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The Practical Renovation of a Privately-Owned Wooden House: Case of Khun Prasit's House, Ang Thong Province, Thailand

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ABSTRACT

The purpose of this study is to explore and explain concepts, processes and resources associated with the practical renovation of a privately-owned wooden house and make recommendations for future best practices in such renovation. The methodology consisted of observation, interviews, and document analysis. The research found that the "practical ecological renovation" of the wooden house emerged from an experienced architect working under time, cost and the availability of material limitations. The concept is not to freeze the architecture, but to transfer cultural significance of the place and to accept certain changes. Accordingly, minimal intervention is desirable in making the house livable. From an ecological approach, natural aspects and traditional knowledge of craftsmanship from previous generations are outlined in this study. A non-linear and improvisational conservation occurred due to the project limitations. Ultimately, five dimensions have been identified in relation to the renovation of privately-owned houses, which are: nature and its essence; the balance between the owner's requirements and the architect's values; a network of craftspeople; craftsmanship and appropriate materials and technologies. However, these five emerging results are interrelated and inseparable. From a practical view, the wooden conservation is not only the preservation of physical fabrics, but it relates to other dimensions, including preservation of traditional knowledge and design techniques.

Keywords

craftsmanship; practical ecological renovation; wooden house; privately-owned heritage; non-linear and improvisational conservation

INTRODUCTION

Renovation of a wooden house extends the building's lifespan through a particular focus on material and maintenance (Sutthitham, 2011), however, renovation concepts and processes in Thailand are still perplexing and unsystematic. Furthermore, there are various common problems and unexpected situations associated with such renovations. For example, in 2020, the over 100-year-old forest office, Chetawan Arboretum in Phrae Province was disassembled without any appropriate documentation. Most of the renovation projects which have followed conservation principles have been carried out under the government's management including important buildings such as the restoration of Mrigadayavan Palace, Phetchaburi, Thailand. Nevertheless, there are a great number of wooden houses in Thailand that belong to private owners and are not recognized on a national registry level although they do have cultural value. These houses, generally, have been repaired and maintained by the owners themselves, with or without proper principles, therefore, they are at risk of losing their historical value in the process of renovation.

Khun Prasit's wooden house is located in Talat Luang, Amphoe Mueang Ang Thong, Ang Thong province, close to a small canal that is directly connected to the Chao Phraya River (Figure 1). Originally, Khun Prasit's piece of land was connected to another person's land which was adjacent to the canal and was without fencing. Later, the neighbor's piece of land was sold; therefore, Khun Prasit's house was disconnected from the canal and the main access to the house changed to be on the roadside (Figure 1). The house is a wooden house with a hipped roof. In the past, the area where the house is located was intended as a local government area for the city hall, government offices and a correctional institution. Later, the government zone was moved to another area and this area was re-classified as residential. From an interview with a local resident, this circa 100-year-old house belonged to Khun Prasit who was a government official (Chuchom. Personal Interview. November12, 2021). An excavation of the foundation revealed some coins of that period, which helped to confirm the age.

Khun Prasit's house renovation was selected as a case study for this research because the renovation of this privately-owned house encompasses historical, cultural, and practical value. The renovation contract was signed from 2021 to 2022 between the owner and Mr. Chunlaporn Nuntapanich, a professional architect. Briefly, the objective of the renovation was to adapt the house to suit the new owner's lifestyle while maintaining the cultural value of the building. The one-year practical renovation under the limitation of budget, time, and material availability is a challenging architectural conservation project.

