Between the Known and the Possible

Reconstructing Identity Through Vernacular Architecture and Post-Conflict Design Frameworks in Yemen

Explore Lab Graduation Studio

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Introduction

Vernacular architecture plays a key role in confirming national identities and forging resilient communities. So how can vernacular architecture elements be used to 'build back better'[1] in a post-conflict setting? The use of recovery, reconstruction and rehabilitation of buildings after (natural) disasters is well documented as a tool to strengthen resilience of affected communities and introduce disaster-prevention measures; this paper will explore whether a similar set-up can contribute to post-conflict reconciliation and reconstruction.

As global conflicts continue to destroy cities and displace populations, there is an urgent need for clear, adaptable, environmentally friendly and culturally sensitive reconstruction guidelines. Frequently, reconstruction processes are implemented hastily, overlooking the cultural and emotional needs of the affected population. However, the use of vernacular architectural elements integrated with modern construction techniques can contribute to preserving cultural identity and shared memory, while simultaneously adapting to contemporary needs.

Existing research focuses on the description of traditional architecture and sustainable vernacular practices, such as Khaled A. Al-Sallal and Ali Sayigh; or it explores the place attachment theory (Goksenin Inalhan) to explain the importance of architectural identity and the emotional ties between residents and their built environment. Other studies explore the relationship between trauma, memory, urban space, and how cities recover after catastrophes, e.g. Adrian Lahoud, Charlotte Heath-Kelly and Lawrence J. Vale. This research aims to build upon the existing body of work to identify how these theories and insights can guide a more informed and culturally appropriate approach to rebuilding in post-conflict settings.

The research will then zoom in on Yemen and more specifically Sana'a, the capital of Yemen. As Yemen remains the scene of armed conflict, reconstruction has not yet fully started and thus offers an opportunity to implement lessons drawn from similar contexts. Yemen is an excellent case study as historically, it boasts distinct architectural craftsmanship that contributed to strong social cohesion in the cities and a built environment that encouraged communal interaction. Primary research confirmed the views, aspirations and expectations of citizens of Sana'a, with respect to the development of a culturally appropriate methodology for reconstruction, that centres on cultural identity and preserves traditional methods and architecture.

Thus, this paper will explore **which vernacular elements, including** craftmanship, spatial logic, and passive design strategies **of traditional Yemeni architecture, can contribute to a more sustainable, culturally and context sensitive reconstruction process** that in parallel contributes to restoring cultural identity and social cohesion.

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[1] United Nations Office for Disaster Risk Reduction (UNDRR), "Build Back Better," In *The Sendai Framework Terminology on Disaster Risk Reduction*, 2017, https://www.undrr.org/terminology/build-back-better.

The conflict in Yemen

Yemen, located on the southwestern end of the Arabian Peninsula bordering Saudia Arabia and Oman in the north and east, the Gulf of Aden in the south and the Red Sea in the west,[2] experiences one of the world's largest humanitarian crises. The conflict began in 2011 when widespread public protests, part of the Arab Spring, forced president Ali Abdullah Saleh–who had ruled the country since the unification of the North and South of Yemen in 1990[3]–to hand over power to his vice-president, Abdrabbuh Mansour Hadi.[4] This transition led to the division of the Yemeni army and enabled al-Qaeda in the Arabian Peninsula (AQAP) to seize territories in eastern Yemen.[5]

By 2013, Yemen was experiencing significant governmental instability, largely due to worsening economic conditions and recuring AQAP attacks. In this weakened state, the Houthis – an armed Zaidi Shi'a group also known as Ansar Allah

Figure 1. Who controls Yemen (2026). Alia Chughtai and Mohamed A. Hussein, "Mapping Who Controls What in Yemen in 2026," Al Jazeera, January 14, 2026, map, accessed January 18, 2026, https://www.aljazeera.com/news/2026/1/14/mapping-who-controls-what-in-yemen-in-2026.

(Supporters of Allah, widely believed to be supported by Iran),[6] which had emerged in the 1990s and gained prominence in 2014[7] – seized control of the Saada province in northern Yemen. They subsequently advanced into the capital, Sana'a, in 2015, forcing President Hadi to flee to Saudi Arabia.[8] Meanwhile, the Southern Transitional Council (STC), with United Arab Emirates' backing, launched initiatives to seek independence of Southern Yemen.[9]

In response to the Houthi take-over in Sana'a, a Saudi-led and US supported coalition launched a military intervention that lasted from March 2015 until 2022. The coalition aimed to restore Hadi's government (PLC) and counter what it perceived as Iran's growing influence in the region. A temporary ceasefire was reached in 2020 in light of the COVID-19 pandemic, though intermittent clashes continued between various armed groups, including AQAP and the STC. Only when President Hadi stepped down in 2022, was a ceasefire declared and subsequently peace negotiations launched in 2023.
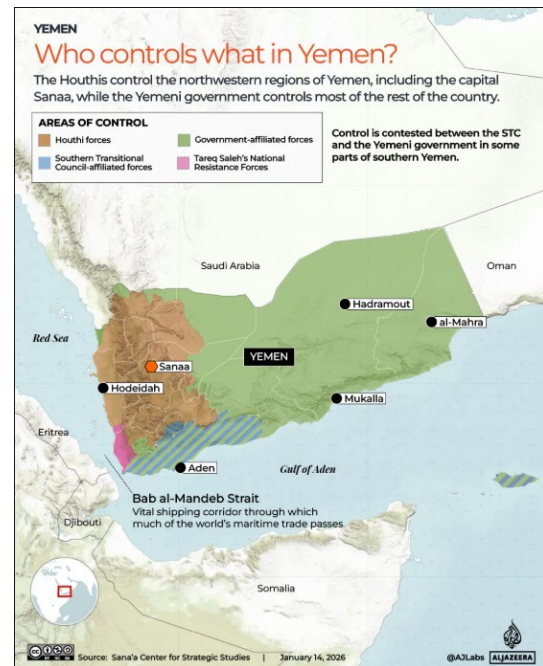
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[2] Varanda, Fernando, *Art of building in Yemen*, (Cambridge: MIT press, 1982).

[3] Al Jazeera, "A Timeline of Yemen's Slide into Conflict and War," Al Jazeera, April 11, 2023, www.aljazeera.com/news/2023/4/11/a-timeline-of-yemens-slide-into-conflict-and-war.

[4] "Yemen: Why Is the War There Getting More Violent?" BBC News, April 14, 2023, www.bbc.com/news/world-middle-east-29319423.

[5] Al Jazeera, "A Timeline of Yemen's."

[6] Haddad, Mohammed, "Infographic: Yemen's War Explained in Maps and Charts," Al Jazeera, February 9, 2022, www.aljazeera.com/news/2022/2/9/yemens-war-explained-in-maps-and-charts-interactive.

[7] Ali, Marium, "Mapping US Attacks on Yemen's Houthis," Al Jazeera, March 16, 2025, www.aljazeera.com/news/2025/3/16/mapping-us-attacks-on-yemen.

[8] BBC News, "Yemen."

[9] Al Jazeera, "A Timeline of Yemen's."

However, this fragile peace was disrupted when Yemen, in support of the Palestinian cause, negatively impacted trade through the Red Sea via blockades and attacks on commercial ships. This led to military retaliation by the United States and Israel, which effectively ended the relatively stable period that had begun in 2022 causing unrest within the country once again.
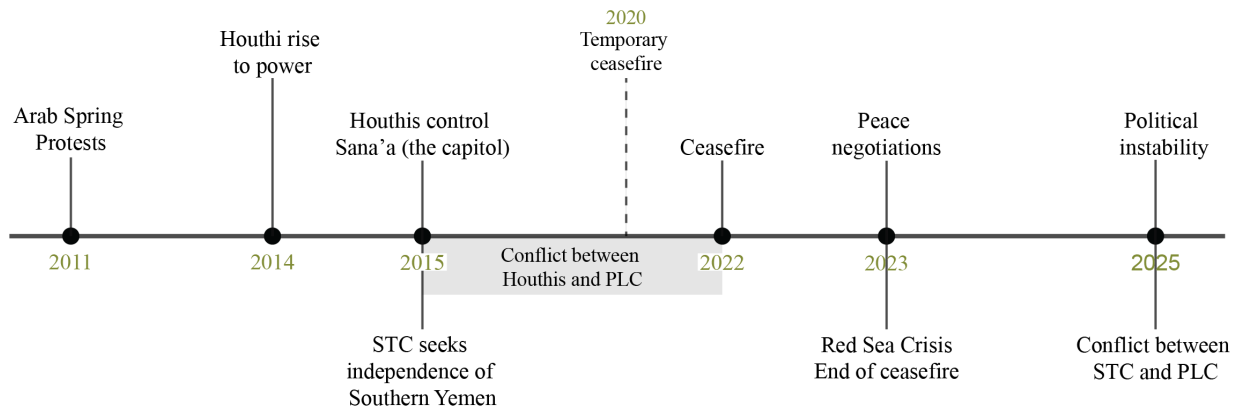

Figure 2. Timeline of the Conflict in Yemen (created by author).

