

Perceptions of Contractors and Consultants Toward Application of Greenship Rating Tools on Apartment Buildings in Surabaya

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ABSTRACT - During the last ten years, the growth of apartment buildings in Surabaya has encountered the bitter experience of global warming, resource depletion, energy scarcity, and other environmental impacts. We cannot avoid them, but we can minimize the negative impacts of global warming. The green building concept is one of the methods to minimize the environmental impact. It takes into account principles of sustainable development in planning, construction, operation, and maintenance. Greenship Rating Tools is used to evaluate and calculate green achievements, prior to green building certification. The aim of this research is to represent the perceptions of contractors and consultants toward application of Greenship Rating Tools on apartment buildings in Surabaya. Based on the data obtained from a questionnaires survey carried out to 41 respondents, the mean value ranking method is used to evaluate the main factors of Greenship. These factors are Appropriate Site Development, Energy Efficiency and Conservation, Water Conservation, Material Resource and Cycle, Indoor Health and Comfort, and Building Environmental Management. In general, the results of this research show that there are a number of differences between perceptions of contractors and consultants toward application of Greenship Rating Tools on apartment buildings in Surabaya. According to the contractors' perception, Visual Comfort is a factor that would easily to be applied, whilst consultants' is Landscape. On the other hand, there are factors that would difficult to be applied. Based on contractors' perception is Climate Change, while consultants'

perception is Renewal Energy. In summary, Greenship Rating Tools can be applied on contractors' and consultants' perceptions, whilst there are some variables which can not be applied.

Keywords: Perception, Application, Greenship Rating Tools

I. INTRODUCTION

During the last ten years, the growth of apartment buildings in Surabaya has encountered the bitter experience of global warming, resource depletion, energy scarcity, and other environmental impacts. A competence of construction project stakeholders, especially for contractors and consultants is very important and vital to minimize the impact on the surrounding environment and natural resources, and to operate within the limits stated in the legal permits. Green building concept is a building, that is designed, built, operated, maintained or reused to protect occupant health, use wisely natural resources and reduce the environmental impact. According to Kubba [1], green building is designed for optimum energy efficiency and is constructed with a preference for natural resources, reclaimed, and recycled materials. Several studies have highlighted project management knowledge and skills

for green construction by Burnett [2]; and Hwang and Ng [3]. While many studies have examined the key performance indicators of project success, few have done so in the context of green construction [4, 5].

Furthermore, the performing organization implements the environmental management system through the policy, procedures, and processes of environmental planning, environmental assurance, environmental control, and performing continuous improvement activities to minimize the environmental impacts. Working closely with project stakeholders is needed to achieve environmental sustainability. Skoyles [6] explained that the generation of construction waste is one of the major negative impacts from a construction project on the environment, which can be measured by the difference between the amount of the total delivery of materials to the site and the amount of work completed. It is a fact that in construction industry the green building concept evolved and contributed an important role in determined the success of project.

Meanwhile, many countries have developed new concept of rating tools in order to improve the knowledge about the sustainable development. Sustainable development was defined as a development that meets the needs of the present without compromising the ability of future generations to meet their own needs [7]. Then, rating system is a device containing the grains of which referred to aspects of the assessment rating and each grain has the highest rating. GreenShip Rating System is an assessment tool developed by Green Building Council of Indonesia (GBCI) to determine whether a building can be declared eligible certified “green building” or not. Each building has different condition and complications of stakeholders. Project stakeholders may have different perceptions and knowledge about green building concept. Therefore, it is important to understand how far the perceptions of contractors and consultants toward application of greenShip rating tools. The aim of this research is to represent the perceptions of contractors and consultants toward application of GreenShip Rating Tools on apartment buildings in Surabaya.

Background

The Agenda 21 on sustainable development was formulated since The Rio Summit in 1992. Agenda 21 has subsequently been interpreted in several local and

sectoral agendas. It introduces several program areas that impact on the construction industry and delineates action that should be taken to increase sustainability in these areas. One interpretation of more specific relevance to the construction sector is the Habitat II Agenda. International Council for Research and Innovation in Building and Construction (CIB), as the leading international organization for research collaboration in building and construction, recognised early on the importance of environmental concerns and commitment in all its multifaceted activities. It is also a fact that the construction industry and the built environment are the main consumer of resources, energy, and materials. The three principal objectives for the Agenda 21 for sustainable construction are to create a global framework and terminology that will add value to all Agendas, to create an Agenda for CIB activities in the field, and to provide a source document for defining R&D activities.

