Architectural elements of Huay Hee

Aitthipat phewphong, Kittin Poonma, Kittitus benjaratanapakee, Metha Thaweeaphiradeephinyo, Nattinee Krengkrut, Pitipat sririttipradit, Puvaded Juntasoponno, Rattanachai malai, Siraphob Netniyom, Saowanun Sirimonthonrat, Thanaporn Tomorn, Thanarat Rattanakorn, Woranitta Sukwattanasombat, Worawan Somsuphan, and Anutorn Polphong*

Faculty of Architecture, Rangsit University, Pathum Thani, Thailand
*Corresponding author, E-mail: anutorn.p@rsu.ac.th

Abstract

The objective of this research was to create an Architectural Prototypes that are simple to use and easy to construct for villagers at Ban Huay Hee community, Mae Hong Son province, Thailand. As an inspiration for the villagers to sustain their unique way of life. From our studies, the researchers found that, nowadays, the unique way of life of the people in the village has slowly vanished. The villager in a Working-age preferred to move to the city, searching for what believed to be an easier and more secure way of life, resulted in a large generation gap between children and the elderly, which caused discontinuation of knowledge, and more importantly, the lost knowledge in local technique found in art & craft & architecture. The villagers found it hard to maintain their local technique in their everyday life, due to various reasons, but mainly because the local techniques take time and are not practical. The villagers then opted for a more accessible way and techniques. Through our Architectural Prototype, the researchers aimed to find ways to inspire people in the village to nullified the vanishing of local knowledge, by finding new material limits through experimentation with local materials with various processes and methods, for simple use and easy to construct. From the result of the experiment, our team discovered 3 Architectural elements are; floor, wall and roof, that are possible and able to meet the criteria set. With these new methods of creating architectural elements, we found an interesting yet simple and easy to construct technique that can be done by a villager in the community, which will allow the villagers to hopefully become closer knitted again like in the past.

Keywords**:** *Prototypes, Material limit, Local wisdom, Local materials, Architectural elements*

1. Introduction

Started from New edge studio's brief, to create prototypes for the local community. The researchers found an interesting village of Huay Hee Village, Village No. 8, Huay Pu Ling Subdistrict, Mueang District, Mae Hong Son Province, which is a community with only 186 people from 36 households. The village is about 26 kilometers away from Mae Hong Son. This village has Karen who called themselves Pakakayo. The village is more than 200 years old. The villagers here are known for their crop rotation method system, which is long-standing agricultural wisdom (Kojchsawas, 2006). Moreover, there are also many interesting art and craft techniques as part of their ways of life, such as basketing, weaving, blacksmithing, and coffee.

From many different ways of life of Huay Hee Village, the researchers organized ourselves into various groups to collect basic information to learn their local techniques as follows:

Figure 1 Dyeing technique: Color extraction (Left), Pouring the dye on silk (Right)

1.1 Dyeing technique (Figure 1)

On staining, we found that there is a binder for dyeing that will last longer. They used two binders which are mud and ash dissolved in water. Both of these binders can be found in the community; the properties are varying. Mud and water helped the color to attach the yarn well for vegetation and bark. Ash and water make the color stick to the yarn well for leafy and root plant species. Mixing with various types of vegetation to make a range of different colors that can be found in the community.

Figure 2 weaving technique: Crushing machine (Left), Step to vertical weaving (Right)

1.2 Weaving technique (Figure 2)

From the yarn obtained after dyeing, the next step is weaving. The tools used in weaving are called crushing machines (Figure 2- Left). This machine has a long, rectangular base, using pine as a base. Holes are drilled in length and bamboo attached as a tool to determine the frequency of patterns. This method is a horizontal weave of yarn. To the next step in vertical weaving, the tool changed from a mess came to hold the fabric on both sides by using the column of the house and the waist of the weaver (Figure 2- Right).

In the past, the weaving threads were made from cotton trees that can be found in the village. Today, the villagers have reduced the process of dying and, instead, used the thread received from the city. Due to the changing age and the different age range of the people in the community, the products from weaving are used as clothing in the village. Some are sold in the visitor center but could not be exported to the city. Tourists could only buy the products in the village.

