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Research paper



Environmentally Friendly Materials Use Strategy on Heirloom Houses of Mandailing Community in Mountainous Area (Case Studies : Heirloom Houses in Singengu and Habincaran)

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Abstract

The ancestor of Mandailing etnic whom lived on mountainous area, since long times ago have been understood about the environmentally friendly materials use strategy for the dwelling. The use of environmentally friendly materials has been found on some bagas pusako (heirloom houses) in two main villages that called huta induk, such as Singengu and Habincaran. This research aims to reveal the strategy of heirloom houses that has been used environmentally friendly materials. The research is uses descriptive-qualitative methode with deductive analysis and focused on sustainable design strategy especially about the material and resources. The result shows that environmentally friendly materialsuse strategy of heirloom houses of Mandailing etnic in Singengu and Habincaran has been done with three part of building, such as at the bottom of building, in the middle of building, and the top of building. The strategies are 1) natural stone for foundation; 2) local wood (ingui) for pole, beam, stair, and windows; 3) gogat (local bamboo) for wall and floor; and 4) iju/rumbia or fibers for roof cover. Residential process of heirloom houses as over the time and the changing of the residents or the heirs have been caused of changes in material use.

Keywords: *Environmentally Friendly Materials, Bagas Pusako, Mandailing Etnic, Village-Mountain*

1. Introduction

Indonesia has long been known as a country with a unique and spectacular local architectural diversity. The unique of local area creation. Indonesia or traditional architecyure is not only shown through the design of forms but also on the game of expression and the use of adaptive material to the surrounding environment. Mandailing also gives a significant contribution to local architecture diversity that spectacular especially in architectureal product that producted by etnic people of mandailing. This can be seen in the room arrangement of the settlement [1] how to manage forest area, river, and it's land [2] the suistanable of the landscape as a habitable village [3] and room arrangement concept is based on mandailing local values [4],[5].

Research on the use of envronmentally friendly materials over the past seven years, has been pretty much published as has been done by Sukawi [6] related bamboo as an alternative to earthquake prone construction materals, Wardhono [7] about the selection of materials building on riverside dwellings, eco friendly & affordable house desigm [8], effect of material on the temperature inside the house space [9], Wibowo [10], related to the application of used material on post earthquake reconstruction shelter and engineering strategy of residential buildings in mountains (Rejeki, 2017).

A number of faacts show that material studies are interesting enough to be done mainly related to the material on local or traditional architectural design in Indonesia. Every region in Indonesia has a wealth of different architecture, especially related to the strategy of using eco friendly materials.

Same thing with some researchs that has been done before, in the rresidential of Mandailing ethic people also found phenomenon of the use local materials adaptive to the environment with different strategies and materials in accorandce with environmental conditions. *Bagas Pusako* or a heritage house that found in the residential of Mandailing ethnic people area, especially in two main huta villages (*Singengu and Habincaran)* shows the wealth of anchestor knowledge of the Mandailing people in terms of selection strategy of residential building materials that adaptive to the environment.

A number of facts described above formulate the problem: what is the strategy of using eco friendly material in heirloom house of Mandailing Ethnic people in ruraland mountains area, especially in Singengu and Habincaran villages. This researchm aims to determine the strategy of using eco friendly materials in Mandailing ethnic heirloom houses in rural areas, especially in the villages of Singengu and Habincaran.

2. Theory

Ecological or environmentally friendly material is a material that comes from nature and does not contain substances that interfere with health, for example, natural stone, wood, bamboo and clay [12]. The characteristics of the ecological materials are :

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A. Exploitation and production use as little energy as possible;
B. Not undergoing material transformation so that it can be returned to nature;
C. Exploitation, production, use, and maintenance do not pollute the environment;
D. Sourced from local natural resources.

Another opinion [13] revealed that environmentally friendly materials can be grouped into six parts, that is :

A. Cultivable materials, such as wood, bamboo, rumbia, reeds, coconut fibers, bark, cotton, animal skin, and wool;
B. Reusable natural materials, such as soil, clay, loam, tras, river stone, and natural stone;
C. Reusable materials, such as waste, scrap, rubbish, dregs, packaging materials, used cars, sawdust, glass pieces;
D. Natural materials undergoing transformation changes, such as red rock, clay tile, brickwork, conblock, metal, glass, cement;
E. Natural materials undergoing some degree of transformational change, such as plastics, synthetic materials, epoxy;
F. Composite materials, such as reinforced concrete, cement fiber plates, composite concrete, chemical paints, adhesives.

3. Methods

This research begins with the exploration of a number of *bagas pusako* or heirloom houses in two main *huta* villages (Singengu and Habincaran) which still have the initial character of an ordinary people's residence (not the king's house). At the time of exploration, there were 89 heirloom houses out of a total of 135 houses, but there were only 45 heirloom houses still inhabited by the heirs, the rest were inhabited by relatives and some were rented out. 45 heirloom houses inhabited by the heirs, there are only 17 heritage houses that can be accessed and researched, while the rest are more often empty due to temporary abandonment by their inhabitants. from 17 heritage houses, there are only 7 heirloom houses that can be traced to the history and development process especially related to the strategy of using environmentally friendly materials.

