

The Mosque as a Resilient Model: Adaptation in Social, Spatial, and Environmental

Bramasta Putra Redyantanu

Department of Architecture, Petra Christian University, Surabaya, Indonesia

Article Info:

Submitted: October 10, 2025

Reviewed: January 18, 2026

Accepted: February 10, 2026

Keywords:

mosque resilience;
floating architecture;
adaptive design;
community building;
Bima Indonesia

Corresponding Author:

Bramasta Putra Redyantanu

Department of Architecture,
Petra Christian University
Surabaya, Indonesia
Email: bramasta@petra.ac.id

Abstract

The Amahami Floating Mosque in Bima, Indonesia was analyzed as an example of resiliency in multi-dimensional adaptation through architecture and how this type of approach may provide a future path forward for sustainability, durability and efficiency with respect to modern mosque architecture influenced by local contexts. This research demonstrates three overall areas of essential integrative adaptation: social, spatial and environmental. With regards to social adaptation, the study emphasized the importance of community involvement beyond that of worship in order to preserve the identity of Bima as an architectural region; with spatial adaptation, the Muslim community incorporated the floating structure of the mosque into their site conditions as well as optimizing waterfront usage; and with environmental adaptation, the design of the mosque incorporated modular construction and structure to maximize the efficiency of material usage as well as to enhance natural light quality and ventilation. In conclusion, using these three integrative adaptations enables the mosque to be viewed as a resilient architectural prototype that links heritage with sustainability in an effort to promote adaptive design. While adaptive architecture is not limited to mosques serving only as places of worship, the results from this study suggest that there exists an opportunity to combine urban planning, eco-awareness and long-term resiliency.

This is an open access article under the [CC BY](https://creativecommons.org/licenses/by/4.0/) license.



INTRODUCTION

The flexibility of architectural spaces has been examined by critics for centuries, primarily focused on their ability to adapt to social, environmental, and spatial change. These various dimensions can be responded to in an integrative response in the form of multiple adaptations in architecture, encompassing societal use, responding to the surrounding natural conditions, and enabling diverse functions through spatial multi configuration (Buğra Tekinalp & Şentürer, 2024; Lehmann, 2023). Mosques, which have historically only been seen as religiously-blended spaces, have recently shown they can also adapt to function laterally to their ritualistic nature and embody resilience via adaptation strategies (Cheema, 2022). Resilience is at the heart of the contingency of adaptation, as virtues of the built settings to be able to adapt as change occurs, while maintaining the primary functions defined (Laboy et al., 2016). Extending beyond adaptation is when we define multi-adaptation, illustrating our ability to alter elements of the spatial, cultural and ecological to make it work in perpetuity (Tucci et al., 2020). Historically, mosques have been known for their resilience in adapting to the changing needs of society, which sometimes extend beyond spiritual needs. Considering the notion of the identity of places of mosques to use as a way of allowing a place to become created, reference the importance of in the urban context where the cultural attachment and spatial adaptability must go beyond the site, but helps as a means to sustain that identity and actions that have derived from/place (Ischak & Gandarum, 2023).

Although mosques are inherently adaptable, achieving resilience is an issue because of fragmented approaches to integration and sustainability. In architectural discourse, a holistic approach has been promoted by emphasising the need for integrating practices that focus on spatial efficiency alongside environmental and social sustainability. However, mosques still often lack holistic plans for resilience that would allow them to adapt and address longer-

term sustainability (Fekry et al., 2023). The necessity for integration is clear in urban waterfronts, as well as in the case study of Bima, where mosques act as significant points in the community, but there is no systematic approach to resilience. The study would need an evolved architectural model, to negotiate and braid adaptive use, flexible space, and ecological consciousness. It aimed to address gaps in the understanding of resilience. This involved discussing resilience through adaptation and showing architectural strategies that improved durability, sustainability, and efficiency. Table 1 shows the recent studies related to mosque and its resiliency.

Table 1. Mosque and resiliency study

Theme	Key Aspect	Citations	Core Argument / Contribution
Resilience & Sustainability	Inherent Agency	Hammad & Hammad (2017)	Resilience is an inherent aspect of sustainability, providing durability and agency to the built environment.
	Temporal Adaptability	Bilello (2014); Setti (2022)	Architecture must "unfold" over time to retain relevance and functionality.
	Modular & Contextual	Dipasquale et al. (2014)	Spatial adaptation via modularity increases design flexibility within contextual constraints.
	Resource Efficiency	Lee (2016)	Resilience frameworks must prioritize material/energy efficiency and longevity.
Social & Cultural Adaptation	User Engagement	Tucci et al. (2020)	Cultural adaptation relies on user interaction to establish site-specific relevance and inclusive identity.
	Community Cohesion	Cheema (2022)	Mosque design strategies can unite community and urban capacity beyond the sacred space.
	Traditional & Modern	Alnajjar & Dinçel (2024); Sari et al. (2022)	Contemporary mosques balance modern architectural language with traditional ornamentation and trades.
Ecological & Waterfront Resilience	Water-Sensitive Design	Redyantanu & Poerbantaoe (2018); Errigo (2018)	Waterfront architecture manages conflicts between ecological integration and urban development through natural cycles.
	Floating Typologies	Lin et al. (2019); Moon (2015); Rosso et al. (2020)	Floating architecture addresses rising sea levels through modular, sustainable, and adaptable visions.
	Coastal Dynamics	Redyantanu (2021)	Specific cases like the Amahami Mosque derive functionality by responding directly to coastal movements.
Identity & Heritage	Place Identity	Akbar et al. (2017); Argubi & Ramadhoan (2020)	The Amahami Mosque acts as a symbol of Bima's heritage and its specific identity as a "bay city."
	Materiality	Nursanty & Wulandari (2023)	Using local materials and trades sustains the viability and beauty of the mosque within its cultural context.

The research gap lies in the lack of integration, where aspects of environmental sustainability, spatial flexibility, and cultural identity are usually studied separately without any connection. Specifically, this is a condition where floating architecture technology is already very advanced technically and modularly, but there is still a lack of study to integrate this technology with cultural values that must remain eternal in a mosque. As a result, mosques on the waterfront are often structurally sound but lack the strength to maintain their existence in the context of multi-faceted resilience.

