THE TRANSFORMATION OF TROPICAL BUILDING IN SOUTHEAST ASIA

by
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Abstract

The tropical building was built for living such as a traditional building but today vernacular building is just a part of the building style or a decoration. People are not lived in a traditional building anymore. They are not also expressing their entire life in this building. Especially, for people who are lived in urban area. When modern era comes (after 1920s), all aspect of the traditional living has left behind. Nowadays, not only the style of building has changed but also the concept of building construction has moved to the other methods (Goldblum, 2014). All buildings using glass as a wall to separate and forming the room, we cannot see the different buildings in Jakarta, Kuala Lumpur, Manila, Singapore and Bangkok. Therefore, in the era of global warming (after 1990), the tropical building expression has suddenly transformed into a new expression of architecture (Goldblum, 2014). The study is aimed at comparing the expression of the tropical building through the style, composition, type, morphology and place before 1920, between 1920 and 1990, and after 1990, in order to know how the change of building features in Southeast Asia, sequentially which is now toward sustainability design. Knowing the tropical building expression that afordable for the urban poor in Southeast Asia and how it will be implemented in current condition. In addition, this study is also intended to get a new consideration regarding concept of tropical building design, particularly in several cities of Southeast Asia. The last, to observed an impact of climate change on the building features in Southeast Asia. The analysis of study used an exploring design situation methods (divergence) and the evaluation methods (convergence) in order to know how the expression of building. It is clear that this research resulted a serial of tropical architecture expression (on the buildings design) from time to time in the cities of Southeast Asia and how it was transformed or sublimed into a new conception due to the climate change impact on it which is now toward sustainability. How a tropical building expression which is affordable and sustainable for the urban poor in Southeast Asia. Also how a Building material (building features) which can adapt to the impact of climate change in Southeast Asia and the last is a new consideration for tropical architectural design studies and design methods of architecture in Southeast Asia which is impacted by climate change.

***Keywords**: Transformation, Tropical, Building.*

INTRODUCTION

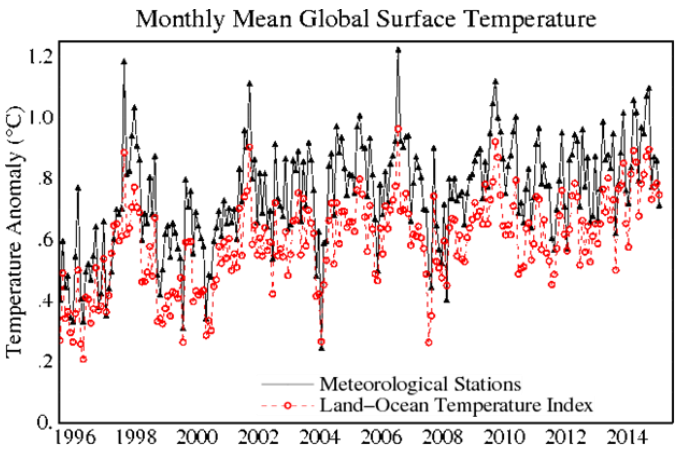
Background:

Southeast Asia includes Philippines, Thailand, Brunei Darussalam, Indonesia, Malaysia and Singapore is a region that crossed by the humid eastern monsoon and the western wind dry monsoon, therefore this region experiences two seasons, rainy and summer (Chen and Chappell,

[1] Lecture in Department of Architecture (UPR)

2009:205-220). These two characteristics, absolutely have many impacts to the buildings and its construction methods either traditional buildings or current buildings. Albeit, the region endures only two monsoons are not necessarily the building expressions that appear just represent two tides but also many other building expressions that emerge from local knowledge.