Last of all, sustainable construction has different approaches and priorities in different countries. The problem of poverty and underdevelopment or social equity are sometimes part of the definitions of sustainable construction. The categories of problems can be classified as physical problems linked to the issue of resource, biological problems linked to the life of

mankind, and sociological problems linked to the socio-political, socio-economic, or socio-cultural.

According to Agenda 21, the key elements in the sustainable construction are reducing the use of energy sources and depletion of mineral resources; conserving natural areas and bio-diversity; and maintaining the quality of the built environment and management of healthy indoor environment. Some topics related to sustainable construction have also been identified as quality and property value, meeting user needs in the future, prolonged service life, use of local resources, building process, efficient land use, water saving, use of by-products, immaterial services, urban development and mobility, human resources, and local economy.

Challenging and rating system in green building

Green construction can be part of an overall plan for sustainable development with optimum energy, natural, reclaimed, and recycled materials. These concepts provide healthier, more comfortable, and productive indoor environment for occupants by maximizing the efficient usage of energy, water, and raw materials. According to Wang and Ng [3], challenges faced in green construction can be explained that green construction tend to cost more to construct, technical difficulty during the construction process, risk do to

different contract forms, lengthy approval process for new green technologies and recycled materials, unfamiliarity with green technologies, greater communication and interest required among project team members, and more time to implement green construction on site. The challenges in green construction not only to determine the optimal balance between the various constraints of the construction act but also to endeavour favour decision without regret in the life cycle of building, and especially in the construction phase.

Richard et al. [8] suggested some key recommendations for sustainable rating tools such as to reduce the barriers between international markets and associated confusion, and it is not possible to use the same rating tools in each country. These preparations should provide some clarification of the assessment tools for sustainable building, which in turn assist stakeholder such as investors, developers, tenants, and government bodies. Firdaus [9] concluded that the rights, obligations, and responsibilities of a GreenShip Professional on the project is not clear and need to explain the legal rules. Every country has their own rating system, for example the United States –LEED (Leadership in Energy and Environmental Design), Singapore - Green Mark, and Australia –Green Star.

Furthermore, the Green Building Council of Indonesia published the Greenship Rating Tools, developed in cooperation with related expert, industries, government, academics, and other key organizations in Indonesia. It is used to evaluate and determine green achievements, prior to green building certification. Greenship Rating Tools as a rating system is divided into six aspects as follows: Appropriate Site Development/ASD 16 points, Energy Efficiency & Conservation /EEC 36 points, Water Conservation/WAC 20 points, Material Resource and Cycle /MRC 12 points, Indoor Health and Comfort/ IHC 20 points, and Building Environment Management 13 points. Depending on the sum of the point values achieved, the building is certified accordingly.

II. Method

The survey method was adopted to represent the perceptions of contractors and consultants toward application of Greenship Rating Tools on apartment buildings in Surabaya. A questionnaire survey was designed for respondents to assess the application of Greenship Rating Tools. A five-point scale (described as 1= very easy to be applied, 2= easy to be applied, 3= fair to be applied, 4=difficult to be applied, 5=very difficult to be applied) was adopted where respondents were presented with a statement in the question sheet. The question were phrased to ask the respondents an affirmative response on the main six

aspects of greenship rating tools. Each aspect is represented with related indicator. These aspects are Appropriate Site Development/ASD, Energy Efficiency & Conservation /EEC, Water Conservation/ WAC, Material Resource and Cycle /MRC, Indoor Health and Comfort / IHC, and Building Environment Management/BEM.