The obsevation of 7 heirloom houses related to the strategy of using environmentally friendly local materials then analyzed using Ervianto's ecological material theory [12] and Frick and Suskiyatno [13] on ecological materials.

4. Results and Discussion

4.1. Bagas Pusako in Two Huta Induk Villages

Two villages called *Huta Induk* (custom village which has the most complete custom structure) which became the focus of observation of heirloom houses or bagas pusako on Mandailing ethnic in this research is Singengu and Habincaran village.The seven heirloom houses that were made as observation unit in this research consisted of four heirloom houses in Singengu and three heirloom houses in Habincaran. Seven samples of the heirloom house can be seen in table 1.

Table 1: Seven samples of heirloom houses

Heirloom House	Inhabitant	Location
Case – 1 (C1)	M Lubis	Singengu
Case – 2 (C2)	N Br Nasution	Singengu
Case – 3 (C3)	B Dalimunthe	Singengu
Case – 4 (C4)	S Br Nasution	Singengu
Case – 5 (C5)	M Br Lubis	Habincaran
Case – 6 (C6)	I Daulay	Habincaran
Case – 7 (C7)	H Lubis	Habincaran

4.2. Strategy of Using Envionmentally Friendly Material

The observations that have been done on seven heirloom houses in two main villages, Singengu and Habincaran villages indicate that there are four strategies performed on three parts of the building, namely 1) the lower part (foundation and lower space); 2) the middle (floors, walls, openings, and ventilation), and 3) the top (roof). The several strategies include:

a. Utilization of local stone and natural stone as the foundation. This strategy is found in *bagas pusako* C1, C2, C4, C5, and C7, whereas other heirloom house have converted river stone and natural stone into bases, as can be seen in table 2.

Table 2: Utilization of local stone and natural stone

Case	Fasade	Foundation Detail
C1		
C2		
C4		
C5		
C7		

b. Utilization of local wood (ingui wood) as column and beams; stairs, windows, and roof construction; The local timber utilization strategy commonly called the ingui wood (resin species) is found in *bagaspusako* (C4, C5, and C7 heritage houses) as shown in table 3 below:

Table 3: Strategy Two: Wood for Piles and Beams, Stairs, and Windows

Case	Fasade	Wood Material Detail
C4		
C5		
C7		

c. Utilization of *gogat* (local processed bamboo) as wall and floor. *Gogat* is a flattened local bamboo.
The strategy of utilizing *gogat* as a wall element was found in C4, whereas C1, C2, C3, C5, C6, and C7 heritage houses have replaced walls from gogat to wood, as shown in table 4.

Table 4: Strategy Three: *Gogat* for Walls

Chase	Fasade	*Gogat* & Wood/Timber
C1		
C2		
C3		
C4		
C5		
C6		
C7		

d. Utilization of fibers / rumbia as roof covering.

At the time of this research, the utilization strategy of fibers as a roof cover can only be found in C4, whereas the other heritage houses have changed the material of fibers to become zinc. According to some sources, before, all the houses initially used the fibers and started to replace the fibers with zinc material since the beginning of 2000. C4 case that still use the fibers material can be seen in table 4.

Table 5: Strategy Three: Ijuk / Rumbia for Roof

Case	Fasade	Fibers/Rumbia Roof
C7		

Seven cases of *bagas pusako* (heirloom houses) in the villages of Singengu and Habincaran have progressed towards the use of modern materials, especially in two types of materials, that is 1) roof covering material (from fibers / rumbia to zinc); and 2) ladder material (from wood material to concrete). Development of the use of materials that also changed but still using local materials are walls and floors, that is materials *gogat* (local bamboo flaked) into wood.

5. Conclusion

The results of the discussion show that the use of environmentally friendly material on *bagaspusako* or Mandailing ethnic heritage house in mountainous rural insight, especially case study of heirloom house in Singengu village and Habincaran consists of two groups of materials, that is:

A. Wood, bamboo, and fibers/rumbia as **materials that can be cultivated**;

B. River stones and natural stone as **reusable natural materials**;

Strategy of the use of environmentally friendly material is done on three parts of the building that is bottom, middle and top. There are four strategies to use them:

A. Utilization of local stone and natural stone as the foundation;

B. Utilization of local wood (ingii wood) as poles and beams, ladders and windows;

C. Utilization of *gogat* (local processed bamboo) as wall and floor; and

D. Utilization of fibers / rumbia as roof covering.

The process of residential *bagas pusako* or heritage house over time and the change of occupants or heirs has caused a number of changes in the use of materials.

Bagas pusako (heirloom house) in Mandailing mountainous area is still very much spread in other villages, especially in villages with the status of *Hiuta Induk*. Therefore, it is interesting to do further research to see or examine the strategy of using environmentally friendly materials in other villages in order to know the pattern of utilization of local materials and their changes throughout the history of Mandailing ethnic settlement in mountainous area.

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