Biomimicry: Function and Aesthetic of Vacation Home, Chonburi

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Abstract. The aim of this research is to look into the architecture world today where sustainability and energy consumption are a new trend of urban architecture. The interpretation of biomimicry architecture that involving in biocentric world. The differentiation of biomimicry and biomorphic led to my extrapolate of the decision in understanding between the two. The understanding of biomorphic versus biomimicry is that biomorphic only form that resemble of nature however, biomimicry is the function that adapt through the study of function of nature. Moreover, because biomimicry takes root from nature itself, the adaptation is not too alien to environment built and can achieve the outcome equal or toward energy consumption and sustainability. Introducing project of biomimicry in Chonburi [1] to provide a new architecture design for vacation home in the area for a new way of sustainability living and invitation to new economy attraction to tourists in Thailand. With the analytical to identify the problem in Chonburi where the province ranked number two in Gross Provincial Product (GPP) according to GPP Analysis from TERRABKK. This research study focuses on the combination of function of biomimicry in architecture and architectural aesthetic. The research topic is to study environmental, climate, and site analysis to find the equilibrium price of the area and construction materials that can be found within the area for the design.

1. Introduction

What is biomimicry architecture?
Biomimicry in architecture design is a design that study from nature using method of mimicking nature surrounding environment and implement it in order to achieve close to zero waste energy consumption [2-6]. This research focuses on the combination of biomimicry and aesthetic of tropical architecture into cutting edge of new era in tourism in Thailand. The goal of this research is to look into achievement of ways to design the project according to the climate of the selected site and employing the function of nature in sustainability living toward dweller or visitors in the vacation home.

1.1 Problem statement and research significance
In the architecture world today where sustainability and the concern of energy consumption are a new trend of urban architecture [7]. In the project of biomimicry in Chonburi vacation home is to set a new architectural design for vacation in Thailand for a new way of sustainability life style and invitation to new economy attraction to tourists. In this research topic, the study of environmental, climate, along with the site analysis are to find the affordable price and construction materials that can be found within the area. The analytical of identifying the problem from the statistic of tourists and Fine Particle Matter (PM 2.5) in the area has become highly increase over the past few years.
Figure 1. Statistic of Tourists Visit in Thailand 2009-2018

Chonburi, one of the vacation destinations for tourists who wish to embark in experience of culture, tradition and relaxation in Thailand. There are many places for tourists to visit during the day such as Mini Siam, Sanctuary of Truth, Underwater World Pattaya, Pattaya Floating Market, Tiger Park, Nong Nooch Tropical Garden and to the famous Pattaya Walking Street during the night time [8]. According to the National Statistical Office (NSO) of tourist visit in Thailand (Figure 1), in the recent statistics of 2018 the number of tourists climbed to 38,174,194 persons during that year. With the latest statistic data in 2011 From Thailand Regional Dataset (Figure 2) of tourist who visited Chonburi, the amount of traveller there reaches 10,823,369 persons in one province. When comparing to the NSO data of tourists who came to Thailand during 2011, the number is 19,230,470 persons who entered Thailand that year. Because the number of tourists who visited Chonburi made up 56.28% of all the tourists who travel to Thailand has brought the economic opportunity in Chonburi. With the economic opportunity from tourists in Chonburi, many locals and investors are prone to establish their ground to intrigue and invite more tourists such as vacation resorts, hotels and vacation homes.

Figure 2. Statistic of Tourists Visiting Chonburi
Figure 3. Pattaya Map – Price Range Vocational Residences; Red: 3,500 - 7,000 Baht/night, Orange: 1,500 – 2,500 Baht/night, Green: 750 – 1,500 Baht/night

Figure 4. Pinpoint of Tourist Attractions in Pattaya: A. Sanctuary of Truth, B. Art in Paradise, Teddy Bear Museum, Alcazar Cabaret Show, C. Mini Siam, D. Pattaya Night Bazaar, E. Pattaya Beach, F. Pattaya Walking Street, G. Phra Tamnak Moutain (Phrabat Moutain)
From the map of Pattaya area (Figure 3), the research in certain type of vocational facilities in this case is vacation homes. As the suggested of the price for vacation home are varies in the area appearing on the map. However, the pricing becomes more expensive when the area is closer to beachfront though, it is not always all the case. In certain area that the price can almost be the same as the one in the beachfront due to their amenities in the areas and the structure of the vacation home itself. Further look into the tourist attraction area can be one of the factors as well (Figure 4). In the figure 1.4 mapping indicate the pinpoint of tourist area which close to the chosen site in the project due to the distant of travel and pricing that affordable rage to tourists. With the increasing of the tourists that visit Chonburi, the city has grown in Gross Provincial Product (GPP) and allowing the locals to invest in the tourism, housing and other activities. Therefore, with the city growing and investment to develop the city, resulting in the increasement of constructions and other activities that manifest pollution due to developments. In order to overcome the current state that post risks to anyone living there, the new way of sustainable living must be implemented.