The primary focus of this research is to treat architecture as a model of resilience and to investigate the various adaptive strategies of mosque design. The chosen case study is the Amahami Floating Mosque, used to examine the potential relationship between spatial design and sustainability, durability, flexibility, and efficiency (Redyantanu, 2021). By investigating the resilience principles of mosque architecture, the study can provide broader learning opportunities for adaptive urbanism that focus on mosque design and urban waterfront design. Floating mosques are not a new typology, especially in Indonesia (Fitriana, 2024). There are quite a number of mosque designs that respond to the natural conditions of the Indonesian archipelago, with floating typologies that are responsive to the environment. However, not many have tried to view them as an adaptive and resilient model from multiple integrative dimensions. Sustainable adaptive strategies embedded in mosque planning can offer the potential for adaptability. They can generate models of more resilient architectural form without losing function to a changing urban environment (Mouhcine, 2025). This research offers a reflection on ways mosques are not only for religious uses, but are adaptive spatial and structural components to respond to urban needs.

LITERATURE REVIEW

Resilience through Adaptation

The concept of resilience in architecture relates to sustainability. Resilience provides for ongoing functionality, and strong ties to ecological or social changes. Incorporating resilience into architecture understands resilience as an inherent aspect of sustainability, which provides durability and agency (Hammad & Hammad, 2017). Resilience as adaptation enables architecture to adjust or 'unfold' in response to change in forms of construction and design, for the purposes of retaining relevance, or functionality through 'time' (Bilello, 2014; Setti, 2022). The social adaptation of architecture, including cultural adaptations, relies on the interaction of users who establish context-specific relevance in the site (Tucci et al., 2020). User engagement produces functionality that is properly consistent with locality. It supports the discovery of inclusive space that needs a fair amount of social identity to be meaningful.

Furthermore, the consideration of spatial adaptation by way of modularity and contextual strategies add increases resilience through flexibility in architectural design, with regard to the constraints of context (Dipasquale et al., 2014). Design strategies for resilience emphasize designing with sustainability in mind and through frameworks of material efficiency, energy efficiency, and longevity of applications (Lee, 2016). These frameworks also comprise sustainable resource and replenishing practices to develop more ecologically harmonious architecture with lower levels of impact. Overall, although these ideas have been proposed or advanced, further development has yet to happen in the full use of resilience principles for different types of architectural typologies. In contrast to these studies, the theoretical basis of resilience and sustainable architectural practices are mostly studied in isolation focusing on environmental sustainability, or spatial adaptability, or aspect of resilience identity. Consequently, studies on urban resilience and sustainable practices are also lacking, integrated research practices synthesizing forms of resilience into frameworks of practice is pivotal, and investigations into coordinated interdisciplinary methodologies that would integrate resilience strategies in adaptive architectural design practices are warranted to build sustainable approaches to culturally responsive urban development.

Mosque as Cultural and Ecological Resilience Model

The resilience of mosques as cultural and ecological exemplars is closely related to their ability to adapt to the physical and social environments. For instance, waterfront architecture may perform an important role in resilience planning, when potential ecological integration conflicts with sustainable urban development principles (Redyantanu & Poerbantano, 2018). Water-sensitive design frameworks offer solutions related to ecological form; they support durability and flexibility based on climate conditions. Natural ecological cycles (Errigo, 2018), rising sea levels and urbanization of the coastal region are being recognized through the floating architecture. However, it is a collection of ideas and visions of how future architecture can be modular, adaptive and sustainable (Lin et al., 2019; Moon, 2015; Penning-Rowsell, 2020; Rosso et al., 2020). In architecture, true resilience arises from the discovery of material efficiency and the recognition of construction traditions in various building materials. It does not stem from the conceptual development of architectural ideas, nor the use of adaptive flexibility, but from a synergistic combination of both material efficiency and other factors that derive from the history of architecture. Examples of this can be seen in how the Amahami floating mosque has been built as a plus architecture representative of the ability to adapt to changes in nature due to being built in a coastal environment.

In addition to their environmental resilience, mosques are used to both provide continuity for culture and community, while preserving the community's identity. The Amahami floating mosque of this era is an example of the cultural identity and heritage of the city of Bima as it relates to its bay (Akbar et al., 2017; Argubi & Ramadhoan,

2020) and contemporary Thai architectural examples representing traditional architecture's historical and current mechanisms for resilience (Redyantanu, 2021; Sari et al., 2022). The mosque as a communal building, used local materials and adapted local trades to maintain the beauty and functionality of the space enhancing its sustainability and viability within the cultural context (Nursanty & Wulandari, 2023). Recent mosque architecture reflects a balance of modern architectural language, with new ability within construction practices while honouring ornamentation and functioning traditions shaped by culture (Alnajjar & Dinçel, 2024). The design rights discussed in the literature suggest strategies for design and implementation into mosques beyond the boundaries of the sacred space that unite community and urban capacity for cohesiveness (Cheema, 2022).

Even though more resilient mosque design is generally progressing, limited research has focused on applying principles of adaptive architecture, especially in waterfronts. Even though floating sustainability and green design principles focus on modularity, material optimization, and sea level responsiveness (Moon, 2014; Yu et al., 2025), there is an absence of research in substantive methodologies to understand resilience in coastal mosque development, seek a deeper understanding to modify frameworks to enhance adaptive capacity while assuring sustainability are the plan for the future and there is cultural permanence in the design of waterfront architecture. The Amahami Floating Mosque can provide a gateway into examining how modern architectural practice can address presumptions about ecological and cultural resilience. So the most pertinent research question remains: How can the architecture of mosques incorporate cultural and ecological resilience, while using adaptive design elements?

METHODS

Using a qualitative descriptive approach, this study investigated resilience through adaptive architectural design including research on the Amahami Floating Mosque in Bima, Indonesia. Qualitative descriptive research is an appropriate approach to examine architectural adaptation in detail to understand design principles, contextual factors, and users (Creswell, 2018). Combining research on the design process with a research stance on resilience strategies provides an opportunity to understand how resilience strategies have influenced the evolution of mosque design throughout history (Frankel & Racine, 2010; Verbeke, 2013). Through archival analysis and reflective analysis of the creative process, we can use a systematic approach to understand past developments as it pertains to the historical documentation of the design process (Lucas, 2016). The Amahami Floating Mosque, as a case study, provides an opportunity to examine the phenomenon of cultural and environmental resiliency presented by the design of mosque buildings on water, based on the selection of materials, modular design, and the ability to adapt to environmental conditions.

Architectural documents collected directly from the design process were the focus of this research study using primary data collection methods for architectural design processes associated with Amahami Floating Mosque. The focus was on architectural design related to spatial and material selections as well as sustainability initiatives (Laboy et al., 2016). Secondary data also be gathered by users through UGC (YouTube, TikTok and Google Maps Reviews) based upon the way that users engaged with and reacted to the Amahami Floating Mosque. The study map user engagement as well as how users have responded to the mosque's design by providing examples of how users have used the space in different ways, as well as how users perceived the mosque as a place of engagement with community members. The case study will describe the study's findings in order to conceptualise design solutions and patterns that are resilient in nature. A deliberative analysis of the design documents and the user's actions to engage with the mosque will illustrate how the Amahami Floating Mosque provides an environmentally sustainable, spatially efficient and socio-cultural resilient type of development for a waterfront mosque.

