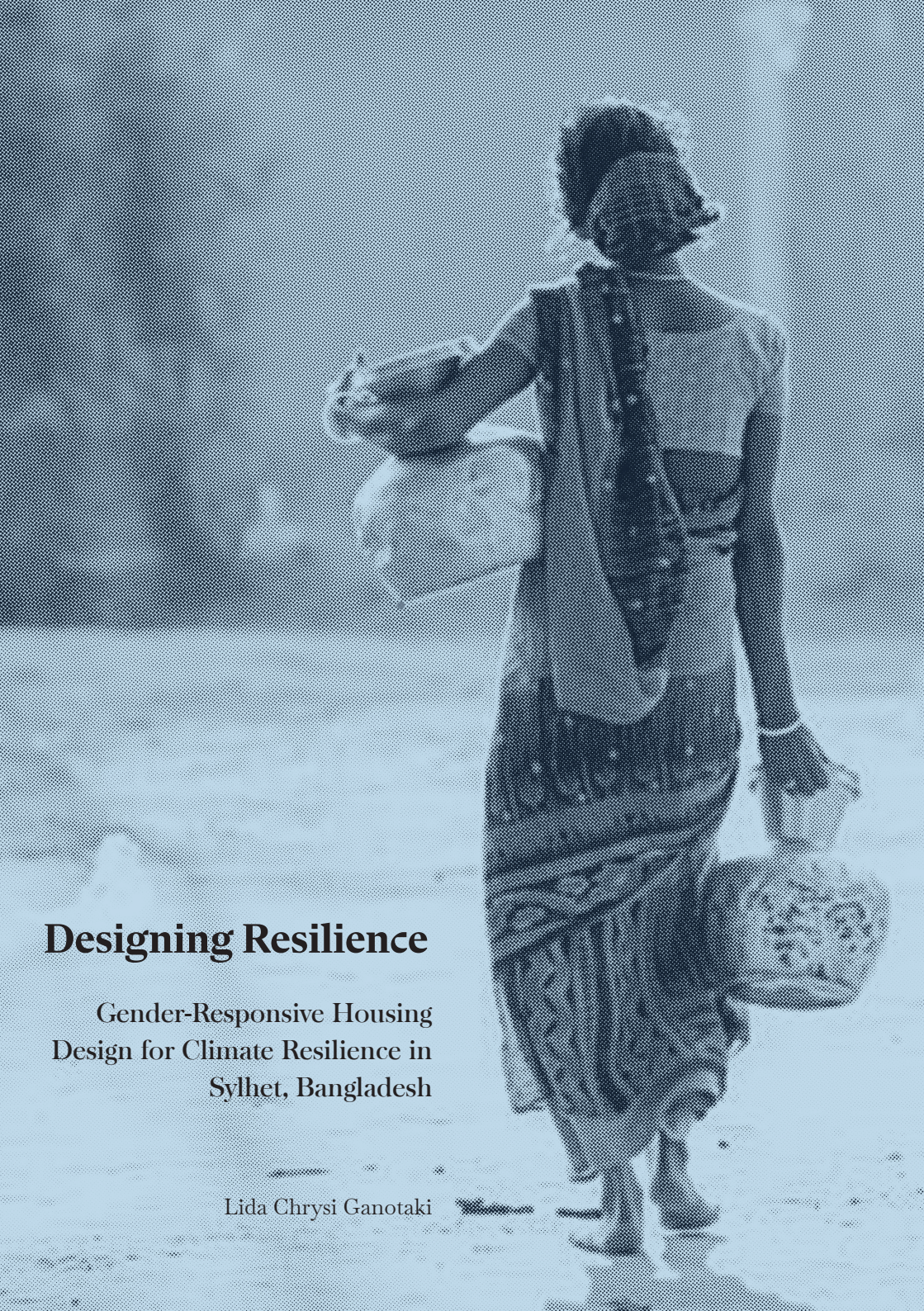

Designing Resilience

Gender-Responsive Housing Design for Climate Resilience in Sylhet, Bangladesh

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INTRODUCTION

Bangladesh, one of the world's most climate-vulnerable countries, faces an array of environmental challenges that are intensifying due to global climate change. The country's low-lying geography and dense population make it susceptible to extreme weather events such as cyclones, seasonal flooding, prolonged droughts, and waterlogging. These climate-induced hazards have far-reaching consequences on various sectors, including agriculture, water resources, health, and infrastructure, thus threatening the stability of local livelihoods. These impacts, however, are not evenly distributed across the population. As noted by Albertyn et al. in the book 'Feminist Frontiers in Climate Justice: Gender Equality, Climate Change, and Rights' (2023), the effects of human-induced climate change are more intensely felt by those who have fewer resources and less power: groups who are poor, vulnerable and disadvantaged, particularly in the Global South. One such vulnerable group is women and girls, especially those in rural areas.

