

Green Architecture - Solution for Sustainable Urban Developments in Viet Nam

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Abstract. The future of the world has been shaped by urban cities while the sustainable urban life is a raising global goal. In recent years, Vietnam has achieved certain achievements in its urban growth and development strategies. However, due to the consequences of rapid and uncontrolled urban growths, concurrently this nation has faced with a heavy challenging pressure and visible barriers to the ability to housing's supply and construction, environmental pollutions, greenhouse effects, climate change ... So that, urban development in a smart and sustainable way has being called on efforts to find a solution for these difficult and polemic problems in Vietnam recently. As a persistent effort, the model of green architecture, the green buildings play an important role to strengthen strategies and solutions for sustainable urban development. This study was based on an urban ecology approach; get along with the exploitation of secondary data sources, as well as observations of the authors from development practices in some major cities in Vietnam.

Keywords: urbanization; green architecture; environmental pollutions; sustainable urban development.

1 Introduction

The recent continuous pace of urban growth is actualizing a prospect of its domination in this world. In its, a half of population might have lived in cities that this is projected up to 70% in 2050 in which 90% from Asia and Africa - developing countries [19]. These cities did not only provide accommodation for people to settle down; but also contribute to variable different aspects as well as created 70% of global GDP, absorbed 2/3 the energy and generated 70% of gas emission [21]. In this context, its factors of worldwide urban expansion have put several countries huge pressure of environmental pollutions, ecological imbalance, especially climate change and natural disasters [17] that Viet Nam has suffered heavily and directly affected by these raising dangers concurrently. Green architecture must be an urgent considerable sustainable solution for this in long run.

Recently, in terms of urban development, modern cities have witnessed severely being affected by the impacts of the natural environmental conditions, consuming a large

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proportion of natural fossil resources inadequately, causing high levels of varying pollutions and toxic emissions in the same place where the largest civilian is distributed. Moreover, urbanization also has recorded spontaneous urban developments that climate change exacerbated its vulnerability much more. In developing countries, the lack of urban planning and infrastructure opened a room of opportunities to develop green architectural models; green building, green growth participating in the process of planning and policy - making for sustainable urban development [4; 14].

The tendency and strategy of sustainable urban development and rapid urban growth requires smarter policies, solutions and governance. However, a visible aspect that most municipal strategies in cities have not adapt to the population growth, the housing demand, and the inevitably high density of constructions occurring across many countries [5]. As continuities of cities development, they exerted beyond the capacity of local infrastructure causing numerous negative effects mutually. Currently, the construction industry has consumed three-quarters of energy notably in the world, especially 17% of clean water, 28% of wood, emits 25% of CO₂ gas ... which has impacted to sustainable urban life² as well as one of 17 global goals of the 2030 Agenda for Sustainable Development [4].

Viet Nam is one of the fastest robust economies in the world at about an average growth rate of more than 6% annually. In particularly, Ho Chi Minh City³ has being solely contributed to generate 1/3 of GDP, 1/3 of industrial output value, 30% of total budget revenue and pilot a large inflow of FDI into Vietnam. Rapid urban growth has created a driving force for national developments while its heavy influences pressured on sustainable urban development continuously. From the theory and practice of this development, it has been shown that the urban development strategy following the model of green architecture, buildings and urban areas is an inevitable urge to saving energy and protect the environment that Vietnam is a vivid case putting efforts to aiming at these sustainable urban development criteria.

2 Literature review

Urbanization and sustainable urban development are inevitable trends for both developed and developing countries [1] that it has become a global concern [19]. This put all of countries had achieved high income and strong economic growth without facing the process of urbanization. In its, each country must have at least 50% urban population initially before achieving full middle-income status as a typical example as Vietnam is on its way [21].

The research and application of several features of green architecture in urban planning and development help people's lives better as well as diminish the destruction of the environment and natural resources promoting urban sustainable development movement. Also, in view of sustainable urban development, Wu (2014) proposed a type of urban ecology named "urban sustainability", defined as an adaptive process, that creates favorable conditions for urban development, benefits; and maintain a proper cycle between ecosystem services and human life. This process addresses the coordination of ecological - economic - social actions to adapt to changes internal and external of the urban landscape [22]. On a further notice, urbanization in developing countries is driven mainly by economic benefits

² The 2nd goal: Sustainable urban and community.

