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Ecoskycraper Concept As A Form of Local Uniqueness Approach

*Rumiati Rosaline Tobing [1],Tantarto Sugiman[2]
[1]*Doctor in Architecture at Parahyangan Catholic University, Indonesia*
[2]*Doctoral Candidate in Architecture at Parahyangan Catholic University, Indonesia*
*Corresponding Author: *Rumiati Rosaline Tobing*

ABSTRACT: This article is an assessment on the sustainable concept approach that is applicable at high rise building as a local uniqueness. The word 'eco' means "environmental friendly'. Ecoskycrapper is expected to be presence as a product with environmental friendly consideration. The presence of high rise building is unavoidable consequence of development. Its presence should be dealt with wiser perception with the concept of sustainable architecture, which then is growing with the terms: ecological architecture, green architecture, energy efficient architecture and many more terms that narrows down to be more detail: eco-design, eco-material, etc. The aesthetic view in the era of global warming problems seems to experience a shift in "taste", particularly for skycrapper which appears in an iconic form with a label 'sustainable'. Through analytical descriptive method, this paper tries to figure out sustainable concepts that can be applied to high rise building. The existing assessment is used to dissect the discussion on high rise buildings phenomenon in Indonesia as a contemplation for designing wisdom.

Keywords: sustainable architecture, eco-skyscraper, eco-aesthetic, iconic, Indonesia.

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I. INTRODUCTION

Architecture continues to grow along with the development of society and culture. There have been plenty of building innovations, in terms of material, building method, as well as the shape of the building. Unfortunately, a lot of those building were built without taking into consideration long-term environmental aspect. As a result a new problem emerges that brings negative impact to the environment itself. Many leading figures have tried to raise the issue of sustainability even though sometimes with different terminologies. James Steele uses the term sustainable architecture (his book: Sustainable Architecture, Principles, Paradigms, and Case Studies). Ken Yeang with the term ecological architecture (his book: Design with Nature and Bioclimatic Skyscrapper) and Brenda Vale with her green architecture (in her book: Green Architecture, Design for A Sustainable Future). Steel (1997) clearly stated that the involvement of architecture and architect are very important in dealing with sustainable development. The practices in real condition could not evade themselves from modern construction problems sweeping the world, which if it is not addressed wisely will lead to environmental degradation and waste of energy, land and other natural resources.

In principles, sustainable architecture will include physical and non-physical elements, institutionally and financially, to maintain the existence of natural resources in fulfilling all basic necessities and developing opportunities for the improvement of economic and social condition of the present and future generation (Abioso, 1999). Sustainable architecture is a consequence of an international commitment on sustainable development, since architecture is closely related to and focuses its attention on human factor with emphasize on the main pillar of economic and social development, i.e. built environment aspect with its environmental development, in addition to economi and social development pillars. As a product, the process of sustainable development begins with planning stage, followed by design, construction, and finally demolition. As a system, sustainable architecture should have a way of thinking that begins with the smallest: material, system, building, site, until its global level. Each existing stage and system is still being explored today, and opportunities are still open for various kind or researches. Architecture as a sustainable product seems to offer various interesting sides that need to be examined deeper. Aesthetic is a human appreciation on a meaning. The taste could change following the trend happening at that time. Aesthetic problem can be very abstract, but it can also be very detail. In the era of classicism, detail elements are the ones that make a building looks beautiful. For functionalist, aesthetic emerges as a result of building conformity with its function. However, for the second stream of the functionalist which is a derivative of structural rationalism, aesthetic emerges in more detail, i.e. how building units can functionally work, it is the aesthetic. So, it is how the nut can work well with the bolt, etc.

At the current era, it seems that aesthetic has shifted to "trend appetite", i.e aesthetic with "eco" label. How building can be very environmental friendly, whether it is natural environment or human being as the users,

seems to show their own aesthetics. Many architects are in pursuit of aesthetic with their own concepts. It is believed that eco-aesthetic will emerge fram the forms of environmental friendly and will provide a local uniqueness that in the end could provide differences.