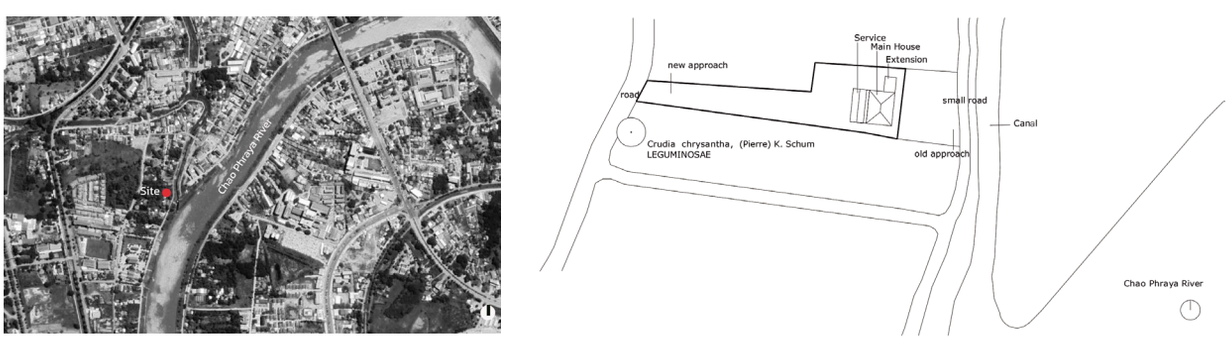

Figure 1 (left) Location of renovation site and (right) the house's layout

OBJECTIVES AND SIGNIFICANCE

The purpose of this research is to explore and explain the renovation possibilities for a privately-owned wooden house from a practical perspective and make recommendations for future best practices in such renovation. The study presents the compromises between historical and physical preservation and new function demands of the owners under the cost, time, and material availability constraints which are common problems for the renovation of privately-owned houses. This research helps to expand the range of conservation ideas and techniques practiced locally or globally. The findings of this study will, directly and indirectly, assist the house owners with renovation by documenting the renovation process conducted by an experienced architect. From an academic viewpoint, the contribution to research reflects the translation of a conservation theoretical framework into practice, thereby providing empirical verification of theoretical constructs. Moreover, this research examines the resources utilized for the adaptation of both tangible and intangible assets in consideration of the values of the renovation's significance and craftsmanship.

METHODOLOGY

This research used a qualitative case study approach based on empirical and in-depth investigations of a wooden house renovation from multiple resources and complex situations in an authentic context. More specifically, three methodologies were used in gathering data. Firstly, literature reviews about wood conservation principles, renovation case studies, and wood technical skills were studied. Secondly, a site survey was conducted before the renovation and during the construction stage. Not only visible elements but also invisible dimensions like craft skills were observed. The field study documented the renovation process that included both planned and unexpected situations. Lastly, semi-structured interviews were conducted with the architect and neighbors. The interview method consisted of an open dialogue.

This case is a purposive sampling of the experienced architect, Mr. Chunlaporn Nuntapanich, as he has renovated, adapted, and built many wooden houses. The 137 Pillars House, Chiang Mai, Thailand, is an example in which he decided to lift the house and support the old structure with steel columns according to the change of function from house to hotel, which required higher load-bearing capacity. A 147-year-old Lanna house is another example, but in this case the architect had the house elevated without changing the original structure. Changes only were made by producing replicas of the hardware to replace the originals that had suffered serious deterioration. Finally, the Baan Suan Mitruamchai House, Ratchaburi, was rebuilt with new features adapted from old elements. In this case, the owner wanted to rebuild the house because it was not suitable for her current lifestyle, therefore, the architect and owner decided to retain the mood and feeling of the old house by using the old elements for the new house.

The Khun Prasit's house is an example of a privately-owned house that has an architectural value of a hipped style and western structure, including craftsmanship. Moreover, the limits of budget, time, and materials are common situations for most privately-owned house renovations. The critical decision between demolition and renovation is common when the owner has to deal with the estimated cost.

LITERATURE REVIEW ON CONSERVATION: CONCEPTS, PROCESSES, AND RESOURCES

1. Wooden architecture conservation concepts

Conservation concepts

The International Council on Monuments and Sites (ICOMOS) International Wood Committee (IIWC) was established in 1975 (Touza Vazquez, 2019) and since then the committee has issued several principles concerning the conservation of the wooden built heritage. A wooden heritage house refers to a structure partly or wholly built of wood that has significant cultural value (ICOMOS, 1999). Value identification can be made through diverse dimensions such as aesthetic, anthropological, scientific, and technological heritage values. These principles respect the diversity of the wooden built environment. The evident skills of craftworkers and their ancestral knowledge also should be recognized and minimal intervention with respect to modernization is desired (ICOMOS, 2017). From an anthropological approach to heritage, this represents a social ensemble of different cultural manifestations (Bouchenaki, 2003). Moreover, there is an underlying ecological approach to the wooden built heritage with respect to craftmanship, traditional materials and traditional crafts, forest and environmental responsibility (Larsen & Marstein, 2016).

The level of conservation intervention varies, and any intervention usually causes a loss of value. Seven degrees of intervention have been identified (Feilden, 2007) which are: a preservation of deterioration; preservation of the existing state; consolidation of the fabric; restoration; rehabilitation; reproduction; and reconstruction. There can be some variability in interpreting these classifications since differences may not be absolute, but fall along a continuum. For example, the goal of a project may be renovation repair construction to bring elements back to original condition, without changing their use. However, this also may include the replacement of some elements such as roofing and windows.

Concepts from other countries

Many countries including Japan, China, and Norway preserve their historical wooden architecture. Practices and regulations vary in different countries. The common issue from reviews is that they conserve not only buildings but also the techniques from the past. Preservation of the forest has become a serious matter in these countries as the quality of timbers is essential for effective conservation.

In Japan, respecting nature is the key. For example, at Rinoji Temple damage was repaired in 2015 by splicing damaged timber with new wood without removing whole elements. Traditional building techniques are more obvious as there are “Selected Conservation Techniques” frameworks from the government to look after their cultural properties (Martinez, 2018). In contrast, there are some cases from Kathmandu, Nepal, representing new materials incorporated within the original design like a “stamp of our time”. The adaptive reuse of the northern courtyard of Patan Durbar Square in Kathmandu, which began in 1982, is a case of adaptive conservation since there is no historical evidence such as photos or oral history to verify traditional techniques. Instead, steel beams were used to represent the new elements (Hagmuller, 2003).

