

**A Study of the Principles of Iranian Architecture in Rural Housing
(Case Study: Kolamu village of Shahroud)**

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ABSTRACT

The Iranian architecture principles have been derived from the culture and values of this country. These principles have existed in rural housing in Iran in the past. Nonetheless, today, social and economic developments have created changes in the pattern of rural housing architecture, and less attention has been paid to the principles of Iranian architecture in today's architecture. Meanwhile, the architecture of the old rural housing has valuable criteria and indicators that can be identified, analyzed, and used to design a new housing model. Consequently, this study aims to investigate the principles of Iranian architecture in rural housing. This research is applied in terms of purpose and descriptive-analytical in terms of method. For this purpose, first by studying the library resources of the principles of Iranian architecture (Human scale, self-sufficiency, structural rigidity, and proportion, avoiding non-essentials and inward-looking) and then by field study, the manifestation of these principles in four housing models of Kolamu village in Shahroud was studied. The results reveal that the prominent housing patterns of Kolamu village are in accordance with the principles of Iranian architecture, and in all patterns, a manifestation of these principles and their components can be seen. Technically, populism has been considered as a component of avoiding identifying and meeting the needs of residents, and in principle, avoiding the futility of moderation in decorations and moderation in the size of the building, and in principle, introversion, forbidding overlooking and creating privacy, especially in Kolamu village. Finally, model extraction based on the principles of Iranian architecture and its components for contemporary rural housing is offered.

KEYWORDS: Principles of Architecture, Iranian Architecture, Rural Housing, Kolamu Village, Shahroud.

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1. INTRODUCTION

Thinking about housing and home corresponds to the concept of “living” in a specific place. Likewise, living has a concept beyond meeting the need and indicates the formation of a meaningful connection between human beings, elements of place, space, and environment (Sartipi pour, 2013, 6). The concept of housing in Iranian architecture is derived from respect for man and space (Aminian, 2013: 3). Iranian architecture is based on certain principles rooted in the culture and values of this country (Peyvastehgar et al., 2017: 2). These principles also existed in rural housing, but with the advent of technology and social and economic structure changes, variations have been made in the pattern of rural housing architecture (Salim and Malekinia, 2017: 2). In today's architecture, less attention has been paid to the principles of Iranian architecture. Nowadays, most rural houses face unrest and biological instability (Zargar et al., 2015: 1). In the meantime, the architecture of the old rural housing has valuable features that can be identified, analyzed, and used in new constructions. In this way, in addition to the continuity of communication between generations, the physical-spatial identity of the village will also be revitalized (Zargar et al., 2015: 1).

In the past, the principles of Iranian architecture have been considered in the housing of Kolamu village in Shahroud, but today, with the reduction in these principles in the new rural housing, several problems have been created, such as lack of identity and lack of coordination in the new texture. Consequently, identifying these principles can be used in today's rural housing and provide a suitable model in adapting to climatic conditions, biological and rural lifestyles. Since this pattern has arisen from the heart of life, culture, and needs of Kolamu village inhabitants, it can effectively promote a sense of belonging and revive the rural lifestyle. Therefore, the chief purpose of this study is to investigate the principles of Iranian architecture in rural housing. For this purpose, after studying the research done in this field, the principles of Iranian architecture have been identified and then in the case study of Kolamu village of Shahroud. Finally, the model extraction based on the principles of Iranian architecture and its components for contemporary housing in the village Kolamu is provided. The main research question can be stated as follows:

What are the principles of Iranian architecture and its components, and what is the manifestation of these principles in the housing of Kolamu village in Shahroud?

2. Theoretical foundations

2.1. Principles of Iranian architecture

Professor Pirnia believes that Iranian architecture has five principles: “human scale, self-sufficiency, structural rigidity; and proportion, avoiding non-essentials and inward-looking” (Pirnia, 2008: 26). In the following, these principles and components are expressed from the perspective of researchers.

2-1-1. Human scale

The house is one of the most important architectural spaces with a direct relationship with a man (Naderi et al., 2012: 6). This principle means having a human scale, or in other words, observing the fit between building organs and human organs and paying attention to his needs in building construction (Pirnia, 2008: 26). Observance of spatial scale is one of the components of human scale in which observing the size and scope is important in creating different spaces (Sartipi pour, 2012: 8). Avoiding the high height of the building is another component of the demographic in which the external height of the building and the height of the interior spaces of the building are important (Peyvastehgar et al., 2017: 10). Another component of the human scale is the avoidance of individuality, in which the avoidance of showing off in the external appearance of the building, especially the house, is considered (Qayyumi et al., 2012: 10). Providing different needs of residents is one of the components of democracy in which the space is defined in accordance with the needs of residents (Raheb, 2014: 11).

2-1-2. Self-sufficiency

Iranian architects tried to get the materials they needed from the nearest places and built them so that they did not need the materials of other places (Pirnia, 2008: 31). According to Pirnia, this principle in architecture means a kind of autonomy (Peyvastehghar et al., 2017: 13), and proper locationing is one of the components of self-sufficiency (Naderi et al., 2012: 11). Providing thermal and refrigeration comfort is another component of self-sufficiency in which the ability of the house to provide its thermal and refrigeration conditions is important (Qayyumi et al., 2012: 11).

2-1-3. Structural rigidity and proportion

In Iranian architecture, structural rigidity and proportion (Niaresh) is called static knowledge and building technology (Pirnia, 2008: 29) and refers to all the work that is done for the stability and static of the building. In this principle, a scale is used that is called a measure (Peymoun). Peymoun is one of the criteria used to determine the fit between building components. (Didehban et al., 2017: 4). Symmetry is one of the components of the Niaresh principle, and in this architectural style, the construction of the building is symmetrically considered as one of the aesthetic values, and this principle is followed both in the whole building and in the construction of its details (Peyvastehghar et al., 2017: 7). Equilibrium is another component of Niarash, one of the derivatives of the concept of justice, and is seen in works of art, especially architecture (Naderi et al., 2012: 12).

