TOWARDS IMPLEMENTATION OF GREEN CRITERIA IN INDONESIA; NEEDS AND REALITY

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ABSTRACT
Implementation of Green Building concept, especially on High-rise Buildings, implies the possibility of using passive and active strategies. Passive strategy refers to how the design of the building is able to interact with the external environment for the benefit of occupants and the environment. On the other hand, Active strategy use an effective and efficient electrical and mechanical equipment to meet the occupant's need and bring out a minimum damage to the surrounding environment. Passive strategy is not something new in architectural context; this strategy is a basic strategy that has been learned for years. However, the reality shows that the implementation of passive strategy is not simple, there are various reasons to consider since the project involved many factors and parties. The study began with interviews of project parties including architects and academics about understanding, role, contribution, willingness and constraints associated with the implementation of passive strategies in high-rise office buildings in Jakarta. The interview indicates that several factors considered by the architects during the design process in implementing passive strategy to the design product. These factors were then confirmed back to the architects using questionnaire to determine the weight of influence. Using the same questionnaire, architects and academics were asked regarding the green performance of passive strategies from their point of view. The green performance in this study represents concept of sustainability (environment, social and economy) and also concept of reciprocity (benefit and effort) of the passive strategies implementation. The results are then compared to obtain a clear direction for future implementation of passive design strategies. The findings are still preliminary since this is an on going research.

Keywords: *Passive Design, Green Criteria, High-rise Building, Passive Strategy*

INTRODUCTION
Data from the US Energy Information Administration 2011 shows that building consumes approximately 39% of total energy consumption, 21% of which is used for residential buildings and 18% for commercial buildings. The majority of the energy consumption is used for the HVAC 40% and lighting 35%, the rest is used for appliances and water heating. Conditions in Indonesia is approximately similar, according to Executive Reference Data, National Energy Management, National Energy Council in 2014, the building sector consumes 31.08% of national energy consumption.

Implementation of green concept in building is intended one of them to obtain a high performance energy efficiency. In order to achieve the intention, green building could adopt active and passive strategies. These strategies is expected to minimize the environmental impact and maximize the building's users benefit. This paper attempt to explore the passive design strategies which represents by building orientation, building shape, building envelope and room layout and greenery arrangement. Passive strategy in humid tropical regions like Indonesia are generally done by heating avoidance, building cooling, exploit drying and utilization of natural lighting. In order to achieve building with high-performance, Ken Yeang (2005) suggest to optimize passive strategies before utilizing active strategy.

Theoretically all architects have known the passive design strategy since passive strategy is compulsory subject for architecture students at the beginning year but the implementation of passive strategies in real project is not simple. As an example, high-rise office buildings (more than 20 floors) along the Thamrin street Jakarta (main street of Indonesia capital city) tend to ignore the strategy of building orientation criteria since most of the facades exposes to the east-west direction so its exposed to direct sunlight. It seems that architects are more likely to keep using glass curtain wall without shading device or rely entirely on the specification of glass to withstand solar radiation. The problem is why was that happened, what is the motives of practitioner behind those condition. How the passive strategies performance is understood by pratitioner and academics This research seeks the difficulties and potential of passive design strategies implementation in high-rise office building and it's performances refers to understanding of practitioner and academics.

THEORY OF PASSIVE STRATEGY

Passive strategy is one of the energy saving strategy in a way that consider the building design environment and use it as optimal as possible for the benefit of its occupants. According to Sharma (2002), the use of passive strategy is done through the following basic strategies:

1. Understand the Climate and the Climatic zone.
2. Identify the comfort zone
3. Identify the heat source or the heat sink
4. Optimize the microclimatic conditions
5. Defining the characteristics required for the configuration of the building or the building envelope

Sarte (2010) adds that each site is unique. Design Team integrate building with its site and reduce building energy consumption through development site analysis, clear definition about the needs and objectives of the project, and matching understanding of the possibilities available energy. Furthermore Sharma (2002) states that one of the important things in passive strategy is passive cooling using placement of window properly and consider natural lighting design, selecting specific material for the glass of windows and

skylights, proper shading design if the heat is not desirable, the use of materials with light color for the building envelope and roofing, proper sitting and orientation, and planning a suitable landscape design

