Using sustainable timber in architecture in Vietnam

Hoang Vu Dang

Faculty of Architecture, Hanoi Architectural University, Vietnam

Abstract. Sustainable architecture trends influence the choice of materials both indoors and outdoors, making timber a strongly preferred material. Increasing numbers of architects, developers, governments, educational institutions and corporations are embracing wood, since timber replace other construction materials in many structures while providing the same functionality. The combination of a rising concern about global warming and sustainability; a growing desire to preserve traditional Vietnamese culture; recent scientific and technological advances which have made wood an even more versatile building resource; and an international push for increased use of timber in construction, makes Vietnam’s timber architecture perfectly placed for expansion. The article presents findings on why using timber is good for environment and the use of timber in design as well as timber revolution in construction and architecture in Vietnam. By applying new technology and methods, and through using sustainably-sourced plantation wood, there is huge potential for the revival of wooden architecture in Vietnam. This would have significant environmental and economic advantages for the country and most importantly, create opportunities to continue the long-standing tradition of using wood for thousands of years in the construction and architectural works, from traditional houses to public buildings for community in Vietnam.

Keywords: sustainable architecture; sustainable timber, sustainable megatrends, timber materials, timber revolution

1 Why is using timber good for the environment?

Across Vietnam and the world, deforestation and illegal and unsustainable logging practices have devastated many environments, with detrimental effects on ecosystems, biodiversity, and rural communities. The use of timber in this manner is not beneficial to the environment. In fact, it is the opposite.

However, if timber is harvested and processed in sustainable manner, it offers huge environmental benefits and socio-economic advantages[1]. These benefits and advantages include the following: Wood is renewable, meaning that it can be regenerated within a
generation, unlike materials such as concrete and steel which rely on non-renewable elements such as fossil fuels and mined minerals. However, renewability is dependent on the replanting and regeneration of felled forests; During its lifetime, trees absorb carbon which remains stored in the wood until it decays, meaning it has a small carbon footprint due to the carbon release (from transport and processing) being off-set. Concrete and steel, alongside core manufacturing materials like plastic, have much larger carbon footprints, typically requiring super-heated furnaces fueled by oil or gas to produce. In fact, the Food and Agriculture Organisation of the United Nations (FAO) have calculated that the buildings and construction sector currently emits almost 40% of energy-related global greenhouse gas emissions[2]. In 2014, the Journal of Sustainable Forestry research found that switching from other materials to wood for infrastructure could reduce CO2 emissions by 14-31%[3]; The energy-intensive processes required to make concrete and steel is financially, as well as environmentally, costly. Wood is cheaper and wooden buildings can be built more quickly and require less specialist training, saving on labour costs. According to the American Softwood Lumber Board, mass timber, such as cross-laminated timber (CLT, see figure 1 below), buildings are roughly 25% faster to construct than concrete buildings[4]. The indirect advantages of using wood are as follows; it reduces stress and fatigue as a natural product[5], it is more aesthetic as it blends into the natural landscape, and it is especially important in rural areas to minimise disruption for wildlife[6].

Given the urgency of the current climate crisis, increasing our use of timber is essential if we are to save our species from gradual extinction. However, all these advantages are entirely dependent on timber being grown, harvested, transported, and processed legally and sustainably.

2 The use of timber in construction and design

After around two centuries of iron and steel being the staple building materials in an era known as the ‘industrial age’, scientists and architects are calling for the 21st century to host a new era - the ‘wooden age’[7]. Increasingly, architects are turning to wood as a more eco-friendly and, in many ways, higher quality, material for both the exterior framework and interior design of buildings.

Advances in technology continue to extend the potential uses of wood in architecture and interior design. A notable development is the now widespread use of CLT. Buildings made of CLT equal, if not out-perform, concrete and steel buildings in relation to fire and water resistance, insulation, and strength, despite being as much as 80% lighter than concrete structures[8]. A company in Finland has also demonstrated the extensive potential of wood chips in interior design, using them to make baths, washbasins, and more. These products are typically made out of porcelain which, like steel, is made in an oil or gas-heated furnace[9].

As a result of these new technologies, wooden buildings are becoming taller and increasingly elaborate. Some examples are The Tree in Bergen, Norway, which is 49m tall and uses a combination of glue-laminated timber (GLULAM, see figure 2) and CLT; and Dalston Lane, a residential block in London that stands at 33m in height and is built entirely out of CLT. Notably, site deliveries during construction for Dalston Lane were 80% lower than for an equivalent concrete structure[10].