2-1-4. Avoiding non-essentials

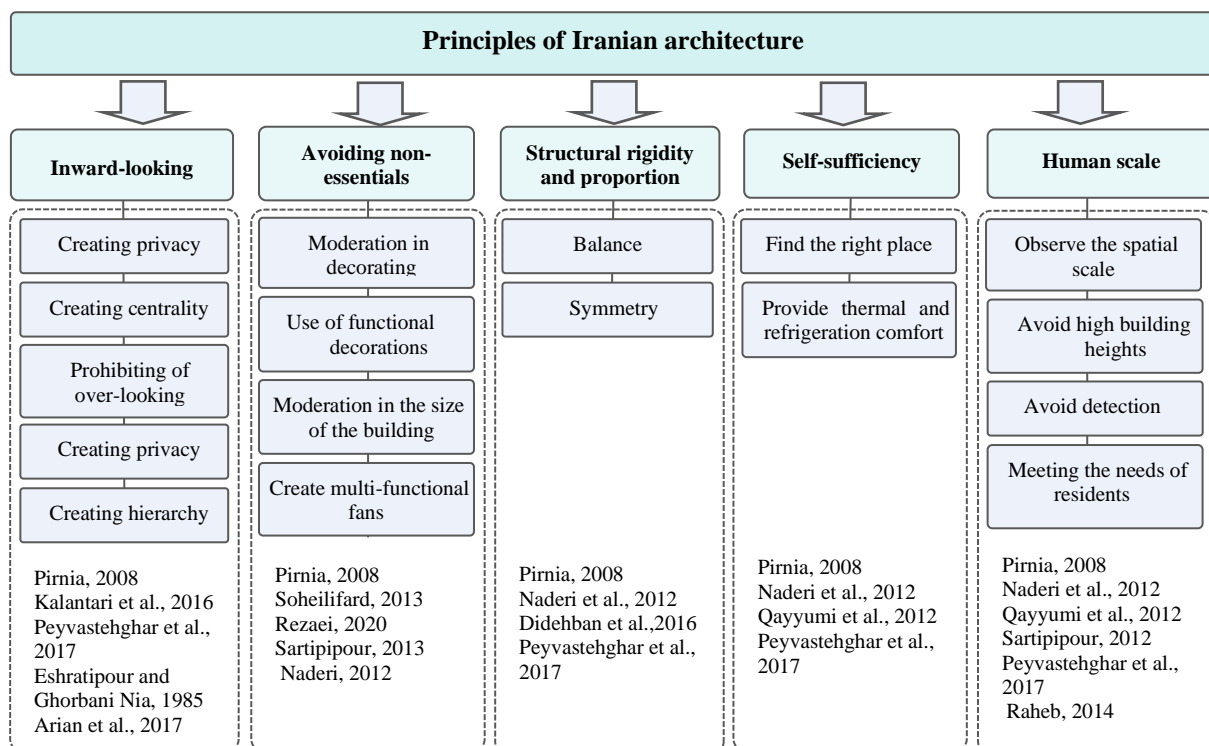
In Iranian architecture, an effort has been made not to do unnecessary and extra work in the construction of the building and to avoid extravagance as much as possible (Pirnia, 2008: 28). Equability in decorations is one of the components of the principle of avoiding non-essentials, and according to it, spending much money on decorations in rooms and unnecessary spaces of the house is not allowed (Rezaei et al., 2020: 3). The use of functional decorations is another component of the principle of avoiding futility, and according to it, the decorative components used in architecture also have a function (Soheilifard, 2013: 10). The word decoration means acts and things that eliminate defects. According to this interpretation, adornment is a truth that does not make a person defective in any of its situations and does not mislead him from knowing the truth (Soheilifard, 2013: 5). Another component of this principle is the creation of multifunctional spaces. One of the characteristics of traditional houses has been the construction of spaces with multiple functions in their spatial organization. These houses were generally built so that several families could live together (Sartipipour, 2013: 10). Equability in the size of the building is another component of the principle of avoiding non-essentials in which moderation and avoidance of excess are considered (Naderi et al., 2012: 13).

2-1-5. Inward-looking

One of the beliefs of the Iranian people is a personal life and its sanctity, which has made Iranian architecture inward-looking (introverted). Iranian architects separated the building from the outside world by arranging the different parts of the building around one or more central courtyards, and only a vestibule connected the two (Pirnia, 2008: 28). Through the introspection of architectural organs and the construction of external walls, the architect made the direct connection of the building with the outside space within the building itself with an element called the yard (Kalantari et al., 2016: 17). Creating privacy is one of the components of the principle of introversion. Privacy in the field of the spatial body is more focused on the principles and laws that form the security of space, and in the field of semantics, it has features that create respect and value for the architectural space (Peyvastehghar et al., 2017: 12). Centralization is another component of this principle. The concept of centrality is rooted in the unity of God, which means that God is the center of time, place, and origin of all existing concepts.

Consequently, the show of unity is manifested in the structure in different ways, one of which is the construction of a central courtyard in the house (Eshratipour and Ghorbaninia, 2015: 3). Another component of this principle is the creation of privacy, in which the privacy of people living in the home is considered (Arian et al., 2017: 8). Creating a spatial hierarchy is one of the components that are effective in forming spatial privacy and pays attention to the separation of spaces inside the house and the hierarchy of access to them (Kalantari et al., 2016: 19). As mentioned, the principles of Iranian architecture were studied from the perspective of researchers, and by reviewing the studies conducted in this field, these principles and their components can be categorized as follows (Table 1).