³ Ho Chi Minh City has been considered an economic, scientific - technological center, education - training, cultural, tourism pilot in Viet Nam.

while developed countries, which have a larger ecological footprint, have focused on the efficiency reduction of urban growth 's impact on the ecosystem [15].

In terms of socio-economic, the future of humanity depends on sustainable cities that this important factor can enable a country to thrive in the global economy. Therefore, green architecture, a pivotal part of urban ecology, can play an important role in the process of urban mobility and development towards sustainability, especially preserving the natural environment.

3 Methodolgy

The Approach: To meet the goals of the article, approaching the urban ecology has been applied in this research. Urban ecology was originally developed as part of human ecology in the 1920s by a group of sociologists at the University of Chicago in which the relationship between people and urban environment was studied. Accordingly, urban ecology addressed sustainability was the core of science, eventually the ultimate goal. However, its journey has only just begun. Urban architecture, planning, management and design have been become increasingly vital components of the current model of sustainable urban construction and development. Accordingly, there are 3 pillars that need to be considered according to the approach to urban ecology, (1) the urbanization model; (2) the impact of urbanization; and (3) urban sustainability.

Data sources: Secondary data sources from the General Statistics Office of Vietnam (GSO), the Organization of World Bank, and some other related documents were also used. With quantitative data, the method of descriptive statistics was put into use. With qualitative data, content analysis technique was applied.

4 Research results

4.1 Urban connotation, urban characteristics, sustainable urban development

The definition of Urban. According to the State of Vietnam, Urban ("đô thị") is the common name of a city or town; It is a crowded residential area which mainly operates in the non-agricultural economic sector; is a political, administrative, economic, cultural or professional center that plays a role in promoting socio-economic development of a country, a territory or a locality [6].

Basic characteristics of the city. Following to Vo Kim Cuong (2013), The city has 3 most common characteristics featuring the basic premise for the development and movement of the city: (1) a city was a living organism in a human body has "birth, old age, illness, death" that in its any failure in the structural system could lead to chaos in the activities of a city; (2) the city was always developing. The "living" of the city illustrated the close connections between the city and human society. Accordingly, the formation and development of the city associated with the history of human development. So that, continuing developments of human society and the commodity economy have nurtured the city developed concurrently⁴; (3) urban mobility and development could be under controlled. Although urban areas are formed and developed by the objective laws of the socio-economy, people could control them⁵. In it, one hand human not only orientate these

⁴ Only in special catastrophic circumstances made cities perished.

⁵ Following to its objective laws.

developments, but also interfere in urban movements, while other hand they impossibly force a city adapting to their personal subjective and contrary wills [20]. In each city, there are 3 types of environment (1) physical environment (natural and built), (2) economic environment, (3) social environment. These entities showed a close mutual relationship. Therefore, strategies and policies for sustainable urban development, civilian required an orientation and an ability in order to maintain a harmonious and reasonable developments between these three types of environment.

Sustainable Urban Development. Many theories and views on this term differs on names such as Livable city, Global city, Sustainable urban development, Smart city), Eco-city... in which all were led to “Sustainable Cities” as well as a common way to recognize these cities [16]. This city was based on the connotation and principles of "Sustainable development" [3] containing comprehensive characteristics of a typical city in that the concept of sustainable urban development emphasized the combination of sustainable development in general with the characteristics of the city. Accordingly, a sustainable urban development still contributed strongly to the principle of consolidation - balanced and harmonious development among the following factors: urban economy; urban social culture; environment - urban ecology; urban infrastructure; urban space; and urban governance that the above-mentioned goal ultimately was for people regarding to fairness, happiness, well-being, and sustainability [10].

4.2 The robust Vietnam's urban growth – The sustainable urban construction posing problems

In 2019, Vietnam's urbans population reached almost 33.8 million people accounting for 35.05% of the total national population [7]⁶. In recent years, following to the policy of innovation and integration along with the rapid socio-economic development promoted the urban network of cities included large and small cities in Viet Nam, it has been enhanced increasingly. According to the statistics, on the urban administrative units (based on subdivision hierarchy of Viet Nam) over the last 2 decades notably clarified this enhancement (see Table 1).

