

Eco-Architecture: The Design of Floating Culinary Tourism Center

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Abstract— Mangrove Ecotourism in Surabaya has not been managed well because around the mangrove area is filled with the activity of street vendors who still simply take advantage of their house yard. The existing ecotourism potential of mangrove can be developed into eco-tourism mangrove, which is expected to provide socio-economic impact in the east of Surabaya. The purpose of design can shift the function of rivers around the ecotourism location into the floating culinary tourism center. Biomimesis design method can identify human needs, interpretation of biological view of the problem to be able to produce design with the concept of eco-architecture and biomimesis. Aesthetic forms is resulted from hypodermic anatomical structures, pore anatomy of mangrove trunks which are transformed into the facade. The dome-shaped roof structure immitate the shape and function of the anatomy of leaf vein and bone. The structure of floating and tracking line is inspired from the morphology and function of taproot, the connecting circulation path of each unit building follow the curve of the river around the mangrove area and limnetic zone, at each 10-15 meters, a place to manage garbage and waste is provided.

Keywords: *Biomimesis, Culinary Tourism, Eco-Architecture, Ecology, Floating, Surabaya*

I. INTRODUCTION

Surabaya is the second largest city in Indonesia after Jakarta, with the number of population of the metropolis which reached about 3 million inhabitants. Based on the data owned by the Department of Population and Civil Registration in the first six months of 2011, the population in Surabaya increased by 36.577 people. For the record, in 2010, the number of population in Surabaya had reached as many as 2,929,528 people. Surabaya is potential as a stopover and shelter for immigrants. This immigration process is what makes the population growth rate of Surabaya to increase from year to year, which increases the density of population, housing, construction and public facilities. Immigrant process may be caused by their desire to change the fate or improve the economy, which mostly is through trading.

The contribution of Surabaya city to the regional economy of East Java is the largest compared to other counties or cities, reaching 30% of total PRDB on current prices in East Java. Of course it makes the city of Surabaya as the center of East Java's economy, which is driven by the

availability of regional infrastructure which is highly adequate, as Purabaya Bus Station, Pasar Turi and Gubeng Railway Station, Tanjung Perak Port, and Juanda Airport. Surabaya city is also becoming increasingly metropolitan by its growth as a city of trade and service that can be seen from the proliferation of modern markets in almost every region.

Street vendors (PKL) is a profession that occur as a result of the limited jobs in the formal sector, so most people turn to the informal sector to keep making money for their lives. According to McGee and Yeung (1977), PKL has a definition of "hawkers", which is defined as those who sell goods and services in the spot which is a space for the public interest, especially on the road and sidewalk. Tourism is now one of the main drivers of socio-economic development in a number of major countries and regions, particularly in the city of Surabaya. Mangrove Eco-tourism is a model of traditional tourism on the east coast of Surabaya city.

The design of the floating culinary tourism center can take into account the environmental aspects that influence the design and how the design of the floating culinary tourism center with the concept of eco-architecture and biomimesis in mangrove area suitable with the ability, in order to support the life of the population which is an environment natural resource.

II. THEORETICAL REVIEW

A. *Eco-Architecture*

Eco-architecture is a strategy that combines the concept of economic efficiency based on the principle of efficient use of natural resources. The purpose of eco-architecture is to reduce the environmental impact to achieve profits as it reduces source along with the higher level of public awareness to develop the industry by considering the aspects of environmental sustainability.

B. *Ecology*

1. *Ecology* is knowledge which studies the interrelationships between living things with each other and with their environment. The function of ecosystem shows a causal relationship which occurs overall between components in the system.