Table 1: Principles of Iranian architecture



Source: Authors, 2021

3- Research background

In recent years, research has been done in the field of principles of Iranian architecture. For example, Ayvazian, in a study, examines the values of traditional Iranian architecture and states the need to preserve it in contemporary architecture (Ayvazian, 1997). In the book *Stylistics of Iranian Architecture*, Pirnia has studied Iranian architectural styles (Pirnia, 2008). Aminian has analyzed one of the principles of Iranian architecture in a study entitled “Democracy in Architecture” (Aminian, 2013). In another study, Sartipipour et al. studied the architecture of popular houses in the villages of Markazi province (Sartipipour et al., 2013). In another study, Didehban et al. have analyzed privacy as one of the principles of Iranian architecture in the architecture of Dezful houses (Didehban et al., 2017). Peyvastehghar et al. have recognized and analyzed the five principles of Master Pirnia in the architecture of traditional Iranian houses based on Islamic religious sources (Payvastehghar et al., 2017). Besides, in another study, the effect of houses with Iranian-Islamic architectural patterns on creating comfort has been studied (Arian et al., 2017). In a study, Hassani has studied the phenomenology of Qajar houses in Tehran with a focus on the methodology of Van Menen and shows the traditional architect's loyalty to the principles of Iranian architecture in Qajar houses (Hassani,

2020). Nouhi and Nowruzi, in a study, have studied the principles of Iranian architecture in architectural styles (Nouhi and Nowruzi, 2021). As evident in all the mentioned research, the principles of Iranian architecture have not been seen in rural housing in particular. Consequently, in the current study, the principles of Iranian architecture in rural housing have been studied in a case study of Kolamu village in Shahroud, and the manifestation of these principles and their components in the housing models of this village has been studied and analyzed. Iranian and its components are presented for the contemporary housing of the village.

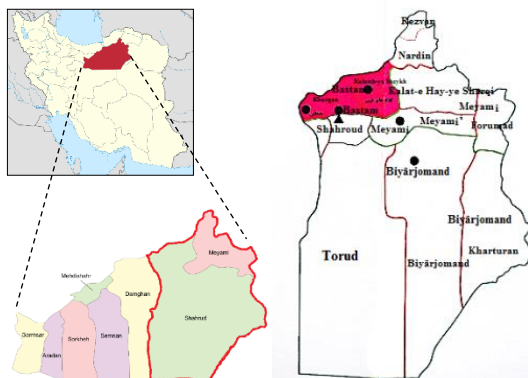
4. Method

This research is applied in terms of purpose and descriptive-analytical in terms of method. To this end, in the first stage, information related to the research background in the field of principles of Iranian architecture has been extracted from library and documentary sources. Then, after analyzing the content, the theoretical framework was determined, then by field study, with the analytical method, the principles of Iranian architecture in the housing of Kolamu village in Shahroud have been studied. To identify the research context, first by field study, four models of rural housing dominant were extracted, and then the principles of Iranian architecture and its components in these dominant models were analyzed. Finally, the model extraction based on these principles for contemporary rural housing was presented.

5. Introducing the scope of research

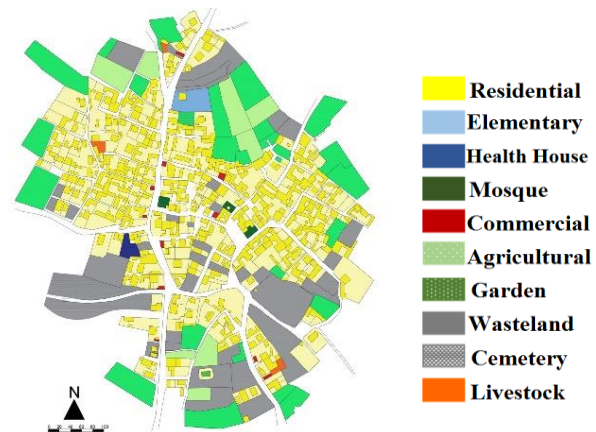
Kolamu is a village in Kharqan rural district, Bastam district of Shahroud city (Semnan province) (Figure 1). This village is located 20 km away from Shahroud city. Good lands, abundant agricultural water, and good weather are the reasons for the formation of the village. The economy of the village is based on agriculture, horticulture, and animal husbandry. This beautiful village with a compact texture is located in a hot and dry climate (Figure 2), and the water it needs is supplied through deep wells drilled in the west of the village (Guide plan, 2014).

Figure 1: Location of Kolamu village in Semnan province and Shahroud city



Source: Authors, 2021

Figure 2: Land use map in the context of Kolamu village



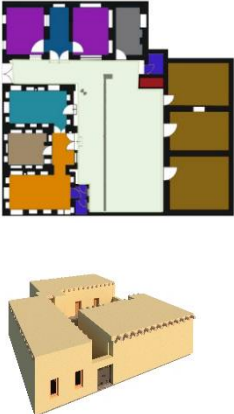
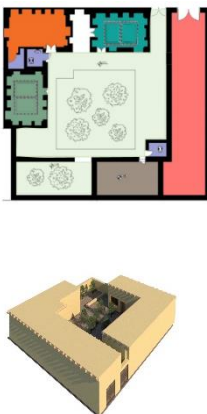
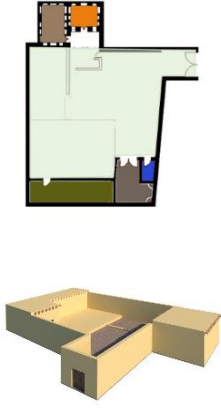
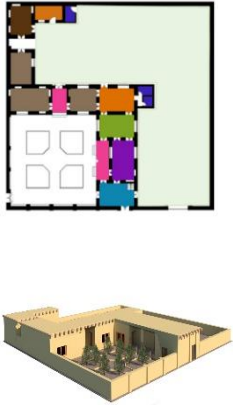
Source: Authors, 2021

6- Analysis of findings

6-1. Study of the principles of Iranian architecture in the housing of Kolamu village

In this research, the first 4 models of the housing dominant in Kolamu village have been extracted with field studies, and then the principles of Iranian architecture in these dominant models have been analyzed. Model 1 is for a 20-year-old house with an area of 313 square meters. The type of livelihood of the family is agriculture and animal husbandry, and the number of people living in it is two people. Model No. 2 is about a 300-year-old house with an area of 363 square meters. The number of people living in it is two families, and their livelihood is agriculture and services (driving). Pattern No. 3 refers to a 150-year-old house with an area of 340 square meters. The family's livelihood is livestock, and the number of people living in it is two people. Pattern No. 4 refers to a 100-year-old house with an area of 300 square meters. The number of people living in that person is three, and their livelihood is gardening (Table 2).