Table 1. The urban administrative units of Viet Nam (1997-2019)

Administrative units	1997	2000	2014	2015	2016	2017	2018	2019
Municipality	4	4	5	5	5	5	5	5
Urban districts	33	3	49	49	49	49	49	49
Province	15	20	64	67	68	68	71	73
Towns	62	62	47	51	50	50	48	48
Wards	951	1.018	1.545	1.581	1.587	1.587	1.596	1.645
Town districts	530	563	615	603	602	602	607	609
Total	1.595	1.700	2.325	2.356	2.361	2.361	2.376	2.424

Source: [8]

Inadequate urban social and technical infrastructure. The last 2 decades (1997-2017), the number of urban areas in Vietnam not only increased rapidly, but also changed, especially number of units at ward and town level. Getting along with the urban momentums in a large scale, several small cities have also been enlarged resulted in

⁶ Viet Nam’s population recorded almost 96.208.984.

Vietnam has existed an average of 1.23 new cities each month [12]. In a comparison over 25 years, the number of urban areas in Vietnam was 500; in 2005 it was 700 in 90's, while by 2015 these upgraded upto 871 and projected to 2025 will be approximately 1,000 cities. Thus, within a short period of time, Vietnam had 371 additional cities. The rapid urban growth has accounted for increasing influx of immigrants into urban areas, rapid growth of the mechanical population rate, high demands for housing construction, urban technical infrastructure and society facing inadaptability of the urban government's response. Specifically, this is one of the major and obvious limitations for densely populated cities like Ho Chi Minh City and Hanoi nowadays.

"Loopholes" in urban upgrading. The urban classification aims to essentially distinguish the administrative management roles and functions⁷, especially the decentralization that has created positive results in the management and operation of urban structure. However, facing the undesirable consequence illustrated a tendency of exploiting drawbacks toward to the classification systems on the urban upgrading improvements. More interestingly, these moves pointed out that urban development has been still "administrative" stemmed from the consolidation and separation of administrative boundaries based on a lack of considerations of economic performance and major functions of a city [21]. The following statistical table provides a visible evidence of the changes in urban rankings in Vietnam between 1999 and 2020 (see Table 2).

Table 2. Urban rankings in Viet Nam 1999-2020⁸

Types	1999	2009	2010	2015	2020	Changes 1999-2020
Municipality	-	2	2	2	3	3
Type I	2	5	10	10	17	15
Type II	8	12	12	23	20	12
Type III	12	40	47	65	81	69
Type IV	64	47	50	79	122	58
Type V	518	625	634	687	757	239
Total	604	731	747	871	1.000	396

Source: [21; 8]

In addition to objective reasons, the rapid growth of the number of urban areas in Vietnam is still put under being heavily "administrative" imposing the urban development policies and undertakings in Vietnam⁹. In particular, in recent years, the striving momentums to the type of city upgrading has become a major concern for local governments in which the higher type levels cities received more attentions and budget allocations.

Consequences. Urbanization is a growth pole as well as one of the main roads to enhance socio-economic development of each countries that it is inevitable. In addition, instead of the achieved results in Viet Nam over years, urban development has taken place strongly, especially a situation of the forced urbanization causing consequences widely.

⁷ Taxing, national budget allocations.

⁸ Can Tho city was upgraded Type I in 2004 and Bac Lieu city (Type IV) upto Type III in 2010.

⁹ See Decree No. 72/2001/ND-CP, dated October 5, 2011 of the Prime Minister, "On urban classification and urban management level" and Decision No. 445/QĐ-TTg, dated April 7, 2009 of the Prime Minister "Approving the adjustment of the orientation of the master plan for development of the urban system of Vietnam up to 2025 and a vision to 2050".

Specifically, the local government has being disorientated to controlling urban development, fully exploiting and wasting natural resources and fossil energy that it also raised imbalance of environmental ecosystems and architectural space, the urban heat island phenomenon and narrowed national architecture, cultural and historical heritages. Moreover, the notably rapid urban expansion in recent years has quickly depleted the urban land fund generating a huge pressure on the urban technical infrastructure eventually. Thus, all these problems will be a source of major barriers towards to sustainable urban development without imposing comprehensive and efficient control.

4.3 Green architecture – Solutions for urban development solution in Viet Nam

Many studies have shown that urbanization and economic growth are the main factors positively correlated with environmental quality [13; 11]. Research by Nguyễn Lưu Bảo Doan (2016), "Đô thị hóa và mối quan hệ giữa thành phố và môi trường" stated that the correlation coefficient of 2 variables (the city and the environment) was positive in which the level of the higher level of the urbanization and the stronger economic activity derived the greater the amount of energy consumed and the more materials generated. The results of this study showed that the urbans in developing economies have been significant to influence the global issues such as the capital flow, the energy crisis, the environmental pollution, and even Climate Change. In its, the residents and local governments responsibility have been taken respectively. Therefore, this urge is raising an important issue for the government to encourage more efficient economic activities and urban life. Nevertheless, becoming a "green" city, "green" development more environmentally and friendly will create a pivotal contribution to the goal of sustainable urban development that many countries chase on. Accordingly, green architecture and green materials are important solutions to visualize the goal of sustainable urban development.