The main proposition that cannot be avoided for nowadays is a scorching heat during the day until late afternoon, particularly a building that directly received northwest wind warm and its heat[1] (See the graphic of monthly mean global surface temperature that has been announced by Goddard Institute for Space Studies) The graph illustrates that the earth temperature on surface has significantly increased on time period given periodically but mostly increasing within every two years [1]. It indicates that world superficies heat also happened in Southeast Asia. Consequently, almost two decades in the summertime, some big cities in Southeast Asia have been suffered as a result of the forest fire and other particles that sublimes to become haze. It has made irritated several countries such as Indonesia, Malaysia, Singapore and Brunei Darussalam. In other words, a building in Southeast Asia that includes style, composition, type, morphology and place[2] should be well-suited with the climate change. Therefore, all buildings should be adapted in order to get a comfortable space inside of building[3].



Source: National Aeronautics and Space Administration (NASA) Goddard Institute for Space Studies (GISS), 2015

Meanwhile, many years ago, tropical building is one of the most popular architecture styles in Southeast Asia (Goldblum, 2014), for example vernacular buildings. Through this style people can live side by side to the nature, particularly on certain locations such as Bangkok, Kuala Lumpur, Jakarta, Manila and Singapore. Before global warming come up to surface, people who lived in a vernacular building were able to felt the nature directly, they could open the window and the door widely as well as construct their house wall and roof from animal skin and foliage (Rapoport, 1977) but nowadays, all door and window with different materials such as glass, concrete, brick, and metal has closed[4]. Then, they are mostly turn on air conditioning in order to

[1] Susan Ubbelohde (2003) in The Journal of International Asociation For The Study of Traditional Environmental describes a typical summer day when the heat is so intense. She used the example of Le Corbusier's Sarabhai House to explain how the building receives the cool moments in early morning, through the furnace the afternoon heat, and into the slow cooling at the evening and dark relief of the night. Which mean that it has also happen in the most buildings in Southeast Asia.

[1] Pitts (2004:13) said that the averange of global temperatures rose by modest but significant amounts during the twentieth century; such changes are small by comparison with some of the very worrying future scenarios.

[2] Groat and Wang (2002:83) said that this five foci for further study.

[3] The United Nations Framework Convention on Climate Change (2007) data show the increase in extreme rainfall and winds associated with tropical cyclones in East Asia, Southeast Asia and South Asia, so that it needs current adaptation plans, strategies and actions; and future adaptation options.

[4] AL-Obaidi et al (2014) in a study on tropical architecture, particularly on building materials, Lauber (2005) wrote that the most commonly used materials in the tropics include clay, wood, and bamboo. However, these materials are rejected by most new cities, which prefer to use concrete, steel, glass, and shiny metals.

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get comfortable temperature in their rooms[1] (Papanek, 1995). This condition is popular and to be custom for people which are lived in urban area[2]. They are never concerned regarding the expression of the building just like many years ago, for nowadays, the important thing is safety and comfortable lived inside of the building (Fallan, 2014).

Finally, in the era of global warming, the tropical architecture expressions are not easily understood as a well-suited building to the nature anymore[3].

The tropical buildings that was built for living such as the traditional building just being a museum for human recreation and a knowledge for kid in kindergarden. Vernacular building is just a part of the building style or decoration. People are not lived in a traditional building anymore. They are not also expressing their entire life in this building. Especially, for people who are lived in urban area. When modern era comes (after 1920s), all aspect of the traditional living has left behind. Nowadays, not only the style of building has changed but also the concept of building construction has moved to the other methods[4]. All buildings using glass as a wall to separate and forming the room, we cannot see the different buildings in Jakarta, Kuala Lumpur, Singapore and Bangkok. Even sometimes, we are confused looking at the building expressions and where we have been lived because world seems to be similar. Therefore, in the era of global warming (after 1990), the most of building in urban area is undoubtedly to be similar with a glass box. A tropical building expression has suddenly been transformed into a new expression of architecture (Goldblum 2014) and become sustained.

Aims/Purposes:

The research is aim at explaining, the transformation of tropical building expression that has a new conception of tropical architecture in Southeast Asia as an impact of global warming, which is toward sustainability. The purpose of the study is comparing the expression of the tropical building through the style, composition, type, morphology and place before 1920, between 1920 and 1990, and after 1990, in order to know the change of building features in Southeast Asia, sequentially. Knowing the tropical building expression which is affordable and sustainable for the urban poor in Southeast Asia. In addition, this study is also intend to get a new consideration regarding concept and theory of tropical building, particularly in several cities of Southeast Asia. The last, this observasion is also seeking an impact of climate change on the building features in Southeast Asia.