RESULTS AND DISCUSSION

The Mosque Design

The floating mosque, amahami, has transformed architectural definition in Bima from being a purely ceremonial/faith-based structure, into an accessible landmark highlighting coastal community, by taking advantage of this prime opportunity to embody visible urban transmissions of remoteness through its design philosophy of floating architecture upon a solid, concrete foundation which establishes itself within the dynamic navigation of Waterways. The floating stages also shows structural concept drawing on already the cultural basis of ngguusu waru in Bima, and the octagonal shape is a cultural typology meaning something to the place as a structure format for semi-outdoor/specific spatial configurations to create openness in the site and as it performs with the space at the coast. As an urban fulcrum, the mosque holds a responsive fluidity of water, land and spirituality while crossing architectural histories and contemporary urbanity (Hariyanto et al., 2016). Figure 1 describes visually the context of the Mosque in Bima, Indonesia as a waterfront city.

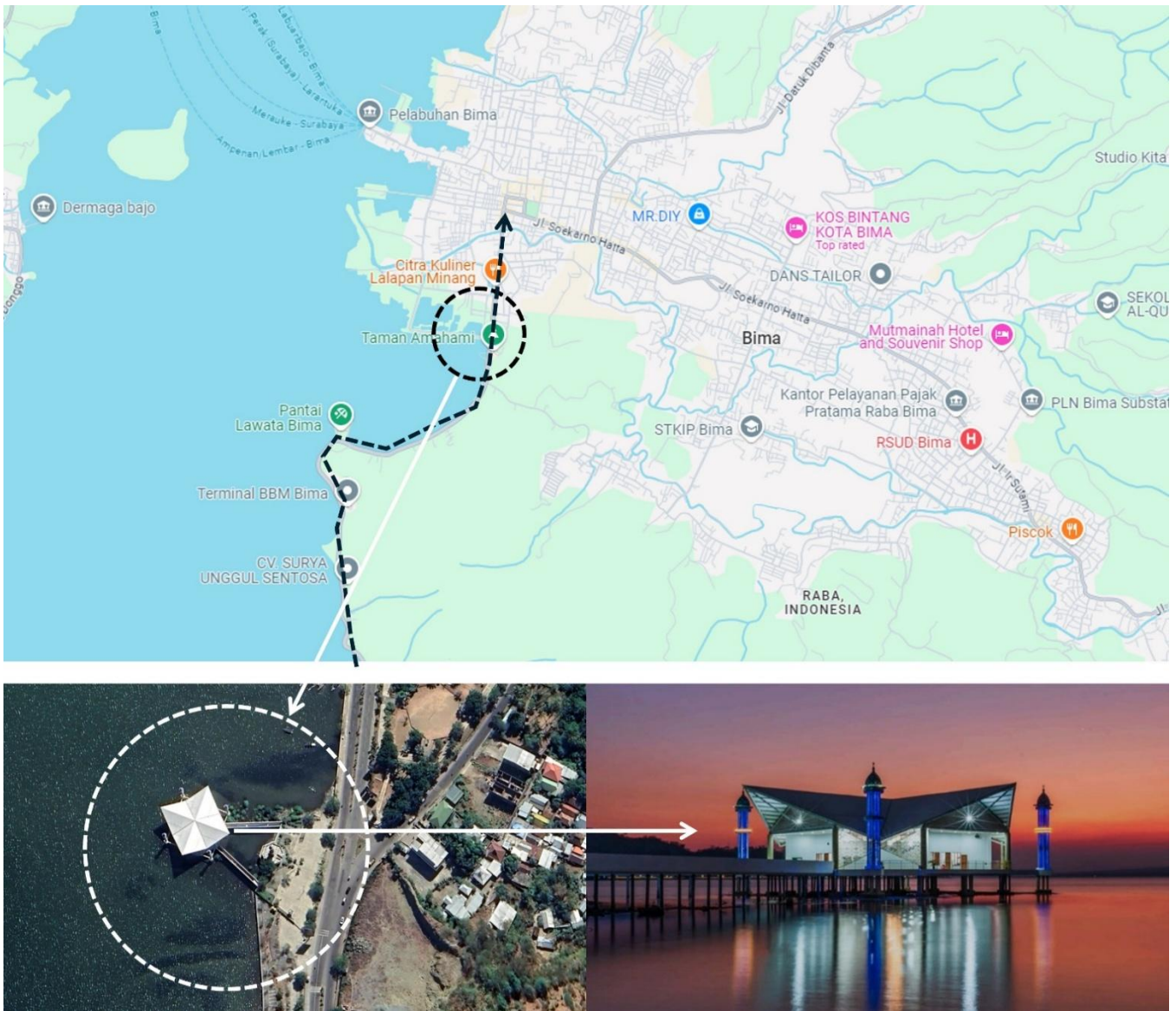


Fig. 1. Site context with waterfront characteristic (Source: author)

Bima mosque is rooted in Bima's culture, using various elements present within Bima's vernacular architecture such as Uma Lenge (Bima traditional house) which has been designed with raised platforms (for protection from flooding) and pyramidal roofs indicative of a tropical climate (Azzahra & Nurini, 2014; Nurhafni, 2017). Building on this foundation, the mosque has been designed with an elevated structure; hence it is protected from flooding and encourages good thermal comfort. The use of a traditional Bima design is reflective of Bima people's collective memory and allows current architecture to be viewed as part of an ongoing cultural continuum (Akbar et al., 2017). Therefore, the mosque promotes national principles of sustainable urbanism while promoting the concept of Bima being a sustainable city through the combination of heritage and responding to the environment (Firmanto et al., 2022).

The mosque also derived influence from the architecture of the Bima's Sultanate as it has a triangular roof form, similar to the historical royal buildings (Abdullah et al., 2022). Built by a roof system of louvered gable, the roof creates ventilation that works with the building by reducing the need for mechanical cooling with optimal airflow moves through prayer space. The mosque is characterized by not having a dome, which deviates from the traditional mosque design. While this is an evident shift from traditional design typologies, it reflects changing contemporary architecture that prioritizes integration with context rather than typology (Hambali et al., 2024; Suhendar et al., 2020). This is an important subsequent development of how Islamic architecture is also adapting in the architectural landscape of a region and is a body of conversation between tradition and practical implementation (Ramadhan, 2019). As shown in Figure 2, local richness can provide a valuable source of inspiration.

