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Social, Economic, and Environmental Benefits of Vernacular Architecture in Post-Disaster Reconstruction

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ABSTRACT

The ongoing process of rebuilding after a disaster has some ongoing challenges with regard to social acceptability, economic viability, and environmental sustainability. The majority of reconstruction programs utilize standardized housing models that may not adequately address local culture, available economic means, and environmental factors. Therefore, the transition from temporary housing to long-term settlement is often not resilient and does not provide residents with a satisfactory solution. This paper will examine the environmental, social, and economic benefits of utilizing vernacular architecture as an alternative to traditional postdisaster reconstruction practices. Although the traditional definition of vernacular architecture may be limited to the use of local building materials and traditional building forms, this study will define vernacular architecture in terms of the process by which vernacular architecture is built, such as relying on the participation of users, utilizing locally available resources, and adapting to the socio-cultural and economic contexts of the users. This study uses a qualitative and comparative approach in order to review academic literature and analyse three live examples: Atmeh Camp in Syria; Housing reconstruction in Sri Lanka after the 2004 tsunami; and housing reconstruction in Haiti after the 2010 earthquake. Each example represents a different context for displacement but shares certain characteristics in terms of their housing practices. All the examples illustrate how vernacular architecture provides cumulative benefits on many levels. Briefly, vernacular structures are credible, sustainable basis for postdisaster housing, and recognizing emergent and transitional communities as vernacular forms can lead to more inclusive, affordable, and sustainable recovery solutions.

Keywords: Post-Disaster Reconstruction; Vernacular Architecture; Sustainability; Community Resilience; Housing Recovery

INTRODUCTION

1.1 Background of Post-Disaster Housing Reconstruction

Housing resulting from disasters and displacement is a major challenge within global humanitarian responses and for reconstruction. Global assistance and funding have worked around the world to provide emergency housing after disasters but have remained generally low in terms of long-term community stability, sustainable economic recovery, and sustainable environments because they have mostly utilized a standard, "cookie-cutter," rapid-response approach to housing—whereby housing is delivered rapidly without any consideration for the future use or performance of that housing. In many cases, what started as temporary shelters eventually become a permanent fixture in the community (Davidson et al., 2007; Lizarralde et al., 2010; UN-Habitat, 2020; UN-Habitat, 2023; Lyons, 2009; El-Masri & Kellett, 2003; Tipple, 2010). Research shows that traditional housing methods frequently fail to take into account people's social structures, cultural practices, and economic capacities. As a result, traditional housing techniques produce low occupancy, informal changes to the home, and abandonment of the unit, all contributing to decreased efficiency and unwillingness to rebuild a community (Kennedy et al., 2008; Barenstein, 2006; Jha et al., 2013; Duyne Barenstein & Iyengar, 2010). The increase in interest in alternative housing strategies has resulted from the identified limitations of the current approaches to provide measurable social, economic, and environmental advantages, and a physical shelter.

Recently, vernacular architecture has re-emerged as an important framework for post-disaster reconstruction. Vernacular architecture has been historically associated with locally sourced materials and traditional building materials; however, the definition of vernacular architecture has changed to be considered a user-driven and process-oriented approach to the construction of housing, which emphasizes user involvement and participation, as well as the availability of local resources, and adaptation to both cultural and economic realities relative to formal architectural design (Oliver, 2006; UN-Habitat, 2015; UN-Habitat, 2019; Alshawawreh & Mason, 2024; Albadra, 2017). By redefining the vernacular architecture movement, it emphasizes that it is more a process to be used in addressing the issues around reconstruction after disaster than a nostalgic or physically-based solution. Research has indicated that both vernacular and self-help housing systems have made great contributions to society, such as creating greater community cohesion, providing for a more sustained culture of building, and producing a greater sense of ownership and dignity of the people affected by the disaster (UNHCR, 2014; IFRC, 2013). From an economic perspective, by making use of local resources and the affected population's own labour, both construction costs and the delivery of housing are accelerated, while at the same time providing local businesses with additional support during the recovery (Habitat for Humanity, 2012; World Bank, 2023; World Bank, 2006). From an environmental perspective, vernacular designs use a wider range of environmentally conscious design techniques, and many have incorporated either reusable or recycled materials, thus resulting in lower environmental impacts and providing greater sustainability in the long term (UN-Habitat, 2015; UNDP, 2017; UNDP, 2021).

The term vernacular architecture is defined in this study not only by the use of conventional building materials, such as mud and stone, but also by how a dwelling becomes established or created by users of that dwelling, utilizing local resources available to those using the dwelling and developing in response to sociocultural and economic needs rather than through formalized means of planning. Three different real-world case studies are provided by the Atmeh Camp in Syria, housing reconstruction post-tsunami (2004) in Sri Lanka, and housing reconstruction post-earthquake (2010) in Haiti to investigate the environmental, social and economic advantages of vernacular-based approaches to reconstruction. While the focus of this analysis

will be on Atmeh Camp as an example of both transitional and hybrid, self-organizing refugee housing that represents an example of the evolution to vernacular architecture, it also provides opportunities for comparison with other models of self-organization through vernacular construction.