The role of vernacular architecture in post-conflict reconstruction

In general, the impact of conflict on architectural heritage is a complex issue that requires careful consideration during recovery efforts. Post-conflict reconstruction must aim to create a balance between the physical rebuilding of cities and the preservation of cultural identity, memory, and social cohesion to achieve sustainable and meaningful urban development. One of the main challenges is in defining the boundaries and meaning of "authenticity" in reconstruction, especially in cities that have been through multiple historic changes.[10] Therefore, ensuring that local communities participate in the reconstruction process is essential in aligning the architectural interventions with the local community needs, values and expectations. This also helps prevent residents from feeling alienated from their rebuilt environments.[11]

Over a decade of armed conflict and civil unrest has caused irreparable damage to ancient architectural sites in Yemen. The physical destruction of heritage sites is a common occurrence in conflict situations. Often architectural landmarks, archaeological sites, and cultural landscapes are damaged or destroyed, especially when they are located in or near battle zones. Such destruction is frequently referred to as "collateral damage".[12] Yet, the destruction of physical infrastructure also often leads to disruptions of social and cultural networks, as displaced people lose their homes, cities and communities, and are forced to cut ties to the places that defined their history and identity.[13] The abandonment of familiar living and working environments contributes to the overall loss of social memory and a collective sense of

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[10] SOUFAN, Anas, "Historiographical Overview on the Post Conflict Reconstruction in Syria: From the Mid-19th Century to the 2011 Crisis," *UNESCO Publications*, (2015).

[11] Miznazi, Diana, *Reconstruction of Cultural Heritage in Aleppo, Syria Reviewed: a critical exploration of current endeavors and practices, (*CEU School of Public Policy, 2023), www.thealeppoproject.com/wp-content/uploads/2023/01/MiznaziPaperWithCoverV01.pdf.

[12] Miznazi, *Reconstruction of Cultural Heritage,* p.1-19.

[13] Lahoud, Adrian, et al, P*ost-traumatic urbanism,* 5th ed. Vol. 80 (Hoboken, N.J: Wiley, 2010), p.137.

belonging.[14] The loss of cultural heritage can diminish the self-esteem of a population and fracture its connection to its shared history.[15] One of the most important aspects of vernacular architecture is its role in preserving cultural identity and collective memory. These buildings are not merely shelters; they are a representation of heritage, traditions, and the experiences of the people.[16] In post-conflict scenarios, where much of a society's cultural fabric has been damaged or lost, the reintroduction of vernacular elements becomes a vital part of rebuilding identity. According to researchers, integrating familiar architectural forms and local materials helps communities re-establish a sense of continuity with the past and contributes to emotional and psychological recovery.[17]

Therefore, cultural heritage plays an essential role in the re-shaping of both individual and collective identity. Thus, in post-conflict contexts, important questions need to be asked that go beyond mere architectural decisions and include deeply symbolic elements that speak to re-establishing national identity and (re)constructing collective memory.[18] Such questions include considerations around the methodology for reconstruction; how reconstruction can represent (collective) identity; the role of culture and memory in rebuilding efforts etc. Another key consideration in the reconstruction of cultural heritage and physical infrastructure centres around balancing between economic gain (e.g. the revival of tourism related to cultural heritage sites) and cultural or social considerations, such as identity and memory.[19]

Post conflict reconstruction can also face structural and practical challenges. These challenges can include a lack of financial and technical resources, outdated legal frameworks, poor coordination between stakeholders, and the challenge between preserving heritage and meeting immediate human needs.[20]

As previously mentioned, vernacular architecture in addition to its cultural value is inherently sustainable. It has a built-in response to local environmental conditions, typically using locally available materials and passive design strategies. This adaptation leads to energy efficient, climate responsive designs that require little external sources.[21] Incorporating vernacular principles in reconstruction can reduce a country's dependence on imported technologies and provide comfort and functionality fitted to the specific environmental context.[22]

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[14] Thiel, Fabian, Rahaf Orabi, *Reviving Aleppo: Urban, Legal and Digital Approaches for Post-War Recover,* (London: Springer Nature, 2024), p. 177, https://doi.org/10.1007/978-3-031-65858-7.

[15] Yang, Minja, Gina Doggett, *Culture/nature: the link to preservation,* UNESCO World Heritage Centre, 2018, https://whc.unesco.org/en/activities/486/.

[16] Thiel, *Reviving Aleppo*, p.311.

[17] Vale, Lawrence J., Thomas J. Campanella, *The Resilient City: How Modern Cities Recover from Disaster,* (New York: Oxford University Press, 2005), p.359.

[18] SOUFAN, "Historiographical Overview."

[19] Thiel, *Reviving Aleppo*, p.168.

[20] Al-Harithy, Howayda, Dina Mneimneh, "Integrating culture, recovery and reconstruction for sustainable urban development: Beirut case study," *UNESCO Publications*, 2022, https://whc.unesco.org/document/175507.

[21] Al-Sabahi, Hatim M, "A Comparative Analysis of the Vernacular Housing Cluster of Yemen: Sana'a and Shibam Hadhramawt A Case Study," *Journal of Science & Technology Vol.* 10, no. 2 (2005): p.27–34, https://doi.org/10.20428/jst.v10i2.71.

[22] Al-Sallal, Khaled A, "Vernacular Tower Architecture of Sana'a: Theory and Method for Deriving Sustainable Design Guidelines," In *Sustainability, Energy and Architecture*, (Oxford: Academic Press, 2013), p.257–287, https://doi.org/10.1016/B978-0-12-397269-9.00010-4.

There are also clear social and economic advantages. For example, the use of local materials and construction methods strengthens the local economy by creating employment opportunities and engaging with local craftsman.[23] This creates a sense of ownership among communities; the use of traditional construction methods offers opportunities for local craftsmen, but also allows the preservation of traditional knowledge and offers opportunities to train younger generations, thus broadening the capabilities found within the local workforce. In contrast, reconstruction projects that overlook the use of traditional knowledge in favour of foreign materials or labour can undermine local autonomy and create long-term international dependencies.[24,25]

Architectural approaches to reconstruction processes

Where the above paragraphs build a case for the socio-economic and cultural advantages of the integration of vernacular architecture elements into post-conflict reconstruction, this section will explore different architectural approaches to reconstruction and how they relate to the use of vernacular elements.

Critical regionalism

Critical regionalism is an architectural approach in which the importance of cultural, historical, and environmental context is emphasised throughout the design process. It focuses on the reinterpretation, rather than replication, of vernacular forms to develop modern architecture rooted in local traditions.
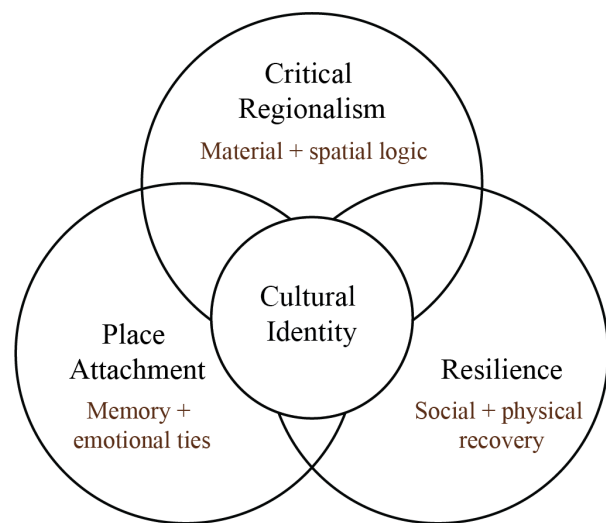

Figure 3. Theoretical Framework Overview (created by author).