For natural ventilation, Sharma (2002) stated that the ventilation is good cooling technique and has been used throughout the world, which provide cooling by using air to take the heat out of the building (convective cooling) and of the human body (physiological cooling). Relates to natural ventilation, windows are an important factor to obtain optimal ventilation. The parameters that need to be considered in the window design are climate, wind direction, the location of openings, opening size, room size, shading elements, curtain and internal partitions

Sarte (2010) adds that the use of passive strategy can improve the energy performance of buildings. Passive strategy can be done through:

1. The building design and orientation of buildings
2. Landscape design to create the desired microclimate
3. Selection of appropriate building envelope
4. Design of natural ventilation
5. Selection of building materials
6. The use of low-emittance glass
7. Installation of radiant barrier
8. The use of bright colors / reflective

About the performance of passive strategies, research conducted by the Xiaoxia, et all (2014) indicate that special attention to the use of the building envelope insulation, overhang, selecting the right color, the right proportion of openings and the selection of the appropriate glass material can help reduce the consumption of HVAC to 46, 81%. Kats, GH (2003) also stated that application of green concept in buildings can save energy up to 37%. On the othe hand, regarding to Kats (2003), the additional cost of investment needed to have a building with green standard is an average of only 1.84% or a maximum of 6.5%.

Referring to William (2007); Mc Lennan (2004); Abdidin (2010); Bauer (2007); Hegger (2008); Bougdah (2010); Sarte (2010); Sharma (2002); and Aun (2009), we trying to draw a whole picture of a passive strategy and implementation on building systems that could be applied in the tropics. Passive strategies are grouped as follows:

A. Passive Strategy for Thermal Environment
    1. Heating Avoidance Strategy
        a. Minimize heat conduction
        b. Minimize heat radiation
        c. Minimize heat convection
    2. Building Cooling Strategies
        a. Striving for convective cooling
        b. Striving for evaporative cooling
        c. Striving for convective cooling

3. Exploit Drying Strategies

B. Passive Strategy for Visual Environment
   1. Replenish the lighting intensity
   2. Optimize the lighting distribution
   3. Minimize the lighting distraction

In order to encourage practitioner for wider implementation of passive strategies, definition of passive strategies expanded to strategies that use low-energy mechanical equipment as well as strategies to utilize the environment potential conditions beside the usual definition that does not use electrical and mechanical equipment (Table 1). Results of mapping passive strategy on building system proposes 30 passive design strategies that can be applied. Specifically for high office buildings there are 17 passive strategies that can be applied and grouped into 6 category, namely material, orientation, shape, envelope, interior and greenery. All of seventeenth passive strategy alternatives are then sought the opinion of academics and architects for rated or assess in accordance to 6 green criteria (considerations), namely energy efficiency improvement, environmental impact reduction, comfort improvement, operational cost savings, ease of implementation, investment cost saving.

Table 1. Scope of Passive Design Strategies

	Passive Strategies	Sub-strategy
1	Without using electrical and mecahanical equipment	Orientation and building shape
		Envelop design and its material
		Room layout and its material
2	Using mechanical or electrical equipment with very low energy consumption	Manual Using device that could be operate manually
		Otomation Technology Using device that operate with fixed input
		Smart Technology Using device that could adjust directly to surrounding environment condition
3	Utilizing surrounding environmental condition	Utilize surrounding landscape condition
		Utilize surrounding building condition
		Utilize surrounding micro and macro climates

METHODS

The research compare between the views of practitioners and academics related to the implementation of passive strategies in high-rise office buildings Jakarta with a minimum building height of 20 floors. The comparative study includes:

1. Comparing green performance of each passive strategies alternatives from the perspective of practitioners and academics by providing appropriate ordinal value Likert scale. The definition of green criteria in this study is refer to sustainable development pillars which consists of environment, social and economy. The pillars represents by :

a. Environmental criteria, namely energy efficiency improvement and environmental impact minimization
b. Social criteria, namely occupant's comfort improvement
c. Economic criteria, namely operational cost savings, ease of implementation and investment cost savings

The above criteria also represents the concept of reciprocity, the relation between effort and benefit. In this study the benefit is represented by energy efficiency improvement, environmental impact reduction and occupant's comfort improvement. While the effort is represented by operational cost savings, ease of implementation and investment cost savings (Figure 1).