2. *According to Heinz Frick (1998)*, Eco was taken from the word ecology, which is defined as the study of the interrelationships between living things and their

environment. Architectural Ecology is: Making the understanding of working together with nature, which natural resource is harmonious as culture which is ingrained and becomes human personality (Mc.Donough cs, 2003); Human plays the most important role in the formation of the built environment, which is the most comfortable and harmonious with nature Buchanan (2005), Salingaros (2007), Hawkes (2002), and Mc.Donough (2003c); About the nature and its relationship with human, there is direction: humans play the most important role in the formation of the built environment which is the most comfortable and harmonious with nature Buchanan (2005), Salingaros (2007), Hawkes (2002), and Mc.Donough (2003c); human should be able to align / perform artificial symbiosis between the nature made and the human made Yeang (1999), MC.Donough (2003), Freestone cs, eds, (2001); Using building/ architecture that does not damage the nature and human in the ecosystem: minimize the use of toxic materials Tsui (1999), and Yeang (1999); minimize the dependence on mechanical environmental control system (Hawkes 2002); minimize deterioration of natural elements: vegetation, water, air, soil Yeang (1999), and Vale (1991); minimize the wasteful use of space Mc.Donough (2003c), and Tsui (1999)

3. *The principles of Fluctuation ecological architecture.* According to Batel Dinur (2004) fluctuation principle states that the building is designed and perceived as a place to distinguish culture and the relationship of natural process. Buildings should reflect the relationship of natural process that occurs at the site and do not only let a process considered as a process and not as a presentation of the process, it also will succeed in connecting people with the reality at that location; Stratification. According Batel Dinur (2004) the stratification principle states that the building organization should arise out of the interaction of the difference in parts and the levels. The kind of organization which allows complexity to be managed in an integrated manner; Interdependence. According to Batel Dinur (2004) the relationship between the building with its parts is a reciprocal relationship. Reviewers (designers and users) as well as the location can not be separated from the part of the building, the interdependence between the building and its parts is sustainable throughout the life of the building; High performance building. Building which has the concept of green architecture is to minimize the use of energy by utilizing energy derived from nature (Energy of nature) and combined with high technology. For energy efficiency, water and waste, indoor air quality such as: water and waste, heating as direct gain, indirect gain and active solar thermal energy system. (Alison G.Kwok, AIA and Walter T. Grondzik, PE.)

4. *The Basic Elements of Ecology Architecture:* According to Ken Yeang (1999) natural elements include: soil, water, air, landscape factor, vegetation, fauna topography, etc., while according to Vale (1991) soil, air, water and fire and also according to Mc. Donough (2002) about soil, water, vegetation and climate: The air to breathe which has close relationship between breathing air and life is the experience of human life. The more polluted air decreases the quality of life.; Water as a source of life for living creatures on earth; Fire (energy), as an energy source and the

source of one of the sources of life for living beings; Earth becomes a source of raw materials and becomes a life of living beings.

C. *Biomimesis*

The design which is inspired by nature, bionic design, biomimetism, biomimicry, or the design which is inspired biologically, though has been a source of inspiration for the design activity for a long time, recently, under the pressure from the concern of sustainability, has got a role as part of a standard series of approaches to deal with design issues. Nature provides an important model to find a solution of the ecological crisis. The main objective of bionics is to carry out a natural benchmark from what is made, tested, and which has evolved over millions of years, in order to improve what the human being created artificially (Benyus 1997). Benyus' book states that there are nine basic laws that define biomimicry: Nature works with the sunlight; Nature only uses the required energy; Nature adjusts the shape in the function; Nature recycles anything; Nature appreciates the cooperation; Nature has diversity; Nature requires local expertise; nature limits the excess from inside; and Nature gives the strength limitation.

D. *Floating and Function of River*

A. *Floating*

Floating Architecture is a science of designing buildings that float on the water surface. In floating architecture as an identity former, based on the form floating architecture can be divided into several groups, namely: fixed floating building, a building which is located on the surface of the water and still has a foundation; Free-floating buildings, this building is located on the surface of the water and really floats. Basically, this building can be like a ship that can move from one place to another place; Semi-free floating building, this building is a building located on the surface of the water but can not move and do not use foundation as a base of the building.

B. *Function of River*

Government Regulation of Republic Indonesia No. 35 of 1991 about River chapter III. The functions of river in Article 7, river as a source of water is a natural resource that has versatile functions for life and human livelihood. In Article 7 Paragraph (1) River has extensive functionality, which is, as a water provider, transportation infrastructure, energy provider, material provider, drainage, and recreational facilities). Government Regulation of Republic Indonesia of 2011 on the River Part Three River Development Article 29 The use of the river as referred to in paragraph (1) include the use of: Paragraph (3) Development of river referred to in paragraph (1) is done by not damaging the ecosystem of the river, considering the the characteristics of river, conservation of biodiversity, as well as the particularities and aspirations of the regions / local communities.