II. MATERIALS AND METHODS

This study was done through literature review to seek definition of sustainable architecture. Then, the concepts are used to analyze a number of design products to describe how sustainable concept was considered in the product. Some practitioners and theoreticians have written principles of sustainable design. Hui (2002) stated that there are basic principles that should be held in sustainable design: (1) Understanding Place: sustainable design requires architects to be willing to understand place, sensitive to place, build without damaging, understand orientation, nature of the place, preservation, even transportation to and from the place; (2) Connecting with Nature: always relate a place with its natural carácter eventhough the building is located in the urban context, moreover if the complexión is a natural complexión; (3) Understanding Natural Processes: understand natural process that is going to happen, how is environment and human lifecycles; (4) Understanding Environmental Impact: every impact of development process should be understood by routinely conducting building evaluation, to the material, and even since the building was still in the construction process; (5) Embracing Co-creative Design Processes: listen to every input from various parties: collaboration of consultants, experts from various scientific disciplines, local neighborhood community, candidate users; (6) Understanding People: a good sustainable design should be able to accommodate cross culture, race, ethnicity, religión and various human habits. Develop also empathy toward powerless community (disabled people).

Meanwhile, Thomas A. Fisher, AIA, proposed five principles of sustainable architecture: (1) Healthful Interior Environment: the use of safe material especially for interior, (2) Energy Efficiency: Minimizing energy use, (3) Ecologically Benign Materials: Materials to be used are not damaging the natural environment. Timber is obtained without damaging the forest. Mateial is produced with a method that is safe to the environment; (4) Environnmental Form: tight calculation between design and site, región and climate. Everything is considered based on the principle of harmony between human being and environment that is friendly toward life cycle and energy efficiency; (5) Good Design: increase in efficiency and sustainable that are considering the use of área, circulation, shape of the buildings, mechanical system and construction technology. Symbolic relationship is related to historical value, spiritual and world view. The product is built well, easy to use and beautiful.

Guy and Farmer (2001) proposed six realms of logic that can be touched by architecture research, based on: Eco-technic, Eco-centric, Eco-aesthetic, Eco-cultural, Eco-medical, and Eco-social. The explanations are as follows: (1) Ecotechnic-building and the global place: attention on the awareness of local and global contexts on the impact of the building; (2) Ecocentric-building and the place of nature: environmental damage was started in the industrial era and management fault of the authority. Re-interpretation is needed from the policy holder institution so that the ecological footprint of a building life cycle can be well recorded; (3) Eco-aesthetic-building and the new age place: the ecological building expressively will show its own aesthetic. Awareness that the paradigm of thinking of the modern society will shift to ecological things, so that in this postmodern era, paradigm of thinking will support aesthetic side from different point of view. Aesthetically, the sustainability of view toward a building that can last long will have more valuable ecological value; (4) Eco-cultural-building and the authentic place: Awareness on the existence of preservation on various existing cultural differences. The genius loci concept applies here; (5) Ecomedical-building and the healthy place: that a healthy environment for an individual will automatically provide a healthy environment for its community; (6) Ecosocial-building and the community place: environmental damage is more a result of dominancy and hierarchy in human civilization. Therefore, a community should be created that forms a good networking, mutually need one another and mutually accept each other. How the principle of democracy can be uphold through participatory design.

III. RESULTS AND DISCUSSION

1. The Product of the Latest Design Related to Ecoskycrapper Concept

a. Design Discourse Related to Ecoskycrapper

Current product design shows the direction of sustainable concept approach with the term “eco”, which if applied to high rise building becomes ecoskyscrapper. There is an assumption that building in current context should be able to solve problems as a result of global warming. Some approaches lead to completion of ways to save energy, problems of envioronmental ecosystem habitat, problems of flooding, waste, shortage of clean water until transportation problem. Some products that emerged can be seen as follows:

- Skyscraper by Makeka Design Laboratory

Figure 1. Skyscraper by Makeka Design Laboratory

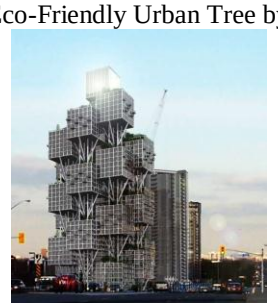
Green skyscrapper that is present with the concept of technological sophistication with wind as the source of energy. The building responds to the relation: social, culture, and sustainable technology. Beauty comes through wind power deposit to turn on the greenhouse. Natural habitat is also present even until sky garden that is considered to be capable of providing comfort to the occupants. Sky garden and garden will look beautiful for the city. The sustainable concept is also presented through building amenities, in the form of land and sea transportation that is interconnected and integrated one to another with other mode of connecting transportation.