1.2 Post-Disaster Housing Challenges

Commonly found challenges of post-disaster reconstruction programs include long-term issues related to cost, time, cultural appropriateness, and environmental performance. Many studies have shown that standardized housing solutions do not provide the long-term needs of the people to whom they are being delivered; this has created increased dependency for those who are part of these programs, created social fragmentation, and resulted in the inefficient use of resources (Davidson et al., 2007; Kennedy et al., 2008; Alexander, 2014). For example, many prefabricated houses were built in favour of some of the worst-hit areas of Sri Lanka following the tsunami, local spatial habits and climate conditions were not taken into account, resulting in not being used or abandoned; yet when International organizations imposed their own model of development for large residential projects in Haiti post-earthquake without consultation with local communities, it produced dislocated living areas that were not connected to local urban centers; and therefore, sustainable **(**see Figure. 1**)**. As a result of these problems, the search for alternative housing solutions that provide not just shelter but also long-term solutions for social, economic, and environmental issues will continue to grow.

Fig. 1 An aerial image of temporary housing camps in Port-au-Prince built in response to the January 12, 2010 earthquake in Haiti (Reuters, n.d.).

1.3 Vernacular Architecture as an Alternative Approach

Due to the increasing recognition of the viability of vernacular building as an alternative to more traditional post-disaster housing, users are becoming more involved in creating their homes. This means that vernacular architecture can now be viewed as the result of a

useroriented process instead of simply using traditional materials or building forms based on past practices. This user-oriented process will continue to rely on local resources and knowledge, as well as culturally-embedded methods of construction (Oliver, 2006; UN-Habitat, 2015;
Alshawawreh & Mason, 2024). As demonstrated by numerous studies, many of the benefits from vernacular-based housing depend on the positive social, economic, and environmental impacts of people working together in a crisis or displacement situation.

1.4 Social, Economic, and Environmental Dimensions of Vernacular Architecture

Many studies support the social benefits of building in a vernacular manner. People who were involved with developing their own homes experienced a greater sense of ownership and dignity for those homes, as well as improved connections to other members of the community and their identities as individuals (Davidson et al., 2007; UNHCR, 2014; Alameddine et al., 2023; Brown & Kelman, 2024). Vernacular and self-built homes allow households to arrange their space according to family structure, gender roles, and daily routines; when compared to standardized housing, this results in a higher rate of acceptance and long-term occupancy (Barenstein, 2006). Additionally, the use of vernacular techniques in building encourages communities to work together and make decisions collectively, which strengthens the social network of a community during recovery after disaster. There is a correlation between these social interactions and post-disaster resilience and mental health (IFRC, 2013; World Bank, 2022).

Vernacular Architecture (VA) provides substantial economic benefits by decreasing both the price and time of reconstruction processes, making them faster and cheaper than other types of building practices. VA relies on local resources for all aspects of the construction process, which limits the use of costly and/or slow international supply lines and importation of technology (especially in post-disaster situations) (Lizarralde et al., 2010; Johnson & Lizarralde, 2012; Lyons, 2009). Self-driven and self-managed rebuilding models focused on VA contribute further to local economy by creating jobs and keeping money in the community where the rebuilding is taking place. Research conducted during post-tsunami reconstruction efforts in Sri Lanka and post-earthquake reconstruction efforts in Haiti found that homes built through Volunteer Action are both more cost effective and scalable than homes constructed through traditional contractor methods (see Figure 2) (Habitat for Humanity, 2012; World Bank, 2023; World Bank, 2006).

Environmental performance is an important consideration in vernacular architecture. Various architects have developed methodologies for designing structures based on local climate conditions so as to complement that environment by using those methodologies including the use of natural ventilation, the use of thermal mass, and application of shade which will reduce the need to rely heavily on high energy systems to maintain a comfortable indoor environment (Oliver, 2006). As demonstrated in the schematic diagram below (Figure 3), the way in which certain types of building materials are used together for the construction of an enclosed building can provide multiple strategies by which the designer/architect can make maximum use of natural forces (wind movement, buoyancy, etc.) for circulatory motion of air into and out of the building(s).

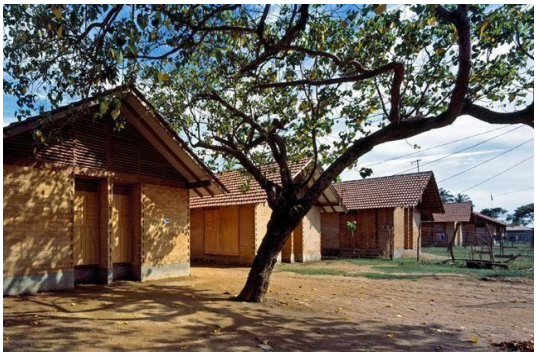

Fig. 2 The post-disaster housing unit construction process uses materials and traditional construction technology for the development of post-disaster housing units (Archnet, n.d.).

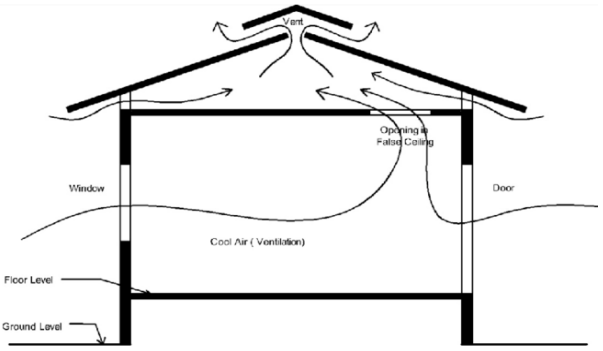

Fig. 3 Schematic of natural ventilation of vernacular housing using wind and buoyant force for air movement in hot, humid regions (Oliver, 2006).