The complex surface of the Amahami Floating Mosque is accounted for by combining the traditional woven aesthetics used by craftspeople from Bima, which create numerous vibrant interactions of light and shadow, as well

as embed a significant cultural meaning in this approach (Dwiasta R, 2014). Furthermore, the porous surface allows for a beautiful visual character while the patterns themselves create a passive cooling system, which supports today's safe and responsible building techniques. The Amahami Floating Mosque encapsulates both the history of local architectural techniques and the ability to be flexible to the conditions of the waterfront environment, while providing an example of how architecture developed over time while also being able to incorporate the growing influence of culture on the architecture of a community, which is learned through generations. Modern designs of mosques need to use the lessons of the past while still addressing today's climate and environment both geographically and environmentally and addressing their impact on a community.



Fig. 2. Inspiration of the locality based design
(Source: author)

Social Adaptation: Community and Flexibility

Although Mosques are primarily a place to worship, they also represent a centre of support for communities and can therefore create pathways to resilience. An example of how mosques can help their communities is through the Amahami Floating Mosque. This facility, in conjunction with the Amahami Series of Public Parks, forms a vital component of how the mosque serves as a bridge between worship and facilitating public engagement. Since the floating mosque has its location on Amahami's waterfront and provides an easy approach to many community activities (other than worship), it creates a connection that enables people to utilise the floating mosque for both spiritual and social interactions. The Amahami Floating Mosque provides access to both spiritual and recreational/cultural opportunities.

Additionally, the many events offered at or near the Amahami Floating Mosque, such as markets and social gatherings, support the social sustainability of the local community and satisfy the community's need for social interaction through thoughtful land use. In short, the Amahami Floating Mosque serves both as a location for prayer and for other forms of activity. It is also a destination for tourism and social interaction. Transformed from a space to a place, a mosque reinforces a bond between community and a built space facilitating ownership and belonging. Whereas mosques are typically designed solely as places of worship, the Amahami mosque and its public amenities create community spaces that assimilate with public activity create a more extensive nature of social interaction and resilience through adaptation. Figure 3 illustrates the integrated park as main attraction to the society.

Based on a review of visitor data, particularly from Google Maps reviews, the place has a score of 4.6 out of 5 from approximately 969 reviews. The majority of the public states that the mosque's area is not merely a place of worship, but is closely connected to other community activities. Keywords extracted from the reviews include its visual quality as an icon, a calm atmosphere with openness, integrated access with a public park, and a functionality that extends beyond a place of worship. The emphasis on additional public activities is supported by design-related reviews that mention its function as a tourist attraction, a pop-up market, and its ability to promote local elements within modernity, as intended by the designer. This reinforces that the role of open public space, when integrated with a mosque, offers the opportunity for a strong sense of place and the flexibility to accommodate public park functions. Figure 4 shows a mapping of the Google review results.



Fig. 3. Public park integrated with mosque landscape
 Captured from Youtube (<https://www.youtube.com/watch?v=D0oHq8nGz3A>)

Masjid Terapung Amahami Kota Bima

GPMC+VR2, Jl. Sultan Muhamad Salahuddin, Belo, Kabupaten Bima, Nusa Tenggara Bar. 84111, Indonesia

Write a review

4.6 ★★★★★ 969 reviews

- All
- place of worship 31
- sea 29
- cold 21
- scenery 20
- +6

Sort by

- Most relevant
- Newest
- Highest rating
- Lowest rating

Theme

- Visual Appeal
- Atmosphere
- Accessibility
- Functionality
- Design Appreciation
- Cultural Identity

Keywords & Phrases

- “Beautiful sunset view,” “coastal panorama,” “Instagrammable,” “iconic landmark”
- “Peaceful,” “serene,” “spiritual calm,” “cool breeze,” “open space”
- “Easy to reach,” “near city center,” “public park integration,” “walkable”
- “Not just for prayer,” “community gathering,” “tourist spot,” “market nearby”
- “Unique architecture,” “floating structure,” “modern yet traditional,” “octagonal shape”
- “Local pride,” “Bima heritage,” “symbol of the city,” “traditional influence”

Fig. 4. Google review that shows the flexibility of integrated park as urban space
 Google Review (<https://share.google/lfVVO2iFhDQjsWZK9>)

Long-term sustainability in designs for future mosques hinges on social resilience, that is, the users and local community take ownership of, activate, and maintain the mosque space. Locating the mosque as a community asset makes flexibility within the architecture feasible, allowing the mosque space to pivot and adapt to societal needs. Amahami Floating Mosque serves as an example of a socially adaptive architecture, where place, culture, and environment come together to provide the shared experience of a mosque. In the same way, urban resilience can be fostered through this design approach, allowing religious landmarks, such as mosques, to maintain their multifunctionality while preserving the contemporaneous dynamics of sharing of space, identity, and connection.

Spatial Adaptation: Modularity and Buildability

The octagonal modular form of the Amahami Floating Mosque reflects an approach to architecture that includes, constructability, resource efficiency, material efficiency, and resilience at the limits of local infrastructure in a small city like Bima. Modularity provides a means of arranging and assembling resources to allow both effective use of construction materials and methods as well as a greater level of integrity for the overall form of an architectural structure. The smaller cities that a mosque might be located in further restrict the possible construction techniques and methods available. Therefore, mosques will typically use a single fixed modular system to achieve maximum efficiency of the construction process and minimize the complexity involved in using multiple construction techniques and methods to build a structural element. Building in segmented forms allows for more efficient utilization of locally available materials and labor in partial or total phases of construction until completion of the building. The phases of modular construction for the mosque and how it relates to the site along the waterfront can be seen in figure 5.