Table 2: Introduction of the general form and micro-spaces of 4 dominant housing models of Kolamu village

| Micro spaces | Pattern No. 1 | Pattern No. 2 | Pattern No. 3 | Pattern No. 4 |
|--|--|--|---|--|
| <ul style="list-style-type: none"> ● Barn ● WC & Bath ● Kitchen ● Room ● Guest room ● Living room or Cistern ● Warehouse ● Living room ● Garage ● Central Yard |  |  |  |  |

Source: Authors, 2021







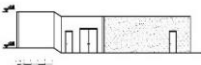
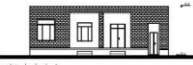




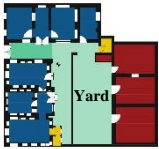



6-2. Human scale

The spatial scale is well observed in the housing patterns of Kolamu village. This is seen in the height proportions of the shelves, ledges, entrances, and doors and can be accessed sitting or standing. The body of the building in Kolamu housing is small and large in proportion to human dimensions. The proportions of micro-spaces in different patterns indicate that the area and shape of micro-spaces (room, porch, yard, barn) are appropriate to the needs of residents. For example, the proportions of the rooms are defined so that it allows the occupants to perform various activities such as sleeping, eating, and sitting. The component of avoiding high heights can be seen in the height of the building as well as the height of the interior spaces. In general, 90% of the houses in Kolamu village are single-story, and the construction of spaces with higher than usual height has been avoided.

Furthermore, in the exterior and interior views of the housing patterns of Kolamu village, avoidance of identification can be seen. The main element of the building in this area is clay, and the general appearance is made entirely of clay, brick, wood, and mud straw, and a certain uniformity and harmony can be seen in the view of the village in terms of materials. The number of rooms, porches, courtyards, and entrances is determined according to the number of households, the needs of the residents, the economy, and the family's livelihood. In fact, according to the livelihood and needs of

residents, residential, livelihood, and service zoning has been formed in micro-spaces to meet the needs of residents well. On average, in Kolamu village patterns, 52% is residential, 35% is the livelihood, and 13% is service. Using multiple yards to separate activities is another solution for the functional zoning of spaces in Kolamu village (Table 3).

Table 3: Demonstration of the principle of human scale in the dominant housing patterns of Kolamu village

