Hypothesis are:

Table 6. Hypothesis Testing

| Research Hypothesis | Statistical Analysis |
|---|----------------------|
| Hypothesis 1 : There is significance relationships between project management procedures/ guidelines with implementation framework of Green Building . | Pearson Correlation |
| Hypothesis 2 : There is significance relationships between Building design procedures/guidelines with implementation framework of Green Building | Pearson Correlation |
| Hypothesis 3 : There is significance relationships between Government policies with implementation framework of Green Building | Pearson Correlation |
| Hypothesis 4 : There is significance relationships between types of project execution with implementation framework of Green Building | Pearson Correlation |
| Hypothesis 5 : There is significance relationships between Project staffs perception with implementation framework of Green Building. | Pearson Correlation |

7. Inferential Analysis

Inferential statistics will be used to make expected decision about analyse data and its relationship between two variables which is Pearson Correlation.

7.1 Pearson Correlation

In this pilot test, relationship between dependent variables and independent variables will be measure. To determine the relationship, correlation coefficient, r, will be analyse to determine the strength between the variables whether it is positive or negative. Criteria set by Davis (1971) (in Mohd Khairul Nizam, 2007) will be referred to evaluate the directions or strength of that relationship. Table 3 shows the strength of the relationship and the value of correlation coefficient, r as mention by Davis (1971).

Table 7. Comparative between Relationship Strength with Correlation Coefficient, r

| r value | Relationship strength |
|---------------------|-----------------------|
| ± 0.70 or higher | Very high |
| ± 0.50 until ± 0.69 | High |
| ± 0.30 until ± 0.49 | Medium |
| ± 0.10 until ± 0.29 | Low |
| ± 0.01 until ± 0.09 | Very Low |
| 0.0 | No relationship |

7.2 Pearson Correlation result in KKR2 Pilot Test Study

Pearson Correlation result in KKR2 pilot test study shows:

Hypothesis 1 : There is significance relationships between project management procedures/ guidelines with implementation framework of Green Building .

Table 8. Correlation for Hypothesis 1

| | | Project management design procedure | Green building design framework |
|------------------------------|---------------------|-------------------------------------|---------------------------------|
| Project management procedure | Pearson Correlation | 1 | .930(**) |
| | Sig. (2-tailed) | | .000 |
| | N | 30 | 30 |
| Greenbuiding framework | Pearson Correlation | .930(**) | 1 |
| | Sig. (2-tailed) | .000 | |
| | N | 30 | 30 |

** Correlation is significant at the 0.01 level (2-tailed).

Table 8 shows Pearson Correlation Test conducted in addition to answers relationship between Project Management Design Procedure/guidelines and Implementation Framework of Green Building Design.

The Pearson Correlation result shows H_1 is accepted. ($r = 0.930$) with ($p < 0.01$). This results shows there is significance, positive and strong relationship between Project Management Procedure/guidelines and Implementation Framework of Green Building Design. The positive correlation values shows that the more comprehensive Project Management Design Procedures the more effective Implementation Framework of Green Building for government building.

Hypothesis 2 :There is significance relationships between Building design procedures/guidelines with Implementation framework of Green Building

Table 9. Correlation for Hypothesis 2

| | | Project management design procedure | Green building design framework |
|---------------------------|---------------------|-------------------------------------|---------------------------------|
| Building design procedure | Pearson Correlation | 1 | .930(**) |
| | Sig. (2-tailed) | | .000 |
| | N | 30 | 30 |
| | | | |
| Greenbuilding framework | Pearson Correlation | .930(**) | 1 |
| | Sig. (2-tailed) | .000 | |
| | N | 30 | 30 |
| | | | |

** Correlation is significant at the 0.01 level (2-tailed).

Table 9 shows Pearson Correlation Test conducted in addition to answers relationship between Building Design Procedure/ guidelines and Implementation Framework of Green Building . The Correlation Pearson result shows H_1 is accepted. ($r = 0.930$) with ($p < 0.01$). This results shows there is significance, positive and strong relationship between Building Design Procedure/guidelines and Implementation Framework of Green Building Design. The positive correlation values shows that the more comprehensive Building Design Procedures/guidelines the more effective Implementation Framework of Green Building for government building.C.