In addition, VA is a methodologically sound way to build homes because it considers sustainability across a number of materials, energy consumption, and environmental degradation (El-Masri & Kellett, 2003; Oliver, 2006; IFRC, 2024; Sanderson, 2008). VA is sustainably viable because it uses resources already available at the local level (or very close by) and therefore minimizes the amount of distance travelled to obtain these resources, thus minimizing the pollution from methods of transport (including vehicle roddage, diesel powered construction equipment).

1.5 Research Gap

While there has been a good amount of literature examining the three main types of benefits of vernacular architecture (social, economic, and environmental), not much research has been conducted on how those benefits develop within self-organizing and transitional settlements built by displaced people. Involuntary displaced people living in refugee camps generally build their homes using informal and incremental construction methods; as such, the subject of this area remains little represented in academic literature. This research will fill that void by comparing three case studies in the real world (Atmeh Camp, post-tsunami Sri Lanka, and postearthquake Haiti) that display how vernacular principles can be utilized in many different contexts and outline the various types of benefits produced by using those principles in each of the three types of reconstruction.

The majority of previous research on post-disaster housing has generally been focused on topdown, policy-driven approaches. This paper instead compares vernacular-based postdisaster housing policies with other types of housing strategies using a comparative approach to determine the effectiveness of both kinds of strategies. The paper argues that the use of vernacular architecture as an adaptive sustainable building approach is a good solution for addressing various social, economic and environmental issues in various post-crisis situations.

1. METHODOLOGY

This study uses a qualitative and comparative research methodology to explore the environmental, social, and economic advantages of vernacular architecture in the reconstruction of post-disaster areas. The said approach helps to examine the practical analysis of housing rather than the model or process of housing.

The research is based on three main methodological components:

2.1 Literature Review

A scrutiny of literature from academic journals, international reports, and post-disaster housing assessments has been carried out to develop the theoretical framework for this study. The literature reviewed includes peer-reviewed journal articles, books, and publications from international organizations like UN-Habitat, UNHCR, World Bank, and the International Federation of Red Cross and Red Crescent Societies. The literature reviewed pertains to the economic and environmental benefits offered by unconventional systems of housing and owner-driven approaches to address the problem of recon BUILDING.

2.2 Case Study Analysis

The research uses a multiple case study approach to investigate the use of vernacular architecture in post-disaster and displacement situations. The cases were selected based on the following criteria:

- Presence of large-scale displacement or post-disaster reconstruction
- Active participation of residents in housing construction
- Using materials readily available or at minimal cost
- Availability of documented evidence and evaluations

The selected cases are: Atmeh Camp, Syria; post-Tsunami housing reconstruction in Sri Lanka (2004); and post-Earthquake housing reconstruction in Haiti (2010). In all these cases, the housing development processes and social, economic, and environmental outcomes would be studied.

2.3 Comparative Analysis

Finally, a comparative analytical framework is used to assess the similarities and differences from the picked case studies. This analytical framework centers on exploring different patterns concerning user participation, material usage, cost efficiency, environmental performance, and social acceptability. Some insights generated from the comparative assessment are used to create generalized insights concerning the role played by Vernacular Architecture following a disaster