| Comp onent | Pattern number 1 | pattern number 2 | Pattern number 3 | Pattern number 4 | Pattern extraction | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|-----------------------------|---|--|--|--|--|-------|-------------|------------|-------------|----------------------|-----|------------|----|----|----|-----|-------------|---|------|---|---|------|---|-----|---|---|---------|---|-----|---|---|------|---|-----|---|---|------------|---|-----|---|---|----|---|-----|---|---|-------|---|------|-----|------|---|-------|-----------|---------|-------|-------|--------|---|------|-----|---|------------|---|------|------|----|---------|---|------|---|---|------|---|-----|---|---|-----------|---|-----|---|---|----|---|-----|---|---|---|-------|-----------|---------|-------|-------|---------|---|------|---|---|------|---|------|---|---|-------------|---|------|---|---|-------------|---|------|---|---|----|---|-----|---|---|---|-------|-----------|---------|-------|-------|------------|---|-----|---|---|--------------------|---|----|---|---|-------------|---|----|---|---|------|---|---|---|---|---------|---|----|---|---|--------------|---|-----|---|---|---------------|---|-----|---|---|------|---|-----|-----|-----|----|---|-----|---|---|---|
| Observe the human scale | <table><tr><th>Space</th><th>C o u n t</th><th>A r e a</th><th>M i n</th><th>M a x</th></tr><tr><td>Split space</td><td>2</td><td>9.7</td><td>4.6</td><td>5.0</td></tr><tr><td>Guest room</td><td>2</td><td>24</td><td>12</td><td>2.5</td></tr><tr><td>Living Room</td><td>1</td><td>14.2</td><td>-</td><td>-</td></tr><tr><td>Room</td><td>1</td><td>8.3</td><td>-</td><td>-</td></tr><tr><td>Kitchen</td><td>1</td><td>4.9</td><td>-</td><td>-</td></tr><tr><td>Bath</td><td>1</td><td>1.2</td><td>-</td><td>-</td></tr><tr><td>Wareho use</td><td>1</td><td>8.9</td><td>-</td><td>-</td></tr><tr><td>WC</td><td>1</td><td>2.2</td><td>-</td><td>-</td></tr><tr><td>Barns</td><td>3</td><td>56.9</td><td>6.2</td><td>22.2</td></tr></table>  | Space | C o u n t | A r e a | M i n | M a x | Split space | 2 | 9.7 | 4.6 | 5.0 | Guest room | 2 | 24 | 12 | 2.5 | Living Room | 1 | 14.2 | - | - | Room | 1 | 8.3 | - | - | Kitchen | 1 | 4.9 | - | - | Bath | 1 | 1.2 | - | - | Wareho use | 1 | 8.9 | - | - | WC | 1 | 2.2 | - | - | Barns | 3 | 56.9 | 6.2 | 22.2 | <table><tr><th>Space</th><th>C o u n t</th><th>A r e a</th><th>M i n</th><th>M a x</th></tr><tr><td>Garage</td><td>2</td><td>44.5</td><td>4.6</td><td>5</td></tr><tr><td>Guest room</td><td>2</td><td>38.3</td><td>15.9</td><td>22</td></tr><tr><td>Kitchen</td><td>1</td><td>19.1</td><td>-</td><td>-</td></tr><tr><td>Bath</td><td>1</td><td>2.5</td><td>-</td><td>-</td></tr><tr><td>Warehouse</td><td>1</td><td>8.9</td><td>-</td><td>-</td></tr><tr><td>WC</td><td>1</td><td>2.5</td><td>-</td><td>-</td></tr></table>  | Space | C o u n t | A r e a | M i n | M a x | Garage | 2 | 44.5 | 4.6 | 5 | Guest room | 2 | 38.3 | 15.9 | 22 | Kitchen | 1 | 19.1 | - | - | Bath | 1 | 2.5 | - | - | Warehouse | 1 | 8.9 | - | - | WC | 1 | 2.5 | - | - | <table><tr><th>Space</th><th>C o u n t</th><th>A r e a</th><th>M i n</th><th>M a x</th></tr><tr><td>Kitchen</td><td>1</td><td>11.8</td><td>-</td><td>-</td></tr><tr><td>Room</td><td>1</td><td>18.7</td><td>-</td><td>-</td></tr><tr><td>Work stable</td><td>1</td><td>37.8</td><td>-</td><td>-</td></tr><tr><td>Sheep Barns</td><td>1</td><td>27.4</td><td>-</td><td>-</td></tr><tr><td>WC</td><td>1</td><td>4.9</td><td>-</td><td>-</td></tr></table>  | Space | C o u n t | A r e a | M i n | M a x | Kitchen | 1 | 11.8 | - | - | Room | 1 | 18.7 | - | - | Work stable | 1 | 37.8 | - | - | Sheep Barns | 1 | 27.4 | - | - | WC | 1 | 4.9 | - | - | <table><tr><th>Space</th><th>C o u n t</th><th>A r e a</th><th>M i n</th><th>M a x</th></tr><tr><td>Guest room</td><td>1</td><td>4.2</td><td>-</td><td>-</td></tr><tr><td>Water storage room</td><td>1</td><td>18</td><td>-</td><td>-</td></tr><tr><td>Living Room</td><td>1</td><td>18</td><td>-</td><td>-</td></tr><tr><td>Bath</td><td>1</td><td>3</td><td>-</td><td>-</td></tr><tr><td>Kitchen</td><td>1</td><td>18</td><td>-</td><td>-</td></tr><tr><td>Chicken barn</td><td>1</td><td>3.1</td><td>-</td><td>-</td></tr><tr><td>Kitchen stove</td><td>1</td><td>8.8</td><td>-</td><td>-</td></tr><tr><td>Room</td><td>3</td><td>9.4</td><td>3.1</td><td>3.2</td></tr><tr><td>WC</td><td>1</td><td>4.5</td><td>-</td><td>-</td></tr></table>  | Space | C o u n t | A r e a | M i n | M a x | Guest room | 1 | 4.2 | - | - | Water storage room | 1 | 18 | - | - | Living Room | 1 | 18 | - | - | Bath | 1 | 3 | - | - | Kitchen | 1 | 18 | - | - | Chicken barn | 1 | 3.1 | - | - | Kitchen stove | 1 | 8.8 | - | - | Room | 3 | 9.4 | 3.1 | 3.2 | WC | 1 | 4.5 | - | - | <p>The average number of rooms in the housing patterns of Kolamu village is at least two rooms.</p> <p>The body of the building in Kolamu housing is small and large in proportion to human dimensions.</p> |
| | Space | C o u n t | A r e a | M i n | M a x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Split space | 2 | 9.7 | 4.6 | 5.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Guest room | 2 | 24 | 12 | 2.5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Living Room | 1 | 14.2 | - | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Room | 1 | 8.3 | - | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Kitchen | 1 | 4.9 | - | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bath | 1 | 1.2 | - | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Wareho use | 1 | 8.9 | - | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| WC | 1 | 2.2 | - | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Barns | 3 | 56.9 | 6.2 | 22.2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Space | C o u n t | A r e a | M i n | M a x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Garage | 2 | 44.5 | 4.6 | 5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Guest room | 2 | 38.3 | 15.9 | 22 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Kitchen | 1 | 19.1 | - | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bath | 1 | 2.5 | - | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Warehouse | 1 | 8.9 | - | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| WC | 1 | 2.5 | - | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Space | C o u n t | A r e a | M i n | M a x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Kitchen | 1 | 11.8 | - | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Room | 1 | 18.7 | - | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Work stable | 1 | 37.8 | - | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Sheep Barns | 1 | 27.4 | - | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| WC | 1 | 4.9 | - | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Space | C o u n t | A r e a | M i n | M a x | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Guest room | 1 | 4.2 | - | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Water storage room | 1 | 18 | - | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Living Room | 1 | 18 | - | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bath | 1 | 3 | - | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Kitchen | 1 | 18 | - | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Chicken barn | 1 | 3.1 | - | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Kitchen stove | 1 | 8.8 | - | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Room | 3 | 9.4 | 3.1 | 3.2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| WC | 1 | 4.5 | - | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Avoid high elevation |  <p>West view</p> |  <p>South view</p> |  <p>North view</p> |  <p>East view</p> | <p>90% of the houses in Kolamu village are one-story.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Avoiding identification |  |  |  |  | <p>The general appearance of the village houses, far from any individuality, is made entirely of clay, brick, wood, and mud straw.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Meet the needs of residents |  |  |  |  | <p>Average</p> <table><tr><th>Space</th><th>Services</th><th>Livelihood</th><th>Residential</th></tr><tr><td>Occupancy percentage</td><td>13</td><td>35</td><td>52</td></tr></table> | Space | Services | Livelihood | Residential | Occupancy percentage | 13 | 35 | 52 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Space | Services | Livelihood | Residential | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Occupancy percentage | 13 | 35 | 52 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

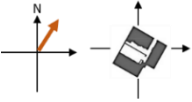
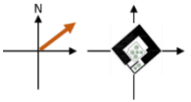
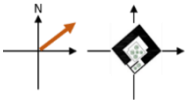
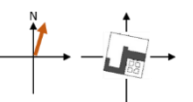
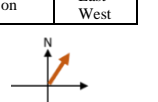
Source: Authors, 2021

6-3. Self-sufficiency

Rural architecture is spontaneous and loyal to nature and is affected by geographical, social, economic, and cultural factors. In choosing the location of the village, the best places to build a house were considered in terms of geographical location and the amount of access to vernacular materials. In constructing buildings in most rural areas, the principle was to use the construction materials that exist in the surrounding nature. Knowing the geographical factors, the villagers, especially in recognizing the materials, used the vernacular material that was related and in accordance with the climate and geography of each region. They knew how to use the native materials to optimize energy consumption in the climate. This is also well seen in the village of Kolamu. The materials used in the prominent

patterns of this village are environmentally friendly, and more materials such as wood, thatch, clay, and lime have been used. Of course, in today's attachments, new materials such as cement can also be seen. In general, houses are stretched almost east-west to have the best light. Similarly, the mass of the building has an average rotation of 29.5 degrees relative to the northern sign, and this shows that in the construction of houses in this village, the issue of providing light, heat, and in general, thermal factors have been considered (Table 4).