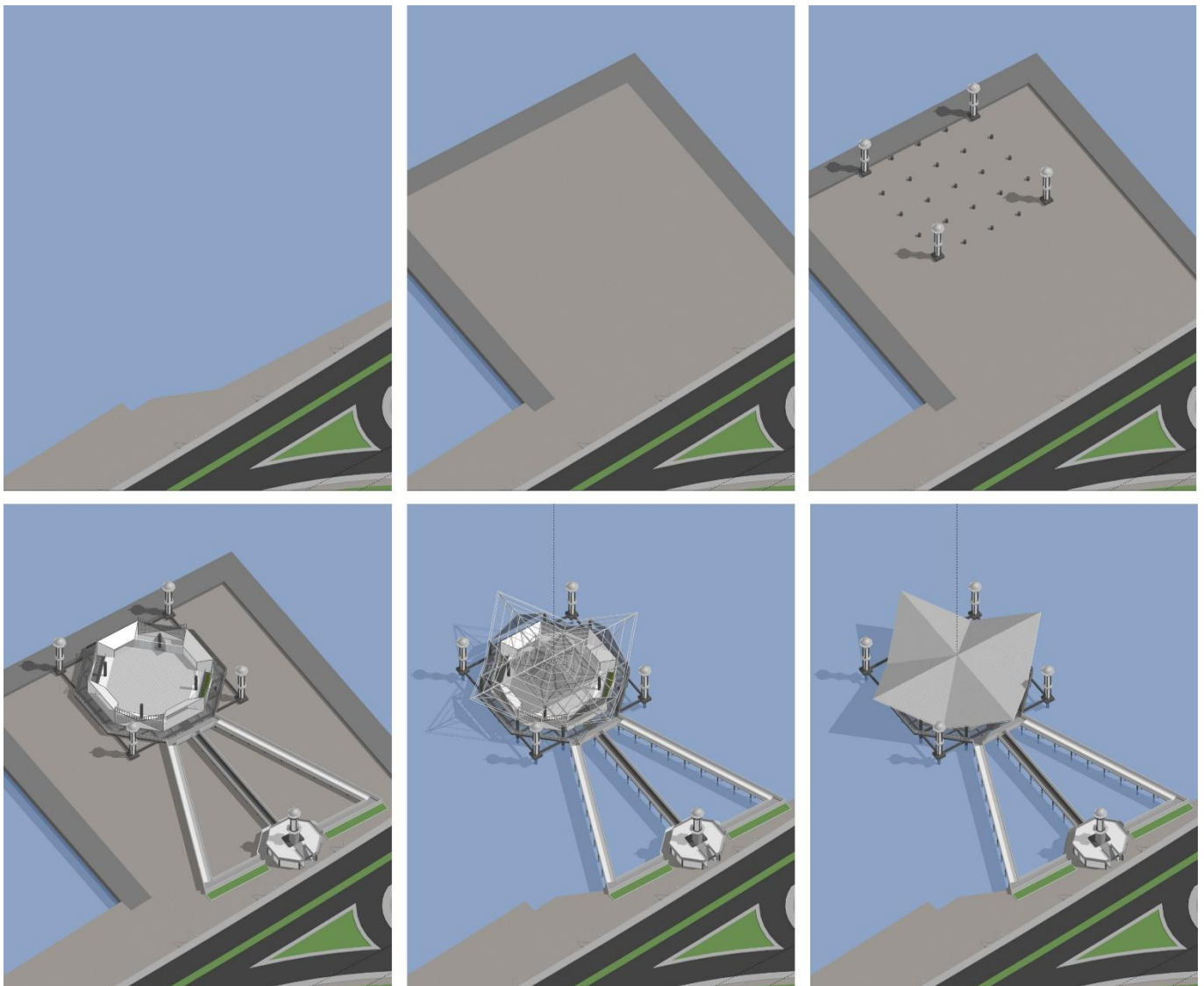


Fig. 5. Construction phase on water site context
(Source: author)

The mosque was constructed utilizing a very unique construction technique for land use in that the method of construction utilizes a floating structural design constructed with temporary fill for the purpose of constructing a foundation for the mosque, and once the mosque has been constructed the temporary fill will be removed, allowing for the restoration of the natural waterfront. This results in minimal disruption to the natural marine environment and minimal impact on the environment as a whole. Additionally, because the mosque was constructed by use of the floating construction method there are many additional opportunities to deal with varying water levels, and thus an increased capacity to adapt to changes in climate (Correia et al., 2014). As such, construction methodologies similar to those used at the mosque could serve as a template for developing single-use sites and event spaces that promote long-term sustainability of the environment, while simultaneously helping limit urbanization in coastal communities. The development process is illustrated in Figure 6.



Fig. 6. Design construction progression
(Source: author)

The modular typology contributes to enhanced adaptability of materials by making use of industrial materials (steel and reinforced concrete) as well as traditional materials (wood). Although it is not implied that local materials will only be used, the industrial materials selected are financially feasible and durable enough to resolve the challenge of not having abundant raw resources in the area. Steel and reinforced concrete can be beneficial for the longevity of structures and resilience to indigenous weather patterns. Modularity can minimize material waste and create ease of material use and firmness of parts. The balance of modern durable elements and economic material choices demonstrates responsible use of resources in a sustainable practice, and supports Bima's capacity to incorporate industrial materials into regional building practices. Figure 7 illustrates the form and material selection of the design.

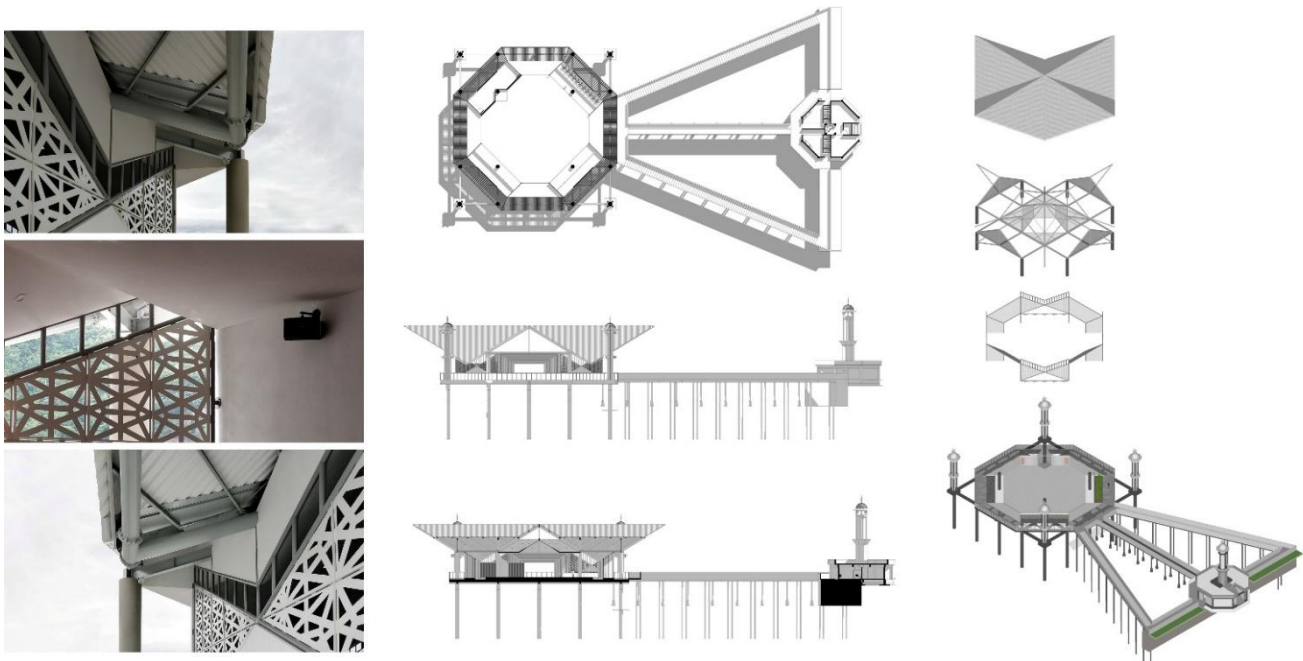


Fig. 7. Locality meets modern construction
(Source: author)