The questionnaire was then developed consisting of question that inquire about the variables that measure the aspect of greenship building. Each question was associated with variables described in the preceding sections. The first part of questionnaire was designed to assess Appropriate Site Development in 7 point. The second part of questionnaire assessed to Energy Efficiency and Conservation in 5 points. The third part is Water Conservation in 6 points. The fourth part is Material Resource and Cycle in 6 points. The fifth is Indoor Health and Comfort in 7 points. The last part is Building Environment Management in 7 points. The questionnaire was administrated via e-mail, hand delivered, and face to face interview to 125 respondents. Among all of these respondents, 43 respondents can not be approached, 27 respondents rejected to answer the questionnaire, 41 respondents accepted and cooperated to answer the questionnaire, and 14 respondents did not return back the questionnaire. The target population of this survey was contractors and consultants. A total of 41 cooperated respondents, consisting of 31

contractors (75.61%) and 10 consultants (24.39%), participated in the survey. The complete questionnaire can be gathered from [10]. Mean analysis was performed for each aspect of Greenship Rating Tools. For the purpose of comparison, mean analysis were carried out for different type of respondents, ie. contractors and consultants.

III. Results and Discussion

Appropriate Site Development/ASD

Table 1 presents the mean analysis for Appropriate Site Development/ASD of Greenship Rating Tools perceived by contractors and consultants.

TABLE 1.
MEAN COMPARISON OF CONTRACTORS AND CONSULTANTS
PERCEPTIONS IN APPROPRIATE SITE DEVELOPMENT

Sub Aspect	Description	Mean	
		Contractors	Consultants
ASD 1	Location	2.84	2.60
ASD 2	Accessibility to public area	2.77	3.00
ASD 3	Public transportation	2.81	3.30
ASD 4	Bicycle	2.90	2.10
ASD 5	Site landscaping	2.81	1.90
ASD 6	Micro climate	3.06	3.40
ASD 7	Rain water management	3.10	3.20

According to the contractors, application of sub aspect accessibility to public area (mean value of 2.77) is the easiest of all sub aspects. Considering the consultants' perceptions, application of sub aspect site landscaping (mean value is 1.90) is the easiest of the others. Meanwhile, micro climate and rain water management are the two sub aspects that can be applied fairly perceived by both contractors and consultants. The shaded boxes highlight these sub aspects in which mean value more than 3.00. It appears that sub aspect micro climate (mean value of 3.40 for consultants) and rain water management (mean value of 3.10 for contractors) can be applied fairly to achieved green building concept. For example, to manage rain water can be made by providing the water tank in the field.

Otherwise, perceptions of contractors showed that applications of sub aspect of accessibility to public area, public transportation, micro climate, and rain water management are easier than consultants. On the other hand, based on perceptions of consultants showed that applications of sub aspect location, bicycle, and site landscaping are easier than constructors' perception.

Last of all, the contractors found that of the appropriate site development, sub aspect accessibility to public area (mean value of 2.77) was the easiest to be applied to achieved green building concept. Then, the consultants

thought that site landscaping (mean value of 1.90) was the easiest of all. This fact in line with Agenda 21 in which promoting sustainable land-use planning and management (Chapter 7), and establishing systems for integrated environmental and economic accounting (Chapter 8).

Energy Efficiency & Conservation /EEC

Table 2 presents the mean analysis for Energy Efficiency & Conservation/EEC of Greenship Rating Tools perceived by contractors and consultants.

TABLE 2.
MEAN COMPARISON OF CONTRACTORS AND CONSULTANTS
PERCEPTIONS IN ENERGY EFFICIENCY & CONSERVATION

Sub Aspect	Description	Mean	
		Contractors	Consultants
EEC 1	Energy efficiency	2.84	2.30
EEC 2	Daylight	2.65	2.20
EEC 3	Ventilation	3.03	2.40
EEC 4	Impact of climate change	3.19	3.30
EEC 5	Renewal energy	3.00	3.80

From Table 2 it can be examined that both contractors and consultants agree that sub aspect daylight is easy to be applied, especially in energy efficiency and conservation. This sub aspect has the mean value of 2.65

for contractors and 2.20 for consultants. It can be assumed that daylight is always conducted in building design to minimize energy.

On the other hand, sub aspect renewal energy (mean value of 3.80 for consultants) is the most difficult aspect to be applied of all. It is interesting to see that there is a different opinion between contractors and consultants. Contractors argued that sub aspect impact of climate change (mean value of 3.19) is the most difficult aspect of all.

In summary, both contractors and consultants have similar perception that daylight system is one of the system to minimize energy consumption. It is in line with Chapter 9 in Agenda 21 that focus on promoting sustainable development and the protection of the atmosphere through energy development, efficiency and consumption.