Green architecture: Architecture, a material culture of society, is the process of creating human living space. That is the residential spot¹⁰ and architectural space. Green architecture was known originated in Europe, North America, recently being developed to Asian countries¹¹. It had the same natures with Ecologic architecture and Sustainable architecture [2] that defined creating and sustaining environmental-friendly features augmenting a harmonious ecological relationship between People - Architecture - Nature. Green architecture is a systematic and complex concept that it highly requires architects to recognize not only a view of protecting the ecological environment, adapting appropriate design methods, but also complying the managers and the businesses with a strong sense of environmental protection. Moreover, other central aspects of green architecture prioritized human behavior in architecture towards to reserving the environment and natural resources, relieving the pressure on the environment and alleviating causing pollution ... Today, the emergence of green architecture gradually has become a modern trend of the era seeing the world rapidly urbanized that its future depended on urban areas.

Principals of Green architecture: The implementations of application and testing in practices, the principles of green architecture design have been clarified into: (1) creating a quality internal environment included in comfort, fresh, pleasant, healthy; (2) protecting the surrounding large environment (being symbiotic with natural environment, climate adaptation) that exploiting the use of nature reasonably combined the environment and nature protection effectively; (3) applying advanced techniques - new technology

¹⁰ Urban, Suburban.

¹¹ Especially in Singapore, Japan, Malaysia, Taiwan.

(green-tech) under intelligent regulation and control towards effective and economical use of natural resources, energy, and waste treatment; (4) integrating a fusion of the humanistic environment and the surrounding landscape, the history and culture towards to space landscape construction.

Criteria for Green architecture evaluation: To encourage green buildings more, there are many organizations and countries have organized the evaluation and honor of numerous alternative green buildings around the world¹². The assessment of green buildings pays attention to existing buildings, especially for newly built in large-scale, high-rise projects, complex technology, heavy energy consumption and emissions. The system of criteria for this type of building is quantitative maximizing efficiency of the green elements that the building achieved. According to researches on the green architecture's criteria assessment of some countries in the world in comparisons within Viet Nam could come into the following 6 groups of basic criteria as this proposed diagram (see Figure 1).

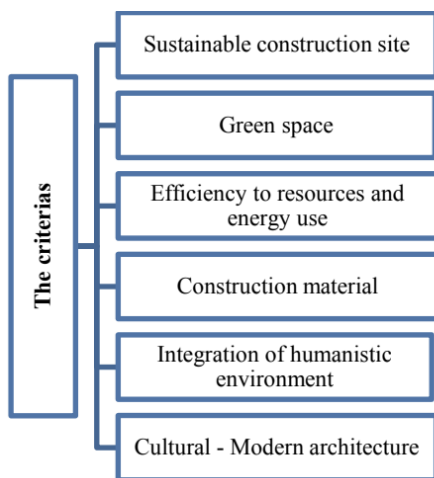


Figure 1. The groups of basic criteria for Green architecture
[Source: Statistics provided by the writers in 2023]

- Sustainable construction site. In accordance with the planning of the area, surrounding spaces, solutions to adapt the climate change within less intervention to the natural; solutions to organize the artificial environment outside the buildings; reducing polluting the environment and architecture landscape in the area. Also, this emphasized creating a harmonious and sustainable scenery, minimizing negative impacts, assisting and promoting beneficial natural elements to the human's living environment.
- Green space. A green urban area is a city with lots of green spaces as well as clean environment qualities (soil, water, air) that minimizing waste, pollution and the causes of environmental degradation. The internal space must be flexible having an open vision, fresh air, pleasant, suitable for human psychology; architectural solutions for climate adaptation, site organization solutions to choosing the

¹² The assessment based on a voluntary, consensus basis and conducted by Non-Governmental Organizations (NGO). For Example: Green Building Council – GBC, World GBC...ect.

direction enhanced the exploitation of natural light and wind. A quality indoor environment ensured safety, hygiene and convenience efficiently.