2. RESULTS AND DISCUSSIONS

3.1 Atmeh Camp, Syria: Self-Organized Housing

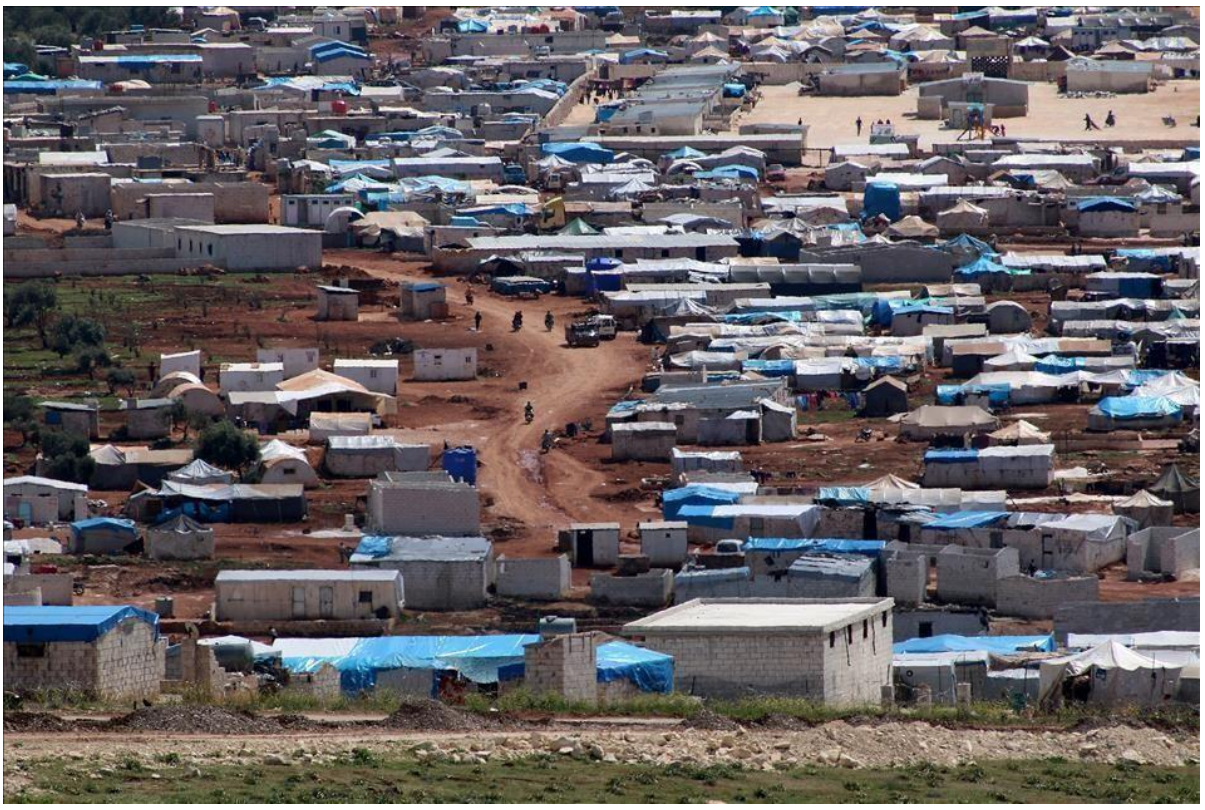

Fig. 4 An aerial view of Atmeh refugee camp in Idlib, Syria demonstrates how the original temporary emergency housing created from shelters has now become an increasingly dense semi-permanent community (Anadolu Agency, n.d.).

3.1.1 Background and Development Context

The Atmeh camp is located at the Syrian-Turkish border and was established as a temporary shelter (in the form of tents and lightweight structures) for those fleeing violence. Because there were no long-term possibilities for those displaced to be resettled permanently, the camp has become a quasi-permanent structure through the development of upgraded buildings (other than tents) using materials such as concrete blocks, wood, metal, fabric, and plastic (REACH Initiative, 2018; Sanderson & Sharma, 2018). Building houses/replacement structures was not done according to established building codes nor were any architects involved in supervising construction; rather, the creation of houses was done incrementally by the user with reference to what was immediately needed, available for building, and shared knowledge about building amongst the residents (Figure 4).

3.1.2 Vernacular Architecture: Definition and Applicability

The term "Vernacular Architecture" as used in this study is defined as:

Housing designed and built by users themselves using resources readily available within their local context (the materials, the methods of construction, and the ways that people use resources), based on their social/cultural and economic needs, as opposed to being designed according to an established architectural style or an urban planning system.

Thus, vernacular architecture will not necessarily be identified by specific building materials, (e.g. mud, stone, etc.) but will be determined by the individual who constructed it, the method

of how the decisions about construction were made, and how the resources were used or obtained.

When applying the commonly used criteria for assessing vernacular architecture, Atmeh Camp meets three of the four major criteria for the definition of vernacular architecture:

- ☑ User-built:
  All structures and homes were built or added on by the residents of the camp, without professional architect or contractor assistance; additionally, this kind of building matches the definitions for self-built and vernacular housing already established (UN-Habitat, 2021; REACH Initiative, 2020).

- ☑ Absence of formal planning systems:
  Housing was developed in a completely organic manner, without any governmentimposed layout, zoning, or building codes, as reported in Studies published by institutions investigating informal Camp Urbanisation north of Syria (UN-Habitat, 2021; REACH Initiative, 2020).

- ☑ Use of locally available and low-cost materials:
  Residents of the camp used building materials available in the local market, as well as materials obtained through donation, donation of recycled building materials, or reuse of existing materials, thereby minimizing their reliance upon the transport and industrial systems for the procurement of construction material.

- ☒ Limited representation of traditional Syrian residential typologies: Although some of the constructed units may be similar in ways to traditional Syrian courtyard homes or other rural vernacular homes, the lack of space, financial constraints, and lack of security prevented the typical form of these types of homes being fully represented in Atmeh Camp.

As a result, Atmeh Camp is not necessarily a direct or pure example of vernacular architecture, but does represent a model of self-organization and transitional housing that has served as a precursor to vernacular architecture in that it is a product of conditions associated with displacement and constraint.

3.1.3 Social Benefits

The self-organization processes related to housing seen in Atmeh Camp provided residents with significant social benefits. By enabling residents to contribute to the design of their living environment, the process of modifying their homes provided them with a sense of ownership, dignity, and personal power. In addition, families were able to modify the internal configuration of their homes to adapt to the number of family members, gender roles, and daily living, thereby facilitating social acceptance and longer-term residences (UNHCR, 2014; UNHCR, 2023; Boano, 2015). Social bonds between residents of Atmeh Camp were also strengthened through the collective building of housing. Informal sharing of knowledge, collective participation in construction, and mutual support among neighbors created cohesion and increased social and emotional well-being during time periods of extended displacement.

3.1.4 Economic Benefits

Additionally, with respect to the cost of building housing, the building practices of residents of Atmeh Camp significantly reduced the cost of construction by using labour performed by the resident and locally-produced materials. Through incremental construction, families were able

to gradually expand their homes based on available resources rather than incurring one-time costs. The above practices also prompted the development of micro-economies inside the camp, through the provision of small-scale construction services; the establishment of materials trade; and the creation of informal labour markets. These economic dynamics at the community level helped to improve household's adaptability and reduce reliance on external assistance over a period of time (REACH Initiative, 2018).