The social structure in rural Bangladesh largely dictates that women are the primary managers of household resources, including water, food, and fuel. Moreover, women are highly engaged in agriculture but lack recognition and access to resources like land, credit, and technology (UN Women, 2022, p. 7). Their responsibilities are often intensified in times of crisis as they become the primary responders to the immediate needs of their families and communities. However, despite their heightened vulnerability, women in Bangladesh have demonstrated remarkable resilience and adaptive capacities in the face of climate change. For example, women in Sylhet play a central role in managing homegardens, which serve as an essential source of food, security, income, and ecological conservation in the region (Akhter et al., 2010, p. 24).

Fig. 1: A woman tends to her homegarden with her son

Fig. 2: Extreme weather evens such as cyclones ravage Bangladesh

Nevertheless, these contributions remain vastly undervalued in formal policy frameworks as discriminatory practices persevere. Additionally, the housing infrastructure in rural Bangladesh often fails to withstand the recurring climate shocks, as it lacks essential features such as water management systems, flood-resistant structures, and safe resource storage. These inadequacies not only increase women's vulnerability to displacement and loss of livelihoods but also hinder their ability to maintain essential household activities and support their adaptive strategies. The absence of safe, resilient, and supportive housing infrastructure is thus critical in reinforcing, reconstructing, and reshaping gendered inequalities that erode social, economic, and legal advances.

Although efforts to integrate gender perspectives into climate resilience initiatives are emerging, they remain largely insufficient. Facing the challenges posed by climate change, women in the Global South have at times been depicted in various roles: as powerless victims, as active proponents of a sustainable future, as holders of specialized knowledge, as tokens inserted into scientific and technical frameworks, as misguided decision-makers potentially destabilizing ecosystems, and as custodians of nature for future generations (Albertyn et al., 2023, p.1). These characterizations risk reinforcing familiar gender stereotypes and could undermine feminist progress. In reality, women's relationship with climate change is complex and nuanced, defying generalizations and deserving deeper engagement from a feminist perspective (Albertyn et al., 2023, p.1). Recent works, such as those by Buckingham and Masson (2017), highlight the importance of considering gender dynamics in policy and planning to ensure equitable outcomes. Similarly, ecofeminist frameworks, as discussed by authors like Karen Warren (1997), link the exploitation of natural resources to the subjugation of women, advocating for a more intersectional and integrated approach to sustainability and social equity. However, while these theoretical advancements have shown promise, practical applications in housing design and infrastructure development are limited. This underscores the need for a holistic integration of housing design, water management, and gender-responsive policies to create safe and supportive environments for women in climate-vulnerable regions like Bangladesh.

LITERATURE REVIEW

The literature on climate change in Bangladesh reveals a combination of environmental, sociocultural, and economic factors that define women's experiences. Works like that of Alston (2015) and Momtaz and Asaduzzaman (2018) explore women's vulnerability to climate change, noting that their livelihoods are greatly influenced by extreme events such as cyclones, floods, and droughts. These events disrupt agriculture, which many rural women rely heavily on, and exacerbate water scarcity, an essential issue for women responsible for household water management. Similar issues are highlighted in the 'State of Gender Equality and Climate Change in Bangladesh' report (2022), emphasizing that women face disproportionate risks due to their social roles and lack of access to resources. For example, water scarcity often forces them to travel long distances for water collection, exposing them to violence and reducing their time for income-generating activities.

A 2023 UNICEF-WHO report further underscores the gendered impact of water scarcity by noting that 70% of households without onsite water rely on women and girls for water collection, burdening them with additional responsibilities that limit educational and work opportunities, while also exposing them to health and safety risks (UNICEF, 2023). In addition, findings from the Climate Change and Gender Action Plan (ccGAP) for Bangladesh indicate that women's limited participation in water resource management committees reduces their influence in decision-making, stressing the need for gender-sensitive water systems that consider women's safety and economic empowerment (Bangladesh Climate Change Trust & UN Women, 2024, pg.15).