Resilience is manifested in mosque architecture as a convergence of multi-layered considerations where structural adaptability, economic viability, and material performance come together. The Amahami Floating Mosque

shows how resilience is a practical application of building design and that it goes beyond outwardly improving the aesthetics of a building. Instead, resilience is a component of an intentional architectural design choice for creating buildings that will remain viable over time. Through its modularity; the design uses materials in a way that reinforces long-term performance; and, finally, it adapts its design to take into account site conditions. In addition, the Amahami mosque demonstrates that developing building forms and structures based on adaptability to environmental and site-related influences enhances both structural and ecological resilience.

Environmental Adaptation: Utility and Renewability

By using the Bima Bay climate and land features as a design foundation, the Amahami Floating Mosque places a focus on sustainable building practices. The design is oriented to take advantage of passive solar design through the correct positioning of the building to maximize natural daylighting and cross ventilation from the prevailing winds, which has helped to reduce the amount of mechanical cooling required by the building. The design of the building envelope also incorporates large openings in addition to using Islamic geometric motifs throughout much of the exterior facade. The large openings and Islamic geometric motifs on the facade provide a dual purpose of creating both a spiritual and modern identity while allowing the building to adaptively shade itself. In addition to providing occupants with thermal comfort in a tropical climate, using these features to reduce the building's overall energy use creates an example of climate responsive architecture that merges traditional forms and design themes with the climate and land resources of the area thereby creating a unique, energy efficient experience of space. Figure 8 illustrates the design that maximize natural ventilation.

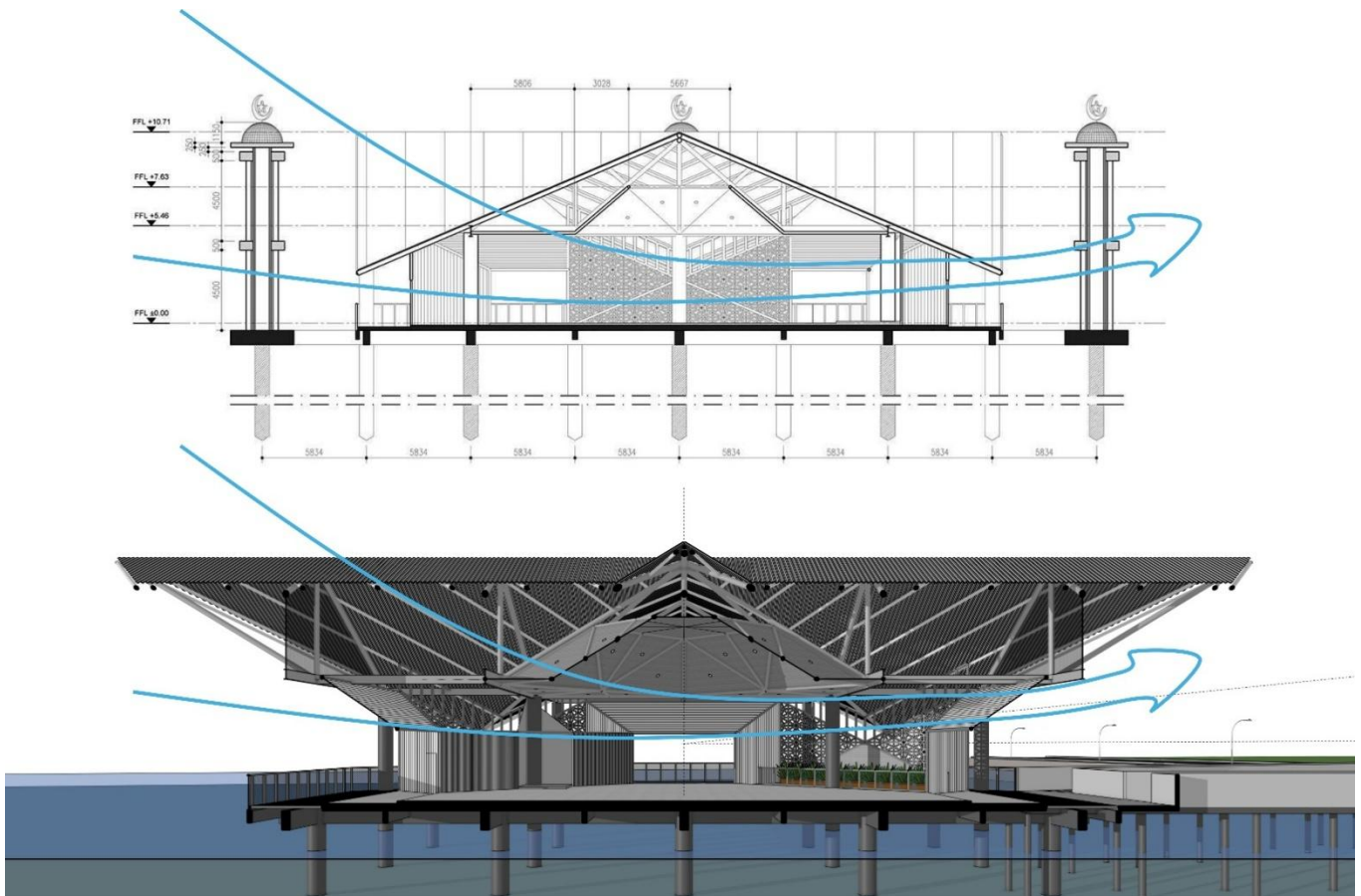


Fig. 8. Schematic section of natural ventilation
(Source: author)

Material selection for sustainability is an essential part of the resilience strategy, which prioritizes avoidance of over-reliance on finite natural resources, such as wood and bamboo. Instead, design included renewable and industrial materials, such as steel and concrete, which maximize longevity and durability, while decreasing degradation of environmental resources. The selection of materials and structural typologies constitutes a responsible response to the resource restrictions observable in Bima, while simultaneously assuring the mosque can accommodate growth in urban form and changes due to the environment, notably climate change. Resilience focuses on the long-term recovery of structural and service conditions. Material selection can help with economic sustainability and create a

pathway for ecological sustainability by avoiding displacement. Figure 9 shows indoor conditions that improve natural ventilation and lighting.