In Norway, skilled carpenters are very important in the creation of the wood architecture. From the Viking era to the modern-day, Norway has developed both tradition and knowledge. For example, cogging techniques have been used for such a long period and evolved into a common application. It is not only the technique but also the wood material selection such as a good heat-insulating capacity that must be considered (Espedal, 2017). Of course, wood is consistent with modern circular thinking, as wood is renewable (Swedish Institute and Architects Sweden, 2020).

In some countries, there is a practice of conserving and restoring privately-owned heritage buildings with the assistance of grant finance or design guidelines. For instance, The Secretary of State and Historic England have powers to access and caretake private properties in the UK. Owners of historic buildings in England are required to send the listed building consent for any change and adaptation of their properties (Historic England, 2021). This approach is true for Edinburgh, Scotland, as well (The City of Edinburgh Council, 2019). In Australia, levels of amenity and comfort are mentioned with respect to the definition of a heritage home (Clark, 2021). By contrast, in Thailand, there are no design guidelines or standards for privately-owned historic buildings, which are non-registered heritage. Consequently, it is rather difficult for private conservation projects to find the right means to conserve the cultural significance of the heritage places. Generally, the Fine Arts Department, which is the government office in charge of heritage conservation, supports private conservation projects by giving advice and recommendations but not financial support. There are no other means of incentive for the conservation of non-registered heritage.

2. Conservation process

In terms of inspection, survey, and research, the structure and elements should be recorded before any action. As they may be concealing by other elements, the components could be temporarily removed only after being fully recorded. As for the replacement of the timber, it is preferred to use the same species as the original or match the original in moisture content. Moreover, the timber should have similar grain. Considering the methods, it is recommended to use the crafts and tools which are the same as those originally employed. Minimum intervention is preferred to ensure its cultural significance, as well as the survival of the structure. Materials used in the building provide useful information on how the building is structured and what action should be taken to ensure adequate functioning of the building (Watt, 2009). Wooden buildings are mostly damaged in humid areas such as the ground floor and external walls. Wood will be damaged if the humidity is at a high level for a long period, therefore, to make the wood last longer, it is recommended that the humidity should be maintained at a level below 20 percent. Careful planning, construction, and maintenance are essential since wood is a demanding material (Heikkilä, 2005).

3. Resources

This section discusses the people, wood, tools, and techniques of conservation. In terms of the craftsman, Japan uses the term “Daiku” to describe a master carpenter, who is both designer and builder. This Daiku will even select the trees to be felled. Daiku belongs to the class of worker called “Shokunin”. These groups of craftsmen work with skills and speed since speed is very important (Odate, 1998). Learning to observe a pattern of action and use is a very critical skill. In Nepal, the wood craftspeople are divided into 3 types; the designers, the woodcarvers, and the carpenters (Bonapace & Sestini, 2003).

The approach to select wood as a resource is also important. Geomancy describes natural forces which affect tree selection and includes three important considerations (Brown, 2014). Firstly, is the orientation, for instance, trees facing south on the mountain which receive strong sunlight should be used for the southern side of the building, but trees grown in the upper part of the mountain receive more sunlight and good air circulation, so these trees could be used for columns. Secondly, the grain of wood used in a structure must be considered so that the grain is suitable for consolidating the structure. Thirdly, the lumber should be adaptable to movement and shrinkage.

As for construction techniques, they vary by region. In Finland, the traditional method is the horizontal log structure where logs behave as the load-bearing structure. At the beginning of the 1900s, the American-style, timber frame technique was brought to Finland, and by the 1930's this technique had generally replaced the traditional log structural technique owing to its cost savings, speed of construction, and thermal insulation qualities (Heikkilä, 2005). There can be challenges related to the availability of traditional tools. For instance, in the preservation of the Gekko-den Pavilion, Japan, a problem arose in that only a few of the tools used during the Edo period still existed, therefore, contemporary tools and traditional tools were both used in the project. The traditional tools were used in the finishing and shaping and the electric tools were generally used for cutting (Park, 2015).