In 2018, the FAO introduced Sustainable Wood for a Sustainable World (SW4SW) to further encourage the use of wood in construction. Circulating the slogan ‘choose sustainable wood’, initiatives like this will drive the growth of the sustainable timber industry globally[11]. Worldwide, sustainable living megatrend is promoted among
consumers, especially among youth, who are increasingly using sustainable products, including timber.

3 The use of timber in construction and design in Vietnam

For centuries, wood has been an essential part of Vietnamese architecture and culture, and the economy. The country’s tropical climate, hilly terrain, long coastline, and heavy forest cover have greatly encouraged this. Wood, treated with indigenous paints, was durable, malleable, light, and in abundance, making it an ideal building resource. The designs it could produce - curved roofs, large open spaces, intricate carved designs - became instilled in Vietnamese culture[12]. Wood’s importance in construction and design in Vietnam’s history remains obvious through the many preserved pagodas and other old buildings from earlier centuries. Some notable examples are the Keo Pagoda in Thai Binh province and Mong Phu Communal House in Hanoi, among others.

3.1 Keo Pagoda

Built in 1632, during the Lê dynasty, and located in Duy Nhat commune, Vu Thu district, Thai Binh Province, Keo pagoda is one of the pagodas of Vietnam that still retains its original architectural features, dating back almost 400 years. It is one of the 10 typical ancient architectural works of Vietnam. The pagoda, consisting of 128 compartments, is made of ironwood and uses only wooden tenons to hold it together. Even so, after several hundred years, the structure of this entire wooden structure remains very solid. The supporting columns and trusses were very delicately carved by sculptors of the later Lê period. In particular, the 3-storey steeple is 11 meters high with a frame composed of nearly 100 overlapping elephants, linked by wooden tenons, supporting 12 elegant curved tile roofs. The entire roof of the temple is covered with fish scales tiles. The curved architecture is elaborately carved with dragons, phoenixes and fish. At Tam Quan Noi, there is a wooden door carved with dragons worshiping the moon, which is considered a masterpiece of carving from the 17th century.

3.2 Mong Phu Communal House

It is still unclear when Mong Phu communal house (Duong Lam ancient village, Duong Lam commune, Son Tay district, Hanoi) was built. However, according to many studies, it was built during the late Lê Dynasty and early Nguyen Dynasty (the Lê Dynasty was from 1533-1789 and Nguyen Dynasty lasted 143 years, from 1802 – 1945). Other documents have proclaimed that it was built at the end of the reign of King Le Hien Tong (1740 -
1786). In 1858, during Tu Duc's reign, the communal house was repaired for the first time, and still retains the architectural and sculptural form of the early 19th century. The house was built in the style of the Chinese character (工) including; the main entrance (Nghi Mon), House on the left (Ta Mac), House on the right (Huu Mac), and the great communal hall (Dai Dinh).

Figure 3. Use of timber in Keo pagoda (bell tower) – photo taken by the author

Figure 4. Use of wood of Keo pagoda (entire house structure) – photo taken by the author
The most interesting architecture is that of the Dai Dinh building, which is built in the style of "five compartments and two wings". It consists of six rows of pillars placed on a low ground, with a wooden plank floor surrounded by wooden railings balcony, therefore is well ventilated. The Dai Dinh hall was built using forty-eight wooden columns, each column having a diameter of about 50-60cm, and contains many carved patterns of flying dragons and dancing phoenixes. The harem (inner pavilion) is a building connecting the three naves of the outer pavilion, extending to the back like the handle of a pestle.

The frame of the communal house is carved mainly with simple motifs of dragons, unicorns, carp, birds and flowers. The roof of the house has curved edges and a shoe tile pattern. The corners are decorated with the four Chinese supernatural creatures; the dragon, unicorn, tortoise and phoenix.

The structure of the wooden frame in the heart of the house, including the roof set in the style of the gong rack above, is actually typical Viet-Muong architecture.