E. *Street Vendors, Tourism and Culinary Tourism*

1. *Street Vendors:* In Indonesia, street vendor is pedagang kaki lima. It is an acronym of *kanan kiri lintas manusia*, which means that they are surrounded with people, which in doing their business, they are always around the crowds. Street vendor is actually an indicator of economic growth in each country, they significantly contribute to the economic growth. Street vendors are actually very missed by

urban in certain days, especially ahead of the Eid-al-fitr or *lebaran*. Most businessmen go to their hometown on those big days.

2. *Tourism attraction* according to Cooper et al (1995) argues that there are four (4) components that must be owned by a tourism object, namely: Attraction, such as attractive and interesting natural, charming local culture and the performing arts; Accessibility such as local transportation and the terminal; Amenity or facility such as the availability of accommodation, restaurants, and travel agencies; Ancillary services which is tourism organizations required for tourism service such as destination marketing management organization, conventional and visitors bureau

III. DESIGN METHOD

The design method employed is the challenge to biological design spiral in every design stage. The design of floating culinary center employs eco-architecture concept referring to the process positioned within the symmetrical problem/solution. First, is conducting identification and clarification of the problems, second stabilizing the functions of the literature review and collecting data from the field study to manage the standard design as well as creating criteria in designing floating culinary center in order to achieve process design which is able to determine the characteristic of the floating culinary center. Interpretation of the biological preview of the problems to develop ideas and solutions based on the natural model by imitating the form and function and referring to the eco-architecture and biomimesis concepts as well as things related to floating which than transformed in to the division of space and form of the building.

IV. CRITERIA OF DESIGN

The embodiment of eco-architecture design is environmentally sustainable buildings that are closely related to the ecosystem and the concept of green architecture. Biomimetics to optimize the application of concept on the design object, in the embodiment of eco-architecture in a building with the following categories:

- Design of floating culinary center should be designed to respond to the context.
- The design of the floating culinary tourism center must be considered or done with the idea of a basic form design which is based on the environment, by implementing metaphor as the basic process of taking an idea from the forms of nature.
- The design of the floating culinary tourism center, which should be done by emphasizing the concept of operation and sustainable maintenance optimization of building can be operated responsibly and maintained properly.
- The design of culinary floating center which is designed for the building should reflect the relationship of natural processes occurring at the location (Fluctuation).
- The design of floating culinary tourism center should be designed for the kind of organization which allows complexity to be set up integrally (stratification).

- The design of floating culinary tourism center which should be designed for the relationship between the building with its parts is a reciprocal relationship (interdependence).
- The design of floating culinary tourism center should be designed to minimize the use of energy which is derived from nature (energy of nature) and combining with high technology. (Utilizing a *void physically* and visual in order to save energy on activities between the water and the building).
- Floating structure which should be used in designing culinary tourism center as a model connecting the real situation in order to support aquatic life or the life of the population which is an environment natural resource.

V. ANALYSIS OF THE DESIGN

1. *Site plan*: the selection and the zoning of pier which should be concerned is the accessibility of achievement and the circulation in a site that is grounded in the water.



Figure 1. (left) existing condition; (right) Selection of site plan and pier zoning

Street vendors in slum area who have not been arranged lead to the environmental pollution from the routine activities of daily living (see figure 1 left). Structure pattern of building mass follows the curve of the river among the mangrove trees that live following the shape of the river, using on the part of exterior among the trees as the area of activity and also the path to connect each building unit (see figure. 1 right).

2. *Form*: The basic process of taking an idea from the forms of nature. Biomimetics with the application of the metaphor is more directed at joint metaphor category.