Figure 3 basketing technique: Smoked products (Left), Product usage (Right)

1.3 Basketing technique (Figure 3)

Basketing is a way of life and general wisdom. Materials used in basketing can be found locally. The productive out of basketing such as baskets, bags, and others. Adding to the potential of the product by smoked will make the device strong, longlasting, and good insect protection (Figure 3-Left). This output will be used to store equipment or collect products from the crop rotation method (Figure 3-Right).

Currently, basketing is reduced. Since there are only a handful of descendants left in the village and the large weave is too difficult for the group of people to weave. So, they weave only necessary equipment but is still a unique feature of the village.

Figure 4 blacksmithing technique

1.4 Blacksmithing technique (Figure 4)

In the past, the material was iron from the plane wreck that fell near the village during the Second World War, but now the steel from the plane are depleted. So, it is necessary to use steel from the city instead. Blacksmithing uses the process of bringing iron to fire to make the steel red and then beating it into sheets. When formed, Yang Khli (rubber from Stingless Bee) is used as an intermediary for welding between steel and wooden handles together. In which Yang Khli is a material obtained from neighboring villages. Nowadays, the blacksmith is almost lost due to the age and the small number of skilled people. Most of the iron-producing products are tools for shifting cultivation, such as axes, sickle knives, and others.

Figure 5 Coffee technique: Coffee seeds (Left), Roasting coffee (Right)

1.5 The coffee-making technique (Figure 5)

Coffee is an up and coming product in the community. The coffee seeds that can be grown in the village are varieties of Arabica, which take five years to grow and yield. It was the reason that it cannot grow in large numbers. Therefore, only 3-4 trees are planted, and currently, only one house is making coffee, causing the ability to make coffee not widely spread. In the process of making coffee, the final product of coffee is coffee grounds. Villagers can transform it into fertilizer for agricultural use.

The current situation of the community, with the majority of the population, are elderly and small children, with no working-age population, creating a generation gap. In which every process will be reduced to various steps and then turned to use more materials that can be purchased in the city. However, even then, it still has some characteristics. These unique local techniques and knowledge started to disappear or reduced, and what remains is only the necessity. Should there be a method which allowed the use of local materials in a simple in term of the process of making, reduced production time and with local technology within the village, there might be a chance to maintain the knowledge and techniques for future generations.

2. Objectives

1. To create an Architectural Prototypes which are simple to use and easy to construct for the villagers in the community, as a way to maintain local knowledge and way of life which are slowly disappeared.

3. Materials and Methods

There are 5 main parts the researchers planned for our research:

Part 1: Secondary data research and analysis. The researcher focuses the research on data relating to diverse ways of life, such as basketing, weaving, blacksmithing, coffee making, and crop rotation methods.

Part 2: Planning for two days on-site, primary data collection. The process began with establishing with the team to survey methods and direction by focusing on villagers' ways of life, local materials, and local art and crafts techniques.

Part 3: Data collection at the village, visiting the school, crop rotation farm, and studying the process of local techniques through action to collect data and materials for further experimentation.

Figure 6 Traditional Architecture style (left), Current Architecture style (right)

The village has two types of houses. The first type is the traditional style, made from natural materials that can be found in the community such as bamboo, hardwood, and palm leaves (Figure 6-left). The second type is the current style, developed according to era and additions to support tourists. Resulted in a change in the usage of local materials to industrialized materials such as concrete, cement tiles, and metal sheet (Figure 6-right).

4. Results and Discussion

Part 1: Analyze data to set criteria for experiments.

Part 1.1 Study and compare architectural styles in villages.

The researchers analyze and compare both types of architecture to find the advantages of each type. (Table 1)

Table 1 Comparison of traditional and current architectural styles.

Traditional Architecture style	Current Architecture style
Unique	No identity
Use for a long time	Minimum construction time
Use of local materials (low price)	Use of materials outside the community (high price)
Easy construction methods	Easier construction methods
Interaction within the community	Each person does

From the study, the comparison of traditional architectural styles and current architectural styles, we take the **uniqueness, minimum construction time, and low cost** as our research criteria because these are the main advantages of Architectural style. As well as these factors should maximize the chance for the villagers to produce and construct by themselves and maintain the identity of the village, by **using old materials and adapted in with our new methods**.

Part 1.2 Classifying properties and material types.

Materials used in the construction were bamboo, palm leaves, and pine. The unused materials included iron, cloth, clay, rattan, Yang Khli, yarn, coffee grounds, and natural materials.