3.1.5 Environmental Benefits

Housing adaptations in Atmeh Camp, although created under very limited circumstances, showcased many sustainable development principles from an environmental perspective. By relying on locally sourced materials that were reused locally, the negative environmental impact associated with transportation emissions and construction waste was significantly reduced. Furthermore, local residents implemented many of the basic strategies associated with climate sensitivity, including using available materials (such as earth blocks, concrete masonry units, salvaged bricks, timber, plastic sheeting, and fabric layers for improved thermal performance of building envelopes and adding insulation layer), as well as adjusting spatial orientation to improve indoor comfort conditions. Many of the environmental responses demonstrated through these housing adaptations are still very basic in nature compared to more traditional vernacular building systems, but they show that self-built housing that occurs in informal settlements can lead to the development of environmentally conscious behaviors.

3.1.6 Analytical Significance

Atmeh Camp is an example of how vernacular architecture should be viewed as a process that is dynamic; reflecting changes, adaptations, and continuity, particularly in the contexts of postdisaster and post-displacement. Rather than rejecting informal settlements for not being a "traditional" material selection or pattern of organization; by recognizing these settlements as transitional forms of vernacular architecture, this can provide valuable knowledge and direction towards devising more holistic and inclusive post-disaster and post-displacement reconstruction methods.

3.2 Sri Lanka – Post-Tsunami Housing Reconstruction (2004)

Fig. 5 Design of Climate-Responsive Post-tsunami Housing in Kirinda, Sri Lanka Shows the Use of Vernacular Design Principles, Passive Design Methods, and Local Materials to Create the New Housing (Dezeen, 2013).

Fig. 6 New housing has been built using both local materials and by using local labour to complete the work (World Bank, 2006).

Fig. 7 The centrally designed open courtyard enhances natural ventilation and shading while accommodating the main daily activities (Dezeen, 2013).

3.2.1 Background and Reconstruction Context

The 2004 Indian Ocean Tsunami inflicted considerable damage to coastlines in Sri Lanka, driving hundreds of thousands away from their homes. Initial responses to housing needs immediately following the disaster were predominantly based on standardized, contractor-led housing schemes to get rapid delivery. But evaluation efforts indicated that very few of these

projects were adequately suited to the local cultural preferences or patterns of livelihood, or climatic conditions, resulting in low user satisfaction and abandonment (Barenstein, 2006).

Consequently, the strategy shifted to Owner-Driven Housing (ODH) models whereby people are empowered to develop the house(s) that they desire with their knowledge of how to build in their community, the materials local to their area and an incremental construction process (Figure 6).

3.2.2 Vernacular Architecture and Housing Practices

In post-tsunami Sri Lanka, vernacular architecture was not merely a duplication of pre-tsunami housing forms, but rather a contextually relevant interpretation of the vernacular way of building. Households used locally available materials such as brick, timber, clay tiles roofing and lime-based finishes, and produced spatial arrangements consistent with the local culture, including semi-open verandahs and outdoor spaces for living (Figure 7). This represents how post-disaster vernacular architecture in Sri Lanka has been created through a continuing, fluid and adaptive reconstruction process where there is an integration between traditional building practices and current conditions.

3.2.3 Social Benefits

The use of owner-driven and vernacular-informed construction methods has provided people with countless communal benefits. Families benefited in several ways by being able to participate in their own home renovation from start to finish, including greater social acceptance of residence, greater cultural identity, as well as more ownership. The designs of the homes typically were developed with regard to extended family composition, gender roles, and domestic functions to encourage the continuation of daily activities that are often performed with family members (Barenstein, 2006). As a result of the community-oriented approach to reconstruction, there has been an enhancement to existing social support systems and networks and how these systems contribute to providing group-based decision making and, ultimately, social resilience and psychosocial recovery after a disaster (IFRC, 2013).

3.2.4 Economic Benefits

There were also several economic benefits to the community and households that employed owner-driven and vernacular methods for the reconstruction of homes, as these methods reduced the costs of housing due to the reduced reliance on imported materials and reliant contractors. Because of the incremental nature of housing construction, families were able to create housing according to their financial capabilities, thus reducing the number of families that became trapped in a revolving cycle of debt and financial dependence. In addition, local labor and materials used for housing construction provided jobs and retained funding for roof repairs within the local economy. Reports by the World Bank approximated that the rate of completion of owner-driven housing in Sri Lanka and overall costs expended for construction were less than those incurred constructing homes in a manner that was centrally managed or directed (World Bank, 2006).

3.2.5 Environmental Benefits

In Sri Lanka, another important outcome of vernacular-based reconstruction processes is environmental sustainability. Traditional building methods used to create homes in this country include design features that are able to respond to the climate, including the use of natural ventilation, shading devices and thermal mass. By incorporating these elements into the buildings, people were less reliant on mechanical cooling systems. Using local materials for

construction has also reduced greenhouse gas emissions associated with transporting materials and created less construction waste, contributing to more environmentally sustainable reconstruction efforts (UN-Habitat, 2015; Brown & Kelman, 2024; REACH Initiative, 2018).