Hypothesis 3:There is significance relationships between Government policies with implementation framework of Green Building.

Table 10. Correlation for Hypothesis 3

| | | Government policy | Green building design framework |
|-------------------|---------------------|-------------------|---------------------------------|
| Government policy | Pearson Correlation | 1 | .661(**) |
| | Sig. | | .000 |
| | | | |

| | | (2-tailed) | |
|-------------------------|---------------------|------------|----|
| Greenbuilding framework | N | 30 | 30 |
| | Pearson Correlation | .661(**) | 1 |
| | Sig. (2-tailed) | .000 | |
| | N | 30 | 30 |

** Correlation is significant at the 0.01 level (2-tailed).

Table 10 shows Pearson Correlation Test conducted in addition to answers relationship between Government Policies and Implementation Framework of Green Building Design. The Pearson Correlation result shows H_1 is accepted. ($r = 0.661$) with ($p < 0.01$). This results shows there is significance, positive and medium strong relationship between Government Policies and Implementation Framework of Green Building . The positive correlation values shows that the more comprehensive Government Policies the more effective Implementation Framework of Green Building for government building.

Hypothesis 4 : There is significance relationships between types of project execution with Implementation Framework of Green Building .

Table 11. Correlation for hypothesis 4

| | | Type of project execution | Green building design framework |
|---------------------------|---------------------|---------------------------|---------------------------------|
| Type of project execution | Pearson Correlation | 1 | .830(**) |
| | Sig. (2-tailed) | | .000 |
| | N | 30 | 30 |
| | | | |
| Greenbuilding framework | Pearson Correlation | .830(**) | 1 |
| | Sig. (2-tailed) | .000 | |
| | N | 30 | 30 |
| | | | |

** Correlation is significant at the 0.01 level (2-tailed).

Table 11 shows Pearson Correlation Test conducted in addition to answers relationship between Types of Project Execution and Implementation Framework of Green Building . The Pearson Correlation result shows H_1 is accepted. ($r = 0.830$) with ($p < 0.01$). This results shows there is significance, positive and strong relationship between Types of Project Execution and Implementation Framework of Green Building . The positive correlation values shows that the more well defined Types of Project Execution the more effective Implementation Framework of Green Building for government building.

Hypothesis 5 :There is significance relationships between Project staffs perception with Implementation framework of Green Building .

Table 12. Correlation for hypothesis 5

| | | Perception | Green building design framework |
|-------------------------|---------------------|------------|---------------------------------|
| Perception | Pearson Correlation | 1 | .809(**) |
| | Sig. (2-tailed) | | .000 |
| | N | 30 | 30 |
| Greenbuilding framework | Pearson Correlation | .809(**) | 1 |
| | Sig. (2-tailed) | .000 | |
| | N | 30 | 30 |

** Correlation is significant at the 0.01 level (2-tailed).

Table 12 shows Pearson Correlation Test conducted in addition to answers relationship between Project Staff Perception and Implementation Framework of Green Building . The Pearson Correlation result shows $r = 0.809$ with $(p < 0.01)$. This results shows there is significance, positive and strong relationship between Project Staff Perception and Implementation Framework of Green Building . The positive correlation values shows that the more positive project staff perception the more effective Implementation Framework of Green Building for government building.

8. Conclusion

According to the pilot test result conducted with KKR2 Project Team, the test result shows positive result with the hypothesis developed and formulated between Project Management Procedures/ Guidelines, Building Design Procedures/Guidelines, Government Policies, Types of Project Execution and Project Staff Perception with Implementation Framework of Green Building. Therefore, the result shows there is significance and positive relationships between Project Management Procedures/ Guidelines, Building Design Procedures/Guidelines, Government Policies, Types of Project Execution and Project Staff Perception with Implementation Framework of Green Building. The comprehensive, well defined Project Management Procedures/ Guidelines, Building Design Procedures/Guidelines, Government Policies, Types of Project Execution and the clear, positive perception of the Project Staff Perception ensure the effectiveness and success of Implementation Framework of Green Building for Government Building. Implementation framework of green building for Malaysian Government Building is important in addition to ensure the success of Public

Works Department as implementers of Green building for Malaysian Government Projects. This framework also important for Malaysia to have a clear and systematic execution/implementation of green government project in Malaysia.

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