After that, we experiment with all materials and try to create a prototype. The old and new materials are used to replace the architectural elements that meet the criteria of uniqueness, minimum construction time, and low cost. The experimental elements are floors, walls, and roof, and then classifying the materials according to their usage (Table 2).

Table 2 Classification of materials

Materials (construction)	Intermediary	Skin covering materials
□ Bamboo	□ Yang Khli	□ Bamboo
□ Palm leaf	□ Clay	□ Palm leaf
□ Tok (thin piece bamboo)	□ Coffee grounds	□ Yang Khli
□ Clay		□ Clay

Part 1.3 Compare and set the criteria for the experiment.

The researchers have analyzed all three architectural elements of the house are floor, wall, and roof according to the needs and problems encountered to set the criteria for the experiment (Table 3).

Table 3 Comparison and set of criteria.

Comparison	Roof	Wall	Floor
Construction period	Duration 3 months In construction (drying palm leaf)	Fast construction period	Fast construction period
Durability	- Useful life 5 years - Weather resistant - Good waterproof and leak-proof - Use local materials	- Useful life 5 - 30 years - Weather resistant - Good waterproof and leak-proof - Use local materials	- Useful life 5 - 30 years - Weather resistant - Good waterproof and leak-proof - Use local materials
Problem	- Short useful life - Long construction period	- Preventing bad wind - Brittle when in contact with water - Not resistant the weather - Many holes. - Not protect against the beast	- Preventing bad wind - Brittle when in contact with water - Not resistant the weather - Many holes. - Not protect against the beast
Cost	No charge	No charge	No charge
Experimental criteria	-Light weight - Fast installation - Quick preparation - Weather resistant - Increase the useful life	- Fast installation - Weather resistant - Increase the useful life - Increase privacy - Protection against bad animals	- Fast installation - Weather resistant - Increase the useful life - Increase strength - Protection against bad animals

Part 2. Experiment on all three architectural elements.

Design and test all three architectural elements according to criteria, that are construction speed, durability, and low cost.

Part 2.1 Floor: cut in bamboo to create a trunk and tied with rope to secure the joints. From the original, the ground was fastened with Tok (thin piece bamboo) to change to using a rope to fasten together (Figure 7).

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Figure 7 Using rope to hold the structure (left), Laying the floor (middle), and Testing the load (right)

The result of the floor is a bamboo flooring developed from the old style by increasing strength and durability by reducing the frequency of bamboo chopping. Then, split the bamboo into three parts, use the middle part to support, use the curve part to articulate the top, and tie with a rope (Figure 8).

Figure 8 Chopped bamboo floor

Table 4 Summary of floor experiment on the speed of construction, durability, and cost.

Criteria	Chopped bamboo floor
Speed of construction.	2
Durability	3
Cost	-

*** Note** 3 = High, 2 = Medium, 1 = Low Evaluate the scores by comparing quality with the old style.

Part 2.2 Wall has three types are:

Type 1: Chop bamboo and overlap. Drill holes to attach the rope. Makes it possible to roll and adjust into windows (Figure 9).

Figure 9 Bamboo chopped overlap (left) and bamboo roll (right)

Type 2: Place bamboo in a zigzag pattern and drill 2 holes to thread the rope (Figure 10). By placing the serrated switch will be flexible and can be retracted. It can be used as a door.

Figure 10 Placing zigzag

Type 3: stretch the bamboo frame to the wooden frame and secure it to create a partition (Figure 11).

Figure 11 Stretching and tightening the fabric

The results of the wall have three types (Figure 12). The first type is the external wall that is stacked bamboo, which can be changed into a window. Type 2, the internal wall is the overlapping bamboo to be flexible; it can be changed into a door. Type 3, brings the fabric to the bamboo stretching as a partition.

Figure 12 Exterior wall (left), Interior wall (middle), and Partition (right).

Table 5 Summary of wall experiment on speed of construction, durability, cost, and privacy.

Criteria	Type 1 Exterior wall	Type 2 Interior wall	Type 3 Partition
Speed of construction.	2	2	2
Durability	3	3	2
Cost	-	-	-
Privacy	3	3	3

*** Note** 3 = High, 2 = Medium, 1 = Low Evaluate the scores by comparing quality with the old style.

Part 2.3 Roof has two types are:

Type 1: experiment by bringing bamboo in half, divided into four parts, then placed upside-down, alternately drilling two holes at both ends to tie the rope (Figure 13).