- Pawar's Eco Skyscraper, by Vikas Pawar, in Noida, India

Figure2. Pawar's Eco Skyscraper, by Vikas Pawar, in Noida, India

Concept: clean wáter, food and wind energy and sun. Spiral concept will present aesthetic, but is also capable of holding water vapor to be processed as drinking water. This building is applying hydroponics system. Units were made modular to achieve cheap price and efficient in the construction since it is made in the field.

- The Eco-Friendly Urban Tree by Geotectura



The aesthetic of futuristic building The Urban Tree by Geotecture is presented through eco-friendly concept. The arrangement of boxes forms a box that will be more efficient. The box is tied with steel stem. The concept of tree has made the building modular, flexible and interesting. The building is also completed with greenhouse concept at the corners and completed with photovoltaic panels to obtain sun energy.

Figure 3. The Eco-Friendly Urban Tree by Geotectura

- Chicago Clean Technology Tower

Figure 4. Design by Adrian Smith and Gordon Gill.

Using save energy concept with wind energy. Wind is considered as save energy source, does not produce toxic emission and does not make emission trap which in the end contributes to global warming.

- The Solar Universe

With a height that reaches 1000 feet, the building that was completed in 2013 tried to achieve its sustainability by producing its own source of energy that comes from the sun.

Figure 5. Architect: Dayco Holding Corporation, Location: Miami.

- O-14 Tower

This building was made with perforated exoskeleton wall that is considered as capable of cooling the building so the energy is more efficient. The open space design concept is without many wall separators in the interior that makes the building looks more environmental friendly.

Figure 6. Architect: Reiser + Umemoto, Location: Dubai, United Arab Emirates.

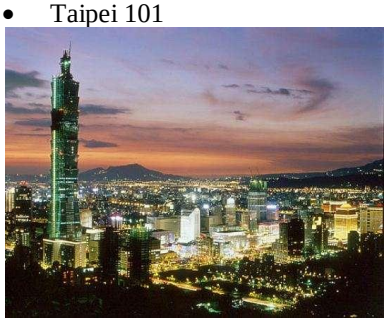
Regarding the issue of global environmental damage, some old buildings have cleaned up and changed their concepts on building issue that can reduce the problems of environmental damage. Buildings that have repaired some concepts in the buildings are:

- Sears Tower, architect: Adrian Smith of Adrian Smith + Gordon Gill Architecture

New concept: eco-friendly makeover.
Succeeded in cutting half of the energy but some changes are still being done on floor plan to cut 10% more from the energy use.
The concept used: wind turbine, photovoltaic cells, new lighting systems, a green roof and additional insulation in wall sections.

Figure 7. Sears Tower

- Taipei 101



The concept is: To Become World's Tallest Eco-friendly Building. Doing eco-upgrades so Taipei 101 can become the world's tallest green building. The thing it did was energy cut through saving energy with the changes in lighting system and smart technology.

Figure 8. SL+A International Asia Inc., Siemens and EcoTech International Inc.

b. Bioclimatic Ecological Approach at Skyscrapper Building

Leading figure in sustainable architecture applied to high rise building is Ken Yeang. Yeang used the term ecological design in the approach of his product design which happens to deal mostly with high rise building. According to Yeang, ecological design is a design process that comprehensively minimizes negative effects that will be anticipated because of the present of product of design process that burdens the ecosystem

and earth resources, and simultaneously prioritizes elimination and minimizes the effects (Yeang, 1995). To achieve this, Yeang argued that collaboration among scientific disciplines is needed, since it is impossible to be solved based solely on the science of architecture. Yeang offered architecture design process with ecological approach consisting of analytical stages, synthesis, and assessment or through holistic approach among the scientific disciplines.

Ken Yeang concept on ecological architecture or in other words sustainable architecture, has been applied more on high rise building or skyscrapper designs. Some Yeang architecture researches have always been based on a question: what is the real definition of high rise building? Has there been a theory specifically on high rise building design? Can a theory totally on high rise building be materialized? These questions eventually lead Yeang to be able to think critically and obtain answer that architects have been too arrogant to be willing to collaborate with various scientific disciplines and/or philosophy (Yeang, 1998).

