Understanding Aceh's contemporary architecture: Neuheun Mandiri Housing, in the hills of Aceh Besar coastal village

C Nursaniah1*, I Machdar2, Azmeri3, A Munir4

1 Engineering Science Doctoral Study Program, Postgraduate Program, University Syiah Kuala, Banda Aceh, 23111, Indonesia
2 Chemical Engineering Department, Engineering Faculty, University Syia Kuala
3 Civil Engineering Department, Engineering Faculty, University Syiah Kuala,
4 Department of Architecture and Planning, Faculty of Engineering, University of Syiah Kuala, Darussalam, Banda Aceh 2311, Indonesia.

*Email: cutnursaniah@unsyah.ac.id

Abstract. This paper attempts to examine the uniqueness of architectural culture to show that through regionalism, Acehnese architecture can still be built by saving and adapting regional conceptions of culture and nature. In the design and construction of housing in Aceh today, the territorial approach is rarely considered due to the dominance of universal architectural trends that spread through globalization. The process of building the Neuheun Mandiri housing includes an astute attitude in dealing with the currents of modernity by reinterpreting the architecture of the past to be updated, and making modifications to suit the current environmental conditions. This paper aims to interpret the vernacular aspects of Aceh in the modernity of the housing development of Neuheun Mandiri in the hills of a coastal village, Aceh Besar, where the locality aspect is shown through the building mass pattern, traditional material approaches, and construction techniques.

1. Introduction
The development of architecture in the world is always influenced by the times. Globalization has resulted in the loss of specialties and turned them into a way of life that pushes aside geographical boundaries. Currently, the regional approach is rarely seen in the construction of housing complexes, due to the dominance of universal architectural trends that spread through globalization. For developing countries, westernization is considered an advanced concept so many housing projects imitate it.

Globalization changes the concept of various environmental knowledge into a universal world culture to the point where the achievements of local historical architecture become backward, insignificant, and meaningless. Traditional construction materials and techniques are also being replaced by mass-produced materials and industrial construction techniques. This phenomenon is often followed by the emergence of various environmental problems, because the development approach is not rooted in the local context. This misunderstanding and naive perception results in a housing typology that is very unsuccessful, because it does not take into account the climate, culture and lifestyle of users and their energy consumption. Globalization that poses challenges, as well as the loss...
of cultural identity has motivated contemporary interest in vernacular architecture [1], providing simple solutions and lessons from vernacular architecture that help build more resilient residential accommodation for a rapidly growing population.

The process of building the Neuheun Mandiri housing includes an astute attitude in dealing with the currents of modernity by reinterpreting the architecture of the past to be updated, and making modifications to suit the current environmental conditions. This paper aims to interpret the vernacular aspects of Aceh in the modernity of the housing development of Neuheun Mandiri in the hills of a coastal village, Aceh Besar, where the locality aspect is shown through the arrangement of building masses, traditional material approaches, and construction techniques. Two important things of vernacular architecture are resources for contemporary architecture, namely deep respect and perfect communion with the natural environment, perfect relationship and understanding of user needs [2].

Three important things in regionalism that must be considered are "Identity, Critical Attitude and the Essence of Place" as a feature in the architectural design so that it is easily recognizable [3]. The locality value is the basis for showing a unique architectural identity, while sustainability is an important part of Identity in the realm of regionalism architecture [4]. There are no barriers to bringing back (through modification) various elements and components of vernacular architecture in the new design to show identity [5]. Meanwhile, locality refers to values to maintain harmony with nature, cultural, social and economic values, so that architecture is sustainable between generations [6]. Contemporary and vernacular architecture is connected to a unified system, if not applied many setbacks in social consequences occur such as poverty and social destruction, environmental consequences as a non-thermal comfortable place to live, and the local economic crisis [7]. The approach is to build with minimal impact on the natural environment by integrating the built-environment and its systems with the ecological systems of the area and where possible, make a positive contribution to the ecological and energy productivity of the site [8].

The concept of housing reconstruction aims to return disaster-affected communities to their pre-disaster conditions while planning to minimize their exposure to future disasters. Understanding user needs based on regional, cultural and social norms, flexibility to local climatic conditions, affordability of housing, are some of the variables that determine the success of any proposed residence [9]. To overcome climate problems, exploration of vernacular architecture is needed because it affects energy efficiency and construction costs in buildings [10]. To produce a completely new and unique facade solution, it is done by applying vernacular principles through harmonization of contemporary vernacular building envelope concepts and technological solutions [11].