Figure 5. Dai Dinh – a view from the left house to the main entrance – photo taken by the author
Figure 6. Mong Phu's main entrance of communal house. The photo taken by the author.
Figure 7. Mong Phu - House on the left. Photo taken by the author
3.3 Other traditional projects

Traditional methods and styles in wooden architecture have also been preserved by certain groups and individuals. For example, the Ede people in Dak Lak province still live in long wooden houses on stilts which can stretch up to 100m in length[13]. Traditional wooden houses have also become popular among the rich in some areas. For example, Bui Duc Giang, head of the Trading and Construction JSC, has completed an old house made from rosewood in the northern province of Dien Bien. The 500m² stilt house, decorated with detailed wood carvings, is estimated to cost over VND200bn (US$8.8m)[14].

Larger restoration projects have also emerged in recent years. In Hoi An, the carpenter Le Van Tang committed his later years to restoring wooden houses. Some were over 150 years old and considerably dilapidated. Their restoration was both expensive and time-consuming but Tang recognised their importance in preserving Vietnamese history and culture. To spread awareness, he set up a workshop for over 300 carpenters and sculptors in the Quang Nam Province. Some of their most impressive projects were the restoration of a temple built to honour Ong Ich Khiem between 1831-1884; Tang and his workers replaced the whole rotten frame without removing the structure's roof and tiles; and the rebuilding of a 140-year-old four-storey French-style wooden house. In 2002, Tang opened a museum consisting of eighteen wooden houses and fifteen other wooden structures to educate people more widely about traditional Vietnamese wooden architecture and encourage its revival in the modern day[15].

A similar project is ongoing in Hue to preserve Rûรง houses. Consisting of wooden beams and pillars and bamboo connectors, the style was used for a range of structures, from palaces to the smaller homes of the lower classes. Traditionally made using jackfruit, hollong and vatica wood, and decorated with dragons, flowers and leaves, people now want to establish a renewed brand for this traditional style using sustainable materials. Plans are underway to provide vocational training for restoring and building Rûรง houses and to bring artisans, house owners, and businesses under “one roof” to protect and manage them[16].

Alongside a renewed interest in traditional Vietnamese wooden architecture, the country is also recognising the necessity for a more sustainable timber industry as well as sustainable architecture. With advances in science and technology, wood has even wider potential as a construction material and houses and other structures can be made far more cheaply than the expensive restoration projects listed above. It requires less energy to process than concrete and steel; construction processes are also easier and quicker; and wood can now be cheaply sustained with oils and mineral paints to ensure durability[17]. All these factors make wood more environmentally-friendly, and more economical, than alternatives, if harvested and processed using sustainable practices.
Traditional methods and styles in wooden architecture have also been preserved by certain groups and individuals. For example, the Ede people in Dak Lak province still live in long wooden houses on stilts which can stretch up to 100m in length[13]. Traditional wooden houses have also become popular among the rich in some areas. For example, Bui Duc Giang, head of the Trading and Construction JSC, has completed an old house made from rosewood in the northern province of Dien Bien. The 500m² stilt house, decorated with detailed wood carvings, is estimated to cost over VND200bn (US$8.8m)[14].

Larger restoration projects have also emerged in recent years. In Hoi An, the carpenter Le Van Tang committed his later years to restoring wooden houses. Some were over 150 years old and considerably dilapidated. Their restoration was both expensive and time-consuming but Tang recognised their importance in preserving Vietnamese history and culture. To spread awareness, he set up a workshop for over 300 carpenters and sculptors in the Quang Nam Province. Some of their most impressive projects were the restoration of a temple built to honour Ong Ich Khiem between 1831-1884; Tang and his workers replaced the whole rotten frame without removing the structure's roof and tiles; and the rebuilding of a 140-year-old four-storey French-style wooden house. In 2002, Tang opened a museum consisting of eighteen wooden houses and fifteen other wooden structures to educate people more widely about traditional Vietnamese wooden architecture and encourage its revival in the modern day[15].

A similar project is ongoing in Hue to preserve Rường houses. Consisting of wooden beams and pillars and bamboo connectors, the style was used for a range of structures, from palaces to the smaller homes of the lower classes. Traditionally made using jackfruit, hollong and vatica wood, and decorated with dragons, flowers and leaves, people now want to establish a renewed brand for this traditional style using sustainable materials. Plans are underway to provide vocational training for restoring and building Rường houses and to bring artisans, house owners, and businesses under “one roof” to protect and manage them[16].