Fig. 3: Water scarcity often forces women and girls to travel long distances for water collection

Women's lack of access to resources can partly be attributed to sociocultural factors, starting from the home. Chowdhury (2023) highlights how gendered spatial practices in traditional Bangladeshi housing—often influenced by Islamic customs such as purdah—create physical separations within the home, which can limit women's access to shared spaces and reduce their mobility, impacting their ability to engage in economic activities. In the book 'Understanding Climate Change Through Gender Relations' (2017), Buckingham and Masson discuss how patriarchal frameworks often overlook the contributions and needs of women in climate discourse, perpetuating barriers to women's participation in adaptation and resilience-building strategies. This oversight not only limits the effectiveness of climate policies but also ignores the expertise women have developed through their roles in environmental stewardship. Recognizing women's contributions can enhance climate adaptation efforts by leveraging their on-the-ground knowledge of sustainable practices.

This knowledge and expertise of women can be demonstrated in homegardens, where women play a central role in management and maintenance. Akhter et al. (2010) highlight that homegardens are not only vital sources of food and income but also contribute significantly to biodiversity and sustainable land use. Women are deeply involved in activities such as planting, watering, and harvesting, drawing on indigenous knowledge to nurture these small ecosystems. Their management of homegardens exemplifies a critical integration of economic and ecological roles, providing a source of resilience against climate-related disruptions.

Further insights come from Datta (2019), who discusses indigenous land and water management practices in Bangladesh's Chittagong Hill Tracts. Datta emphasizes a relational approach to environmental management, where people, land, and water are closely interconnected. This holistic framework aligns well with climate-resilient housing designs that integrate community and ecological needs, supporting women in their roles as caretakers and resource managers. Community-led initiatives provide additional pathways for resilience, as illustrated by Huq et al. (2023) in their study on women-led savings groups, such as Shabolombee Samity in northern Bangladesh. These groups serve as collective support systems, allowing women to pool resources and mitigate the financial strain of climate-related adversities. By providing social and economic security, such initiatives empower women to become more resilient to environmental shocks and offer a model that could be expanded through housing and water management practices to support broader community adaptation efforts. These examples demonstrate that building resilient housing and water systems is not solely a matter of infrastructure but also of fostering community networks that empower women economically and socially.

In conclusion, integrating indigenous knowledge and water management systems into housing design not only addresses the practical needs of women in flood-prone areas such as Sylhet, but also respects and builds upon the cultural, social, and spiritual dimensions of these communities. Housing should therefore be viewed as part of a broader ecological and cultural system, where both human and environmental needs are met through symbiotic design processes. These approaches highlight the necessity of community participation, cultural sensitivity, and environmental sustainability in the creation of housing solutions that empower women and build resilience to climate change.

PROBLEM STATEMENT

Despite an increasing focus on the intersection of gender and climate change, there remains a significant gap in understanding how gender-responsive housing can contribute to women's empowerment in climate-vulnerable regions such as Bangladesh. Existing research has predominantly expanded upon women's increased vulnerability, highlighting the ways in which climate change can exacerbate existing inequalities, yet few studies have examined how housing infrastructure can address these challenges.

Moreover, the existing literature has documented women's adaptation strategies, such as the establishment of community savings groups and the diversification of agricultural practices (Huq et al., 2023 and Akhter et al. , 2010). However, there is a lack of research on how housing infrastructure can be reimagined to incorporate these strategies and create safe, supportive environments that enhance women's capacity to manage resources and contribute to household resilience. The gap is further enhanced by the limited integration of ecofeminist perspectives in practical application of climate adaptation, despite the theoretical framework's emphasis on the interconnectedness of sociocultural and environmental systems.

This research aims to fill these gaps by exploring the ways in which housing design, incorporating water management systems, can create supportive environments that facilitate women's income generation, enhance their livelihoods and build community resilience to climate change in Bangladesh. By focusing on the intersection of architecture, gender and water management, it seeks to contribute to the development of inclusive solutions that address the unique challenges faced by women in climate-vulnerable regions.