Table 4: Representation of the principle of self-sufficiency in the prominent housing models of Kolamu village



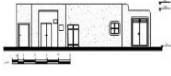

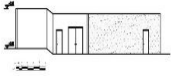

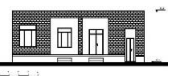

| Component | Pattern number 1 | Pattern number 2 | Pattern number 3 | Pattern number 4 | Pattern extraction | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---------------------------|---|-------------------------|------------------|------------------|--------------------|------------|-----------|--|-------------------|----------------|---------------|-----------|------------|-------------|---|-------------------|-----------------|---------------|-----------|------------|-----------|--|-------------------|-------|---------------|-----------|------------|-----------|--|---------|--------|-------------------|---------------------|--|------------|------------|------------------|---------|------|--------|-----------------|---|------------|---|---|---|-------------|--------|-----------------|------|------|--------|-----------------|------|-------|---|---|---|---------|--------|-----------------|------|----|------|------|--------|--|-------|-------|------|---------|------|-----------------|-------------------------|---|------------|---|---|---|-------------|------|------|------|------|------|--------|------|-------|---|---|---|---------|--------|------|------|----|--------|--------|--------|---|-------|-------|------|---------|------|--------|-------------------------|---|------------|---|---|---|-------------|--------|-------------------|------|------|--------|-------------------|------|-------|-----------------|-------------------|------|---------|--------|-------------------|------|----|------|------|------|--|
| Find the right place | <table><tr><td>Building lighting</td><td>South and East</td></tr><tr><td>Rotation rate</td><td>28.2 degree</td></tr><tr><td>Elongation</td><td>East-West</td></tr></table>  | Building lighting | South and East | Rotation rate | 28.2 degree | Elongation | East-West | <table><tr><td>Building lighting</td><td>North and East</td></tr><tr><td>Rotation rate</td><td>49 degree</td></tr><tr><td>Elongation</td><td>East-West</td></tr></table>  | Building lighting | North and East | Rotation rate | 49 degree | Elongation | East-West | <table><tr><td>Building lighting</td><td>South and North</td></tr><tr><td>Rotation rate</td><td>30 degree</td></tr><tr><td>Elongation</td><td>West-East</td></tr></table>  | Building lighting | South and North | Rotation rate | 30 degree | Elongation | West-East | <table><tr><td>Building lighting</td><td>South</td></tr><tr><td>Rotation rate</td><td>11 degree</td></tr><tr><td>Elongation</td><td>East-West</td></tr></table>  | Building lighting | South | Rotation rate | 11 degree | Elongation | East-West | <table><tr><td colspan="2">Average</td></tr><tr><td>Building lighting</td><td>From all directions</td></tr><tr><td>Rotation rate</td><td>29.5° East</td></tr><tr><td>Elongation</td><td>Mostly East-West</td></tr></table>  | Average | | Building lighting | From all directions | Rotation rate | 29.5° East | Elongation | Mostly East-West | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Building lighting | South and East | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Rotation rate | 28.2 degree | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Elongation | East-West | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Building lighting | North and East | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Rotation rate | 49 degree | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Elongation | East-West | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Building lighting | South and North | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Rotation rate | 30 degree | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Elongation | West-East | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Building lighting | South | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Rotation rate | 11 degree | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Elongation | East-West | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Average | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Building lighting | From all directions | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Rotation rate | 29.5° East | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Elongation | Mostly East-West | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Providing thermal comfort | <table><tr><td>Space</td><td>Floor</td><td>Wall</td><td>Ceiling</td></tr><tr><td>Yard</td><td>Cement</td><td>Cement and brick</td><td>-</td></tr><tr><td>Stair case</td><td>-</td><td>-</td><td>-</td></tr><tr><td>Living room</td><td>Cement</td><td>Lime</td><td>Wood</td></tr><tr><td>Room</td><td>Cement</td><td>Lime</td><td>Wood</td></tr><tr><td>Porch</td><td>-</td><td>-</td><td>-</td></tr><tr><td>Kitchen</td><td>Cement</td><td>Lime</td><td>-</td></tr><tr><td>WC</td><td>Cement</td><td>Cement</td><td>Cement</td></tr></table> | Space | Floor | Wall | Ceiling | Yard | Cement | Cement and brick | - | Stair case | - | - | - | Living room | Cement | Lime | Wood | Room | Cement | Lime | Wood | Porch | - | - | - | Kitchen | Cement | Lime | - | WC | Cement | Cement | Cement | <table><tr><td>Space</td><td>Floor</td><td>Wall</td><td>Ceiling</td></tr><tr><td>Yard</td><td>Mosaic</td><td>Clay and thatch</td><td>-</td></tr><tr><td>Stair case</td><td>-</td><td>-</td><td>-</td></tr><tr><td>Living room</td><td>Mosaic</td><td>Clay and thatch</td><td>Wood</td></tr><tr><td>Room</td><td>Mosaic</td><td>Clay and thatch</td><td>Wood</td></tr><tr><td>Porch</td><td>-</td><td>-</td><td>-</td></tr><tr><td>Kitchen</td><td>Mosaic</td><td>Clay and thatch</td><td>Wood</td></tr><tr><td>WC</td><td>Tile</td><td>Tile</td><td>Thatch</td></tr></table> | Space | Floor | Wall | Ceiling | Yard | Mosaic | Clay and thatch | - | Stair case | - | - | - | Living room | Mosaic | Clay and thatch | Wood | Room | Mosaic | Clay and thatch | Wood | Porch | - | - | - | Kitchen | Mosaic | Clay and thatch | Wood | WC | Tile | Tile | Thatch | <table><tr><td>Space</td><td>Floor</td><td>Wall</td><td>Ceiling</td></tr><tr><td>Yard</td><td>Soil and mosaic</td><td>Clay, thatch, and brick</td><td>-</td></tr><tr><td>Stair case</td><td>-</td><td>-</td><td>-</td></tr><tr><td>Living room</td><td>Lime</td><td>Lime</td><td>Wood</td></tr><tr><td>Room</td><td>Lime</td><td>Cement</td><td>Wood</td></tr><tr><td>Porch</td><td>-</td><td>-</td><td>-</td></tr><tr><td>Kitchen</td><td>Cement</td><td>Lime</td><td>Wood</td></tr><tr><td>WC</td><td>Cement</td><td>Cement</td><td>Cement</td></tr></table> | Space | Floor | Wall | Ceiling | Yard | Soil and mosaic | Clay, thatch, and brick | - | Stair case | - | - | - | Living room | Lime | Lime | Wood | Room | Lime | Cement | Wood | Porch | - | - | - | Kitchen | Cement | Lime | Wood | WC | Cement | Cement | Cement | <table><tr><td>Space</td><td>Floor</td><td>Wall</td><td>Ceiling</td></tr><tr><td>Yard</td><td>Mosaic</td><td>Clay, thatch, and brick</td><td>-</td></tr><tr><td>Stair case</td><td>-</td><td>-</td><td>-</td></tr><tr><td>Living room</td><td>Cement</td><td>Plaster and paint</td><td>Wood</td></tr><tr><td>Room</td><td>Cement</td><td>Plaster and paint</td><td>Wood</td></tr><tr><td>Porch</td><td>Cement and clay</td><td>Plaster and paint</td><td>Wood</td></tr><tr><td>Kitchen</td><td>Cement</td><td>Plaster and paint</td><td>Wood</td></tr><tr><td>WC</td><td>Tile</td><td>Tile</td><td>Tile</td></tr></table> | Space | Floor | Wall | Ceiling | Yard | Mosaic | Clay, thatch, and brick | - | Stair case | - | - | - | Living room | Cement | Plaster and paint | Wood | Room | Cement | Plaster and paint | Wood | Porch | Cement and clay | Plaster and paint | Wood | Kitchen | Cement | Plaster and paint | Wood | WC | Tile | Tile | Tile | The materials used are environmentally friendly, and materials such as wood, clay, thatch, and lime have been used more. |
| Space | Floor | Wall | Ceiling | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Yard | Cement | Cement and brick | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Stair case | - | - | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Living room | Cement | Lime | Wood | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Room | Cement | Lime | Wood | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Porch | - | - | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Kitchen | Cement | Lime | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| WC | Cement | Cement | Cement | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Space | Floor | Wall | Ceiling | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Yard | Mosaic | Clay and thatch | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Stair case | - | - | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Living room | Mosaic | Clay and thatch | Wood | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Room | Mosaic | Clay and thatch | Wood | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Porch | - | - | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Kitchen | Mosaic | Clay and thatch | Wood | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| WC | Tile | Tile | Thatch | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Space | Floor | Wall | Ceiling | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Yard | Soil and mosaic | Clay, thatch, and brick | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Stair case | - | - | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Living room | Lime | Lime | Wood | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Room | Lime | Cement | Wood | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Porch | - | - | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Kitchen | Cement | Lime | Wood | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| WC | Cement | Cement | Cement | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Space | Floor | Wall | Ceiling | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Yard | Mosaic | Clay, thatch, and brick | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Stair case | - | - | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Living room | Cement | Plaster and paint | Wood | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Room | Cement | Plaster and paint | Wood | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Porch | Cement and clay | Plaster and paint | Wood | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Kitchen | Cement | Plaster and paint | Wood | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| WC | Tile | Tile | Tile | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Source: Authors, 2021