1.2. Purpose of study
The focus of this study is to implement architectural design with function that uses biomimicry and aesthetic in vocational home in Chonburi. The purpose is to provide a new architecture design for vacation home in the area for a new way of sustainability living by using energy conservation, renewable energy and materials that can be found and made from locals. The research-design will be applied to the selected site in the area of the orange circle (Figure 3). This location is viewing as an opportunity area to build new type of vacation home that innovative in design, aesthetic and environmentally friendly in affordable price in the area toward sustainability living.

1.3. Scope of the study and research methodology
The scope of this study focuses on the analytical data of the finding in Pattaya, Chonburi. From the tourist attractions relation to the vacation home in various prices range. The analysis of case studies that focuses on biomimicry structure, energy consumption system and material that mimicking living organism [9]. In addition of the finding of local materials are also part of the study in order to implement in the function of biomimicry design for sustainability and energy conserving [10-12].

1.4. Benefit of the study (Research outcome)
As the research drawn to the conclusion, the propose of single type vacation home will be chosen in the selected site. The benefit of this project will provide new adaptation toward vacation and environmental surrounding thus promoting the environmental awareness at the same time as appreciation of the local aesthetic in architecture.

2. Case studies
The research of biomimicry architecture which is well known of mimicking the function of termite mound in the Eastgate Center in Harare, Zimbabwe (Figure 5). The structure mimicking the intricate ventilation tunnels of termite mounds to reduce energy costs [13]. “The Eastgate Centre is a shopping center and office building located in Harare, Zimbabwe. Rather than using a traditional fuel-based air-conditioning system to regulate temperature within the building, the Eastgate Centre is designed to exploit more passive and energy-efficient mechanisms of climate control. The building’s construction materials have a high thermal capacity, which enables it to store and release heat gained from the surrounding environment. This process is facilitated by fans that operate on a cycle timed to enhance heat storage during the warm daytime and heat release during the cool night time. Internal heat generated by the building’s occupants and appliances also help to drive airflow within the building’s large, internal open spaces, as it rises from offices and shops on lower floors toward open rooftop chimneys. Various openings throughout the building further enable passive internal airflow driven by outside winds. These design features work together to reduce temperature changes within the building interior as temperatures outside fluctuate. The $35 million building saved 10% on costs up-front by not purchasing an air-
conditioning system. Rents are less expensive in this building compared to nearby buildings because of the savings in energy costs.” [14].

Another research case study is an architecture that uses biological function integrated in the building after the extensive researching on the its properties in nature. This kind of architecture is new to the world and is one of a kind building that uses biological system to provide energy. The system that uses in this architecture is called “bioreactor façade” [15-16]. This architecture is the Algae House in Hamburg, Germany (Figure 6). This architecture immered as the first “Bio-Intelligent Algae house is the first algae powered building in the world” [15-16].

Also, another case study of the material in mimicking nature can also provide another route in energy conservation as well. In this case study of Prototyping a Self-Ventilating Building Skin With Smart Thermobimetals by Doris Kim Sung. The objective of the particular material which made of metals interlocking, cross patterning with each other acted as human skin that breath through temperature in hot and cold climate (Figure 7 & 8). “Thermobimetals uses a combination of any two compatible sheet metals. The combinations of metals with different expansion coefficients and at various thicknesses can produce a wide range of deflection.” [17].