Water Conservation/WAC

Tabel 3 presents the mean analysis for Water Conservation/WAC of Greenship Rating Tools perceived by contractors and consultants.

TABLE 3.
MEAN COMPARISON OF CONTRACTORS AND CONSULTANTS
PERCEPTIONS IN WATER CONSERVATION/WAC

Sub Aspect	Description	Mean	
		Contractors	Consultants
WAC 1	Reduce water usage	2.94	2.50
WAC 2	Water fixtures	2.84	2.70
WAC 3	Water recycle	3.06	3.70
WAC 4	Alternative water resource	3.13	2.80
WAC 5	Rain water usage	2.71	2.70
WAC 6	Efficiency of landscape water	2.87	3.00

Based on Tabel 3, it can be seen that both contractors and consultants agree that sub aspect alternative water resource (mean value of 3.13 for contractors) and water recycle (mean value of 3.70 for consultants) are the most difficult aspect to be applied in which to obtain water conservation. On the other hand, they also agree that sub aspect rain water usage (mean value of 2.71 for contractors) and reduce water usage (mean value of 2.50 for consultants) are the easiest sub aspect to be applied of all. These aspects in line with water and urban sustainable development (Chapter 18).

Material Resource and Cycle /MRC

Tabel 4 presents the mean analysis for Material Resource and Cycle/MRC of Greenship Rating Tools perceived by contractors and consultants.

TABLE 4.
MEAN COMPARISON OF CONTRACTORS AND CONSULTANTS
PERCEPTIONS IN MATERIAL RESOURCE AND CYCLE /MRC

Sub Aspect	Description	Mean	
		Contractors	Consultants
MRC 1	Reuse of material and building	2.71	3.40
MRC 2	Product with kindly environment process	2.97	3.30
MRC 3	Non Ozon Depletion System (ODS) usage	2.77	3.30
MRC 4	Certified wood	2.58	2.30
MRC 5	Modular design	2.68	2.30
MRC 6	Local material	2.35	2.00

Similar to the above analyses, Table 4 shows the lowest and highest mean value in material resource and cycle. The lowest mean value is sub aspect local material (mean value of 2.35 for contractors and 2.00 for consultants). The highest mean value is sub aspect product with kindly environment process (2.97 for contractors) and sub aspect reuse of material and building (3.40 for consultants). It means that both

contractors and consultants agree to use local material easily in which to obtain green building concept. It can be understood, because local material is very easy and cheap in the local market. This finding in line with Zhang et al. [11] that using green materials would cost from 3% to 4% more than conventional construction materials. In case of import material, it will be compatible for local use, extensive testing may be required. Materials are as effective cost as possible (therefore replicable) and should follow the sustainability guidelines. The decision making skill is the most critical to effectively mitigate material [3].

In contrast, all respondents agree that they did not easy to make construction product with kindly environment process and reuse material. Furthermore, to result this problem, there are specific knowledge area and skills that should be strengthened in order to effectively manage green material and green construction [3].

Indoor Health and Comfort/ IHC

Tabel 5 presents the mean analysis for Indoor Health and Comfort/ IHC of Greenship Rating Tools perceived by contractors and consultants. Based on the perceptions of contractors, it can be seen that sub aspect CO₂ monitoring, chemical pollutant, outside view, visual comfort, thermal comfort, and acoustic level are easier to be applied than perceptions of consultants. Both

contractors and consultants agree that sub aspect CO₂ monitoring (mean value 2.84 for contractors and 3,60 for consultants) is the most difficult aspect to be applied.

TABLE 5.
MEAN COMPARISON OF CONTRACTORS AND CONSULTANTS
PERCEPTIONS IN INDDOR HEALTH AND COMFORT/IHC

Sub Aspect	Description	Mean	
		Contractors	Consultants
IHC 1	CO ₂ monitoring	2.84	3.60
IHC 2	Smoke monitoring system	2.39	2.00
IHC 3	Chemical pollutant	2.58	3.50
IHC 4	Outside view	2.77	3.00
IHC 5	Visual comfort	2.29	2.40
IHC 6	Thermal comfort	2.65	2.80
IHC 7	Acoustic level	2.67	3.10

They realize that monitoring CO₂ is not easy for them during construction period or building operation. Green construction projects are still relative new in Surabaya. Consequently, team members and workers have little experience. It should provide straight policies and regulations to protect human health and environment issues. No smoking campaign is required to support in door health and comfort.