6-4. Structural rigidity and proportion

The facades are relatively symmetrical in the dominant housing patterns of Kolamu village, and in terms of the number of openings and the amount of use of each type of material, the facades are balanced. The rate of filling and emptying of the plan indicates the balance in the level of occupancy of the building in which the area of different areas, according to the needs of individuals, is balanced and appropriate (Table 5).

Table 5: Representation of the principle of Structural rigidity and proportion in the dominant housing models of Kolamu village









| Component | Pattern number 1 | Pattern number 2 | Pattern number 3 | Pattern number 4 | Pattern extraction |
|----------------------|---|---|---|---|--|
| Balance and symmetry |  <p>Openings make up 32% of the main façade surface.</p>  |  <p>Openings make up 21% of the main façade surface.</p>  |  <p>Openings make up 11% of the main façade surface.</p>  |  <p>Openings make up 17% of the main façade surface.</p>  | <p>Balance is seen in the number of openings and the number of façade materials. On average, openings make up 20% of the main façade surface. There is also a balance in the rate at which the plan is emptied</p> |






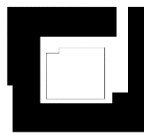
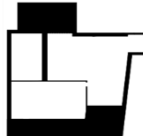


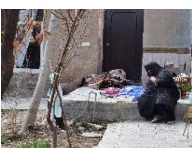


Source: Authors, 2021

6-5. Avoiding non-essentials

In decorating the dominant patterns of the housing of Kolamu village, the simplest type of decorations has been used in a balanced way. The plasterwork around the niches is an example of this decoration. In addition to beauty, functional decorations in Kolamu village also have a special function. For example, in addition to structure and support, the beam ceilings also decorate the interior spaces. In addition to beauty, ledges and shelves have a significant function in the furniture of rural houses. Village handicrafts (felt, kilim and needlework) and beauty have a role as a cover for the floor and walls. Likewise, the size of the building is defined regarding users' needs, and moderation in the size of the building is well seen in proportion to the full and empty space of the plan. Averagely, 53% of the land is filled space, and 46% is space and yard. The existence of multi-functional spaces is one of the influential components of Kolamu village houses. In the micro-spaces of the room, porch, and yard, various activities (eating, sleeping, daily chores, cooking, talking and interacting, drying fruit) can be seen day and night. Similarly, these houses were generally built so that several families could live together (Table 6).