The research aligns with this concept by exploring which specific vernacular elements from Yemen can contribute to modern construction. These could possibly include sustainable strategies such as passive cooling systems and thermal comfort, which are embedded in traditional techniques.[26] An integrated approach (traditional into the modern) seeks to capture the *genius loci* – the spirit of the place – through the intentional use of local materials and methods that align with the cultural memory of the place and the contemporary needs of the people.[27]

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[23] Benslimane, Nawal, Ratiba Wided Biara, "The urban sustainable structure of the vernacular city and its modern transformation: A case study of the popular architecture in the Saharian Region," *Technologies and Materials for Renewable Energy* (2018): p.1241-1252, https://doi.org/10.1016/j.egypro.2018.11.290.

[24] "Reconstruction and Recovery in Yemen: Recommendations from the Development Champions," *Rethinking Yemen's Economy,* April 8, 2019, https://devchampions.org/publications/policy-brief/Reconstruction_and_Recovery_in_Yemen/.

[25] Sultan, Basel, "Modern/Traditional Buildings in Yemen and Sustainability," 2008, www.researchgate.net/publication/256599703_Modern_Traditional_Buildings_in_Yemen_and_Sustainability.

[26] Sayigh, Ali, and al, *Sustainable Vernacular Architecture: How the Past Can Enrich the Future,* (Cham, Switzerland: Springer Nature, 2019), p.23, https://doi.org/10.1007/978-3-030-06185-2.

[27] Sayigh, *Sustainable Vernacular Architecture,* p.141-163.

Another principle of critical regionalism is the integration of architecture into the natural landscape. This includes site sensitive design and the use of traditional techniques or appearances that unify the built structure with its surroundings. Furthermore, the idea of using rubble from destroyed structures in new construction does not only recycle the material but also provides a level of historical continuity, anchoring the reconstruction to a specific movement in history.[28]

Most importantly, the critical regionalist approach does not aim to replicate the past, but rather to reinterpret it. By incorporating vernacular features in new ways, this method encourages innovation while simultaneously respecting tradition. It supports the central goal of this research: to propose a hybrid architectural approach that merges tradition with modernity in a way that serves the present while honouring the past.

Place attachment theory

Goksenin Inalhan explores place attachment theory as the emotional and psychological bonds that people form with their physical environments.[29] In post conflict contexts, these bonds are often broken due to displacement, destruction or the loss of familiar surroundings.[30] Therefore, the reconstruction of destroyed cities becomes not only about the physical rebuilding of the environment but also a matter of restoring the emotional and cultural connections to the place. The integration of vernacular design elements – such as the architectural forms, spatial organisation, and materials familiar to the community – can help rebuild environments that resonate with people's memories and identity, consequently restoring the people's sense of belonging and emotional stability.

Additionally, reinvesting in urban heritage is strongly related to encouraging displaced populations to return and reviving social cohesion within the city. This can increase the urban recovery and economic development, further highlighting the community's sense of place and purpose.[31] When people feel emotionally connected to a place, they are more likely to reinvest in rebuilding their community and strengthening its resilience.

Failing to consider place attachment theory during the reconstruction process can lead to a deeper sense of loss, especially among the displaced populations. The lack of familiar landmarks and architectural expressions could make it difficult for individuals to reconnect with their surroundings.[32] Incorporating vernacular design elements can help mitigate this risk by re-establishing visual and cultural connections within the built environment.

Resilience

The concept of resilience is fundamental to post-conflict reconstruction, especially when viewed as both a physical and sociocultural process. Resilience can be described as the ability of a city or community to recover from trauma and rebuild itself.

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[28] Sayigh, *Sustainable Vernacular Architecture,* p.181-205.
[29] Inalhan, Goksenin, et al, "Place Attachment Theory," In *A Handbook of Theories on Designing Alignment between People and the Office Environment*, (London: Routledge, 2021), p.181–194.
[30] Risk, Yara, "Beirut Post-War Reconstruction: The Case of the Grand Theater," *Beirut Post-War Reconstruction: The Case of the Grand Theater*, 2019.
[31] Thiel, *Reviving Aleppo*, p.177.
[32] Thiel, *Reviving Aleppo*, p.165.

From an urban planning perspective, resilience is often paired with rapid restoration of public infrastructure and services.[33] However, a more general understanding of resilience includes the healing of cultural wounds and the rebuilding of social and religious networks that were broken by war.[34] With this in mind, resilience can be strengthened by recreating a deep connection to identity, memory, and place – all of which are linked to vernacular architecture.

Vernacular architecture contributes to resilience by preserving cultural heritage, encouraging emotional recovery, and promoting a sense of continuity in disrupted communities. Additionally, rebuilding with traditional materials or methods can serve as a collective cultural expression, confirming the community's identity and values.

Resilience is in fact a socially constructed narrative; it is shaped by how leaders and inhabitants interpret and respond to a crisis.[35] Therefore, post-conflict reconstruction is once again not just about physical buildings; it is about telling the story of recovery that resonates with the people. Integrating vernacular architecture into this narrative creates a vision of resilience rooted in local identity and tradition.

It is crucial to examine the reconstruction process of any war-torn city through the lenses of these three theoretical concepts. It is through studying them all that we truly understand that reconstruction is much more than just the physical rebuilding of such cities, but it is rather a collective of physical, social, cultural and emotional reconstruction processes that encourage displaced or destroyed communities to connect on a deeper level. Post-conflict reconstruction is an architectural approach that allows communities to reinterpret their identity and strengthen their social bonds.

Understanding Yemeni vernacular architecture

Figure 4. Vernacular Sana'ani building. Mary Horvers, 1997 Trip through Yemen ©1997, CC BY-NC-SA 4.0.

Figure 5. Vernacular Building in Shibam. Matthew Maganga, "Yemen's Ancient High-Rises: How Conflict Erases Heritage," ArchDaily, July 13, 2022, image, accessed 18 April 2024, https://www.archdaily.com/985073/the-ancient-high-rise-the-permeability-of-conflict.

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[33] Heath-Kelly, Charlotte, *Death and security: Memory and mortality at the Bombsite,* (Manchester: Manchester University Press, 2017), p.178.
[34] Vale, *The Resilient City,* p. 42.
[35] Vale, *The Resilient City,* p. 355.

Yemen's vernacular architecture, in particular the iconic examples of the mud-brick tower houses in Sana'a and the centuries' old clay buildings of Shibam Hadhramawt demonstrate a deep understanding of and adaptation capabilities to harsh climatic conditions.[36] These structures which use earth-based building materials, traditional construction techniques, and decorative façade elements, represent the efficiency and identity of Yemeni architectural heritage. Their relevance goes beyond technical performance, it demonstrates the architectures resilience, continuity, and ability to bring up collective memory in a fragmented society. Thus, using some of the traditional elements in post-conflict rebuilding strategies[37] in Yemen may contribute to strengthening social cohesion and sense of community in this particular context where civil strife and local conflicts have impacted negatively on the social fabric of the society.