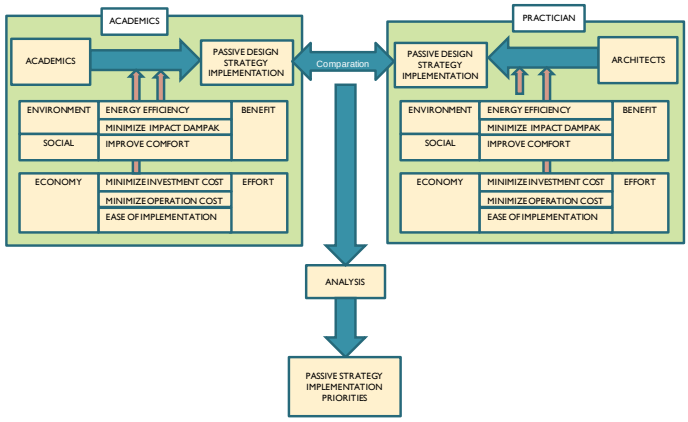

Figure 1 Comparative Study of Practitioner and Academics

The passive strategy alternative is an alternative that has been generated from previous studies on mapping the passive strategy. In order to fit with the case study which is high-rise office buildings in Jakarta with minimum 20 floors, there are 17 alternatives available that proposes to apply. All of the 17 alternatives could be group into 6 groups of alternatives.

2. Comparing green performance between groups of alternative design strategies. All of seventeenth passive strategies alternatives can be grouped into 6 groups, namely material, orientation, shape, envelop, interior and greenery/ landscape (including roof graden and vertical landscape)
3. Comparing the performance of each green criteria, namely energy efficiency, minimization of impact, occupant comfort, operational cost savings, ease of implementation and cost savings investment.
4. Mapping out a the performance of passive strategies that could be considered to be agreed or disagreed between academics and practitioners
5. Comparing academics and practitioners opinions regarding the green performance of each passive strategy alternatives by giving the value in the questionnaire using a Likert scale.

6. Researcher also involving practitioner (architects) in determining matters that affect their design processes and products related to green issues. This process is a confirmation process to the results of interviews that have been done at the initial stage. In a previous interview, researcher gained some points related to the design process and product by architectural consultants. Confirmation process was done by giving questionnaires to determine architect's consideration in design stage to deliver a design product.

COMPARATIVE ANALYSIS BETWEEN THE POINT OF VIEW OF ACADEMIC AND PRACTITION (ARCHITECT)

The results shown on the paper are temporary since the research is still on progress. The input data is about 30%, but there are already some interesting findings from this research.

1. Regarding comparison of green performance based on passive strategy alternatives between practitioner and academic, Figure 2 shows the result so far of passive strategy alternatives performance. Number 1 to 17 on x-axis represents the order of passive strategy, while y-axis represents the total performance of six green criteria. The total performance is a mean from passive strategy performance's score sum.
   - Based on statistical result using software *SPSS v21*, it is known that whether practitioner and academics found 17 alternatives are not significantly different, based on practitioner's *p-value* or *asymp.Sig* (0.218) and academic's (0.458) which are more than significance probability (0.05).
   - Generally there is a same pattern between practitioner and academic, but in detail there are significant value differences on alternative 1 and 3 (material), 5 (form strategy), 8 (envelope strategy), 12 (interior strategy), and 15 to 17 (greenery strategies)