Table 6: Representation of the principle of avoiding non-essentials in the dominant housing patterns of Kolamu village

| Component | Pattern number 1 | Pattern number 2 | Pattern number 3 | Pattern number 4 | Pattern extraction |
|-------------------------------|---|---|---|--|---|
| Moderation in decorating |  |  |  |  | <p>Plastering around niches is the simplest type of decoration that is used in a balanced way. Niches, shelves, roof beams, and handicrafts are among the functional decorations of this village.</p> |
| Use of functional decorations |  |  |  |  | |

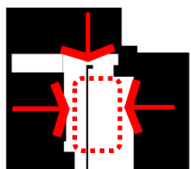
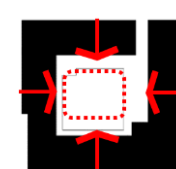
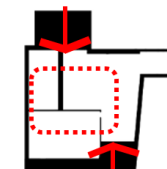
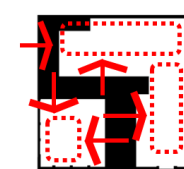
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| |  |  |  |  | |
| Moderation in the vastness of space |  Full space: 72% Empty space: 28% |  Full space: 70% Empty space: 30% |  Full space: 45% Empty space: 55% |  Full space: 25% Empty space: 75% | Average Full space: 53% Empty space: 47% |
| Create a multifunctional space |  Sleep and rest |  Washing dishes and cooking |  Sitting and talking |  Planting trees and vegetables | The micro-spaces of the room, porch, and courtyard are multi-functional, and various activities can be seen in them. |

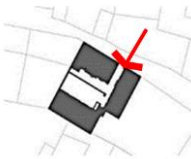
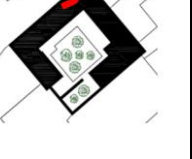
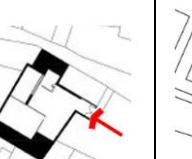
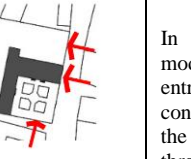
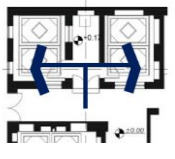

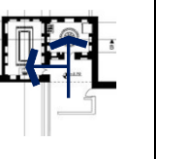
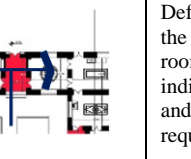


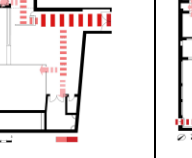
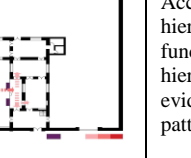
Source: Authors, 2021

6-6. Inward-looking

The houses of Kolamu village are introverted, and the spaces are formed around the yard, which has created centrality and privacy. In some models (such as model 4), the separation of the house into two parts, inner and outer, with two separate courtyards, has increased the privacy of the private space. In most models, the entrance connects to the courtyard through the corridor, and the direction of the entrance is such that it does not have a direct view of private spaces and has prevented the over-looking. In the patterns for entering private rooms, the entrance is defined, and it is not possible to enter the rooms directly to provide the required privacy. The visual hierarchy in the patterns is well observed, and first open spaces and then closed spaces through semi-open spaces are accessed. Likewise, the functional hierarchy has been created with appropriate public and private spaces (Table 7).

Table 7: Representation of the principle of inward-looking in the dominant housing patterns of Kolamu village

| Component | Pattern number 1 | Pattern number 2 | Pattern number 3 | Pattern number 4 | Pattern extraction |
|------------------------|---|---|---|---|--|
| Privacy and centrality |  |  |  |  | The establishment of spaces around the yard has formed and created privacy and centrality. |

| | | | | | |
|----------------------------|--|--|---|--|---|
| Prohibition of overlooking |  |  |  |  | In most models, the entrance is connected to the courtyard through the corridor, and the direction of the entrance is such that it does not have a direct view of private spaces. |
| Create privacy |  |  |  |  | Definition of the entrance to rooms for indirect entry and privacy required. |
| Create a spatial hierarchy |  |  |  |  | Access hierarchy and functional hierarchy are evident in the patterns. |

Source: Authors, 2021

7. Conclusion

As mentioned, the principles of Iranian architecture are rooted in the fabric of culture and civilization of this land and have been used to construct buildings for a long time. From the researchers' perspective, the principles of Iranian architecture and its components include five principles of human scale (observance of human scale, avoidance of high building height, avoidance of individuality, meeting the needs of residents), self-sufficiency (finding a suitable place, providing thermal comfort), structural rigidity and proportion, (balance and symmetry) avoiding non-essentials (moderation in decorations, use of functional decorations, moderation in the size of the building and creating multifunctional spaces) and inward-looking (creating privacy, creating centrality, forbidding aristocracy, creating privacy, creating spatial hierarchy). In the past, rural housing has also benefited from these principles. However, extensive social and economic changes have created changes in the pattern of rural housing architecture, and in today's rural architecture, less attention has been paid to the principles of Iranian architecture. In the meantime, the architecture of the old rural housing has valuable criteria and indicators that can be identified, analyzed, and used to design a new housing model. Consequently, in this research, the principles of Iranian architecture in rural housing (a case study of Kolamu village in Shahroud) have been studied.

The results reveal that the dominant housing models of Kolamu village are in accordance with the principles of Iranian architecture, and in all models, a manifestation of these principles and their components can be seen. In the principle of human scale, the component of avoiding identifying and meeting the needs of residents and in principle avoiding non-essentials, the component of moderation in decorations and moderation in the size of the building and in the principle of inward-looking, the

component of forbidding over-looking and creating privacy have been paid special attention. The results also showed that the body of dominant housing models in Kolamu village on a micro and macro scale is appropriate to human dimensions, and the use of multiple yards to separate activities is another solution for functional zoning of spaces in Kolamu village. The use of environmentally friendly materials in the dominant housing models of this village and adapting to the village climate has created a good unity and coordination in terms of the texture of the village. Likewise, the results of the analyzes indicate that in most models of the housing, the entrance is connected to the courtyard through the corridor and the direction of the entrance is such that it does not have a direct view of private spaces and has prevented the over-looking. In most of the housing models of this village, pre-entrance is defined for entering private rooms, and it is not possible to enter the rooms directly to provide the privacy required for private rooms.

In the research, pattern extraction based on the principles of Iranian architecture and its components were presented. The results of this study can be used as practical suggestions in the modern housing of Kolamu village. Since the pattern is derived from the life, culture, and needs of Kolamu village residents and adapt to climatic conditions, biological and rural lifestyle, it can also be effective in promoting a sense of belonging and reviving the rural lifestyle.

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Architectural engineering students of Shahroud University of Technology (Leila Omidi, Fatemeh Zafari, Zeinab Toosinejad, Zohreh Ghadimi, and Mahmoud Darabi) are thanked for their efforts in field information collection and preparation of texture and housing maps of Kolamu village.

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