In contrasts, contractors can maintain sub aspect visual comfort (mean value of 2.29) easily. Then, consultants argued that they can make system for smoke monitoring easily. Both of them in line with a healthy and productive life in harmony with nature. It concerns with health risks as related to the occupation of building. It is in line with promoting cleaner production (Chapter 30).

Building Environment Management/BEM

Tabel 6 presents the mean analysis for Indoor Building Environment Management/BEM of Greenship Rating Tools perceived by contractors and consultants.

TABLE 6.
MEAN COMPARISON OF CONTRACTORS AND CONSULTANTS
PERCEPTIONS IN BUILDING ENVIRONMENT MANAGEMENT

Sub Aspect	Description	Mean	
		Contractors	Consultants
BEM 1	GA/GP as a member of project team	2.74	3.30
BEM 2	Pollutant of construction process	2.77	2.80
BEM 3	Waste management	2.81	3.00
BEM 4	Right procedures	2.71	3.30
BEM 5	Submission implementation green building data	2.74	3.00
BEM 6	Completely contract	2.84	2.60
BEM 7	Quarantee from the owner	2.71	2.40

According to the contractors in Table 6, it can be portrayed that sub aspect right procedures and guarantee from the owner (mean value for 2.71) are the two easiest sub aspect to be managed in building environment. In line with contractors, the consultants' perception also agree that guarantee from the owner (mean value of 2.40) is the easiest sub aspect to be applied of all. Communication is especially critical for the green project in order to convey the sustainable practices expected from the team members [3]. Tagaza and Wilson [12] recommended that to support the building environment management and to ensure that sustainable practices are implemented on-site can be achieved by random checking and site visiting.

In opposite, according to contractors, completely contract (mean value of 2.84) is the most difficult thing to reach building environment management. Therefore, to obtain a good contract, the participants should prepare it before starting the construction project.

Unlike contractors, consultants have different perception that GA/GP as a member of project team and working with right procedures (mean value for 3.30) are the most difficult of all aspects. Greenship Professional conducts and involves from the conceptual design stage to operation the project stage. In addition, the main challenge is that green technologies are different from conventional technologies [12]. Ahadzie et al. [13]

suggested that to reach a good project performance outcome, task performance behaviours and contextual performance behaviours are required. It may help to build a good project team and obtain the right procedures in green construction.

IV. Conclusion

The finding of this study provides valuable insight for perceptions of contractors and consultants toward greenship rating tools on apartment building in Surabaya. Since contractors and consultants such as primary project stakeholders play an important role in the greenship building, it is therefore essential to know their perceptions toward six aspects of greenship rating tools. As a result, the aim of this study can be identified by obtaining the factors that would easily and difficult to be applied. According to the contractors' perceptions, some factors that would easily to be applied are accessibility to public area (mean value of 2.77), daylight (mean value of 2.65), rain water usage (mean value of 2.71), local material (mean value of 2.35), visual comfort (mean value 2.29), and right procedures and guarantee from the owners (mean value of 2.71). Then, based on the consultants' perceptions, these factors are site landscaping (mean value of 1.90), daylight (mean value of 2.20), reduce water usage (mean value of 2.50), local material (mean value of 2.00),

smoke monitoring system (mean value of 2.00), and guarantee from the owners (mean value of 2.40).

Otherwise, contractors recommended some factors that would difficult to be applied such as micro climate (mean value of 3.06), impact of climate change (mean value of 3.19), alternative water resource (mean value of 3.13), product with kindly environment process (mean value of 2.97), CO₂ monitoring (mean value of 2.84), and completely contract (mean value of 2.84). Last of all, consultants argued the difficult conditions such as micro climate (mean value of 3.40), renewal energy (mean value of 3.80), water recycle (mean value of 3.70), reuse of material and building (3.40), CO₂ monitoring (mean value of 3.60), and GA/GP as a member of project team, and right procedures (mean value of 3.30).

In summary, Greenship Rating Tools can be applied on contractors' and consultants' perceptions, whilst there are some variables which can not be applied.

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