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[1] Rahman et al. (2013) in Obaidi et al (2014) indicated that affordable houses in Malaysia suffer from a high level of heat build-up, which has to be controlled to overcome the effects of global warming. Most of the cooling energy demands in the tropics are directly related to building materials, particularly the roofing area.

[2] Al-Obaidi et al (2014) said that the tropical region is an uncomfortable climate zone that receives a large amount of solar radiation, high temperature, high level of relative humidity, and long periods of sunny days throughout the year.

[3] Herzfied, Michael (Harvard University- in IIAS report **The Newsletter** | No.67 | Spring 2014) mention that in Southeast Asian contexts, the inhabitants act in several different, sometimes singular or unusual ways, depending on their relation to the power. 'Local democracy', the laissez- faire admitted by the authorities, or conversely, policies based on incentives, determine the role played by the inhabitants and sometimes encourage their active participation in the urbanisation processes. The residents are agents in the housing field: they transform, adapt and appropriate their dwellings according to their exigencies.

[4] Goldblum, Charles (Paris VIII- in IIAS report **The Newsletter** | No.67 | Spring 2014) Said that in the last few decades, Southeast Asian cities have experienced rapid urban development, which **has dramatically changed** their forms (architectural shape), scales and social compositions. Beyond these dramatic transformations, these cities are still marked, as cultural and social facts, by their diversity, which is one crucial peculiarity of the region.

Material and Methods:

The analysis of study used an *exploring design situation methods* (divergence)[1] and then, the next analysis used *the evaluation methods* (convergence) in order to know how the expression of building work especially regarding (style, composition, type, morphology and place) in 1920, in 1920-1990 and after 1990. Data analysis used qualitative analysis and quantitative as well as combination both of them. Qualitative analysis used for in-depth exploring about the concept and theories of the expression of building (style, type, morphology and place) in each country such as in Indonesia, Malaysia, Thailand and Singapore (Southeast Asia). Therefore, some information from observation was used for discussion and evaluation (models, pictures, sketches and videos). Then, data that was found from the observation of architecture expression from all countries, used to find the change of the expression of building from time to time (such as before 1920, between 1992 – 1990 and after 1990). The result of analysis was used for juxtaposing the expression of tropical building in Southeast Asia countries to find the same architecture characteristic, regarded it transformation. Meanwhile, quantitative analysis was used to identify about the composition of (material, natural ventilation, passive heating and cooling, solar protection, fabric thermal storage, daylight and solar strategies and architectural acoustics) and global warming factors[2], particularly its climate change impact on the expression of building. Once making list of the impact of climate change on the expression of building, then it is followed by juxtaposing to each other to find which part of architectural expression that sublimed into a new tropical architectural expression (see Table 1).

Table 1.
The Architectural Expression vs. Climate Change

Expression	Architecture	Climate change impact on Building
Before 1920	(style, composition, type, morphology and place)	(Heat, Wind, Humidity and Particulate)
between 1920 – 1990		
after 1990		

Source: The inception observed (2015)

SIGNIFICANCE

What the characteristic features of tropical building expression in Southeast Asia can be retained[3] or it is no longer needed as a part of the building? Whether tropical building or past building in

[1] Exploring design situation methods (divergence) including stating objectives, literature searching, searching for visual inconsistencies, interviewing users, Questionnaires, investigating user behaviour, systemic testing, and selecting scale of measurement, data logging and data reduction. While, evaluation methods (Convergence) including check lists, selecting criteria, ranking and weighting, specification writing (Jones, 1992).

[2] Al-Obaidi et al. (2016) said that in their research result, the use of the day light factors has had a negative impact on most modern buildings in Malaysia, which are afflicted with excessive levels of daylight due to the use of inappropriate design methods.