Figure 13 Bamboo cut in half (left), Place the bamboo (middle) and drill a hole for rope upside down (right)

Type 2: Experiment on making tiles from the clay in the village with the mixture of clay, coffee grounds, and rice husk, with a ratio of 3:1:1 (Border patrol police region 4, 2016). By experimenting with both pure clay, clay mixed with coffee grounds, and clay mixed with coffee grounds and rice husk to test the weight and soil adhesion. After that, each type is tried to extrusion, both flat and wavy forms, and divided into two ways: dry release type and waterproof coating. Then, the type that is burned at a temperature of 900 Degrees Celsius (Figure 14).

Figure 14 Before burning (left) and after the burn (right).

From the experiment, it is found that the clay that contains coffee grounds and rice husks is the lightest and has good adhesion. When it is allowed to dry or heat, it can be seen that the clay containing all three types will not crack. When tested with the water flow will find that it can absorb and dry quickly, and does not leave steam or leak.

The results of the roof have two types (Figure 15). The first is a bamboo roof, which after placed upside down will have a roof similar to roman tile. The second style of roof tiles by embracing the clay with printed molded from bamboo wavy.

Figure 15 Bamboo Wavy (left) and Clay tiles (right)

Table 6 Summary of roof experiment on the speed of construction, durability, cost, and weight.

Criteria	Type 1 Bamboo Wavy	Type 2 Clay tiles
Speed of construction.	2	2
Durability	3	3
Cost	-	-
Weight	2	3

*** Note** 3 = High, 2 = Medium, 1 = Low Evaluate the scores by comparing quality with the old style.

From the study and architectural element experiment of floor, wall and roof elements, each element can meet most of the criteria set as follow:

1. The floor is a bamboo flooring that has been developed from the old style, with increased durability, with equal construction time.

2. Wall there are three types, the first type is the external wall, the second type is the interior wall, both types have the same construction period as the original, and are more responsive to users. Both the duration and privacy, and the third type of partition is the least durable, but it can answer much privacy.

3. Roof there are two types: the first type is a wavy bamboo pattern, and the second type is the clay tile. The construction period of both types is shorter than the palm leaf. More durable and last longer although a little heavier. When comparing both types, the first type is more convenient because it is a material that is easy to find in the village, and the second type may be difficult to control the temperature and more fragile.

From the three experiments, some criteria and conditions cover the use of local materials, the process that the villagers can do by themselves in the community, and the minimum dependence on the outside technology for creating a simple-to-use and easy-to-construct Architectural Prototypes. All three elements are discovered to have small costs in terms of accessories. For example, we can reduce the cost by using a natural banana rope, which has comparable features and can found in the village. From the results, each element; floor, wall, and roof, has many experiment types to let the villagers know more about the possibilities of the material around them than they used to These may result in the villagers being inspired to do new things through these new techniques.

5. Conclusion

The purpose of this research was to study materials and to show the limitations of materials in other dimensions. Introduce people to see the new possibility that is possible from the materials around them. The researchers, therefore, offer ways to inspire to people in the village by finding new material limitation by experimenting with local materials through various processes and methods, which is demonstrated through the closest thing to humans is architecture, with limitations in the use of local materials process and production that the villagers can do by themselves in the community. By dependence on the outside benefits and technology to a minimum.

The researcher has studied various local materials that can be obtained from the community by studying the properties and the transformation of each material through new methods to find the limit of the material that is very likely to be an architectural element and experimenting and demonstrating in the form of floor, wall, and roof under the limitation and criteria for speed of construction, price, and durability.

The results of the research show that all three elements of the experiment are feasible and meet the criteria set. When new methods occur in the village with simple construction which can be done by yourself in the community, causing the villagers to think together to create, resulting in good interaction as follows. It can also create inspiration for new things through the above process that has been tried and demonstrated through all three elements.

Suggestion: Due to the way of life and accessibility of the community, the above studies and experiments are subject to the constraints that require local materials and processes that can be done within the community and rely on technology to a minimum. If able to use modern technology and tools that may make the process of testing each element can develop and further improve the quality better.

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7. References

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