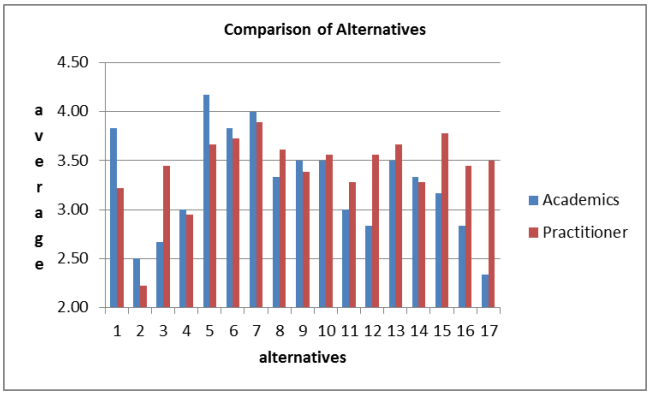

Figure 2. Comparison of alternatives

2. Regarding comparison of green performance based on group of alternatives between practitioner and academic, Figure 3 shows passive strategy group of alternatives performance's result so far. X-axis represents the groups of passive strategy alternative, while y-axis represents the total performance of six green criteria.
   - Based on six groups of alternative's statistical result, it is known that whether practitioner and academics are not significantly different, based on practitioner's *p-value* or *asymp.Sig* (0.416) and academic's (0.416) which are more than significance probability (0,05), in other word both of them are good.
   - Generally there is a same pattern between practitioner and academic except greenery group of alternative

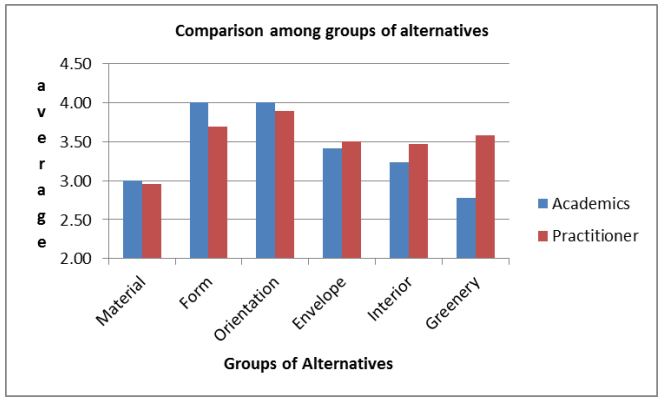

Figure 3. Comparison among groups of alternative

3. Regarding comparison of total green performance between practitioner and academic, Figure 4 shows the result of total green performance between practitioner and academic. The x-axis represents criteria while y-axis represents the total performance of 17 alternatives.
   - Based on statistic result for practitioner and academic consideration, it is concluded that all six consideration are significantly different by the score of *p-value* atau *asymp.Sig* on practitioner (0,008) and academic (0,003) which are smaller than the significance probability (0,05). In other word, there are something more prioritized by practitioner and academic among these six consideration.
   - Generally there is a same pattern between practitioner and academics, but in detail there is a difference in comfort criteria, technical criteria, and investment saving criteria.

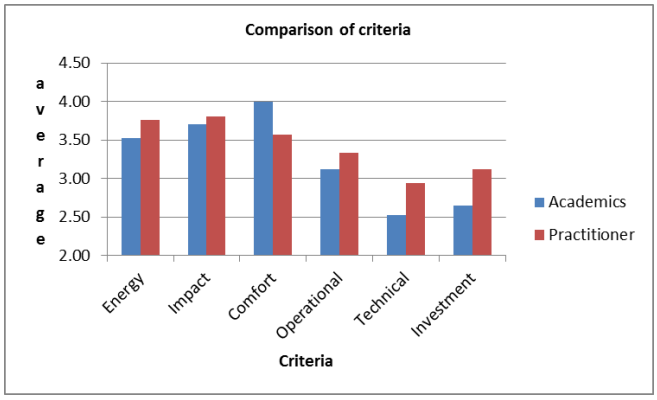

Figure 4. Comparison of green criteria

4. Regarding comparison of partial green performance between practitioner and academic, Figure 5 shows the comparison of economic performance (operational saving, implementable degree, and investment saving), social performance (comfort enhancement), and environment performance (energy efficiency and impact reduction). Academic shows less confident in economic performance in passive strategy (score less than 3) but sure enough about social and environment performance (score more than 3), while practitioner much more confident to all three aspects in passive strategy (score more than 3).