[3] Esposito Adele (Leiden University- in IIAS report **The Newsletter** | No.67 | Spring 2014) ask the same question the conception, implementation and reception of policies, planning and projects, **which aim to safeguard architectural and urban forms in Asian cities**. They analysed the role of multiple stakeholders in the design and the implementation of instruments of planning (e.g., politicians, public offi cers, experts, etc.). They also examined the forms of resistance exerted by other categories of stakeholders – such as inhabitants and real estate promoters – who contest dominant heritage meanings, regimes of ownership imposed from the top or the implementation of plans and projects, while they propose alternative visions of heritage.

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tropical area to become forgotten memories when global warming has influenced building features[1]? Architectural expression can be understood through the influence and intellectual experience of the observer before (Frampton, 1984 in Nesbitt, 1996). Some people believe that have a unique background and various experiences would increase their knowledge and their response such as in architecture. Meanwhile, response to the architectural expression that arose from a building has different perceptions as well. A unique background and an observer experience comes from the difference levels of education, religion, culture and also the information that was already consumed. It cannot be doubted that a half part of response is on a subjective opinion. Nevertheless, there are some expression aspects that can be seen objectively by the observer, for example library should have appropriate lighting. Every architectural theory framework always contains the expression as a principle[2]. Architectural expression is an experience to feel the influence of some aspects such as beauty, structure and function, culture, climate and environmental (Papanek, 1995; Lang, 1987). Therefore, for nowadays, building expression is tend to relate to a global warming[3].

On the other hand**,** global warming has given various impacts to all aspect of living, not only in biodiversity but also in architecture**[4]**. The impact of global warming on earth has been resulted many devices invented for mankind be able to live ease in this world, one of them is air conditioning[5]. This device is popular since firstly introduced in United State in 1902 (Lechner,

[1] Lancret and Tiry-Ono (Researcher in CNRS-in IIAS report **The Newsletter** | No.67 | Spring 2014) ask the same meaning : today in Southeast Asia, the architectural and urban fields are experiencing diversified renewal processes. This panel analysed new situations and resulting changes introduced by architectural and urban projects: do projects **shape original expressions** of modernity which, simultaneously, **relate to local contexts**?

[2] Paauwe (2010) in D. Greefhorst, E. Proper (2011:32), summarized Vitruvius, an architect in ancient Rome, already used the concept of principles to explain what is true and indisputable, and should apply to everyone. Vitruvius considered principles as the elements, the laws of nature that produce specific results. For instance, he observed how certain principles of the human body, such as symmetry and proportion, ensure 'perfection'.

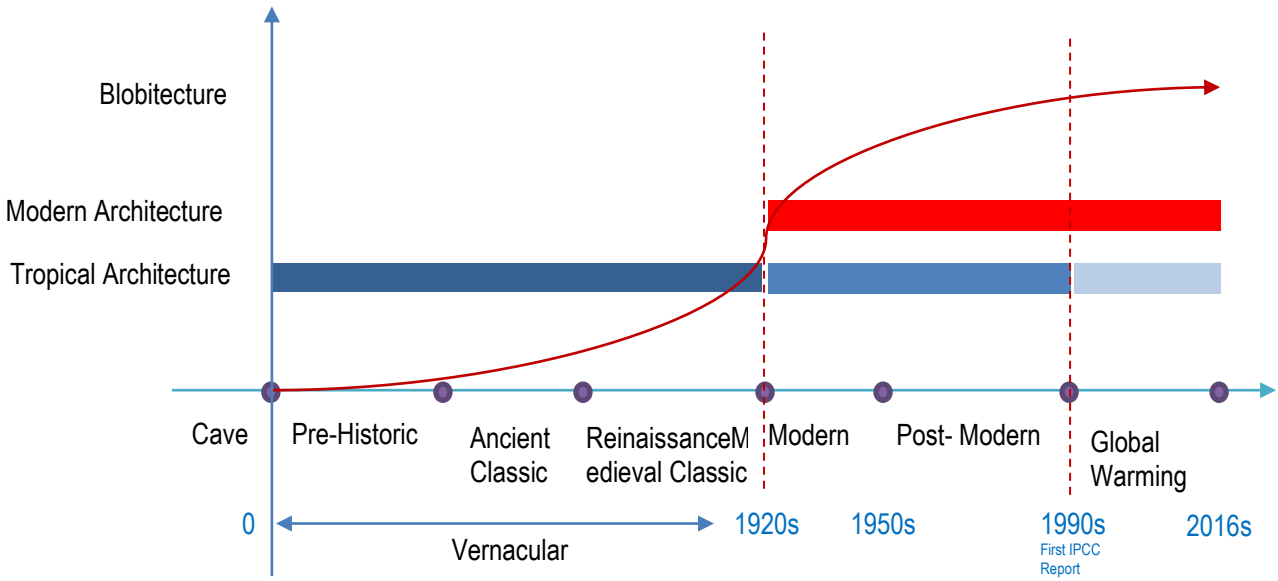
[3] UNEP (2009) Buildings are responsible for more than 40 percent of global energy use and one third of global greenhouse gas emissions, both in developed and developing countries: Pitts (2004:17) state that the effect of climate change will thus cause the need to rethink building design to cope with such changes, especially in coastal cities where a potential rise of almost a metre in sea level combined with more frequent storm surges would be catastrophic.