Ali Sayigh defines vernacular architecture as the traditional and indigenous architectural practices that emerge from local customs, materials, and environmental conditions.[38] It is often characterised by its ability to respond to the specific needs of a local community and the available resources. By nature, vernacular architecture is a form of sustainable architecture, as it relies on locally sources materials and construction methods that are both environmentally and culturally appropriate.[39]

In the Middle East, vernacular architecture responds to climate, cultural, and economic challenges. Some vernacular design elements that are commonly found in houses across the Arabian Peninsula, include *mashrabiyas*,[40] courtyards, and windcatchers. These elements are specifically designed to provide thermal

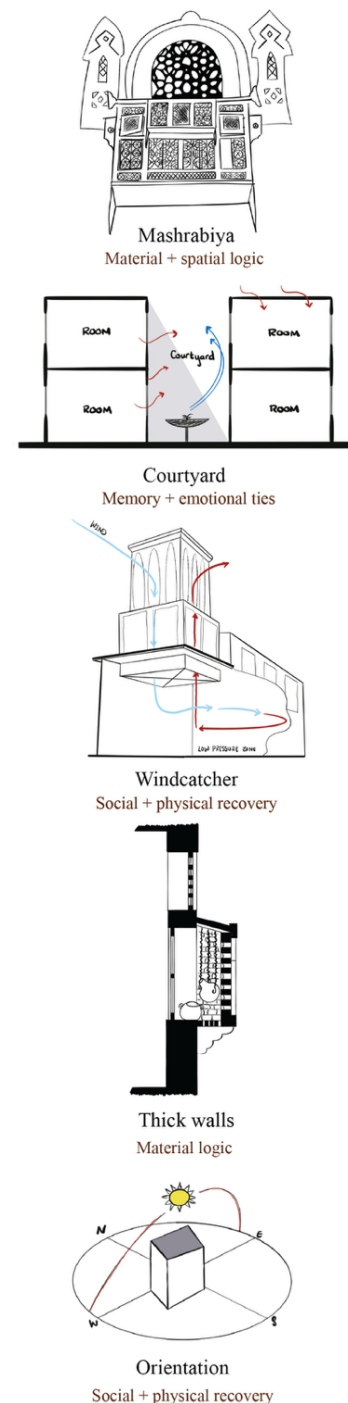*Figure 6. Vernacular Elements in the Middle East (created by author, adapted from Sayigh, Sustainable Vernacular Architecture, and Veranda, Art of building in Yemen).*

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[36] Al-Sallal, "Vernacular Tower Architecture," p.257-287.
[37] Sultan, "Modern/Traditional Buildings."
[38] Sayigh, *Sustainable Vernacular Architecture,* p.1-5.
[39] Sayigh, *Sustainable Vernacular Architecture,* p.5.
[40] Veranda in the *Art of Building in Yemen* (p.86) describes a *mashrabiya* as a window screen mostly made of a wooden lattice covering a perforated window which increases air flow and ventilation while reducing the amount of direct sunlight entering a room. A *mashrabiya* also has a socio-cultural meaning as it allows (generally female) members of the household to observe the surroundings and streets without being visible to others; in muslim countries, where women are often veiled when in the company of non-related males, this offers an opportunity to unveil in private quarters.

comfort and reduce energy consumption in hot climates.[41] Other vernacular strategies such as aligning entrances with courtyards, using linear housing plans, orienting rooms based on sun paths and wind directions, and using thick walls and local materials are all proven strategies in effectively creating environmentally responsive architecture.[42] At the same time, the use of low-cost and locally sourced solutions offer economic sustainability in the construction process, while contributing to a sense of continuity and belonging among the people.[43]

Beyond the environmental and economic benefits, vernacular architecture is deeply rooted in cultural identity. In the Middle East, it is not just a response to the environmental conditions but also a strong expression of regional traditions and values.[44] For example, in Yemen and across the region, houses are often organised to reflect social customs. Certain rooms that face the street or have a direct connection to the outside are used for receiving guest and are typically occupied by men, while more private spaces – often situated behind inner courtyards or higher floors – are reserved for women and family life. This separation is closely tied to cultural concepts of privacy, hospitality, and family honour, ensuring that social interactions respect tradition. It reflects the connection between community and its place, and it serves as a visual and spatial representation of their cultural heritage. The specific architecture of a region can represent centuries worth of accumulated knowledge, presenting local customs, family structures, and collective memory.[45]

Zooming in, Yemen provides a number of rich vernacular architecture examples, ranging from the iconic tower houses of Sana'a and Shibam to a few religious structures such as the Al-Mihdhar mosque in Tarim, which has one of the highest clay minarets in the world. Described in more details below, these buildings use several architectural elements – including multi-storey earth structures, architectural rhythms, light-coloured facades with gypsum coating, intentionally positioned windows, and thick insulating walls – to reflect the environmental adaptation and the cultural expression of the cities.[46]

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[41] Bagasi, Abdullah Abdulhameed, John Kaiser S. Calautit, Abdullah Saeed Karban, "Evaluation of the Integration of the Traditional Architectural Element Mashrabiya into the Ventilation Strategy for Buildings in Hot Climates," *Energies Vol 14,* no. 3: 530(2021): p.1-24, https://doi.org/10.3390/en14030530.

[42] Sayigh, *Sustainable Vernacular Architecture,* p.23.

[43] Sayigh, *Sustainable Vernacular Architecture,* p.353.

[44] Tamimi, Azzam Khalid S.A, Dr. Halil Zafer Alibaba, "Integration of the Vernacular Passive Cooling Systems with Contemporary Architecture in the Middle East," *International Journal of Recent Research in Civil and Mechanical Engineering Vol. 3,* no. 2 (2017): p.8-16, www.paperpublications.org/upload/book/Integration%20of%20the%20Vernacular-859.pdf

[45] Sayigh, *Sustainable Vernacular Architecture,* p.2.

[46] Sayigh, *Sustainable Vernacular Architecture,* p.24-40, 337.

In the Yemeni context, vernacular architecture has successfully met functional needs while also supporting sociocultural values. Among the vernacular elements identified, the **housing cluster** in Sana's stands out. Such a cluster is composed of houses organised around a communal urban garden that offers semi-private spaces and fosters neighbourly cohesion.[47] The iconic **tower houses** of Sana'a and Shibam Hadhramawt are typically tall, square structures ranging from three to nine floors and commonly adjoined by neighbouring buildings.[48] The towers are organised around interior staircases that support the vertical expansion of the buildings to accommodate growing families,[49] allowing for co-living of multiple generations within a single structure. Their verticality enhances privacy,[50] provides wide-ranging views from different heights, and underscores the city's architectural identity.[51]

Building materials and wall construction vary per region: in Sana'a, lower floors are made of stone while upper floors feature brick as the main building material; in Shibam, mud brick is the dominant building material.[52] Load-bearing walls may consist of exposed hewn stone or earth blocks, while sandstone is most common in mountain areas. Burnt clay and mud bricks serve as both interior and exterior wall materials, and local gypsum contributes to plastering and decorative details.[53] Exterior thick walls – often over 50 cm – provide significant thermal mass, moderating temperature extremes by gradually releasing heat into

Figure 7. Housing Cluster with Communal Garden. "Losing Old Sanaa: Historic City Reels from Yemen War," Al Jazeera, August 20, 2023, photograph, accessed 18 April 2024, https://www.aljazeera.com/gallery/2023/8/20/losing-old-sanaa-historic-city-reels-from-yemen-war.
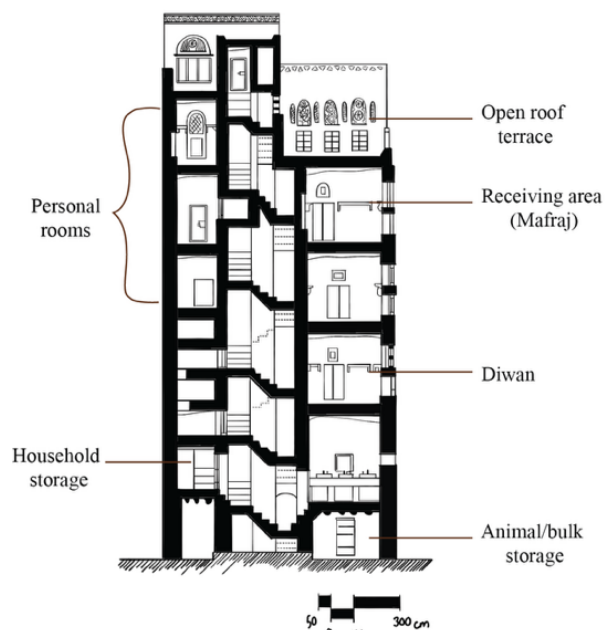

Figure 8. Vertical Organization of Yemeni Tower House (created by author, adapted from Veranda, Art of building in Yemen).