3.2.6 Analytical Significance

The case of Sri Lanka indicates that when vernacular architecture is integrated into post-disaster reconstruction through owner-driven approaches, it produces quantitative benefits socially, economically and environmentally. This case provides strong empirical support for the argument that vernacular architecture improves the reconstruction process beyond simply providing shelter.

3.3 Haiti – Post-Earthquake Housing Reconstruction (2010)

Reintegrating Vernacular Knowledge After the Failure of Imported Models

Fig. 8 The reconstruction period of Haiti done according to limitations of temporary imported shelter models, showing the movement away from unsafe and temporary homes and toward safer and permanent home (United Nations Office for Project Services, n.d.).

Fig. 9 Local workers are involved in post-earthquake reconstruction in Haiti under the 16/6 Project, reflecting community-based employment and locally driven rebuilding efforts (United Nations Office for Project Services, n.d.).

3.3.1 Background and Reconstruction Context

The 2010 earthquake that devastated Haiti devastated the country with massive destruction of housing and mass displacement of people. At first the efforts of reconstruction focused on the use of prefabricated units and imported methods of construction that were intended to provide rapid solutions. These prefabricated units and imported methods ultimately proved to be very expensive, took a long time to implement, and were poorly suited for the social, economic and environmental conditions of Haiti (Lizarralde et al., 2010; Lyons, 2009). As reconstruction continued, there was a growing realization among communities as well as humanitarian organizations that these imported models were insufficient in addressing the needs of those affected by the disaster. Consequently, the emphasis shifted back to the indigenous knowledge of local communities and the use of vernacular techniques of building in order to address these issues.

3.3.2 Vernacular Architecture and Housing Practices

Using regionally constructed structures, built from locally available materials, congregate living, and self-built housing incrementally, these methods rely on either utilising or modifying traditional vernacular building methods to support rebuild efforts with increased resilience to earthquakes but keeping the means of familiarity. In this context, vernacular architecture is an experience that assists the population to create dwellings with culturally familiar construction methods that are able to support them by using culturally appropriate ways to recreate dwellings.

3.3.3 Social Benefits

Community participation restored control for the Haitian population impacted by Vernacularbased reconstruction. Building their own homes granted families a means to recreate their previous way of life according to their culture, routine and patterns, thus allowing for longerterm occupancy and social stability (Habitat for Humanity, 2012). Through community engagement in the reconstruction effort—by providing space for members of the community to share knowledge and learn collectively—Haitians were able to increase their capacity to respond in the future to build resiliency.

3.3.4 Economic Benefits

Economically speaking, there was strong case for using globally based vernacular construction in Haiti. The use of local labour and materials lowered the cost of building for the families and provided jobs in the community while recovering from the earthquake (Figure 9). Incremental home building allowed families to construct essential spaces first and add on from there; therefore, reducing financial pressure. Studies have shown that the cost of building with an owner builder approach in Haiti produced much more cost-effective and scalable building into the future when compared to the contractor builder approach (Overseas Development Institute, 2011).

3.3.5 Environmental Benefits

Environmentally speaking, using Vernacular housing in Haiti has reduced material waste and emissions (due to reduced transportation), therefore resulting in environmentally friendly building methods. Adapting traditional building methods have also resulted in the reuse of debris and locally available construction materials in an environmentally responsible manner.

3.3.6 Analytical Significance

This case demonstrates how important vernacular architecture is to recovering from disasters by providing comprehensive socio-economic-environmental value. We see the problems of not considering local knowledge when rebuilding and the benefits that vernacular methods provide for durable recovery (Hamdan, 2022; Mulligan & Nadarajah, 2012; García & Torres, 2025).

3.4 Comparative Analysis and Integrated Discussion

3.4.1 Comparative Analysis of Case Studies

The assessment of the environmental, social, and economic advantages of vernacular architecture for post-disaster reconstruction will be evaluated in this section through a comparison of the above-mentioned three examples of Atmeh Camp (Syria), housing posttsunami (2004) in Sri Lanka and housing post-earthquake (2010) in Haiti. The case studies have demonstrated how vernacular principles have been applied to different environments/contexts related to displacement and disaster recovery.

Table 1: Comparative Analysis of Vernacular-Based Housing Approaches

	Atmeh Camp, Syria	**Sri Lanka (post-Tsunami 2004)**	**Haiti (postearthquake 2010)**
Type of Crisis	Prolonged displacement	Natural disaster	Natural disaster
Housing Approach	Self-Organized Housing	Owner-driven Housing	Owner-driven Housing
Used Local Materials	Concrete blocks, timber, reused materials	Brick, timber, clay tiles	Local masonry, timber, reused debris

Community Engagement	Full resident led construction	Resident design control	Technically assisted selfbuild
Formal Planning	Non-existent	Minimal institutional support	Limited technical frameworks
Use of Traditional forms	Incomplete	Relatively strong	Moderate
Social Benefits	Social empowerment and dignity	Cultural alignment and acceptance	Community resilience and stability
Economic Benefits	Gradual low-cost expansion	Economic efficiency and local employment	Cost savings and economic support
Environmental Benefits	Recycled materials and transport reduction	Climateadaptive design	Waste reduction and local sourcing