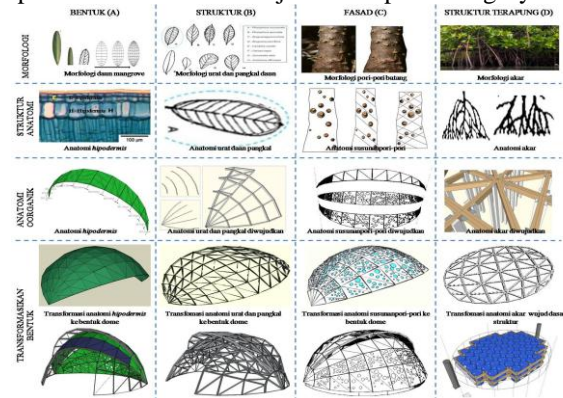


Figure 2. The basic process of taking an idea from the forms of nature

The form and function of leaf and stem (see figure 2. A and C): The exchange of oxygen and carbon dioxide (respiratory apparatus in plants); Transporting water and minerals from the roots to the leaves; Secrete salt (salt-secretors). This kind of mangrove species absorbs water with high salinity levels and then removes or secretes the salt out of the tree to produce an aesthetic form of a hypodermic anatomical structure, the pore anatomy of mangrove trunks are transformed into the facade. The form and function of the leaves and the veins (see Figure 2. A and B): To produce the framework structure of the dome, imitating the shape and the anatomy function of bone veins and leaves. Stem and root (see figure 2. C and D): Underpinning the plant body; Strengthen the establishment of the plant on which it grows; Helps the absorption of oxygen in the air, like on the mangroves. To produce a floating structure which is inspired by the morphology of taproot and its function.

VI. RESULT OF DESIGN

1. *Site Plan*: The design of culinary tourism center must be designed to utilize a void physically and visually in order to save energy on activities between the water and the building.

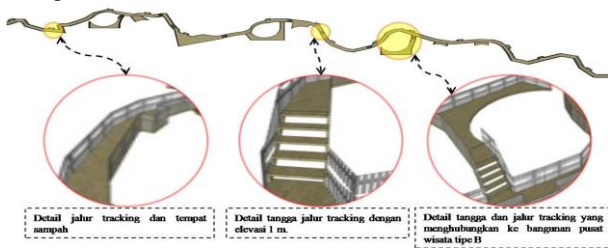


Figure 3. (Top) tracking path for accessibility; (Left) detail of tracking path and trash; (Middle) detail of stairs in tracking path with an elevation of 1 m.; (Right) Detail of stairs and tracking path that connects to the stage building.

The design of the site plan can harmonize the environment on the ecosystem with various constituent components, i.e. abiotic and biotic factors. Because ecology is also closely linked to the levels of organization of living organisms, populations, communities and ecosystems which affects each other and is a system that shows unity.

2. *Building with Tread*: The need of floating culinary tourism building with the arrangement of the building into the site in order to reduce the large volume of the building by making the building into several buildings with different zoning.

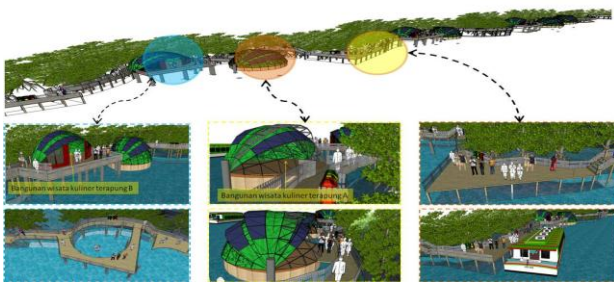


Figure 4. (top) Building with a tread; (left bottom) the stage building; (center bottom) floating structures; (right bottom) pier.

Capable of designing site and building (see Figure 4. Top), by utilizing a form of river in the region of mangrove fauna (littoral zone), in order to maintain the condition and preserve the nature, utilize and optimize the shape of the river curve and optimize the elevation of tracking path with the concept of attraction so that the nature remains interesting and charming (see figure 4. left and right bottom), the accessibility of tourists' achievement in utilizing sea fauna area (limnetic zone) with boat (see picture 4. right bottom).