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[47] Al-Sabahi, "A Comparative Analysis," p.28.
[48] Al-Sabahi, "A Comparative Analysis," p.31.
[49] Al-Sabahi, "A Comparative Analysis," p.27.
[50] Privacy is a significant cultural requirement that heavily influences the architecture in Yemen. The verticality within the tower houses ensures for greater privacy and more seclusion within the higher floors of the structure, as the connection to the street and open spaces reduces.
[51] Al-Sallal, "Vernacular Tower Architecture," p.271.
[52] Al-Sabahi, "A Comparative Analysis," p.31.
[53] Sultan, "Modern/Traditional Buildings."

interior spaces, which can result in long-term fuel and maintenance savings.[54] Materials like burnt mud bricks and earth-filled roofs offer superior thermal comfort compared to many modern alternatives[55] while reducing import costs[56] and environmental impact. Additionally, materials such as stone, mud bricks, and clay return to nature at the end of a building's life cycle.[57]

Beyond functional advantages, these materials shape the architectural expression of the country. For example, stone cladding can be used in contemporary construction to simulate traditional aesthetics while offering thermal benefits.[58] In regions like Shibam, repetition of mud-brick texture imparts visual rhythm and cohesive expression.[59]

Figure 4. Material Palette Board (created by author).

Facades in vernacular Yemeni houses are defined by ornamentation, diverse openings, and varied materials–creating rich and dynamic building faces.[60] **Windows** constitute a distinctive feature in the tower houses,[61] typically consisting of 4 main parts: an upper section, a lower opening, the vents, and an overhang.[62] These components, which can appear in various combinations, respond to functional and climatic conditions – improving ventilation, thermal comfort, solar control, and views.[63] Larger windows on upper floors offer similar benefits, while also having *mashrabiyas*

Figure 10. Example of Window Composition (created by author, adapted from Veranda, Art of building in Yemen).

covering the openings for privacy. **Connecting passages** between upper floors enable residents, often women, to move between homes without descending into public streets, thus maintaining privacy and social connection.[64]
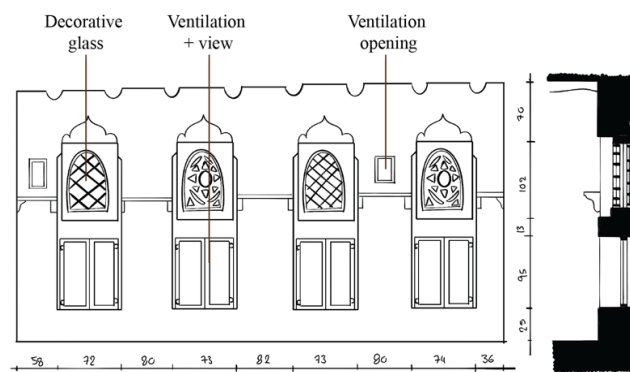
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[54] Sultan, "Modern/Traditional Buildings."
[55] Sayigh, *Sustainable Vernacular Architecture,* p.43.
[56] Benslimane, "The urban sustainable," p.1252.
[57] Abdallah, Mohamed reda, et al., "Traditional Yemeni Architecture and Its Impact on Energy Efficiency," *International Journal of Engineering Research and Technology Vol.* 13, no. 8 (2020): p. 2016, https://doi.org/10.37624/ijert/13.8.2020.2014-2022.
[58] Sultan, "Modern/Traditional Buildings."
[59] Sayigh, *Sustainable Vernacular Architecture,* p.337.
[60] Al-Sabahi, "A Comparative Analysis," p.31.
[61] Al-Sallal, "Vernacular Tower Architecture," p.258-261.
[62] Al-Sallal, "Vernacular Tower Architecture," p.263.
[63] Al-Sallal, "Vernacular Tower Architecture," p.263-265.
[64] Al-Sabahi, "A Comparative Analysis," p.31.

Although less common in Sana'a, **courtyard houses** remain central to regional architectural traditions, particularly in Yemen's coastal areas[65] and the broader Middle East and Gulf region. Courtyards offer social and climatic benefits, delivering daylight, shaded communal areas, and ventilation, while affording privacy and flexibility for extended families.

The dense urban fabric of historic Sana'a, with its balanced mix of buildings, narrow alleys, and green or communal spaces, enhances passive heating in winter, shade in summer, and creates effective air circulation. In summary, Yemeni vernacular architecture depicts a refined use of local materials and responsive techniques developed through climate and culture adaptation – resulting in built environments that are both distinctive and organically sustainable.

Lessons learned from regional reconstruction processes: the cases of Aleppo and Beirut

Before presenting a theoretical approach for a reconstruction of Sana'a, Yemen by using vernacular elements to support a culturally and socio-economically viable reconstruction, there are valuable lessons to be drawn from other regional reconstruction processes. The Middle East has seen multiple conflicts and subsequent reconstruction efforts in recent history that have shed light on the above outlined architectural approaches and their respective pros and cons.

After the Lebanese Civil War (1975-1990), large-scale reconstruction efforts in **Beirut** were driven by the government-backed private development company Solidere, founded in 1994. [66] The reconstruction process prioritised rapid redevelopment of the central business district according to the vision of the then-Prime Minister Rafik El-Hariri, which was to transform the city into a "Dubai-like city" to attract investors and regenerate the country's economy.[67] This method revived the city centre economically, but received criticism for erasing much of Beirut's historic urban fabric, displacing long-term residents, and replacing the pedestrian-scaled neighbourhoods with generic commercial architecture.[68]

This top-down recovery approach demonstrates the risks of profit-driven reconstruction in heritage-rich contexts.[69] Beyond physical redevelopment, the economically focused project was criticised to have jeopardised Beirut's cultural identity and collective memory,[70] replacing the historic centre with an "ultra-modern cityscape" that erased much of the city's historical character.[71] The process has been described as one of "enforced amnesia,"[72] in which traces of war-damaged yet historically significant structures were deliberately demolished in favour of contemporary towers,[73] leading to the spatial erasure of the traditional urban fabric, transforming the city into an unfamiliar, disconnected environment.[74] Archaeological heritage was also neglected. Critics argue that the rush for profit prevented thorough excavations, while the revised plan in 1994 included some findings without proper assessment or coherent

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[65] Abdallah, "Traditional Yemeni Architecture," p.2015.
[66] Al-Harithy, "Integrating culture," p.1-7.
[67] Risk, "Beirut Post-War Reconstruction," p.5-9.
[68] Al-Harithy, "Integrating culture," p.3, 8-9.
[69] Al-Harithy, "Integrating culture," p.12.
[70] Risk, "Beirut Post-War Reconstruction," p.5.
[71] Risk, "Beirut Post-War Reconstruction," p.11.
[72] Lahoud, *Post-traumatic urbanism,* p.56-57.
[73] Risk, "Beirut Post-War Reconstruction," p.12.
[74] Al-Harithy, "Integrating culture," p.13-16.

integration.[75] This "tabula rasa" mentality led to widespread demolitions,[76] including traditional souks and parts of the traditional urban fabric, despite calls to balance heritage conservation with modernity.[77]

Additionally, the reconstruction plan created risks of social and economic exclusion. The new city centre became an elitist enclave –[78] a "space of exclusion – catering mainly to wealthy groups while marginalising local communities.[79] Gentrification displaced residents[80] and reduced the original vibrant social and economic exchanges that once defined central Beirut.[81] The absence of necessary amenities for public good and general welfare, such as affordable housing and public transport, further isolated the city.[82] Simultaneously, the reconstruction failed to reconnect the divided eastern and western parts of the city, leaving it ethnically segregated.[83]

Furthermore, governance and transparency were major points of concern throughout the reconstruction process. Although the plan was government-backed, Solidere's control essentially marginalised the state from the planning process by taking over the public sphere with private enterprise, focusing on profit rather than public welfare.[84] The government's role was reduced to creating regulatory frameworks, while decision-making processes excluded property owners, and community members.[85] The absence of public participation demonstrated a top-down model[86] that favoured private interests over collective needs.[87]