Agenda that continues to be conducted by Yeang in his on-going research and product design is the development toward bioclimatic and ecological effects on building desing such as: (1) the utilization of wind and rain characteristics, (2) Life-cycle approach on the use of material and building equipment, (3) the development of new patterns for internal lives of the high rise building occupants, and (4) seek new pattern for spatial configuration avoiding the tendency of the creation of a concrete environment (Yeang, 2011). Then, in the summary of bioclimatic design by Yeang for high rise building, Abioso (1996) noticed the following ítems: (1) Energy calculation: the application of architecture design should begin with the consideration of energy saving principle; (2) A design that is responsive to the environment: bioclimatic approach can be done with two basic considerations, i.e. rational with comfort-based and passive low-energy. Energy saving can be calculated easily in the context of financial saving and at the same time explaining to the client with comercial base; (3) Criteria of multi-story Highrise Building Design: premises of specific design is certainly needed for highrise building since it has different carácter with low-rise building. In this case, climatic approach is easier to be done; (4) Pragmatism principle: the presence of high-rise building is inevitable in big cities, since it will relate to saving of various ítems: land cost, waste of energy due to transportation and the increase of urban population; (5) the Economy of Skyscrapper building: high-rise building design is attempted to have a máximum internal área at every inch of the floor and máximum building dirty área at the site, or comparison of máximum plot and minimum net-to-gross, considering that high-rise building is a compromise between land cost and building economy, location preference of the occupants, and the wish of the owner statue associated with the building; (6) Bioclimatically rational: a design that is taking into account meteorological data is inevitable; (7) High-rise Building occupants: responsive design toward climate will créate comfort to the occupants; (8) Ecological consideration: a design with ecological insight can certainly reduce operational cost as a result of a decline in electricity energy use.

2. Aesthetic Keywords Appears at the Eco-Skyscrapper

Keyword that can be concluded from the concepts addressed by eco-skyscrapper so it can transmit its aesthetic value is:

KEYWORDS	THEME GROUP	KEYWORDS	THEME GROUP
Wind turbine and solarcell	POWER GENERATING SYSTEM FOR BUILDING	Natural ventilation	BUILDING ENVELOPE
Solar power		Breathing Wall	
Rain-collector		Waste recycle	TRY TO SOLVE ENVIRONMENTAL PROBLEM
Wind-collector		Flood	
Vertical-zoo	ATTENTION TO ECOSYSTEM	Slums area	
biodiversity		Smart technology	TECHNOLOGY
Sky urban landscapping	GREEN MANAGEMENT	Concept of tree	TAKE FORM OF NATURE AS DESGN INSPIRATION
Garden terrace		Concept of forest	
		Concept of leaves	
Added with factors:			
TERMS		**DETAIL**	
Integration with the Environment		: connectivity with transportation mode facility, "neighborhood" environment	
Building facilities		: internal facility	

Diagram 1. Aesthetic Keyword Eco-Skyscrapper

3.The Application of Eco-Skyscrapper in Indonesia, is it posible?

It seems that sustainable development as a concept will not cause contradictory views and can be accepted by various parties. However, new problem will emerge whenever this sustainable concept will be applied in reality. Likewise, whenever this sustainable concept can be developed from three scientific disciplines, i.e: social science, economy and ecology (Serageldin, 1994). Problem that appeared next in this concept is how this approach can raise social and economic aspects that are more anthropocentric and integrated with environmental aspect that is certainly very ecocentrist. The discourse of sustainable development has been

done in developed countries, where human welfare aspect and minimizing energy use have been applied, although the problem of environmental quality still needs to be the main attention. However, at least the issue of sustainable development can gradually be applied in developed countries. It seems that the issue of economic power has become the most fundamental thing that triggers the encouragement to that direction. How about countries that economically is not strong or weak? Economic power seems also to encourage development to the direction that is abandoning the principle of sustainable: how is the declining environmental quality, society experiencing social disparity, and in the end will cause a slumping economic on the other side.