2. Materials and methods

2.1. Samples
The research was conducted qualitatively with the aim of understanding the application of contemporary vernacular architectural principles in the construction of the Nurani Mandiri housing which was built in the hills of the coastal village of Aceh Besar. This is a relocation housing for victims of the Aceh earthquake and tsunami, as shown in figure 1. Data collection used the field observation method by observing, taking photos, and interviewing the owner. Theory becomes a parameter for testing the data.

Figure 1. Study location.
2.2. Theory for analysis
As a theoretical basis that will strengthen this research is the theory of locality or locality which was coined by Josef Prijotomo, which is used as a tool to conduct analysis and synthesis to obtain architectural identity. Hidayatun et al [3] mention, Locality is a "difference" that is spatially formed from where the locality grows and or is grown. The criteria for locality or locality values are:
1. Locality is not synonymous with history, or copying a construction of the past, but how we must try to understand and understand it and then respond to it critically and or use it cleverly so as to produce a new creation with a local soul that has high value.
2. Locality is how to see a place that should have a special/personal touch for a hidden uniqueness/beauty.
3. Locality in its development must be able to demonstrate sustainability, especially in terms of materials and technology, so that sustainable results are obtained.
4. Locality must be able to show how the relationship between form and values and ways of modification, reinterpretation and integration in architecture.

Theoretical assessment aims to find and describe the similarities and congruence between the conceptions of the correlations between natural, social, and cultural contexts. The analysis process is carried out through descriptive and logical arguments, by taking factors and phenomena that appear to be different, but form connections.

3. Results and discussion
The relocation housing for Neuheun Mandiri was built in the hills by the NGO Nurani Mandiri, for tsunami victims who previously lived close to the sea. This stilt house building was built using conventional techniques in the hills of Neuheun Village on the north coast of Aceh to relocate the victims who had lost their homes. We should appreciate what the donors did in designing this housing, because it applies the local context as a reflection of the culture, resources, and experiences of the community.

Based on locality criteria, it is concluded that the study of locality theory on objects is inseparable from a sustainable architectural design strategy which has three important factors, namely the socio-cultural, economic and environmental context, with due regard to standardization and industrialization of materials and structures supported by the building industry.

3.1. Socio-cultural factors
The form of the housing unit follows the concept of an aceh vernacular house (transformation of rumoh aceh) with a stage construction and a gable roof. The standard plan of the housing unit and the appearance of the building is shown in figure 2.

![Figure 2. Plan and building view.](image-url)
The classification of space consists of the under zone and the stage zone. In the stage zone there are bedrooms, living rooms, and balconies. In the zone under there is a kitchen, and a service room. While the open part can be used as a public space. Columns are made of reinforced concrete in the zone under the dimensions of 20cm x 20cm, while the wood in the stage zone has dimensions of 15cm x 15cm.

The building design is a transformation of the aceh vernacular architecture with a gable roof and parallel floors. Essentially adopting space zoning in rumoh aceh, although there is no difference in floor height on the stage floor. The balcony room is identical to the room to receive male guests at rumoh aceh. The position of the bedroom in rumoh aceh is higher, but it is not adopted in this design. The family room is identical to the foyer for women in rumoh aceh. The under zone is identical to the concept of rumoh aceh as a service area and a public area. This discussion shows that the zoning and placement of spaces in rumoh aceh are still appropriate to be applied to the design for the current dwelling as a sustainable design.

Identical to residential arrangements in traditional Acehnese villages, the concept of mass arrangement with a cluster pattern in this housing has formed a common yard that can be used by every resident in the cluster if there are events that bring many guests, such as weddings, maulid Nabi, and other public activities, shown in figure 3.

![Figure 3](image)

**Figure 3.** Each cluster has a shared space as an effect of the cluster concept.

This housing layout consists of basic spaces needed by the community, and is in accordance with the culture of life of the Acehnese. This design creates a sustainable place that supports well-being, by understanding what people need from where they live and work. Physical design collaboration with social infrastructure design is carried out to support social and cultural life, social facilities, civic engagement systems, and spaces for people and places to thrive.