Contrarily, following the 2020 port explosion, Beirut saw a rise in community-led reconstruction efforts.[88] The Ottoman- and French-era buildings in neighbourhoods like Gemmayzeh were restored through collaborative efforts between local architects, NGOs, and artisans.[89] These projects often combined modern safety measures (like steel bracing) with original materials and features, such as timber shutters (*mashrabiyas*), decorative stone facades, and coloured glass.[90] This hybrid preservation approach respects Beirut's layered heritage while also preparing it for upcoming resilience challenges.[91]

Unlike the 1994 Solidere-led model, which was criticised for erasing heritage and displacing more than 2,600 families[92], the 2020 recovery plan was more fragmented and multi-sectorial.[93] Civil organisations, professionals, and citizens became major stakeholders, taking control of participation and recovery visions, while international donors influenced financial

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[75] Al-Harithy, "Integrating culture," p.13-16.
[76] Lahoud, *Post-traumatic urbanism,* p.56-57.
[77] Al-Harithy, "Integrating culture," p.11, 22.
[78] Al-Harithy, "Integrating culture," p.11.
[79] Risk, "Beirut Post-War Reconstruction," p.11.
[80] Lahoud, *Post-traumatic urbanism,* p.56-57.
[81] Al-Harithy, "Integrating culture," p.11, 22.
[82] Risk, "Beirut Post-War Reconstruction," p.11-12.
[83] Risk, "Beirut Post-War Reconstruction," p.11-12.
[84] Risk, "Beirut Post-War Reconstruction," p.11-12.
[85] Al-Harithy, "Integrating culture," p.11-13.
[86] Al-Harithy, "Integrating culture," p.11-13.
[87] Al-Harithy, "Integrating culture," p.10, 26.
[88] Al-Harithy, "Integrating culture," p.20-26.
[89] Al-Harithy, "Integrating culture," p.6, 12-14, 20-21.
[90] Al-Harithy, "Integrating culture," p.20-24.
[91] Al-Harithy, "Integrating culture," p.24-26.
[92] Risk, "Beirut Post-War Reconstruction," p.12.
[93] Al-Harithy, "Integrating culture," p.27.

requirements.[94] The 2020 recovery plan prioritised crisis control, rather than focusing on profit, providing shelter and basic services for 300,000 homeless people and preventing new slums from forming.[95]

Community acceptance also differed strongly. Although Soldiere was criticised for prioritising economic gain at the expense of cultural identity and memory,[96] the post-2020 reconstruction – though burdened by Lebanon's financial limitations[97] – favoured "co-created" recovery visions by civil society, NGOs, and professionals.[98] This implied a potential shift towards a more bottom-up approach that could improve heritage preservation compared to the 1994 reconstruction model. However, without sufficient state funding, risks of urban informality[99] and new slums forming around the city remains high.[100]

Between 2012 and 2016, during the peak of the Syrian Civil war (2011-2024), **Aleppo's** historic centre – a recognised UNESCO World Heritage site, consisting of souks, mosques, and its residential quarter – suffered extensive destruction.[101] The city's reconstruction efforts are shaped by tensions between heritage conservation and modern rebuilding needs. International heritage organisations, such as UNESCO and the Aga Khan Trust for Culture (AKTC), have encouraged a heritage-led approach, advocating for the restoration of important landmarks using traditional materials and local craftsmanship.[102] However, in areas of complete destruction, a hybrid reconstruction approach emerged: reinforced structural building cores with modern materials (such as concrete) are combined with restored or reconstructed traditional facades.[103] This hybrid approach preserved the city's historic visual character while meeting contemporary safety and durability standards.[104]

The reconstruction process officially started after the government regained full control over the city in December 2016 and is still ongoing.[105] A recovery strategy was published in 2018 that outlined the short-, medium-, and long-term reconstruction phases extending beyond 2030,[106] however, the progress has been limited due to political instability, international sanctions, and financial constraints.[107] Since 2023, reconstruction has been largely focused in priority zones such as the souks and citadel area.[108] Nevertheless, only 0.06% of residential properties have

[94] Al-Harithy, "Integrating culture," p.27.

[95] Soliman, Ahmed, et al, *Urban informality: Experiences and urban sustainability transitions in Middle East Cities*, (Cham: Springer, 2021), p.326.

[96] Risk, "Beirut Post-War Reconstruction," p.5, 11-12.

[97] Al-Harithy, "Integrating culture," p.6.

[98] Al-Harithy, "Integrating culture," p.27.

[99] According to Ahmed Soliman, 'urban informality can be defined as a larger system of informal norms and processes that determine the use of space and allow new forms of social and political behaviour for many of the world's poor.'

[100] Soliman, *Urban informality,* p.326-328.

[101] Thiel, *Reviving Aleppo*, p.V, 26-28.

[102] Miznazi, *Reconstruction of Cultural Heritage,* p.7-9.

[103] Thiel, *Reviving Aleppo*, p.230-238.

[104] Thiel, *Reviving Aleppo*, p.310-311.

[105] Miznazi, *Reconstruction of Cultural Heritage,* p.9.

[106] Thiel, *Reviving Aleppo*, p.162-163.

[107] Thiel, *Reviving Aleppo*, p.1-5.

[108] Thiel, *Reviving Aleppo*, p.4.

been restored, showing the narrow and monument-focused approach of the current recovery plan.[109]

Community response to these efforts have been mixed. While small-scale heritage restorations supported by the AKTC have been received positively for respecting Aleppo's architectural identity,[110] the overall reconstruction process has been criticised for its limited participation and exclusion of residents from decision-making processes.[111] Reconstruction efforts have become closely related to the regime's political agenda, which focuses on heritage restoration as a legitimacy tool while neglecting the boarder needs of the displaced citizens.[112] Resulting in a process that prioritises the symbolic reconstruction of landmarks over the complete rehabilitation of neighbourhoods and housing.[113]

Few internally displaced people have returned, reflecting ongoing insecurity, economic hardship, and legislative barriers – which restrict the return of opposition-affiliated citizens – the city is facing.[114] Until security and governance conditions improve many citizens refuse to return.[115] Housing recovery is underfunded, forcing locals to rely on their limited resources to clear debris and rebuild homes.[116] The lack of a coordinated housing strategy increases the risk of informal settlements emerging, further fragmenting the city's urban fabric.[117]

Aleppo's reconstruction also faces many financial challenges. Damage to residential building alone is estimated at $1.5-1.9 billion USD,[118] with additional losses from the 2023 earthquake bringing total recovery costs to around $7.9 billion USD.[119] Unlike Beirut's reconstruction plan – driven by the estimated $5.2 billion USD Solidere reconstruction model[120] – Aleppo's efforts primarily depend on local resources and targeted NGO funding.[121] Therefore, reconstruction in Aleppo is not only a technical and financial challenge but also a social and cultural one, since it seeks to balance the restoration of identity and memory with the realities of strained resources and ongoing political instability, including the 2024 political shift within the city creating new opportunities for reconstruction.

The case of Sana'a, Yemen: integrating vernacular elements into reconstruction

Many lessons can be extracted from the above case studies that can help inform the reconstruction process of Sana'a. The Aleppo process showcases the added value of a heritage-led but technically adaptable approach, while the most recent Beirut experience highlights the importance of community engagement and local agency in determining reconstruction priorities. The earlier Beirut reconstruction efforts offer a powerful disincentive against large-scale, commercially driven redevelopment that neglects a city's cultural identity. Regional experiences thus point towards the benefit of exploring hybrid strategies – integrating

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[109] Thiel, *Reviving Aleppo*, p.4-5.
[110] Miznazi, *Reconstruction of Cultural Heritage,* p.10-11.
[111] Miznazi, *Reconstruction of Cultural Heritage,* p.13.
[112] Miznazi, *Reconstruction of Cultural Heritage,* p.13-14.
[113] Miznazi, *Reconstruction of Cultural Heritage,* p.13-14.
[114] Miznazi, *Reconstruction of Cultural Heritage,* p.13.
[115] Miznazi, *Reconstruction of Cultural Heritage,* p.12.
[116] Miznazi, *Reconstruction of Cultural Heritage,* p.11.
[117] Miznazi, *Reconstruction of Cultural Heritage,* p.12-13.
[118] Thiel, *Reviving Aleppo*, p.31.
[119] Thiel, *Reviving Aleppo*, p.2.
[120] Al-Harithy, "Integrating culture," p.9.
[121] Thiel, *Reviving Aleppo*, p.57-58, 158, 222.

vernacular aesthetics, traditional materials, and contemporary structural systems – to achieve a balance between authenticity, safety, and functionality. Tested architectural approaches, such as resilience, place attachment theory and critical regionalism confirm the positive impact of using vernacular elements in post-conflict reconstruction processes.