3.4.2 Social Benefits: Comparative Discussion

All three of these examples demonstrate the advantages of using vernacular and self-organized housing methods to provide social value by placing people who are impacted by the housing crisis at the centre of the reconstruction process. In the case of Atmeh Camp, refugee self-built housing allowed individuals to regain a sense of agency and dignity while living in protracted conditions of displacement. While the housing types did not replicate the traditional Syrian

types of homes, the residents of the camp adapted the internal configuration of their homes in order to meet their family and cultural needs, which helped to establish social acceptance. In Sri Lanka, the ownership-driven housing programme helped maintain the continuity of cultures by enabling households to re-establish familiar configurations of space used in their everyday activities and social practices. Likewise, the community-based reconstruction efforts in Haiti helped to restore social stability to the community by empowering residents to participate in the rebuilding of their homes and their neighborhoods. Based on these three examples, it is clear that vernacular architecture provides support for social resilience through engagement in a participatory process that provides ownership, identity, and community cohesiveness rather than through the formal design of the building.

3.4.3 Economic Benefits: Comparative Discussion

Economic efficiency was repeatedly demonstrated as a benefit of vernacular-based recovery in all instances studied. In the case of Atmeh Camp, building using self-labor and local building materials had an economic impact by lowering building costs and allowing for a gradual growth of housing as household resources allowed. This method of construction helped to create less dependence on financial assistance and support informal micro-economies within Atmeh Camp. The owner-driven housing programs in Sri Lanka are further evidence of how a decentralised approach to construction can produce a more rapid delivery of housing while providing a lower overall cost than contractor led schemes. Local-building material and the use of local labour were also employed in the recovery of Haiti's economy after the earthquake. Using local materials and labour retained a majority of the financial resources within the communities of those impacted by the earthquake and played an important role in the recovery of their economies. The comparison of these three projects illustrates that vernacular architecture is an economically adaptable system that is capable of scaling the reconstruction of communities affected by a disaster while reducing the financial burden on both the institutions and the households that must be handled through a process of recovery.

3.4.4 Environmental Benefits: Comparative Discussion

Another important part where vernacular construction methods did better than standardized housing is in the area of environmental performance. In Sri Lanka, traditional forms of construction used 'passive' (the use of natural methods to achieve comfort) methods to achieve comfortable living (through natural ventilation, shading, and thermal mass), reducing the need for energy-consuming systems. In Haiti, the use of locally available materials and use of debris to build homes reduced construction waste and the transportation of materials to the site. In the Atmeh Camp, environmental strategies were limited due to extreme constraints, but the use of re-used and/or locally available materials resulted in less environmental impact compared to imported housing systems and demonstrated how vernacular forms of construction promote environmental sustainability through the efficiency of the materials they use, their local sources, and their ability to respond to the climate in which they are built.

3.4.5 Integrated Discussion

Comparative analysis shows that (1) the interrelationship of environment, society and economy created by vernacular architecture produces many benefits to all three areas together, as opposed to separate isolated outcomes; and (2) socially-engaged participation by the community creates the basis for incremental investment leading to better economic resiliency, while at the same time creating greater levels of efficiency in the economy and providing for a greater degree of environmental sustainability through the use of locally produced materials. What is important to note is that rather than using the aesthetic similarities of interest (i.e. the similarity of

traditional types of housing) to measure or appraise the significance of vernacular architecture, the basis for determining value in vernacular architecture is based on the process of producing housing; i.e. user control over production, adaptability and responsiveness to context. Even in constrained and informal environments, the principles of vernacular architecture create the means for creating resilient ways of reconstructing housing (i.e. Atmeh Camp).

3.4.6 Implications for Post-Disaster Reconstruction

The study's major conclusions indicate that through policies about reconstruction following disasters should work towards promoting not just standardized deliveries of houses but also accepting and supporting housing used in vernacular styles and self-organized processes for developing homes. By giving legitimacy to transitional and hybrid settlements as important components of the reconstruction process, more inclusive, cost-effective and sustainable outcomes for housing are possible.

3.5 Vernacular Architecture in Post Crisis Reconstruction

This section summarizes the results of comparative analysis of the three case studies, and uses this information to outline the main environmental, social, and economic advantages of using vernacular architecture for rebuilding after disasters.

3.5.1 Social Benefits of Vernacular Architecture

The ability of vernacular architecture to provide a stable social base for communities and promote their resilience after a disaster is one of its most important features. From the cases studied, the process of developing housing solutions based on user participation has given the individuals affected by disasters back a part of their control over the built environment; this has helped them to feel they own their houses (a sense of dignity) as well as enjoy better mental health because they are again comfortable in their living situations. In Atmeh Camp, the ability of displaced families to design their own housing for size, gender, and daily use demands allowed them to use whatever means were available to create a safe place where they could have a home, even though the amount of land they could occupy or the amount of money they had to spend were severely limited. Similarly, in both Sri Lanka and Haiti, "by using ownerdriven reconstruction," family members could restore their ability to remember and to recreate social norms based on the spatial patterns they were familiar; this type of social continuity is critical to the recovery process. Furthermore, through processes that were based on the use of vernacular building materials and techniques, collective action, shared labor, and the exchange of knowledge occurred within the community, which ultimately contributed to the development of social cohesion and networks of support necessary for a community to recover from the effects of a disaster. In contrast to standardized housing models that isolate families, building with vernacular methods and materials provides for social interaction and the development of community bonds.