### 3.2 Environmentally responsive design

The geographical character of the land in the form of hilly land with fairly dynamic contours, is understood as an opportunity offered by nature. This natural condition forms a pattern of housing that is arranged to form clusters, adopting small mass groups and separate from each other. Each cluster consists of five housing units, consisting of ten clusters arranged according to the topography of the land.

An important characteristic of the Neuheun housing is the "pattern of arrangement that blends naturally with the environment", as an expression of respect for nature which has provided building materials, medicine, and food. This reminds us of the arrangement of Aceh's vernacular houses in a tropical rain forest environment as a provider. The main building materials for houses, such as wood, bamboo, and roofing leaves, these natural materials are useful for making houses seem to blend with their environment, and produce environmentally friendly architectural constructions that are energy efficient.

Given the hot-humid climate and the lack of air conditioning in rural areas of Aceh, thermal comfort in the house is sought through the design of house structures that respond adequately to the environment, namely by utilizing wind patterns, controlling heat gain, and providing adequate
ventilation. To minimize the amount of surface that receives solar radiation, the position of the house also extends west-east like the Aceh vernacular house so that the longest side faces north-south.

Vernacular buildings also incorporate protective measures to prevent damage to vulnerable parts of internal and external building elements. With this aim, the design of this housing analyzes the potential for strong winds from the Asian continent through the vast Andaman Sea which have the potential to damage buildings. Due to the destructive effects of sea breezes over time, the facade of the house is constructed with concrete materials, while most of the rest is wood. This description is clearly illustrated in figure 4.

![Figure 4. Housing position on geographical environment.](image)

The arrangement of the cluster-patterned building mass on the site is such that it forms a strong, non-frontal flow of sea breezes towards the building, and slows the flow of wind that enters the settlements. The position of the mass of buildings that are separated from each other provides an opportunity for wind flow to spread throughout the residential area, entering and passing through each building removing hot air, shown in figure 5.

![Figure 5. The position of the cluster patterned mass consists of five housing units.](image)

For additional ventilation, the house is elevated on stilts. In principle, this design takes advantage of the fact that the wind over the leaves moves at a higher speed. This stilt house is also a response to the natural flow of rainwater. The gable type roof efficiently forms ventilation in the roof space to isolate heat from the space below. This stilt house may be successful in answering the problem of thermal comfort for its residents. The indicators of thermal comfort (humidity, temperature, wind speed) of most stilt houses have results that meet the standard. Porous wood walls and nako windows allow air to enter and circulate well, moving freely in the space.

To build the housing, aid providers have studied environmental conditions and topographical constraints to align with the natural potential. Due to the geographical conditions and hot coastal climate, they built a single mass unit of stilt houses with conventional construction to meet all
community needs and provide a sense of comfort and safety. The construction process uses natural resources and materials that are easily accessible in the surrounding environment, both wood and factory production materials. They do this through an excellent process of evaluating climatic conditions and mastering techniques for adapting to natural disasters. Figure 6 shows how the house is placed among nature, with nature providing the necessary protection for humans.

![Figure 6. The close relationship between home and nature.](image)

Figure 7 shows that the house construction technique is concrete on the ground floor and wood on the upper floor. Due to the humid climatic conditions, the wooden parts of the building are protected from the ground (the Acehnese vernacular houses are also the same). The concrete used in the lower floors is also a very suitable material for buildings erected on sloping areas.

The concept of a stilt house with reinforced concrete columns at the bottom and a wooden construction at the top is a lightweight construction that was chosen as a response to the contoured tread. The brick walls together with the concrete columns form the lower support structure. The upper building is dominated by the use of wooden walls, floor construction of wooden planks, and glass windows to achieve a light impression, as a response to earthquakes and contoured land. The floor beams also use a lightweight construction system in the form of wooden planks of size 3/15. This system allows the building to breathe because it has cavities. Good quality wood, durable and brings a warm element.