KHUN PRASIT'S HOUSE: THE EXISTING, UNIQUE CHARACTERISTICS AND GENERAL CONDITIONS

Khun Prasit's house is situated near the Chao Phraya River in an area susceptible to flooding. Flood deposits have elevated the ground level such that the height of the first floor was only 1 meter above the ground. By observation, the wooden columns and roof structures were severely damaged due to moisture and age. The floors and walls had partially deteriorated. The house consists of bedrooms, kitchens, and a toilet (Figure 2). It was difficult to identify some of the original architectural features since no pieces of evidence regarding the original design remained. From observations in 2021, the roof was made of galvanized iron corrugated sheets which were imported from a foreign country. However, in the old days, wooden houses with the hipped roof were mostly finished with Thai kite-shaped tiles. The roof structures such as rafters, purlin, and roof beams are believed to have been made of Dipterocapus alatus Roxb. ex G.Don Dipterocarpaceae (Yang Na trees). These woods are highly prevalent in tropical settings, especially along the Chao Phraya River in central Thailand. However, the structure is usually made of wood with higher strength such as Hopea odorota R.oxb. Dipterocarpaceae, Shorea obtusa Wall. Dipterocarpaceae and Pterocarpus macrocarpus Kurz Fabaceae (Forest research and development office, 2005)

Figure 2 Surveying the existing house, prior to renovation
(Credit: (top left) North Forest Studio, (top right and bottom) researcher)

The owner required working space on the first floor and a new entrance stair. The service area such as kitchen and restroom had to be rebuilt due to the much-decayed wooden structure. For the main wooden house, there was water leakage from the roof which caused damage to the ceiling and roof structure. All the columns had to be replaced due to severe damage. The entrance stair was added with a roof covering. Overall, the house would be elevated, the service zone reconstructed, and the main wooden house restored (Figure 3).

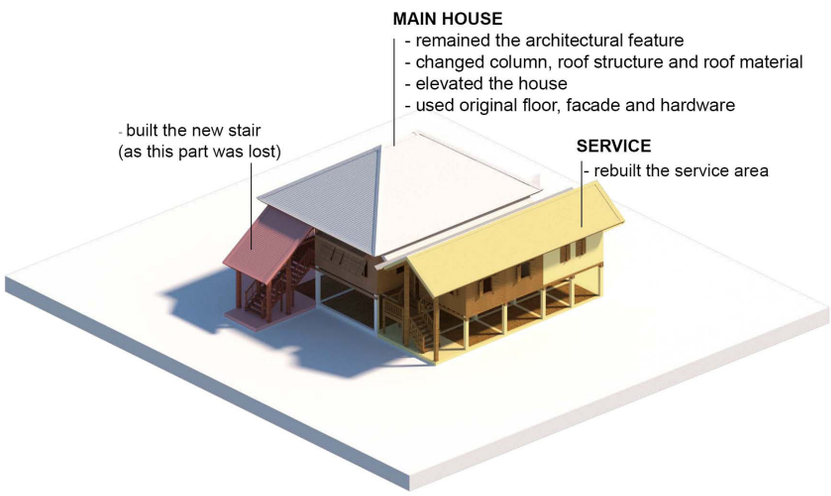

Figure 3 Design proposal for renovation (Credit: North Forest Studio, adapted by researcher)

The unique characteristics of the house were the roof style and roof structure. Khun Prasit's wooden house is not vernacular, but an adaptation of western-style architecture. From a historical viewpoint, in that period of modernization of Siam, Western culture had influenced the country in several aspects including architecture. The "colonial-style architecture" featuring a hipped roof was popular in King Rama IV and King Rama V periods (No Na Paknam, 2020). From the architect's assumption, the roof structure represents the western style (C. Nuntapanich, personal communication, December 4, 2021) (Figure 4).

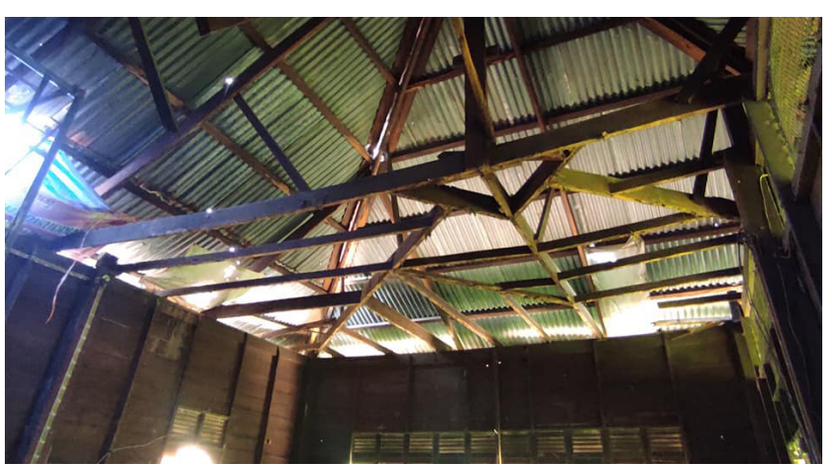

Figure 4 Unique characteristics of the roof structure (Credit: researcher)

The budget limitation was the primary concern for this project. In the beginning, the owner had to decide between disassembling the house and selling the wood or renovation. The time frame was another factor since the contract duration was only one year. Materials such as original wood species were considered with respect to availability and also future use.