3. *Floating Building*: The form of the plan is designed according to the morphology of leaves of mangrove and able to accommodate 18 tourists equipped with two service units, each unit can provide 3 booths (6 units of booth) with a variety of menu which is ready to be served (see Figure 5. Left).

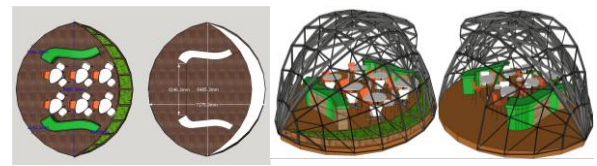


Figure 5. (Left) floating building plans; (Right) perspective of floating building with the roof frame.

The basic shape utilizes the function of skin layer which is the home of collagen cells, which is hypodermic morphology of mangrove leaf which is transformed into a dome shape to solve the aesthetic problems of the building. The anatomical structure of wood cell or pore as an inspiration so that the building does not depend on the artificial energy for lighting and air circulation, arranged according to the needs and aesthetics of the building's facade. Dome structure immitates leaf veins, base and its function (see Figure 5. Right). Utilizing the elements of biochemical in the process of leaf photosynthesis (see figure 6), to produce the formation of solar light energy (Self-healing solar).

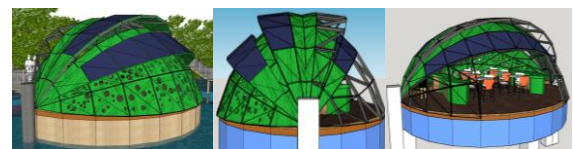


Figure 6. (left) perspective from the lake; (Middle) side view; (Right) the perspective from land or tracking path.

4. *Stage Building*: The shape of the plan is designed according to the morphology of mangrove leaf and provides public service facilities such as mosque, toilets, and warehouses for the provision of a culinary tourism.

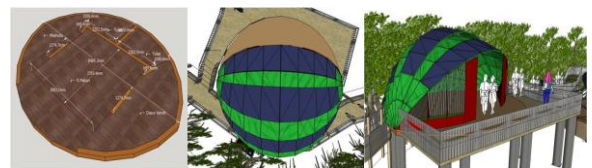


Figure 7. (Left) stage building plans; (Middle) top view; (Right) the perspective of stage building from the lake.

The basic shape utilize the function of skin layer which is the home of collagen cells that is hypodermic morphology of mangrove leaf which is transformed into a dome shape to solve the problem of building aesthetic, to bring out the concept of reducing energy saving with various shapes (fenestration). Utilizing the elements of biochemical in the photosynthesis process of leaves (see figure 6), to produce the formation of solar light energy (Self-healing solar).

VII. CONCLUSION

The design result of floating culinary tourism center can solve aspects that affect the problems associated with waste minimization, resource conservation, and maintenance to guarantee the balance and harmony of the environment, and sustainability of using natural resources and life of the population of natural resources, which is influenced by river, which is the environmental aspect in which the human, living beings and non living objects interact (inter-related) directly with water; trash is an aspect of the environment which is resulted from human behaviour which can lead to damage of the natural elements; ecosystem is an environmental aspect because it covers an area of land and sea or water.

The floating culinary tourism center building is designed not to damage the surrounding environment and create the nature explicitly, by designing the site plan that utilizes the shape of rivers in the mangrove fauna area (littoral zone), and optimizing the tracking path elevation, accessibility of the achievement of tourists who utilize local marine fauna (limnetic zone) by boat.

Building with tread: the need of floating culinary tourism building with arrangement of the building into the site in order to reduce the volume of large building by making the building into several buildings with different zoning;

Shape: immitate the shape, function and standards of mangrove trees by metaphor process, to produce the form of organisms that can not change the surrounding environment and present nature into the building, utilize the shape and function of mangrove leaves on the skin layer, namely hypodermic morphology of mangrove leaves which are transformed into a dome shape, to solve the problem of building aesthetics;

The anatomical structure of cell as an inspiration of the shape of building ventilation, so that it does not depend on the artificial energy like lighting and air circulation, and also as the aesthetics of the building facade. Dome structure immitates the leaf vein, base and functions. Utilizing the biochemical elements in the photosynthesis process of leaf to produce solar light energy formation (*Self-healing solar*);