What does that mean for an economically viable, socio-culturally sensitive, resilient and adaptable reconstruction for Sana'a in Yemen? The above paragraphs have outlined several well-known vernacular elements in traditional Yemeni architecture that can contribute to a successful reconstruction that takes into consideration local climatic conditions, cost efficiency principles and cultural identity. Yet, recent engagements with Yemeni citizens[122] confirm that the current authorities appear to favour a reconstruction approach that mirrors more the initial Beirut process. This approach tends to favour modern-day construction, extensive use of cheap imported materials and fast rebuilding of physical infrastructure. There is little evidence of meaningful community engagement, or of introducing vernacular elements. Yet, ordinary Yemeni citizens did express a keen interest to see certain specific and localised characteristics within the reconstructed houses and communal structures. They confirmed the need for re-establishing national and communal identity and recognised the power of vernacular architecture in identity-building.

Thus, this research concludes that an ideal reconstruction process in Sana'a, Yemen, should consider the use of a hybrid design framework that balances heritage preservation with modern construction. Such a framework should include particular Yemeni elements, such as (1) passive cooling systems that can provide thermal comfort at low energy costs[123] and thus respond to modern-day climatic demands. These can include the use of thermal mass, cross ventilation, strategically placed courtyards, vertical staircases that function as windcatchers, and deliberately designed shading elements (whether that be window coverings or landscape design) that can significantly reduce heat gain and enhance user comfort. (2) Intentionally designed openings, whereby the purpose should not be about the direct replication of traditional forms, but rather the incorporation of their abstract functional logic.[124] In vernacular architecture, each opening had a specific role – openings for ventilation, for viewings or for ornamentation – which can be incorporated in modern design approaches to create openings with a clear environmental and social purpose, that reflects Sana'a's socio-cultural priorities. (3) Shared open spaces, such as courtyards or communal gardens, that not only respond to socio-cultural values of interaction and privacy,[125] but also offer opportunities for home gardening and thus create economic and social benefits for residents. Ideally, these elements – that traditionally were only found in residential contexts – should be adapted to diverse building types with minor modifications. The idea is not to model vernacular residential reconstruction in full; rather, it extracts and reinterprets core spatial and environmental design strategies for broader application. An example can be the (re)construction of a modern school building that incorporates courtyards and vernacular-style windows.

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[122] Author conducted a limited survey among Yemeni citizens (family and friends) between the ages of 18 and 30, via remote means to gauge understanding and desires for post-conflict reconstruction.
[123] Sayigh, *Sustainable Vernacular Architecture,* p.2.
[124] Al-Sallal, "Vernacular Tower Architecture," p.267.
[125] Sayigh, *Sustainable Vernacular Architecture,* p.23-50.

Similarly, a well-designed reconstruction process should consider tested spatial design approaches, whereby traditional methods (e.g. green spaces or narrow winding streets) can contribute to a more sustainable urban design.[126] In order to reduce costs, strategic use of locally available stone and materials is recommended. A process that (re)introduces traditional elements can make use of historic knowledge and skills found among local (or returned) craftsmen – allowing older professionals to share their traditional knowledge with younger generations can not only contribute to safeguarding intangible cultural heritage, but also contribute to fostering social cohesion, furthering inter-generational skills development and offering economic opportunities for local populations.

Furthermore, urban planners, architects and designers should enhance their familiarity with regionally rooted materials to offer cost-efficient approaches. Finally, it is paramount to have adequate government support, inclusive community engagement and transparency throughout the design and building stages of the reconstruction process to sustain the vernacular character[127] and contribute meaningfully to restoring cultural identity and social cohesion alongside physical infrastructures.

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[126] Sayigh, *Sustainable Vernacular Architecture,* p.24-25, 42-43.
[127] Sultan, "Modern/Traditional Buildings."

Reflection

Throughout my research, I focused on understanding the strategies behind post-conflict reconstruction – from the theoretical frameworks such as resilience and place attachment theory to more tangible findings like vernacular Yemeni architecture and the lessons learned from the reconstruction efforts in Beirut and Aleppo. While my research focused on traditional Yemeni domestic architecture (largely available information), I wanted to challenge myself in the design project by exploring how these vernacular design principles could be adapted and applied in other building programs.

Through the survey I conducted with family and friends and further investigation into the current situation in Yemen, it became obvious that the country's educational system is one of the most affected sectors by the ongoing conflict. According to UNICEF, around 2,916 schools have been destroyed (at least one in four), leaving two million children out of school.[128] The International Institute for Educational Planning (IIEP) identified that girls aged 6-14 are one of the most vulnerable groups in Yemen, with only 36% completing primary education compared to 44.9% of boys.[129] Given these findings, I chose to focus my design project on the construction of a **primary school for girls between the ages of 6-14**.

Learning from the different reconstruction approaches in Beirut and Aleppo (profit-driven redevelopment or landmark preservation), I wanted to propose a project that has an immediate and meaningful social impact. Rather than focusing solely on economic recovery or tourism, my goal was to design something that directly helps the community to rebuild from within. Schools play a vital role in this process; they are not only spaces of learning but also spaces that nurture the next generation. Foster social cohesion, and act as anchors for post-conflict recovery.

However, designing a school involved a complex decision on the kind of educational environment I want to create. Initially, designing a mixed school seemed appealing, given my own background and experiences. However, further research on Yemen's cultural expectations and current educational context illustrated that an all-girls school would be more contextually appropriate and impactful – providing a safe and accessible space for girls to learn, grow and participate in rebuilding their future.

My design aims to present how vernacular elements and materials can be integrated with modern construction techniques to form a hybrid architectural design. For example, the use of wooden frame systems combined with local materials seeks to merge structural efficiency with cultural familiarity. This hybrid approach can serve as a model for other building types, showing how tradition and innovation can coexist to create resilient and identity-driven architecture.

Although the school is initially proposed as an all-girls institution, the design encourages and anticipates the possibility of further expansion – either by introducing mix-gender educational opportunities or by extending the school to include secondary education – by developing adaptable and modular systems. Beyond its educational function, the project also envisions for

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[128] UNICEF. "Education | Unicef Yemen," UNICEF, March, 2015, https://www.unicef.org/yemen/education.

[129] Alsharif, Radhwan, et al, "Diagnostic Tools for Improving Education Policy Planning: A Case Study on Yemen Girls Dropout in Primary Education in Emergencies," Geneva: KIX EAP Hub, 2023.

the program to serve as a local hub, offering opportunities for local employment and participation through 'cash for work' programmes. The facility can provide jobs not only during the construction phase but also through teaching and maintenance, ensuring that the community remains actively involved in its development.

The design plays with the constant tension between the familiar and unfamiliar throughout the project. It demonstrates how vernacular materials and construction techniques can be combined with contemporary architectural systems to form a hybrid environment that is both culturally grounded and forward looking. In Yemen, the primary educational system remains teacher-cantered, where students are placed in formal classrooms and information is received passively. The project intentionally maintains this education structure within the main classrooms in order to respect the existing societal expectations and educational norms. Rather than attempting to radically transform the system, the project seeks to work within what is culturally accepted while gradually introducing alternatives that allow for long-term adaptation and growth (for example the addition of art and workshop classes).

At the same time, the overall spatial organisation of the school draws from international school design principles, including Herman Hetzberger's concept of the "school as a small city", the use of thresholds to encourage informal interaction, and collective ownership, and Alvar Alto's emphasis on warm materials, human-scale architecture, and landscape integration. These ideas are selectively implemented to the Yemeni context, providing the school with a neighbourhood-like feel. Landscape elements, courtyards, and locally sourced materials are integrated throughout the project to create continuity between tradition and contemporary design practice.