To achieve sustainable development, it seems that the issue of driving force or the final objective should be followed by economic factor. Development growth is certainly triggered by economic power. However, in sustainable development, the society that was developed, should be well-off, which means that there is no slumping economic and disparity; economic of the society increases, and capitalists also benefit. Here, win-win solution for both parties should be established. Society productivity should increase, in order to créate a healthy and qualified environment. Biodiversity remains well preserved, environmental ecosystem is also stable. It goes without saying that all of them should have support from the society, institution and management system and goodwill of the policy makers. There should be an inter or intra correlation among social factor, economic factor, and environment that guarantees the sustainable of the life of the next generation.

4. Government Support to Eco-awareness Building

In an effort to repair the environment, the Provincial Government of the Jakarta Special Capital Territory has a Governor Regulation on the implementation of Green building. Through this governor regulation, in addition to environmental friendly, buildings in Jakarta should be enervy-saving building. This is the first regulation of its kind in Indonesia. This regulation stipulated the requirements of efficiency in the use of energy, wáter, air quality in the room and comfort. In addition, there are also requirements on land and waste management during the building construction, elements of adaptation at the climate change are included in the building design.

Governor Regulation No. 38 Year 2012 on Green building was enacted for all new and existing buildings in Jakarta effective on 23 April 2013. This regulation is mandatory for offices, commerce, apartment, and building with more than one occupant with total floor of more than 50,000 m^2. In addition, the regulation is also intended for hotel and health facility with total floor of more than 20,000 m^2 and education facility with total floor of more than 10,000 $m^{2.}$

5. The Phenomenon of Building with Changing Facade

The phenomenon of changes in the façade of a building shows a sign that, aesthetic wise, building has a sustainable value. Over period of time, human aesthetic feeling can shift, so that old building aesthetic is considered boring and no longer appropriate with the trend, and it is even considered as does not meet the criteria of comfort anymore. The examples of buildings with changing façade are:

Figure 9. Bank Bukopin Main Office, Jakarta Indonesia

Main office of Bukopin Bank which experienced a make over because it is considered as no longer trency (figure 9). This building used to be dominated by ceramic materials. Now, it has been changed with glass as one of its features.

Figure 10. LIPI Building, Jakarta

LIPI (Research Center) Building in Jakarta has also changed its facade with material replacement and smaller windows path (figure 10). The solar supply in certain part of the buildings is considered as not appropriate with the functions contained inside.

6. The Presence of Building with Environmental Friendly Concept in Indonesia

Nowadays, the presence of buildings with environmental friendly concept in Indonesia has become a necessity that cannot be ignored anymore. Some buildings have even been designed with this concept, such as

Figure 11. Loyola Building - Akademi Teknik Mesin Industri (ATMI)
Architect: Urbane Indonesia
Construction Management: PT Holcim

The concept of this 4-story building with an area of 3,672 m^2 was designed responsively toward climate condition in Cikarang area (Figure 11) – including sunlight, air circulation, and rainwater – and was integrated with the current technology as a support so that it can provide comfort for the tenants as well as to lower operational cost. This environmental friendly and energy saving lecture building (sustainable building) with radiant cooling system is capable of saving the use of electricity up to 60%. The radiant coolant system inside the piping network was planted inside the floor with room temperature is kept at 20 – 23 Celcius degree. The roof was designed like an open book to get maximum sunlight that can be utilized as electrical energy. The shape of the roof is also intended to collect rainwater, which then can be used for necessities inside the building. To absorb heat from outside of the building, the building wall is layered with foam and gypsum, whereas for outside wall, creeping will be used to prevent sun heat from directly entering the building. For room lighting, LED lamps are used with a consumption of 8 watts per square meter. The 5P aspects, i.e. Progress, People, Planet, Prosperity, and Proficiency become the basic of design. The building uses low E double glass, and the wall and roof use isolation to create an energy saving effect. Then, the air conditioner (AC) system used chilled water temperature with temperature 16-19 celcius degrees so that chiller efficiency is better.