![Figure 7. Structural systems and construction of stilt houses to respond to natural conditions and forms of disaster mitigation.](image)

3.3. Affordable technology

Building materials other than wood that have been used by the community from time to time can be referred to as traditional materials, such as cement, concrete, mass-produced concrete blocks, mass-produced clay bricks, zinc, and asbestos. Its use can be limited but does not limit the development of regional architecture. Then, the locality aspect is shown by constructing the building using a combination of traditional and conventional construction techniques.

There are advantages and disadvantages to discussing and implementing residential building safety codes. Its application will limit the scope of locality as building codes generally favor the primary use of industrial materials. In this case, fire resistance requirements limit the use of naturally processed wood, leaf roofs, and bamboo for contemporary vernacular architectural construction.

The basic concept of planning related to the locality aspect concerns the potential, natural and human resources, as well as the availability of local materials so that it influences decisions on the use of materials in the completion of structures and constructions. The virtue in this contemporary
vernacular architectural design is to base architectural production on the use of new and local traditional materials, local craftsmanship, and intermediate/conventional and combined construction technologies.

4. Conclusions
This housing development has at least attempted to produce an architecture that is responsive to time and at the same time appreciate the historical, cultural, and physical context. Also, produce harmonization of local identity by developing designs that lead to regional socio-cultural, local building materials, and construction techniques. The simple construction design is better able to respond to the tropical climate as happened in Neuheun Village, it is economically affordable to build.

As a building in a humid tropical climate it is very important to control sunlight and ventilation. The varying building heights in this residential neighborhood provide the greatest environmental benefits from shade, reflected light and ventilation.

The most important factors that shape the architectural design of the stilt houses in the Neuheun housing estate are the natural, economic, and socio-cultural conditions of the Acehnese people. Neuheun housing which shows the integration of the concept of vernacular architecture and sustainability today can be used as an example and is considered an open exhibition.

The use of new traditional materials or mass-produced local materials can be limited, but not limited to the development of regional architecture. The locality aspect can be applied by assembling buildings using traditional (knockdown) or intermediate construction techniques or a combination of both.

References
[1] M. Vellinga and L. Asquith, 2006, Vernacular Architecture in the 21st Century: Theory, Education and Practice, http://dx.doi.org/10.4324/9780203003862.
[2] E. Creangă, I. Ciotoiu, D. Gheorghiu, and G. Nash, 2010, Vernacular Architecture As A Model For Contemporary Design, WIT Press. Doi: 10.2495/ARC100141.
[3] M. Hidayatun, J. Prijotomo, M. Rachmawati, M, 2014, Arsitektur Nusantara sebagai Dasar Pembentuk Regionalisme Arsitektur Indonesia, Seminar Rumah Tradisional 2014: Transformasi Nilai-nilai Tradisional dalam Arsitektur Masa Kini, Lombok.)
[4] M. Hidayatun, J. Prijotomo, M. Rachmawati, Sustainability is Important Part of the Identity in The Dimension of Regionalism Architecture, [Online]. Available: https://www.researchgate.net/publication/277654604.
[5] J. Prijotomo, 1988, Pasang Surut Arsitektur Indonesia, CV Arjun, Surabaya.
[6] G. Pangarsa., Wijil, 2006, Merah Putih arsitektur Nusantara, Penerbit Andi Offest, Yogyakarta.
[7] M. Bayoumi, 2017, Nubian Vernacular architecture & contemporary Aswan buildings’ enhancement, Alexandria Engineering Journal (Elsevier). Nomor 57, vol 2 Doi: 10.1016/j.aej.2016.01.002.
[8] K. Yeang, 2006, Green Design in the Hot Humid Tropical Zone, Chapter of BookTropical Sustainable Architecture, 1st Edition, 2006, ImprintRoutledge, Pages12 eBook ISBN9780080470924.4
[9] R. Faragallah N, 2021, Fundamentals of temporary dwelling solutions: A proposed sustainable model for design and construction, Ain Shams Engineering Journal No. 12, https://doi.org/10.1016/j.aej.2020.11.016.
[10] M. Widjaja, Carolina, 2018, Vernacular Architecture and Its Relation with Sustainable Contemporary Architecture in Indonesia. Jurnal Architecture Innovation, No. 2
[11] S. Zaric, A. Salihbegovic, R, Alexander, 2016. Towards a Contemporary Vernacular Building Envelope. The 3rd International Conference with Exhibition 25–27 May 2016, Budva, Montenegro.