[4] Edwards, Brian (2010) said that focus on global warming has tended to reduce the importance architects attach to protecting biodiversity. Yet the impact architecture has upon ecosystems, both at the building and further afield, is enormous. Architects impact upon biodiversity in five main ways: Decisions regarding roofs, walls, landscape; Materials used in construction- their sourcing, assembly and disposal ; Resources needed to sustain buildings in use (energy, water etc); Adverse affects of buildings in terms of air and water pollution and Conservation and rehabilitation of existing structures.

[5] Al-Obaidi et al. (2014) cited that in their research related to the use of air conditioning. The studies conducted by the Building and Construction Authority (BCA) indicate that the buildings in **Singapore**, the world's fourth leading financial centre, accounts for about 57% of the country's entire electricity consumption (Dong et al.,2005). In addition, the results show that the country's total household electricity consumption increased from 6514 GWh in 2009 to 6560 GWh in 2011 (The Energy Market Authority,2011). The Hand book of Energy and Economic Statistics of 2011 indicate that energy consumption in **Indonesia** increased by 15% from 2009 to 2010. The country's energy consumption climbed from 446.49 million BOE in 2000 to 998.52 million BOE in 2011, given that 51% of the energy is still derived from fossil sources (Handbook of Energy and Economic Statistics of Indonesia, 2011; Ministry of Mineral Resources,2011). The Energy Commission (2010) of Malaysia indicated that the electricity demand increased from 14,245 MW in 2009 to 15,072 MW in 2010, reaching 15,476 MWin2011. The residential sector consumes about 20% of the energy supply. Approximately 21% of this portion is used to power air-conditioning and 2% to power other mechanical fans (IEA, 2009). Chan (2004) showed that in 1999, the total number of air-conditioning units in residential buildings owned by **Malaysian** was 493,082. This figure increased by 6.7%

2007). Not take long after this device was designed for usage in a car and room, all aspect of building and automobile have used this appliances as one of the important parts of their developments. Building itself in this world is not only built for living but also built for work and play[1]. Then, this condition lets people stay longer in a building. When global warming becomes popular, people aware that living inside of a building will give a secure life rather than to live outside of building, particularly for people who lived in Southeast Asia. Furthermore, people who lived in urban area in Southeast Asia **(**below the equator) has felt the climate change inasmuch as the impact of global warming. Which means that they are regularly exposed by heat for long time when summer period coming. Therefore, tropical architecture is designed in order to get a thermal comfortably through the use of building features, such as sunshades, cavity walls, light shelves, overhangs, roof and wall insulation and even shading from trees.[2]

Figure.1
The timeline of architectural style until blobitecture



The modern architecture expression (steady)
The tropical architecture expression (become disappear)

Source : Paper work (2016), modify from world architecture timelines.