Alongside a renewed interest in traditional Vietnamese wooden architecture, the country is also recognising the necessity for a more sustainable timber industry as well as sustainable architecture. With advances in science and technology, wood has even wider potential as a construction material and houses and other structures can be made far more cheaply than the expensive restoration projects listed above. It requires less energy to process than concrete and steel; construction processes are also easier and quicker; and wood can now be cheaply sustained with oils and mineral paints to ensure durability[17]. All these factors make wood more environmentally-friendly, and more economical, than alternatives, if harvested and processed using sustainable practices.

Architects and construction companies in Vietnam are also seeking to source more sustainable materials and abide more strictly to international timber regulations. For example, VTN Architects preach the slogan of ‘Greening the City’ and work in collaboration with Wind and Water House JSC, a construction company that also promotes ‘green building’[18]. In 2021, Vo Trong Nghia, founder of VTN, completed his first, and award-winning, wooden building in the Bến Tre Province. He describes his efforts to ensure the project was sustainable, replanting any coconut trees cut down during construction and using imported wood that was FSC certified[19].

282 Design is another company in Vietnam that prioritises sustainability, with a sole focus on wood products[20]. They have also won awards for their impressive structures, such as the Teak House[21]. Teak wood is found in abundance in Vietnam; hence, this project demonstrates the full potential of Vietnam’s domestic timber industry. 282 Design have promised to source timber only from plantations and reduce excess, as well as expressing a desire to educate people more widely about the dangers of using natural, instead of planted, forests[22].

Now, Vietnam has a world-renowned timber industry as the 5th largest exporter of wood globally[23]. It is an essential part of the Vietnamese economy, contributing a total of US$10.3bn in 2019 and US$12.9bn in 2020[24]. However, as these above examples illustrate, there is huge potential for expansion into the domestic market, especially in the field of housing.

Figure 8. VTN’s first wooden architecture (Source: VTN Architects)

Figure 9. Teak-House-282 from outside
4 Recommendations for the future

With the accelerating pace of global-warming, sustainability is becoming a growing priority for consumers in Vietnam. Construction and design companies must adjust their own priorities and processes to be more environmentally-friendly, following in the footsteps of 282Design and VNT. A wider program of education and training for smallholders, young designers, architects alongside other organisations along the timber supply chain, in sustainable practices and providing access to attaining certification and funding will help accelerate such adjustments.

Another area of development for Vietnam’s timber industry is extending the appeal of wooden houses to the general population. Currently, the companies focused on providing ‘green architecture’ and using sustainable certified timber are primarily targeting wealthier individuals and corporations[25]. Some examples are Timber House[26], AA Corporation, and 282Design. Timber has the potential to be a cheaper alternative to wood, both for manufacturers and consumers. Education, awareness and more accessible and lower-priced options will surely accelerate the growth of timber construction and design.

There is also a great need for the conservation of traditional wooden projects and public works for promoting cultural tourism and heritage conservation. However, according to local carpenters, there are clearly some materials that are used that cannot be replaced by plantation woods (for example, when carving or sculpting part of a house, such as the roof). Therefore, additional research on possible materials that can be replaced, or innovations in design in conservation projects, should be further promoted.
With the accelerating pace of global-warming, sustainability is becoming a growing priority for consumers in Vietnam. Construction and design companies must adjust their own priorities and processes to be more environmentally-friendly, following in the footsteps of Design and VNT. A wider program of education and training for smallholders, young designers, architects alongside other organisations along the timber supply chain, in sustainable practices and providing access to attainment of certification and funding will help accelerate such adjustments.

Another area of development for Vietnam’s timber industry is extending the appeal of wooden houses to the general population. Currently, the companies focused on providing ‘green architecture’ and using sustainable certified timber are primarily targeting wealthier individuals and corporations. Some examples are Timber House, AA Corporation, and 282Design. Timber has the potential to be a cheaper alternative to wood, both for manufacturers and consumers. Education, awareness and more accessible and lower-priced options will surely accelerate the growth of timber construction and design.

There is also a great need for the conservation of traditional wooden projects and public works for promoting cultural tourism and heritage conservation. However, according to local carpenters, there are clearly some materials that are used that cannot be replaced by plantation woods (for example, when carving or sculpting part of a house, such as the roof). Therefore, additional research on possible materials that can be replaced, or innovations in design in conservation projects, should be further promoted.

Figure 11. Teak house’s wall
Bibliography


6. Ibid., p. 25.

7. Ibid., p. 42.


26. [26] Also known as TDH Green Building Solutions.