A BRIEF ON THE RENOVATION PROCESS

The renovation process began with an agreement between the owner and the architect, followed by a survey of the building, site, and landscape. Interviews were undertaken with local residents to obtain the oral history of the house. The active work started with measuring the existing house. The renovation process was divided into 3 phases; lifting the wooden houses, rebuilding the service zone, and restoring the main wooden house (Figure 5), each of which required different skills and knowledge.

Figure 5 The three phases of the renovation process; (top) lifting the house, (middle) rebuilding the service zone, and (bottom) wood reconstruction and repair (Credit: researcher)

ANALYSIS OF THE RENOVATION

1. Renovation concepts evolving from the existing house and current living situations

For this project, the concept of renovation had two approaches. The first one was based on the wooden house itself, whereby "nature and its essence" is essential. The second perspective, related to the level of intervention, was based on the collaborative dialogue and decision-making between "the owner's requirements and the architect's values".

Wood as natural material: nature observations and understandings

To use wood efficiently requires knowledge and understanding of wood from a natural perspective. The availability of wood is essential to the decision-making, consumption, and production. The architect's decision on the wood application was based on the characteristics of the original house and its landscape. This area previously was zoned government and penitentiary use before the central town was moved to the other side of the river. Subsequently, the zoning was changed to become a residential area. However, as time passed, wooden houses in the area gradually disappeared. From the interview, the architect found a Crudia chrysantha, (Pierre) K.Schum tree (Figure 6), which is approximately 100 years old, and can be related to the boundary of the landscape. This is one of the clues to the setting of the house.

Figure 6 Nature observations and understandings: Crudia chrysantha, (Pierre) K.Schum tree (Credit: researcher)

Furthermore, in the process of survey, knowledge about the tree species can increase processing speed. Floor plank observation, for example, is influenced by the grain pattern and color which differs between species. As shown in Figure 7, mostly the wood used for flooring is Pterocarpus macrocarpus Kurz, a bright wood identifiable by the bird-feather pattern with reddish-yellow color (a bright wood in the bottom of Figure 7). However, some pieces of wood in the floor plank are not the same species. The dark brown wood with an elaborate bird-feather grain is Dalbergia cultrata Graham ex Benth (a dark wood in the top of Figure 7). The original roof structure was constructed using Dipterocarpus alatus Roxb. ex G.Don wood, but it was later replaced with a harder wood during renovation.

Figure 7 Floor plank material survey of the pattern grains in different species of wood (Credit: researcher)

Without properly written documents about the building, the study of forest and landscape helped understand the historical context of the wooden house. Generally, it is not popular to use Dipterocarpus alatus Roxb. ex G.Don wood for the roof structure because of its strength. These species of tree are commonly found in this area and do have an advantage in their height, which could be produced into long lumber.

A person who knows the basics of forest and landscape understands the wood and its locality in the forest, and the person who knows how to use the basic woodworking tools understands the wood material behaviors and the appropriate position of wood in the building. Using the basic hand tools helped retain the natural grain of the wood instead of using machine tools which produce a more rigid geometry of elements and forms in the wood. Most people consider lumber just as lumber but ignore its natural characteristics and its life cycle. For a building with living material, it is necessary to observe the cycle of wood. Consequently, planting trees plays an important role in sustaining the cycles of wooden heritage. The architect also suggested the owner plant trees around the house for future repairs. The architect refers to dendrology, the study of trees, which helps understand the wood for construction (Nuntapanich. Personal Interview. January 23, 2022).

The wooden house as a human dwelling

The decision to renovate is based on the collaboration between the owner and the architect. The core concept is to adapt the house for the present living requirements with minimal intervention. The architect noted that it is necessary to understand the lifestyle of the owner in order to find proper design solutions for the current and future use of the building. A consulting engineer was another key person who collaborated throughout the process.

The renovation focused on the house's adaptation to suit the current and future living requirements while keeping the unique character of the architecture as much as possible. In the beginning, the conservation architect identified the significant features of the place and found that the main features were the architectural appearance and space of the wooden hip-roofed house that represents the style of King Rama V- King Rama VI periods.

The main activities of renovation were elevating the house by 1.50 metres, rebuilding the kitchen and restrooms, and removing the wooden columns, roof structure, and roof tiles. The first floor would be used as a working space and the second floor would be a living room and bedrooms. Both concrete and wood columns had to be replaced due to deterioration. The foundation had to be rebuilt, and the old roof had to be dismantled and reconstructed.