Figure 12. Multimedia Nusantara University (UMN) through New Media Tower
Architect: Budiman Hendropurnomo

Figure 12 shows New Media Tower which is one of buildings that have been completed from six energy saving buildings that were planned to be constructed by Media Nusantara University. This building was officiated in September 2012. It was designed with passive design concept: attention to the building mass orientation, applying doublé skin concept using perforated aluminum material designed with certain patterns. Therefore, it is capable of reducing heat from direct sun and give optimum lighting to the classrooms inside. For additional lighting, energy saving light and T5 fluorescence are used. The building is also maximizing wáter absorption from the entire área, at the same time implementing the recycling of dirty water. Rainwater is collected in an open wáter pond together with recycled wáter from sewage plant treatment (STP). After the recycling process through wáter treatment plant (WTP), the wáter is used to wáter the plants, for toilet flushing wáter, and to be used in cooling tower to cool the working rooms through wáter cooled air conditioning. Meanwhile, for ventilation system, the building is designed with optimizing natural ventilation, i.e. increases the number of openings to that air circulation can occur well.

Figure13. Allianz Tower, Kuningan, South Jakarta.
Developer: PT Medialand International
Number of floor: 28.
Architect: Budiman Hendropurnomo from Architecture Bureau PT Duta Cermat Mandiri

Figure 13 shows Allianz Tower with the concept of support from environmental friendly material with dual flush and open space that create healthy and comfortale air quality for the office occupants. The design application was done with: (1) Building Orientation: Design of this tower is that the western and eastern sides of the tower are the slimmest to reduce heat and UV exposure from direct sunlight directed to the front side, (2) Natural water absorption: Allianz Tower minimizes basement area; therefore 70% of the location can be functioned as natural rainwater absorption area. This is important as a solution of flood problems in Jakarta. With this system and rainwater and waste water recycle, the amount of run-off water that would be disposed of to the river can be substantially reduced. The soil surrounding the tower is maximized as natural water absorber and natural filter. Jakarta City Council only recommended minimum 30% of the area to be uses as absorption area, but the tower allocated close to 70% of the area; (3) Water Recycle: 80% of the waste water will be recycled to water the plants, toilet flushing water, and for the operational of coolant tower, like water coolant system to COOL the building (4) Rainwater collection: rainwater is collected from the roof building and stored in underground water tank for future needs as recycled water and together with recycled water from the leftover of watering. Only 20% of waste water will be chanelled to the existing Waste Water Treatment Location, in the northern side of the Allianz Tower and is operated by the provincial government of Jakarta; (5) the latest technology of glass construction. Double glass construction was used as the building feature; a combination of 8 mm reflective glass and 6 mm transparent glass with a 12 mm air vacuum distance among them. This double glass construction will reduce heat drastically and eliminate excessive traffic noise from the main road; (6) the use of energy saving lamp such as LED and T5 fluorescence in almost entire office area to reduce the use of electricity; (7) The use of Cobble Stone as the base of road and driving area, so that each area surrounding the building can function as natural water absorber, The large part of the parking area was built on the ground at the base of the tower. This will reduce energy for operational since it does not require mechanical ventilation and artificial lighting (during the day). This is an option that is more environtmental friendly compares to multi-level underground parking. The tower parking area is cheaper to be constructed and is minimizing underground coverage area, and so it cleared 70% of the total area out of 7000 m^2 as absorption soil for rainwater; (8) large and beautiful trees.

VI. CONCLUSIONS

The principle sustainable design will involve various aspects: aesthetic, environment, social, politics and moral. Sustainable architecture needs architects imagination and their technological ability to integrate various aspects in harmonious nuance with the environment. Architects are smartly demanded to think rationally regarding the issues: sustainability, time duration, use period, the appropriate material and certainly sense of place aspect. The challenge is to brinhg together environmental consideration and economic constraint. Wise consideration will lead to human welfare and life support system for the existing ecosystem.

Based on the exposure that was done, a conclusion was obtained based on eco-skyscrapper design insight:

1. The latest trend has created aesthetic (high-rise building) emerges whenever a building is capable of solving environmental problem. Whatever the shape, probem solving should be able to solve one of the following aspects: (a) Energy saving; (b) Self-suficient energy that does not depend on fossil resources and government; (c) the problem of slums neighborhood; (d) the problem of flood; (e) the problem of clean water availability; (f) the problem of environmental pollution; (g) Occupants comfort; (h) transportation.

2. What is needed is learning and a change in thinking concept, that even though economically "eco" concept in the building is quite expensive, but the future aspect in the form of life sustainability of the future generation apparently produces priceless benefit.

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