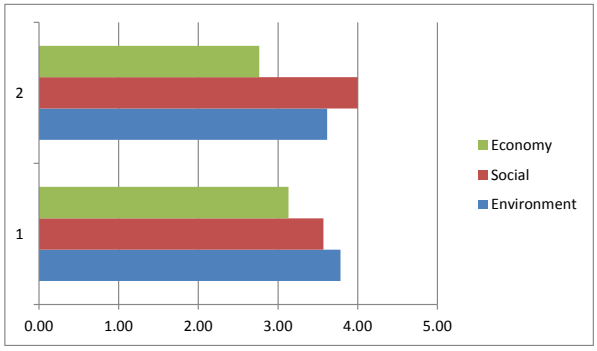

Figure 5. Comparison of green performance

5. Regarding comparison of benefit and effort between practitioner and academic, Figure 6 shows the comparison between effort (operational saving, implementable degree, and investment saving) and benefit (energy efficiency, impact reduction, and comfort enhancement). It is shown that from benefit point of view, both parties believe in the advantage of passive strategy performance. But from effort point of view, practitioners are slightly surer of passive strategy performance than academic. Both parties

also believe that the benefit in implementing passive strategy is bigger than the effort.

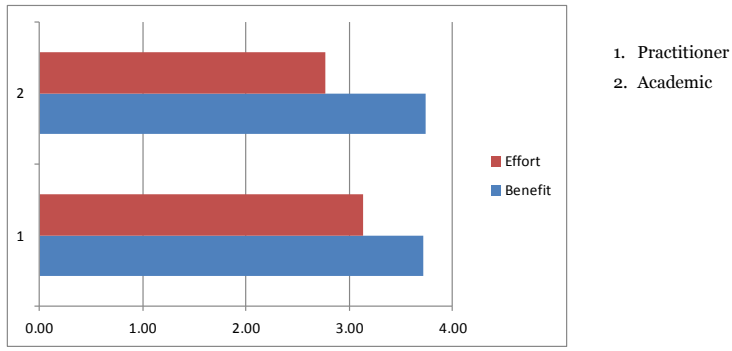

Figure 6. Benefit versus Effort

6. Regarding comparison of stake holder impact, this section was gathered by asking designers about the stake holder role on process and product design. Stake holder factor generally has a significant impact on the green building process and product design by consultant (*Asymp.Sig/p-value* = 0,035 < 0,05). Developers has the biggest portion, followed by government and academic (Figure 7). It means that government and academic can contribute by giving input for designers in rule's establishment or even research result's dissemination.

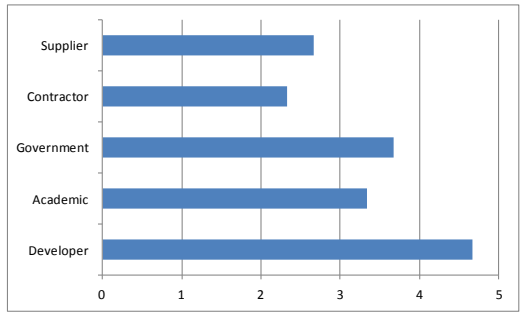

Figure 7. Stake Holder Factors

7. Regarding comparison of external factor impact
   Generally, internal factor has no significant impact on the green building process and product design by consultant (*Asymp.Sig/p-value* = 0,810 > 0,05). But based on the rank and graphic, green building rules are considered to have most impact compare to others (Figure 8). Designers still consider the concept of green building as an obligation rather than a consciousness to design a better building

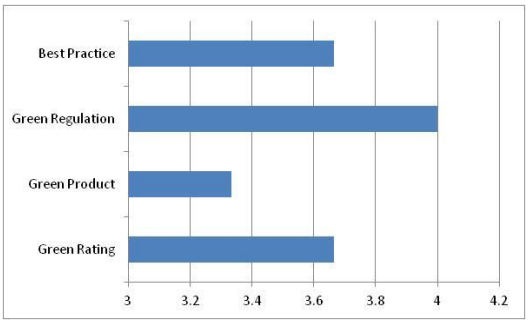

Figure 8. External Factors

8. Regarding comparison of internal factor impact
   Generally, internal factor has no significant impact on the green building process and product design by consultant (Asymp.Sig/p-value = 0,301 > 0,05). But based on the rank and graphic, operational process has more impact than the others (Figure 9). It can be concluded that the designer's knowledge about operational as the most energy consuming process, makes the implementation of passive strategy which effect the operational energy efficiency process gain more consideration.