Fig. 9. Skin that support pattern and natural ventilation and lighting
(Source: author)

The mosque has a floating platform and a stage-like design, which provide a flexible and resilient framework that goes beyond materiality. Land fill was the means of building up the site temporary during the site preparation phase, and it will return to its original condition when this phase is completed so as to maintain the health of the waterfront ecosystem. In the end, the site will not only have less impact on the environment but will also prevent urban development from causing problems to aquatic habitats. The floating platform will be able to use all of the available resources on the site. The design of the mosque is responsive to flexible ecologically-conscious growth over time and utilises the sun, orientation and air flow in the building [the design of the site was integrated as much as possible, but ultimately limited by available materials]. This model represents a novel form of resilience and use, re-use, and care for the environment in waterfront architecture today. The proposed framework of integrated adaptation can be viewed in Table 2.

Table. 2. Integration of Adaptions

Adaptation Dimension	Focus Areas	Key Findings & Resilience Strategies
Social Adaptation	Community & Identity	<ul style="list-style-type: none"> Strategically placed as a landmark of the Amahami Public Park, to provide support for religious, as well as non-religious, activities for members of the local community. Acts as a source of stimulation for local business through pop-up markets, enabling them to grow, as well as, promote local tourism and recreation. Supports cultural identity by providing opportunities for congregation beyond ritualistic worship by acting as a 'place-maker', encouraging residents from the neighbourhood to take ownership of the park through public gatherings.
Spatial Adaptation	Form & Flexibility	<ul style="list-style-type: none"> The building has been designed with an octagonal modular layout which optimizes all resources and minimizes the complexity of building within a remote urban area where many obstacles exist regarding construction methods and access. The building includes an elevated "stage" as a reference to the local (Nggusu Waru and Uma Lengge) traditions which have adopted to accommodate changing tidal patterns. The building utilises a combination of reinforced concrete and industrial steel as its primary material, providing long-lasting durability and the possibility for future uses while also incorporating a combination of traditional and industrial design elements into the overall building structure.
Environmental Adaptation	Climate & Ecosystem	<ul style="list-style-type: none"> Utilizes passive design strategies such as large openings into its spaces and louvered gables for maximum effectiveness of natural cross-ventilation and daylighting in its environments. Utilizes Islamic geometric patterns (perforated) on its façade to allow for shading while keeping occupants thermally comfortable in a tropical marine climate. Utilizes a low-impact construction method which provided opportunities for restoring natural aquatic ecosystem after completion of building.

CONCLUSION

Architecture that exemplifies elements of strength and resilience to withstand changing environments; the design of the Amahami Floating Mosque combines the traditional Bima heritage (Nggusu Waru, Uma Lengge) along with modern industrial design principles to create a unique octagonal structure located on a waterfront. The combination of social use and spiritual importance creates a place for community identity as well as environmental awareness. The use of durable materials, sustainability and transitional spaces maintains the continuity of the culture of the mosques but allows for adaptation to the rapid evolution of urban coastal areas.

However, industrial materials (e.g., steel and concrete) present a disadvantage; they're less available to local sources, which means that their use will likely increase our ecological footprint. Current social media findings do provide a first insight into the potential community impact of this structure; however, further empirical evidence is required to establish how this building will be used by the public. Consequently, the future direction of research should involve the development of new and innovative design and construction methods to improve both the resilience and sustainability of the coastal mosques as we adapt to changing climate conditions.

REFERENCES

- Abdullah, A., Aksa, A., & Megawati, L. (2022). The Sultanate of Bima in the fragments of Islamic civilization in the archipelago. *9th Asbam International Conference (Archeology, History, & Culture In The Nature of Malay)(ASBAM 2021)*, 16–21.
- Akbar, H., Antariksa, A., & Meidiana, C. (2017). Memori Kolektif Kota Bima Dalam Bangunan Kuno Pada Masa Kesultanan Bima. *The Indonesian Green Technology ...*, 8–18. <https://igtj.ub.ac.id/index.php/igtj/article/view/167>
- Alnajjar, A., & Dinçel, T. E. (2024). Changing Forms and Functions: The Transformation of Mosque Architecture from The Early Islamic Period to The Present. *Mekansal Çal{\i}{c}{s}malar Dergisi*, *1*(2), 94–106.
- Argubi, A. H., & Ramadhoan, R. I. (2020). *Pengembangan Pariwisata di Kota Tepian Air (Water Front City) Berbasis Nilai Kearifan Lokal*. 11–21.
- Azzahra, S. F., & Nurini. (2014). Struktur Dan Pola Ruang Kampung Uma Lengge Berdasarkan Kearifan Lokal Di Desa Maria, Kabupaten Bima Nusa Tenggara Barat. *Jurnal Ruang*, *2*(1), 321–330.
- Bilello, J. (2014). Design for Resilience: mitigation, adaptation and transformative design. *ARCC Conference Repository*.
- Buğra Tekinalp, S., & Şentürer, A. (2024). Evaluating public spaces through the concept of other: A heterotopic approach. *Journal of Design for Resilience in Architecture and Planning*, *5*(1), 01–17. <https://doi.org/10.47818/DRArch.2024.v5i1116>
- Cheema, A. R. (2022). *Role of Mosque in Building Resilient Communities*. Springer.
- Correa, M., Dipasquale, L., & Mecca, S. (2014). *VERSUS: Heritage for Tomorrow: Vernacular knowledge for sustainable architecture*. Firenze University Press.
- Creswell, J. (2018). *Qualitative inquiry & research design : choosing among five approaches*. SAGE.
- Dipasquale, L., Mecca, S., Özel, B., & others. (2014). Resilience of vernacular architecture. In *VerSus: heritage for the future. Vernacular knowledge fo sustainable architecture* (pp. 64–73). FUP Firenze University Press.
- Dwiasta R, A. Y. (2014). Pemanfaatan Tema Arsitektur Tradisional Lokal Terhadap Transformasi Bentuk Dan Fungsi Arsitektur Di Perkotaan Dalam Konteks Kekinian. *Forum Bangunan*, *12*(1), 33–39.
- Errigo, M. F. (2018). The Adapting city. Resilience through water design in Rotterdam. *TeMA-Journal of Land Use, Mobility and Environment*, *11*(1), 51–64.
- Fekry, M., Mohamed, M. A. A., Visvizi, A., Ibrahim, A., & Ghamri, L. F. (2023). *Mosque Architecture: A Transdisciplinary Debate*. Springer.
- Firmanto, T., Ridwan, R., Gufran, G., Irawansah, D., & Mardiansjah, A. (2022). Policy On Spatial Planning And Regional Development Based On Substainable Development In Bima City. *The Indonesian Journal of Legal Thought (IJLETH)*, *2*(1), 26–34.
- Fitriana, D. N. (2024, July 2). *Masjid Terapung di Indonesia | IDN Times*. <https://www.idntimes.com/travel/destination/masjid-terapung-di-indonesia-c1c2-01-m17hw-np7yxr>
- Frankel, L., & Racine, M. (2010). *The Complex Field of Research: for Design, through Design, and about Design in durling, D., Bousbaci, R., Chen, L, Gauthier, P., Poldma, T., Roworth-Stokes, S. and Stotlterman, E. (eds.)*. 7–9. <https://dl.designresearchsociety.org/drs-conference-papers/drs2010/researchpapers/43>
- Hambali, I., Sukowiyono, G., & Winarni, S. (2024). PUSAT KEBUDAYAAN DI KOTA BIMA TEMA: ARSITEKTUR NEO VERNACULAR. *Pengilon: Jurnal Arsitektur*, *8*(02), 1577–1590.
- Hammad, N. A., & Hammad, M. A. (2017). Sustainable design thinking: Adaptability, resilience, and productivity at the core of regionally responsive architecture. *Architecture Research*, *7*(3), 53–68.
- Hariyanto, A. D., Poerbantano, B., & Redyantanu, B. P. (2016). Identifikasi Visual Arsitektur Lokal Bima. *Seminar Nasional Semesta Arsitektur Nusantara 4, June*, 1–6.
- Ischak, M., & Gandarum, D. N. (2023). The role of mosques in the establishment of place identity in supporting settlement resilience. *AIP Conference Proceedings*, *2706*(1).
- Laboy, M., Fannon, D., & others. (2016). Resilience theory and praxis: a critical framework for architecture. *Enquiry The ARCC Journal for Architectural Research*, *13*(1).
- Lee, A. J. (2016). *Resilience by design*. Springer.