Building use technology which is appropriate, efficient, and exploits nature by extracting natural materials: the color and texture is exploited from nature by functioning material as natural elements but it does not perfectly resemble the nature, however it can only add an attractive visualization but still appreciate nature;

The building of floating culinary tourism center can solve the problem of waste and trash which are generated in order to maintain the nature, and floating culinary tourism center can only provide the kind of food that is ready to be served, in addition to providing trash bins every 10-15 meters and waste place in order to be operated easier;

The structure of floating buildings, pier and tracking path is inspired by the morphology of taproot and its function, equipped with floating material of plastic drums, the most important component in the structure of pile system, at the tip of the building so that the building structure is more stable. The height of floating structure is 1 meter higher than the photic zone, the height of tracking path depends on the natural condition of mangrove and pier as the main path of achievement with the height in accordance with photic zone in order to ease the circulation of visitors.

VIII. REFERENCE

- [1] Benyus, Janine M. (1997), "Biomimicry: Innovation Inspired by Nature". William Morrow & Co., New York, NY
- [2] Buchanan, Peter, 2005, Ten Shades of Green: Architecture and the Natural World, eds. 1-st edition, The Architectural League of New York.
- [3] Cooper, Christopher P., (1995), "Tourism: Principles and Practice". 3rd edition, London: Longman.
- [4] Departemen Kebudayaan dan Pariwisata, (2015), R P J M D Kota Surabaya, dalam Analisis Isu, Departemen Kebudayaan dan Pariwisata Republik Indonesia; www.budpar.go.id
- [5] Dispenduk Capil, (2011), Dinas Kependudukan dan Pencatatan Sipil dalam enam bulan pertama.
- [6] Dinur, Batel. (2004) "Interweaving Architecture and Ecology-A theoretical Perspective"
- [7] Freestone, Robert, cs, eds,2001, New Garden City in The 21st Century?Kobe Design University, Tsukuba, Japan.
- [8] Frick, H. (1998). Dasar-dasar Eko-Arsitektur. Yogyakarta: Penerbit Kanisius dan Soegijapranata University Press.
- [9] Hawkes, Dean cs, (2002), The Selective Environment. An Approach to environmentally responsive architecture, Spon Press, London.
- [10] Mc.Donough, William and Gissen, David ,2003. Preface dalam Big & Green: Toward Sustainable , Architecture in 21st Century, , National Building Museum, Princeton Architecture Press .
- [11] Tsui, Eugene, 1999, Evolutionary Architecture, Nature as a Basis for Design, Canada : John Wiley & Sons .
- [12] Yeang, Ken, 1999, The Green Skyscraper, The Basis for designing Sustainable Intensive Buildings, Prestel, Munich.
- [13] Mc Donough cs, 2003, "Toward a sustaining Architecture for the 21th century/the promise of cradle design" dalam Industry & environment, a quarterly.
- [14] Mc. Donough & Braungart, M, 2003c, "Regulation and Re-design. Tapping Innovation and Creativity to Preserve the Commons", green@ work, September/October 2004).
- [15] Presiden Republik Indonesia (1991), "Peraturan Pemerintah Republik Indonesia, Nomor 35 Tentang Sungai"
- [16] Rachmawati, Murni dan Prijotomo, Josef, (2010), "Pelestarian Alam Dalam Arsitektur: Masalah dan Usulan Pemecahannya", Jurnal Bumi Lestari, Volume 10 No. 2, Jurusan Arsitektur FTSP-ITS, Surabaya
- [17] Versos, Carlos A. M. dan Coelho, Denis A., (2011), Industrial Design-New Frontiers, "Biologically Inspired Design: Methods and Validation", Prof. Denis A. Coelho (Ed.), ISBN: 978-953-307-622-5, InTech.
- [18] Watanabe, E., Wang, C.M., Utsunomiya, T., dan Moan, T. (2004), "Very Large Floating Structures: Applications, Analysis and Design", dalam Centre for Offshore Research and Engineering, CORE Report No. 02, National University of Singapore.