There were some uncertainties about the original house elements, particularly with respect to the roof materials. The existing roofing material was galvanized iron sheets, as mentioned above, overlying the Dipterocarpus a latus Roxb. ex G.Don Dipterocarpaceae wood structure. However, since there was no clear evidence of previous restoration or renovation, the architect assumed from the context that this galvanized iron roof was the original, based on the species of the wooden roof structure. This type of tree is available around the area. This softwood is suitable for lightweight roofing, such as the galvanized iron roof. However, typically this hip-roofed type design employs kite tiles and hardwood structures such as Shorea obtusa Wall. ex Blume Fabaceae. By interviewing the local resident, a 65-year-old neighbor said it was a galvanized roof when he was young (Chuchom. Personal Interview. November 12, 2021). He knew the house's story and features from his mom, who is 90 years old, which helps to corroborate the conclusion regarding the original roof composition.

A decision on roofing material was made between the owner and the architect, who opted for kite roof tiles instead of the galvanized iron roof. The structural loading of kite tiles is considerably greater than galvanized iron, consequently, the architect decided to build a new roof structure and keep the original wood frame character of the old structure in place, which preserves the evidence of the original roof.

2. The collaborative processes between the surveying and the pragmatic renovating process

The architect managed the direction of the renovation process. Due to time limitations, the process was adapted to fit the time frame. A network of craftspeople such as engineers, carpenters, and wood suppliers were essential in supporting the process. From this study, it has been found that a short process does not mean poor design or workmanship. The process can be both detailed and informal with collaboration between specialists being very important. For instance, instead of doing the survey and renovation sequentially, both were carried out almost simultaneously (Figure 8). In the beginning, the drawings were made, including the detailed measurement drawings of the existing house and the conservation design drawings. However, for the diagnosis of decay, the architect followed an informal process and continued the work during the renovation. There is no formal documentation for wood decay in this case, but the architect used his experience in analyzing the wood and made informal notes to shorten the process. In the early stage of observation, house elements that concealed other elements were not removed. In this case, the working team had to accept the unpredictable problems which might occur during the renovation. A network of skilled craftsmen was one of the key elements of the project in case the process faced immediate problems and help from experts was required. From the interview, the architect said:

"We need an economical and efficient process, so the in-depth survey and inspection process was done by observation. The team might not open or reveal any invisible elements. So, we need to prepare if there is an unpredicted situation. But we have done many wooden house renovation projects, so we somehow can predict some urgent situations. The overlapping between surveying and renovating can shorten the process and cost but need experience and a network of good craftsmen and wood suppliers. The depth of study will make your work more profound." (C. Nuntapanich, personal communication, January 23, 2022).

To illustrate, when the builder tried to lift the house, the wooden beam showed signs of cracking thus the process had to stop so that the wooden beam could be changed immediately (Figure 9). It was necessary to expose the joints before lifting the house, which revealed that the wood around the joints was severely damaged due to moisture. The original beam was approximately 2"x6" and the decay was serious at the joint between concrete and wood. The carpenters, as well as the wood suppliers, supported the workers who were elevating the house by immediately making a 3"x8" replacement beam.

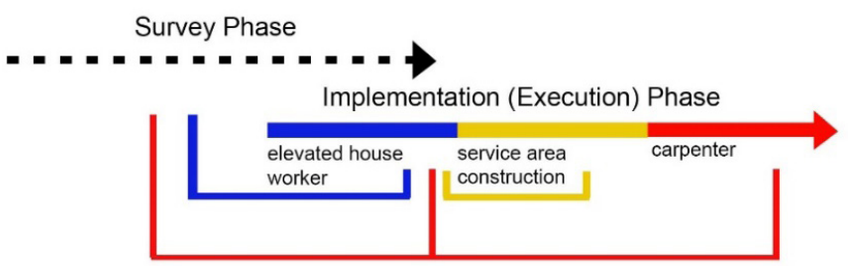

Figure 8 The overlapping process between the survey and the implementation

Figure 9 An unplanned situation resulting from the sign of a cracked beam during house lifting (Credit: researcher)

3. Relearning craftsmanship and selecting appropriate materials and technologies

The local wisdom and current living conditions informed the selection of resources. “Craftsmanship” can be transferred to the next generation by revitalizing the old techniques. In this project, some techniques were relearned but some have been lost. Specifically in this section, “appropriate materials and technologies” are examined with respect to improving building performance.

Layout and access were changed from the riverside to the roadside, so the service area can be seen from the new entrance (Figure 10). In terms of structure, the footings, columns, and beams were all removed and replaced with stronger new members. For example, the old 8”x8” columns were changed to 10”x10” columns. The species of wood might be different from the original species, but they were of similar strength. The wooden columns on the upper floor were also removed due to the biological decay of wood. The joist was repaired by splicing the old wood with the new wood (Figure 11).