Figure 5. Showing how the Eastgate center functions
Figure 6. Algae Haus: Illustration by Brown Bird Design

Figure 7. A lamination of two metals together with different thermal expansion coefficients simply deforms when heated or cooled

Figure 8. As temperature rises, one side of the laminated sheet will expand more than the other resulting in a curved or curled piece of sheet metal

In the research of Breathing Facades: a New Concept to Create Dynamic Thermal Ambiances in building located in hot climates by Mahmoud Elghawaby followed the depiction of Hassan Fathy in traditional construction that they are breathing building in according with the Bedouins logic to thermal comfort. “These constructions have the ability to absorb moisture form the air and allow the passage of airflow through the entire surface, thereby reducing the temperature by evaporative cooling, with guarding its ability to prevent direct sunlight.” [18]. Elghawaby design concept on breathing wall consists of three layers to minimizing direct sunlight and allowing cooling temperature inside the building. In the external layer the priority of the function is to minimizing the high temperature casing from sunlight by using “materials that has the ability to absorb the moisture and allowing the air flow to pass through such as natural textile, clay, wood or reeds.” [18]. In the middle layer, the function is similar of epidermis of human skin that control airflow. In the final layer or “internal layer contains controlled ventilation outlets managed by both building management system and occupancy desire to create the requested internal thermal ambiances.” [18].
3. Selected site

3.1 Pattaya – Design base Site

This design-base site is located in south Pattaya area from the collected data and personal site visit was performed prior the pandemic of COVID-19. From the mapping of South Pattaya site (Figure 9), the pricing of the site was determined to be in the average pricing area according to the zoning categorize in the price range mapping in Figure 3. Furthermore, another fact of determination for base-site gathered from the information of surrounding familiar facilities in the area; vacation homes, pool villas. According to the raw research data of vacation homes, pool villas in the area of the selected site from Airbnb.com, the average price to stay per night is significantly affordable for anyone to stay for a short time visiting Pattaya. The pricing varies from 1,722 baht to the maximum of 6,642 baht. The average of the amount of people the vacation home, pool villas can accommodate is between 6 to 12. In each vacation home, pool villas provided similar amenities such as the basic essentials; towels, bed sheets, soaps, toilet papers, dishes, silverwares, cooking utensils and cooking seasoning. Even though, the essential is a must in the decision when choosing vacation home, pool villas to stay, another fact that will help narrowing down to the best interest for one who will be staying depends on varies of the other amenities and features or key features of that place. In determination of what the other amenities are such as parking on premises, Wi-Fi (Wireless Fidelity), A/C or Heating, refrigerator, stove, friendly working space, television and cable television. On another hand, the features or key features may help further to cut the tie in choosing vacation home, pool villas such as the outdoor facilities of the place; patio, balcony, garden or backyards with barbeque grill. Other features or key features may be focus on the safety of occupants such as carbon monoxide alarm, smoke alarm, first aid kit, and fire extinguisher on the premises. Lastly, in some cases, vacation home, pool villas may offer family features such as baby bath, baby sitter, children’s books, stair gates, game console, baby changing table, crib and travel crib for any family with children.

Figure 9. South Pattaya Site
3.2 Survey
The preceding in determination of the vacation home program relying to the survey that has been sent out to 65 responders which separate into two focus group of people. The first group targeting Thai nationality people in varies age group and their information on vocational ideal. On the other hand, with the same questions are focusing on foreigner group on their vocational ideal. From the first group, 45 responses of Thai people who did the survey the age between 21-73 years old which majority of them 46% are married, 15% are in relationship and 37% are single spending time for vacation on the average of 10 days per year. Although, the second group with 20 responses from foreigner who did the survey are between the age of 21-63 years old in the majority of them are 45% single, 30% married and 25% in a relationship spending time for their vacation on the average of 10 to 20 days per year.

Figure 10. Survey Vacation + Sustainability

Figure 11. Ventilation Survey

Figure 12. Environmental Awareness Survey
4. Conclusion
From the responses data above in the survey and the data collected table from Thai and English version (figure 10-13) indicate that people who are going on vacation from 2-4 person as regular family size are made up of 50% of all the responses. In addition, another high percentage group of people who are going on vacation are between 5-7 persons which is 30% of all the responses. Due to this outcome of the percentage data, the program for this selected site will accommodate of 5 bedrooms with bathroom included to make sure that each individual or couples in the family will be able to enjoy their privacy while on vacation. The program will include large living room for family and guests for indoor activities, with fully function kitchen in the house, outed space for Thai style kitchen and barbeque for those who love to grill and those who enjoy downtime preparing food. The spaces in the selected program will accommodate, encourage the use of both ventilation system: AC and natural. According to the Act of Parliament 2558 states that the selected site area for this project allowed building height for homes, and town homes which cannot exceed 9 meters. Therefore, this project program will be two story single home for vacation renting. Through the information from case studies and research data, the local material will be selected in the design with innovation of function mimicking human skin for users thermo comfort while staying in tropical climate vacation home.

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