With regards to the significance of the research context, the contextual framework should be used to explain the phenomenon of tropical architecture expression in Southeast Asia, while it has changed in the concept, theory design and visual perception on the certain periods. The issue has significantly impacted on the tropical building design in Southeast Asia such as style,

(528,792 units) in 2000 and by roughly 42% (907,670 units) in 2009 (Saidur et al., 2007). Al Yacouby et al. (2011) showed that about 75% of Malaysians rely on air-conditioning to maintain a comfortable environment.

[1] The World Green Building Council (2013b) declares the same goal: to create a built environment that will give people better, brighter, healthier spaces to live, work and play.

[2] Amado de Jesus, "Green Architrends: Tropical Architecture", *Philippine Daily Inquirer*, September 16 2011. Available from http://business.inquirer.net/19613/tropical-architecture (accessed 6 December 2015).

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composition, type, morphology and place. Which means that it has been transformed into a new tropical architecture expression (see Figure 1)

The figure illustrates the timeline of architecture fragments that sequentially focused on tropical architecture changed compare to the straightness of modern architecture today. The graph uses timeline periods from the pre-historical architecture until early years of 1920s which is named vernacular. Then, the next periods are from the 1920s to the 1990s when global warming has initially become as a defiance problem. Finally, the period of 1990s until today when global warming is not a foster anymore but as an acceptable climate that should be understood as an adaptation. It has also defined as a high cost building consumption (Angela et al, 2010). Overall, the graph shows the tropical architecture has experienced many movements from their first initially within vernacular periods, modern and post-modern periods, and until today in the global warming periods.

Market in Bangkok before 1920 (Observation, 2016)

Market in Makati, Manila between 1920-1990 (observation, 2016)

Market in Bangkok between 1920 - 1990 (Observation, 2016)

Market in Kuala Lumpur after 1990 (Observation, 2015)

Figure 2.
Shows the transformation of market building in several cities in SouthEast Asia

In vernacular periods, the tropical architecture movement reached their golden era when some traditional architectures are means of housing and enormous buildings in Southeast Asia for example some building offices in Malaysia and Singapore, traditional houses and temples (Borobudur and Prambanan) in Indonesia, Angkor Wat in Cambodia, and several temples in Bangkok. Likewise, some of them were influenced by other architecture styles for example Moorish architecture in Malaysia[1]. At the time, those buildings were used as its functions. When

[1] Gafar, Ahmad (1999) Presented his paper at the Symposium on Mosque Architecture, King Saud University, Riyadh, Saudi Arabia 31 Jan - 3 Feb 1999, said that there are a number of mosques built during the British occupation of Malaysia between 1795 and 1957. Some of the mosques were designed by local architects and designers whilst others were designed and supervised by British architects and engineers from the Public Works Department. Most of the mosques built during the colonial period are architecturally different from the vernacular mosques in terms of scale and proportion, form, features and building materials. Domes (either onion-shaped or top-shaped), turrets, classical columns, pilasters, pointed arches, keystones, pediments and plastered renderings on cornices and capitals are common features found in the colonial mosques. Effectively, the British architects, at

rainy season, traditional roof with sloop was the best way to overcome the rain and the overhangs eluded the building construction from decays. Then, when dry season, the overhangs became a sunshade, protects the house wall and windows from the heat[1].

The second periods that achievied in this research was in the era of 1920s to the era of 1990s when modern architecture came up to surface then the tropical architecture began less popular as a means of architecture style. In this terms, tropical architecture was still a choice of urban citizen to build their houses or buildings but some building morphologies have changed within its forms and patterns[2]. Several buildings deny used overhangs as a sunshade and replaced with a concrete list. While the others, louver wood windows substituted with glass windows as a popular means of building. Moreover, in building pattern, some rooms have switched from acceptance the natural wind to refuse the breeze from outside when air condition turn on which mean that room orientation reduced follow the solar movement (Kubota et al, 2014).