- Efficiency to resources and energy use. Aim to reasonable and economical use of land for construction and environment-friendly interior works having solutions to save clean water, use rainwater; reduce the use of clean water to water plants, apply wastewater treatment technology for reuse ... The maximum use of power-saving equipment operated completely for lighting, air conditioning, ventilation. Usage of solar, wind, and geothermal energy utilized thoroughly supporting to the goal of reducing from 30% to 50% of energy from fossil sources under energy control devices. Improved efficiency saving resources and energy; reducing the impact on the natural environment and minimize the greenhouse effect in using land, water, energy, materials resources... for architectural developments.
- Construction material. Increase to use of materials of natural origin or locally available materials. Construction materials must be suitable for the climatic characteristics of each different geographic areas that avoiding overuse of glass in the exterior design of the building to minimize the harmful effects of temperature increase due to the "greenhouse" effect. Focus on storing, collecting and recycling of materials, domestic, production, construction waste management ...
- Integration of humanistic environment. To adopt solutions to conservation and harmoniously connect the relic space and regional architecture meeting the cultural and spiritual needs of the community that being suitable with the local lifestyle, customs and traditions followed to progressive civilization. Architectural development must be associated with the goal of creating, preserving and nurturing a stable and sustainable social - humanistic environment.
- Cultural - Modern architecture. Modern architecture not only suites the trends, but also for socio-economic conditions that the architecture has proved its alternative characteristic style contributing to the formation of the local identity. The development of progressive architecture associated with inheriting traditional values, especially creating identity of urban architecture in Viet Nam.

The benefit of Green architecture:

- Environment. The biggest benefit of green architecture is a huge impact on the current as well as human environment. This green promotes and protects ecosystems and biodiversity, improves air and water quality, and reduces solid waste and conserves natural resources. Using green buildings saves energy and limits the amount of emissions into the environment saving a lot of natural energy. According to experts of the World Green Council, a conventional commercial building compared to a green building used less than 26% energy, 13% of maintenance costs and 33% of the amount of greenhouse gas emissions [9] that mitigating climate change in the world. On the other hand, using green architecture helps to diminish the phenomenon of "heat island" in the city.
- Economy. There are numerous alternative economic benefits stemmed from green architecture. Recently, building a green one costs less than a modern one that green architecture is always orientated in a long-term sustainable direction. Tax incentives for green buildings that in most developed countries, green constructions have received favorable tax incentives to encourage energy-efficient

green buildings. High Productive efficiency, labor productivity is improved within reducing the number of sick days off work, workers' income increases by about 5% compared to conventional buildings when working in green buildings.

- Social. Social benefits of green architecture are becoming evident increasingly where a user can enjoy friendly environment in many aspects including better indoor air quality and optimize the comfort of all functions in the building. Experts showed that the design elements of green architecture contributed to minimize the occurrence of respiratory diseases, symptoms of allergies and asthma. Green life in Green architecture and Green spaces bring people a peaceful, healthy, happy life, and a green planet.
- Architectural identity. Finally, green architecture adapted to indigenous climate would lay the foundation to new, beautiful and rich architectural works. Green architecture was not considered a “fad”, instead of the future of Vietnamese architecture that it is suitable for the specific climate, people’s characteristic demands of Vietnam. Green architecture has reflected the soul and living space of the Vietnamese people considered in harmony with nature for years.

5 Conclusion

The future of the world depends on cities that sustainable urban development is the major goal of mankind. Viet Nam is on the verge of rapid urban growth, considered its achievements that the country still has faced heavy barriers and pressures on sustainable urban development. Constant and persistent effort aims to solve housing problems; technical infrastructure, urban social infrastructure, environmental pollution; greenhouse effect; urban heat island; the depletion of natural resources effectively ... have required governments, municipalities, specialized agencies and citizens participations in order to take drastic actions, policies and solutions to control, repel and limit the spontaneous urbanization and eventually focus on step by step in depth urban development within a better governance. On the other hand, the research, application and integration of green architecture and green buildings into construction and urban development is one of essential methods and vital solutions for the city developed sustainably in the context of rapid urban growth. Accordingly, in terms of legislation, green architecture should be legalized by specific criteria and regulations in the current assessment, upgrade and classification of urban areas in Viet Nam. For further research, observing sustainable urban, state-owned and private construction sector policies must be considered thoroughly, in which they have interacted mutually, that green architecture is also under this pressure directly. The future green architecture should be amended and enhanced practically.

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