3.5.2 Economic Benefits of Vernacular Architecture

Economic analysis of vernacular architecture show that it is a cheaper way to construct a building than to use a contractor-based rebuilding method. The use of locally available building materials and the homeowner's labour significantly lowers the cost associated with constructing a house, while reducing reliance on an external supply chain. This is especially important for rebuilding after a disaster when supply chains are disrupted. Homeowners have been able to build their homes incrementally, allowing them to prioritise the construction of essential spaces such as kitchens and bathrooms, and expanding upon their homes as funds become available. This form of building has reduced the risk of accumulating debt and has allowed families to

invest in housing while simultaneously investing in their livelihoods. By utilising vernacular building materials, reconstruction in areas affected by natural disasters has generated jobs in local communities for builders, tradespeople and material suppliers. Research from Sri Lanka and Haiti shows that homeowner-led rebuilding efforts have kept financial resources within the affected community and created the basis for larger community economic recovery while also reducing the long-term use of aid.

3.5.3 Environmental Benefits of Vernacular Architecture

Vernacular architecture is defined by its environmental sustainability. Commonly used in construction were buildings created by professionals who built them properly. Thus, many, if any of the Building Professionals created the building using energy-efficient and resource conserving practices or used climate responsive strategies were provided through natural means of ventilation, sun shading, and thermal massing to create comfortable interiors and minimize energy usage. Using locally available materials and recycled materials, e.g., earth, stone, wood, block and debris, reduces both transportations associated with the material and increases waste disposed of by recycling. Reusing materials that were on remotely sourced basis would have a lesser impact on the environment than doing the same with industrially manufactured products This was the case with reconstruction efforts after the 2010 earthquakes in Haiti and in June 2011 Sri Lanka Nicolson and Calder gave additional examples of how material reuse combined with using a local source of supply in the constrained context of Atmeh Camp in Syria resulted in providing environmentally sustainable solutions through housing. In summary, these examples show the close relationship between the principles of environmental sustainability, resource efficiency and building vernacular architecture as evidenced by their strong correspondence in locations of both material equity and ecological/mechanical ecological hazards.

3.5.4 Integrated Benefits and Interdependencies

The analysis indicates that the environmental, social and economic advantages of vernacular architecture have interrelationships. Socially engaged building solutions increase the resilience of local economies by facilitating incremental resource stewardship by households. At the same time, the use of locally sourced materials supports economic efficiency and environmentally sustainable practices. Instead of providing separate results, vernacular architecture provides a more comprehensive approach to reconstruction by addressing many aspects of recovery all at once. This integrated process makes vernacular-based housing different from standardized housing, which tend to only address providing shelter and don't consider the broader social, economic, and environmental consequences.

3.5.5 Implications for Post-Disaster Reconstruction Practice

The findings of vernacular architectural practice demonstrate how post-disaster reconstruction policy should provide for user-led/adapted localised housing approaches. Recognising vernacular and self- assembled housing as legitimate forms of reconstruction can achieve faster delivery, increased acceptance and greater sustainability. Importantly, vernacular architecture should have no limits or defined forms of materials typologies. Vernacular architecture must therefore be understood as a adaptive process capable of responding to the diverse conditions resulting from disasters, such as relocation, resource shortfalls and long-term uncertainty.

3. CONCLUSION

4.1 Conclusion

This research reviewed the literature and conducted a comparative analysis of case studies of vernacular architecture's environmental, social and economic benefits in post-disaster reconstruction through three sites: Atmeh Camp (Syria), Sri Lanka's post-tsunami housing reconstruction (2004) and Haiti's post-earthquake housing reconstruction (2010). Findings indicate vernacular architecture generally provides an all-encompassing, effective housing alternative to standardised house types produced through conventional, top-down production. As a stylistic or material; vernacular architecture is a process-based methodology based on user involvement, utilisation of local materials and adaptability to context. Across all case studies, all examined instances of housing supported by vernacular design were associated with an increased degree of community acceptance, a more cost-effective method of creating homes and increased sustainability regarding the environment.

The findings further substantiate that both displaced and disaster-affected communities can participate as agents in the process of reconstruction. By utilising self-organised and ownerdriven building practices; communities were able to adapt housing solutions to their own cultural norms, economic capacities and environmental circumstances. The result of these methods was to create higher levels of ownership, dignity and long-term viability when compared to externally imposed housing solutions. The example of Atmeh Camp demonstrates that vernacular architecture is not limited to the use of traditional materials or historical styles. Even though Atmeh does not replicate historical vernacular housing typologies found throughout Syria, it does conform to core principles of vernacular architecture which include self-building, incremental development and the use of locally available building materials.

Therefore, Atmeh represents a transitional and proto-vernacular condition providing valuable lessons about post-disaster and displaced reconstruction. In conclusion, this research suggests that vernacular architecture offers a range of interconnected environmental, social and economic advantages that warrant recognition as a valid and effective mechanism for building resilience in the aftermath of a disaster.

4.2 Future Work

The next stage of this research is to create measurable descriptions for evaluating the long-term impacts (environmental, social, economic) of vernacular or self-organized housing systems in the context of post-disaster reconstruction. To achieve this, future research will be required to conduct empirical studies (including field-based assessments of effectiveness) over extended periods of time to explore how transitional or self-built housing systems develop over time and identify ways to formally incorporate vernacular principles into post-disaster construction policies/procedures.

Conflict of Interest Statement

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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