Figure 10 After renovation of main house and service area
(Credit: (left) researcher, (right) North Forest Studio)

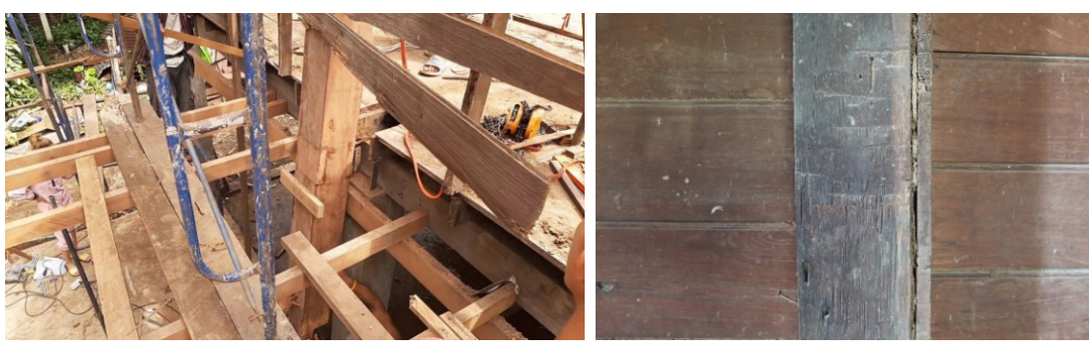

Figure 11 Different levels in interventions: changing columns and replacing wood in joists
(Credit: researcher)

In terms of the column texture, the old columns’ surface was rough because the log was whittled by an adze. The traditional tool was called a “Khwan Yon” (throwing adze) (Figure 12). This project used prefabricated wooden columns sourced from a lumber factory due to the convenience and the availability of resources. This can be considered a loss of the traditional techniques.

Figure 12 Old and new column texture and an adze
(Credit: (left) researcher, (right) North Forest Studio)

The roof structure was replaced with new members, but the original frame character was retained. The architect used Hopea ferrea Dipterocarpaceae for the roof structure renovation. The wood frame members were fastened by bolts. The galvanized iron roof was changed to kite tiles, which considerably increased the structural load of the house (Figure 13). This type of roof material is normally seen in the hip style of the contemporary period. Apart from the load of the material itself, the small size of the tiles resulted in the multiplication of the number of wooden purlins. Consequently, the decayed columns could not carry the load of the new roof, which affected the structural performance. Roof flashing was added to keep the roof sealed and avoid leaks.

Figure 13 Roof structure and roof tiles (Credit: (left) researcher, (right) North Forest Studio)

The damaged walls needed to be replaced by a similar quality wood. Only deteriorated wall frames were removed and replaced. As shown in Figure 14, the vertical dark wood frame is the old frame, while the bright teak frame is the new one.

Figure 14 Replacing the damaged facade with new wood (Credit: North Forest Studio)

Apart from this, the traditional joint construction, for instance, the Dueai-khen joints, were added in the extension area of the main stairs (Figure 15 (left)). This type of joint, which is generally found in Central Thailand, was used based on the architect's experience, after consultation with the owner. The application of the Dueai-khen in this house was another means to preserve local wisdom. This technique might have been introduced by Hainanese craftspeople who developed wood crafting from boat construction. (C. Nuntapanich, personal communication, February 4, 2022). All the usable accessories were preserved (Figure 15 (right)).

Figure 15 Inventive intervention of joints and the reusable accessories
(Credit: (left) researcher, (right) North Forest Studio)

The architect used hand tools instead of machine tools for surface finishing. In the architect's experience, hand tools are better able preserve the nature of the wood. The floor remained as the original version (Figure 16 (left)). The carpenter used both jack planers and smooth planers for refinishing. A jack planer is for a general task and a smooth planer is for finishing the wood surface. A grooving plane also was employed to make grooves on the edge of walls and the wall frames (Figure 16 (right)).

Figure 16 Traditional tools: (left) a jack planer and (right) a grooving planer (Credit: researcher)

DISCUSSION

This study presents the main findings relating to research questions associated with authentic and practical renovation of an historical wooden house. This documented process could be one of the practical and logical models employed for privately-owned house renovation or preservation. This "practical ecological renovation" was conducted from real evidence as undertaken by an experienced architect. In following the ecological approach, this study considered craftsmanship skills and natural aspects of wood. This non-linear and improvisational conservation occurred under certain limitations and five concerns were identified that relate to concepts, processes, and resources. The first two issues were associated with the concept of renovation. The third concern originated from the processes, while the two last points emerged from the resources. However, these five issues are interconnected and are explored below;

1. Nature and its essence

In this case, the concept comes from the material itself. To understand the basics of the wooden house is to understand the wood as a natural resource. This leads to the appropriate use of material. Furthermore, understanding from the natural point of view can result in a delicate and efficient renovation. The concept led to the implementation, for example, of hand tools that are better able to secure the texture of the wood. Observations and an understanding of nature should be an essential part of the renovation process. However, observations of nature are not often considered in the conservation process because it also requires traditional or local knowledge about the landscape, forest, and its settings. The essence of nature produces the dynamic cycle of the wood and this links with the architect's attitude and decision on renovation.