- Lehmann, S. (2023). The unplanned city: public space and the spatial character of urban informality. *Emerald Open Research*, 1(5). <https://doi.org/10.1108/EOR-05-2023-0007>
- Lin, Y.-H., Chih Lin, Y., & Tan, H.-S. (2019). Design and functions of floating architecture--a review. *Marine Georesources & Geotechnology*, 37(7), 880–889.
- Lucas, R. (2016). *Research methods for architecture*. Hachette UK.
- Moon, C. (2014). Three dimensions of sustainability and floating architecture. *International Journal of Sustainable Building Technology and Urban Development*, 5(2), 123–127. <https://doi.org/10.1080/2093761X.2014.908809>
- Moon, C. (2015). A study on the floating house for new resilient living. *Journal of the Korean Housing Association*, 26(5), 97–104.
- Mouhcine, B. (2025). Architectural Resilience for Sustainable Development: A Bibliometric Analysis. *Sustainable Development*.
- Nurhafni. (2017). *EKSISTENSI RUMAH TRADISIONAL "UMA LENGGE" SEBAGAI DESTINASI WISATA BUDAYA DI NUSA TENGGARA BARAT*. 575–585.
- Nursanty, E., & Wulandari, A. (2023). Unveiling the Authenticity of Islamic Values: the Evolution and Transformation of Traditional Villages. *Journal of Islamic Architecture*, 7(4), 595–612. <https://doi.org/10.18860/jia.v7i4.21258>
- Penning-Rowsell, E. (2020). Floating architecture in the landscape: climate change adaptation ideas, opportunities and challenges. *Landscape Research*, 45(4), 395–411.
- Ramadhan, S. (2019). *CULTURAL CENTER DI PANTAI LAWATA KOTA BIMA DENGAN CIRI PERPADUAN ARSITEKTUR BIMA (UMA LENGGE) DAN ARSITEKTUR MODERN*. UAJY.
- Redyantanu, B. P. (2021). Identifikasi Unsur Lokalitas Dalam Pendekatan Arsitektur Metafora Pada Desain Masjid Apung Amahami Di Bima. *Identifikasi Unsur Lokalitas Dalam Pendekatan Arsitektur Metafora*, 4, 2021. <http://ejournal.upi.edu/index.php/jaz->
- Redyantanu, B. P., & Poerbantaoe, B. (2018). Pengembangan Potensi Visual Semenanjung Lawata sebagai Salah Satu Simpul Rangkaian Wisata Tepian Air Kota Bima Visual Potency Development of Semenanjung Lawata as One of The Tourism Node of Waterfront City Bima. *Jurnal Humaniora*, 15(2), 73–80. http://dev2.kopertis7.go.id/uploadjurnal/1_HumanioraV15No2Des2018.pdf
- Rosso, F., Mannucci, S., Ferrero, M., Cecere, C., & others. (2020). Adapting towards resilience. Analysis of the construction features and dynamic energy performance of amphibious and floating houses. *TEMA*, 6(1), 31–40.
- Sari, L. H., Wulandari, E., & Idris, Y. (2022). A Review of the Resilience of Historical Mosques in Indonesia in Mitigating Natural Disaster Toward the Environmental-Friendly Mosque Design. *Aceh International Workshop and Expo on Sustainable Tsunami Disaster Recovery*, 366–381.
- Setti, G. (2022). Adaptation and Resilience. Architectural Design Tools between Uncertainty and Transitory. In *Design Actions for Shifting Conditions* (pp. 74–79). TU Delft OPEN.
- Suhendar, R., Fatimah, T., & Trisno, R. (2020). KAJIAN BENTUK MASJID TANPA KUBAH STUDI KASUS MASJID AL-IRSYAD BANDUNG A Study of Mosque 's Form without Dome. *Arsitekta*, 2(01), 19–31.
- Tucci, F., Cesare, S., & others. (2020). *Resilience between mitigation and adaptation*. Palermo University Press.
- Verbeke, J. (2013). This is research by design. In *Design research in architecture* (pp. 137–160). Routledge.
- Yu, H., Zahidi, I., Fai, C. M., & Madsen, D. Ø. (2025). Sustainable development in mosque construction. *Scientific Reports*, 15(1), 1–11.