The last periods that resulted in this research was in the era of 1990s until recently years. Obviously, the tropical architecture has neglected because modern movement has become most popular building options. Style, composition, type, morphology and place have transformed into a new concept and theory inasmuch as new materials have invented as an insulation from the heat, as a building construction, and as an economical purpose. In this period, building expression has been sublimed into a new conception of tropical architecture[3]. Unfortunately, new concept of building does not fit to the most of urban citizen, particularly in Southeast Asia that still lived below poor level[4]. Therefore, the transformation of building expression in Southeast Asia needs

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the turn of the century, had combined the Moorish influence and the classical styles to portray an Islamic image to the mosques. For example, the Sultan Abu Bakar Mosque in Johor Bahru, Johor has four wings with minarets, pinnacles and domes as well as classical elements. Another interesting example is the Jamek Mosque in Muar, Johor which is a combination of Baroque classical style and the Moorish influence. Rather than a mosque, the building depicts a public building commonly built in the 17th and 18th century Europe which features a complexity of forms and decorative elements.

[1] Roslan, Qairuniza et.al (2015) Implementing reflective cooling with optimum roof pitch and ventilated roof approaches in the current passive design of the roofing system could assist in the reduction and removal of heat gained at the upper part area, thereby reducing indoor temperature. These recommendations could lessen energy demands, which minimize the cost of generating electricity for cooling purposes. However, the traditional Malay house is the best instance that uses both stack effect and wind-driven concept in its construction. It is important to consider the adaptation of these perceptions into the current and future modern passive design of a house.

[2] Hanson, Julliene (2001) said that morphology, the study of pattern and form, is crucial to design because it constitutes an essential part of its corpus of coherent knowledge. Proceedings 3rd International Space Syntax Symposium Atlanta.

[3] Hock Beng, Tan (1995) Currently, buildings around the world are rarely produced by craftsmen, and traditional forms no longer represent how buildings are being constructed . Once, the logic of construction of traditional architecture was visually apparent to everyone: the architecture represented directly the materials used and the method of construction employed. But these "transparent" technologies are now being displaced by the evolution of material science. Quality now is not judged by the skill of fabrication, but more by the skill of installation. Workman ship is thus valued above craftsmanship, and figutation in architecture has come to have less to do with response to materials than with the associative attributes of particular shapes and forms. td s r vol . vi no. ii 1995 page 25-36. National University of Singapore.

[4] Zami MS, **Angela Lee** (2010) Most cities and towns in developing countries are experiencing a massive influx of population from rural areas. The majority of the rural population migrates to urban areas hoping to find a job and a higher income for their survival. This large influx creates a high demand for urban housing and infrastructure, which the majority of the migrants cannot afford. Moreover, the insufficient use of low-cost traditional building materials and construction techniques in residential construction has resulted in expensive housing stock for the majority of the poor. There is therefore an urgent need to assess alternative building materials and techniques that are both

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reconciliation toward afordability and sustainability for the poor and middle class that needed comfortability[1].

Figure 3.
Shows the difference styles of building in several cities in Southeast Asia from time to time

OUTCOMES

This research product is a serial study regarding tropical architecture expression (the expression of building such as style, type, morphology and place in each country such as in Indonesia, Malaysia, Filipina, Thailand and Singapore/Southeast Asia) from time to time and it is transformed or sublimed into a new conception of tropical architecture due to the climate change impact on it which is now toward sustainability. A tropical building expression which is affordable and sustainable for the urban poor in Southeast Asia can be seen as a building needs a lot of cost. Building material (building features) which is an adaptable to the impact of climate change in Southeast Asia need arranged by architect and other engineers in order to be affordable for the poor. The new consideration for tropical architectural design studies in Southeast Asia is absolutely facing the impacted by climate change.

This research publication is an inception study about tropical architecture in Southeast Asia which is to be continued in another part of other research.

affordable and sustainable. Stabilised earth is an alternative building material that is significantly cheaper than using conventional brick and concrete, and is also environmentally sustainable.

[1]UN Habitat (2012 at the same idea proposed that each place, each culture, is unique. Questions of societal norms, climate, and tradition must all be considered. What works for a Northern European city might be completely inappropriate for one in Southeast Asia. Therefore, every culture needs to find the tools and approaches that work for them.

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