2. The balance between the owner's requirements and the architect's values

The autonomy of conservation in the private sector depends on the owner together with the experience of the architect. This is quite different from the public wooden house renovation. The decision in the private sector is not limited by systematic order and guidelines, therefore, the architect has a very important position to identify the values and the characteristics of the house, what to conserve or what to change, which may be considered the "improvisation approach" to the conservation process. Minimal interventions were used in this renovation, for example, the repair of damaged wood walls and joists was done following the approach employed at the Rinoji Temple in an effort to keep the old wood to the extent possible.

A collaboration between architect and owner was very clear in the decision-making process. The main decision was generally based on the current and future use rather than the study of historical fabric. At present, there are no regulations or guidelines specifically made for the conservation of privately-owned property which are considered non-registered monuments in Thailand. In some countries such as the UK, there are privately-

owned heritage properties, for which the owner has to follow several processes specified in the Listed Building guidance, from maintenance to protecting the home for future generations.

3. A network of craftspeople: professionals, carpenters and wood suppliers

In practical renovation, the implementation process differs from the theoretical process due to various limitations. The work experience of the architects and network of craftsmen and wood suppliers can shorten many aspects of the process. This study found that the renovation work could be conducted along with the study of details, part of which were not written or documented. Compared to the international standard, this project did not record every element due to time and budget limits. Nevertheless, the team recorded the essential parts of the renovation, such as roof structure, while some small details were recorded informally in the form of short notes.

The process was not only structured but also improvised. The overlapping process reduced cost and time. The continuing survey during the renovation was carried out in informal ways. Presumably, if the survey of deterioration stages was carried out in a linear operation, the renovation process would have been longer than one year, with higher costs. The work experience of the architect is quite important because it can help to predict the possibility of emerging problems which must be dealt with in urgent situations. Compared with listed building or standard guidance for some countries, the two key positions that help maintain the authenticity during the process are;

- Professional architects and engineers: architects and engineers bring professional expertise to the table, considering factors such as the quality of heritage spaces and the overall appearance of the project. They also take into account the cultural significance of the project and are able to handle unexpected problems.
- Craftsmen/ Local builders: skilled tradespeople, such as carpenters, can assist in the efficient execution of the project by utilizing their ancestral knowledge and skills, which can also help to preserve traditional techniques.

4. Craftsmanship

Handcraft and traditional tools have both been revitalized. These two things are inseparable since the quality of craft depends on the tools. The architect emphasized the use of hand tools rather than modern power tools because the trace of hand tools is similar to natural wood. Hand tools can also transfer intangible assets such as local skills and knowledge, which is a means to conserve the traditional tools. This intangible element of the project is reflected by the wooden wall frame and the linear lines.

However, without guidance or standard, the process may miss some details which leads to the loss of cultural significance. For example, the texture of an adze was missing when using the prefabricated columns. Moreover, a concern that came from the direct experiences of the architect was associated with traditional construction techniques, such as traditional joinery. The Dueai-khen joints, which reflect the local craftsmanship, were added to the extension area of the house since the research could not uncover evidence about the original techniques used for this area of the house. This decision-making represents the deeper technical value of the architect.

5. Appropriate materials and technologies

New materials and appropriate technologies were introduced into the renovation, including use of roof flashing, to improve the safety and efficiency of the house. Wood materials must meet the new construction standards. The material of the wood structure was changed to include new hardwood species like Hopea ferrea Dipterocarpaceae instead of Dipterocarpus alatus Roxb. Dipterocarpaceae because the new tile roofing

increased the structural load. The efficiency and performance of the building have to fit with the current living and security. It is not necessary to freeze everything as in the past.

CONCLUSION

To conclude, this "practical ecological renovation" emerged from the experienced architect working under limitations. This renovation case study could represent a logical and practical model for privately-owned house renovation. Accepting changes is key, as the living heritage focuses on how the past is used in current situations and contexts. Due to project limitations, this renovation was non-linear and improvised for effective conservation. The privately-owned wooden house renovation normally encounters challenges such as limits to budget, time, and materials, which necessitate inventive conservation practices for the preservation of the house. Five emerging interrelated themes were identified for privately-owned house renovation: nature and its essence; the balance between the owner's requirements and the architect's values; a network of craftspeople; and craftsmanship and appropriate materials and technologies. There are no standards or regulations for privately-owned wooden house renovation in Thailand, and as such, this case study can provide valuable guidance for future projects.

LIMITATIONS

The generalizability of the results depends on the existing conditions of specific locations and the owners. The cost of renovation possibly varies in different places. Without proper regulation, the privately-owned property renovation can represent a dynamic condition, with varying styles and experience.

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AUTHOR CONTRIBUTIONS

The author confirms sole responsibility for the following: conceptualization, methodology, formal analysis, investigation, data curation, interpretation of results, manuscript preparation, writing - original draft, writing - review & editing and visualization.

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