These design strategies are introduced subtly rather than strongly. By maintaining familiar spatial hierarchies and visual references while adding new spatial opportunities (such as outdoor learning spaces, extended circulation areas, and flexible communal zones) the project allows users time to adapt to alternative ways of using educational environments. This approach demonstrates that core cultural values such as privacy, formality, and spatial order can coexist with more open, interactive, and exploratory learning settings.

Ultimately, the project aims to show that a school can be more than a place for formal education. It can be a symbol of hope and renewal; a space where young girls can grow, connect, and form lasting social bonds. Instead of focusing solely on classrooms or the curriculum, the design emphasises the "in-between" spaces – courtyards, shaded paths, and gathering spaces – where everyday interactions and meaningful memories are created. The design respects Yemen's cultural traditions and expectations while gently introducing 'modern' principles of openness, interaction, and inclusivity, symbolising a step towards reconstruction through empowerment and understanding. The project frames architectural modernisation not as a replacement, but as an evolution: one that preserves identity while enabling new forms of education and interaction.

Bibliography

Abdallah, Mohamed reda, Hassan Ahmed Hassan, and Ali Abbas al-Olofi. "Traditional
Yemeni Architecture and Its Impact on Energy Efficiency." *International Journal of
Engineering Research and Technology Vol* 13, no. 8 (2020).
https://doi.org/10.37624/ijert/13.8.2020.2014-2022.

Al-Harithy, Howayda, Dina Mneimneh. "Integrating culture, recovery and reconstruction
for sustainable urban development: Beirut case study." *UNESCO Publications*, 2022.
https://whc.unesco.org/document/175507.

Al Jazeera. "A Timeline of Yemen's Slide into Conflict and War." Al Jazeera, April 11,
2023. www.aljazeera.com/news/2023/4/11/a-timeline-of-yemens-slide-into-conflict-
and-war.

Al-Sabahi, Hatim M. "A Comparative Analysis of the Vernacular Housing Cluster of
Yemen: Sana'a and Shibam Hadhramawt A Case Study." *Journal of Science &
Technology Vol.* 10, no. 2 (2005): 27–34. https://doi.org/10.20428/jst.v10i2.71.

Al-Sallal, Khaled A. "Vernacular Tower Architecture of Sana'a: Theory and Method for
Deriving Sustainable Design Guidelines." In *Sustainability, Energy and Architecture*,
edited by Ali Sayigh, 257–287. Oxford: Academic Press, 2013.
https://doi.org/10.1016/B978-0-12-397269-9.00010-4.

Ali, Marium. "Mapping US Attacks on Yemen's Houthis." Al Jazeera, March 16, 2025.
www.aljazeera.com/news/2025/3/16/mapping-us-attacks-on-yemen.

Alsharif, Radhwan, Yasmeen Mohammed Alhaimi, Ahmed Alroba'ee, and Yusef Alraymi.
"Diagnostic Tools for Improving Education Policy Planning: A Case Study on Yemen
Girls Dropout in Primary Education in Emergencies." Geneva: KIX EAP Hub, 2023.

Bagasi, Abdullah Abdulhameed, John Kaiser S. Calautit, Abdullah Saeed Karban.
"Evaluation of the Integration of the Traditional Architectural Element Mashrabiya
into the Ventilation Strategy for Buildings in Hot Climates." *Energies Vol 14,* no. 3:
530(2021): 1-24. https://doi.org/10.3390/en14030530.

Benslimane, Nawal, Ratiba Wided Biara. "The urban sustainable structure of the
vernacular city and its modern transformation: A case study of the popular
architecture in the Saharian Region" *Technologies and Materials for Renewable
Energy* (2018): 1241-1252. https://doi.org/10.1016/j.egypro.2018.11.290.

Haddad, Mohammed. "Infographic: Yemen's War Explained in Maps and Charts." Al
Jazeera, February 9, 2022. www.aljazeera.com/news/2022/2/9/yemens-war-explained-
in-maps-and-charts-interactive.

Heath-Kelly, Charlotte. *Death and security: Memory and mortality at the Bombsite*.
Manchester: Manchester University Press, 2017.

Inalhan, Goksenin, Eunhwa Yang, and Clara Weber. "Place Attachment Theory." In *A

Handbook of Theories on Designing Alignment between People and the Office Environment, edited by Rianne Appel-Meulenbroek and Vitalija Danivska, 181–194. London: Routledge, 2021.

Lahoud, Adrian, Charles Rice, and Anthony Burke. *Post-traumatic urbanism*. 5th ed. Vol. 80. Hoboken, N.J: Wiley, 2010.

Miznazi, Diana. *Reconstruction of Cultural Heritage in Aleppo, Syria Reviewed: a critical exploration of current endeavors and practices*. CEU School of Public Policy, 2023. www.thealeppoproject.com/wp-content/uploads/2023/01/MiznaziPaperWithCoverV01.pdf.

"Reconstruction and Recovery in Yemen: Recommendations from the Development Champions." *Rethinking Yemen's Economy,* April 8, 2019. https://devchampions.org/publications/policy-brief/Reconstruction_and_Recovery_in_Yemen/.

Risk, Yara. "Beirut Post-War Reconstruction: The Case of the Grand Theater." *Beirut Post-War Reconstruction: The Case of the Grand Theater*, 2019. https://www.researchgate.net/publication/341883106_Beirut_Post_War_Reconstruction-_the_case_of_the_Grand_Theater.

Sayigh, Ali. *Sustainable Vernacular Architecture: How the Past Can Enrich the Future*. Cham: Springer Nature, 2019. https://doi.org/10.1007/978-3-030-06185-2.

Soliman, Ahmed, Hernando de Soto, and Nezar AlSayyad. *Urban informality: Experiences and urban sustainability transitions in Middle East Cities*. Cham: Springer, 2021.

SOUFAN, Anas. "Historiographical Overview on the Post Conflict Reconstruction in Syria: From the Mid-19th Century to the 2011 Crisis." *UNESCO Publications*, 2015. https://www.academia.edu/37619972/Historiographical_Overview_on_the_Post_Conflict_Reconstruction_in_Syria_From_the_mid_19th_Century_to_the_2011_Crisis.

Sultan, Basel. "Modern/Traditional Buildings in Yemen and Sustainability," 2008. www.researchgate.net/publication/256599703_Modern_Traditional_Buildings_in_Yemen_and_Sustainability.

Tamimi, Azzam Khalid S.A, Dr. Halil Zafer Alibaba. "Integration of the Vernacular Passive Cooling Systems with Contemporary Architecture in the Middle East." *International Journal of Recent Research in Civil and Mechanical Engineering Vol. 3,* no. 2 (2017): 8-16. www.paperpublications.org/upload/book/Integration%20of%20the%20Vernacular-859.pdf

Thiel, Fabian, Rahaf Orabi. *Reviving Aleppo: Urban, Legal and Digital Approaches for Post-War Recovery.* London: Springer Nature, 2024. https://doi.org/10.1007/978-3-031-65858-7.

UNICEF. "Education | Unicef Yemen." UNICEF, March 2015. https://www.unicef.org/yemen/education.

United Nations Office for Disaster Risk Reduction (UNDRR). "Build Back Better." In *The Sendai Framework Terminology on Disaster Risk Reduction*. 2017. https://www.undrr.org/terminology/build-back-better.

Vale, Lawrence J., Thomas J. Campanella. *The Resilient City: How Modern Cities Recover from Disaster.* New York: Oxford University Press, 2005.

Varanda, Fernando. *Art of building in Yemen*. Cambridge: MIT press, 1982.

Yang, Minja, Gina Doggett. *Culture/nature: the link to preservation.* UNESCO World Heritage Centre, 2018. https://whc.unesco.org/en/activities/486/.

"Yemen: Why Is the War There Getting More Violent?" BBC News. April 14, 2023. www.bbc.com/news/world-middle-east-29319423.