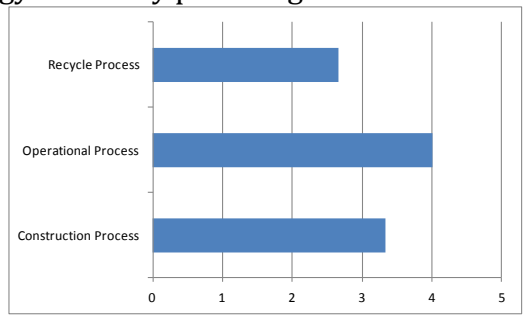

Figure 9. Internal Factors

9. Regarding comparison of the stake holder, external, and internal factor impact
   Generally, there are no significant impact between stake holder, external, and internal factor on the green building process and product design by consultant (*Asymp.Sig/p-value* = 0,873 > 0,05). But based on the rank and graphic, external factor has more impact than the others (Figure 10). It means that the existence of green building rules, rating system, material or green component, and best practice will be so helpful for designers to design a green product.

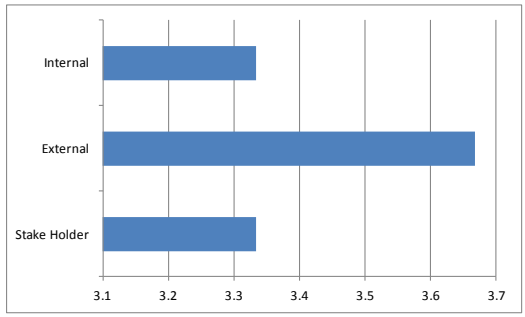

Figure 10. Comparison among factors

CONCLUSSION AND RECOMENDATION

Although this research is still in progress of completion however there are some interesting indications to be observed, including:

1. Indication of different understanding between academics and practitioners (architects) including :
   a. Different understanding on alternatives :
      - In term of material, the difference indicates that practitioners tend to depend on strategy to obstruct heating process whereas academics on strategy to store heating process.
      - In term of building form, the difference indicates that academics tend to rely on strategy to minimize the area that directly exposed by sun's radiation whereas practitioners seem to optimize the strategy to minimize sun's radiation and maximize the natural daylight.
      - In term of building orientation and building envelope, both parties seem to have a same consideration.
      - In term of interior, both parties seem to have the same understanding except the strategy to use plant inside the building. The difference indicates that practitioners might be disoriented between capability to absorb CO2 and capability to reduce heating.
      - In term of greenery, practitioners much more confident on its performance than academics. The difference indicates that practitioners tend to consider appearance than performance.
   b. Different understanding on group of alternatives :
      In general, both parties have the same understanding except on the performance of greenery group's alternative (which consists of greenery on site, façade, and roof). The difference might indicate misunderstanding of actual performance of greenery on green building concept.

c. Different understanding on green criteria :
   In general, both parties have the same understanding, however in detail there are wider gap on comfort, technical and investment criteria. Academics tend to more confident on comfort performance of passive strategies than practitioners, in contrary to the technical and investment performance which are practitioners are more confident. The difference indicates practitioner's hesitancy on the performance of passive strategy to create a comfort environment and practitioner's conviction of passive strategy to be easily implemented and minimize the investment cost.
d. Different understanding on sustainable concept :
   In general, both parties are more likely to have the same understanding about the economic, social and environmental performance of passive strategy, although academic shows less confident in economic performance
e. Different understanding on reciprocity concept :
   Both parties believe in the advantage of passive strategy performance and both parties also believe that the benefit in implementing passive strategy is bigger than the effort. However the difference indicates that practitioner tend to assume that the effort is quite high

2. Indication of external factors influence on process and product design and also party's factors influence.
   - Developer is the most influential party that affects process and product design followed by government and academic.
   - Architects still consider that green building concept as an obligation rather than a consciousness to design a better building
   - In the design process, architects tend consider operational process higher than construction and recycle process
   - In the design process, architects tend to consider external factor (green building rules, rating system, material or green component and best practice) higher than internal and stake holder factor.

Regarding to tentative conclusions above, this study recommends to:

1. Encourage the practitioners and academics to share their green performance perception of passive design strategies
2. Encourage the government and academics to play a significant role in supporting the implementation of a passive design strategy (especially for high-rise building) by dissemination of passive design strategy performance and also formulate and establish green regulations to enforce practitioner implementing passive design strategies.
3. Encourage practitioner to optimize the implementation of passive strategy since it would resulting a minimum operational cost

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