Fig. 4: A woman holds on to a roof while standing in her submerged yard in northern Bangladesh

THEORETICAL FRAMEWORK

This research is grounded in ecofeminist theory, which links the exploitation of nature with the oppression of women. According to ecofeminist writers such as Karen Warren (1993) and Kate Wilkinson-Cross (2023), the dominant anthropocentric framework enforces a hierarchical division between humans and nonhuman nature and sustains patriarchal power structures, which subjugate both women and the environment. Additionally, drawing from Astrida Neimanis' 'Bodies of Water' (2017), the concept of relationality is central to this framework. According to Neimanis, water is not merely an abstract commodity but a symbol of fluidity and interconnectedness, thus challenging the notion of discrete, bounded bodies. She introduces the idea of 'embodiment,' which is, in essence, 'the opposite' of the Western idea of bodies as discrete and fundamentally autonomous individual subjects. This perspective challenges the dichotomy between humans and nature and is used to explore shared vulnerabilities and ecological entanglements.

Donna Haraway's concept of "sympoiesis," or making-with, extends this understanding by emphasizing collaborative processes that involve humans and nonhumans (Haraway, 2016, pg.58). By acknowledging the complex relationship between human life and ecosystems, she highlights the necessity of housing designs that integrate with natural processes like water management rather than exerting control over or exploiting them. In Bangladesh, where women's routine engagements with water and land are crucial for both family sustenance and ecological stewardship, housing approaches that mirror this interconnectedness can provide significant transformative opportunities. Therefore, integrating water management systems into housing while considering the ecosystem as a co-actor in survival aligns with Haraway's vision of fostering multispecies flourishing through shared responsibility and collaboration.

Moreover, the research is significantly influenced by Nabeel Hamdi's participatory design principles. In his work 'Housing Without Houses' (1995), Hamdi provides a potential 'toolkit' for amplifying women's voices during the design process. His work advocates for community-based initiatives that engage local populations in planning and design. He introduces the key concepts of 'participation," 'flexibility," 'enablement' and 'indeterminacy,' which aim towards building social capital, empowering marginalized communities, and creating adaptable, culturally appropriate housing projects that are not seen as finalized structures but as ongoing processes that emphasize the dynamic nature of communities. Through inclusive development practices, women's unique experiences and knowledge could thus come to the forefront, and their specific needs can be addressed. Hassan Fathy's work on vernacular architecture in Egypt (1973) offers additional insights into this participatory approach. By utilizing materials sourced from the local area and employing traditional construction methods like mud bricks, he demonstrates how traditional knowledge can be applied to build sustainable, culturally meaningful, and cost-effective housing that is adaptable to climate conditions. This participatory approach guarantees that housing designs are in tune with the local environmental and social contexts, similar to Fathy's efforts with rural communities in Egypt.

Furthermore, Christopher Alexander's A Pattern Language (1977) reinforces the participatory approach by introducing a flexible "pattern language" that communities can use to shape their spaces collaboratively. His method empowers individuals to design their own environments by utilizing a set of interconnected patterns, from city planning to small architectural details, that can be adapted to local needs.

Fig. 5: A snapshot of the 'Jhenaidah Community Upgrading' project by Co.Creation.Architects - an inspiring example of participatory design in Bangladesh, where women took on an active role during the design process

Alexander's concept aligns with the ecofeminist and participatory frameworks in this research, as it encourages community-driven, contextually sensitive designs that respond to social and ecological needs. By embracing Alexander's vision of a pattern language, this research underscores the potential of housing projects to reflect the lived experiences and values of the women of Bangladesh, creating spaces that are ecologically attuned and socially meaningful.

Finally, the research considers indigenous knowledge and building systems, such as traditional water-harvesting techniques, which can promote a harmonious relationship between people and their environment when integrated into a housing project. Amos Rapoport's theory of vernacular architecture, as discussed in 'House Form and Culture' (1969),' supports this view by emphasizing that the most effective housing designs arise from local traditions and environmental adaptations. This theory reinforces the importance of integrating water management systems that are not only functional but also culturally attuned to the social fabric of Bangladeshi communities. Wajiro Kon's concept of "Modernology," as discussed by Izumi Kuroishi (2016), provides further insight into this framework by underscoring the significance of examining daily practices in informing adaptable housing design. His technique for examining how individuals engage with their surroundings ensures that housing solutions are based on actual, lived experiences. This methodology is essential in creating housing for at-risk communities, enabling solutions that incorporate both practical and cultural aspects.

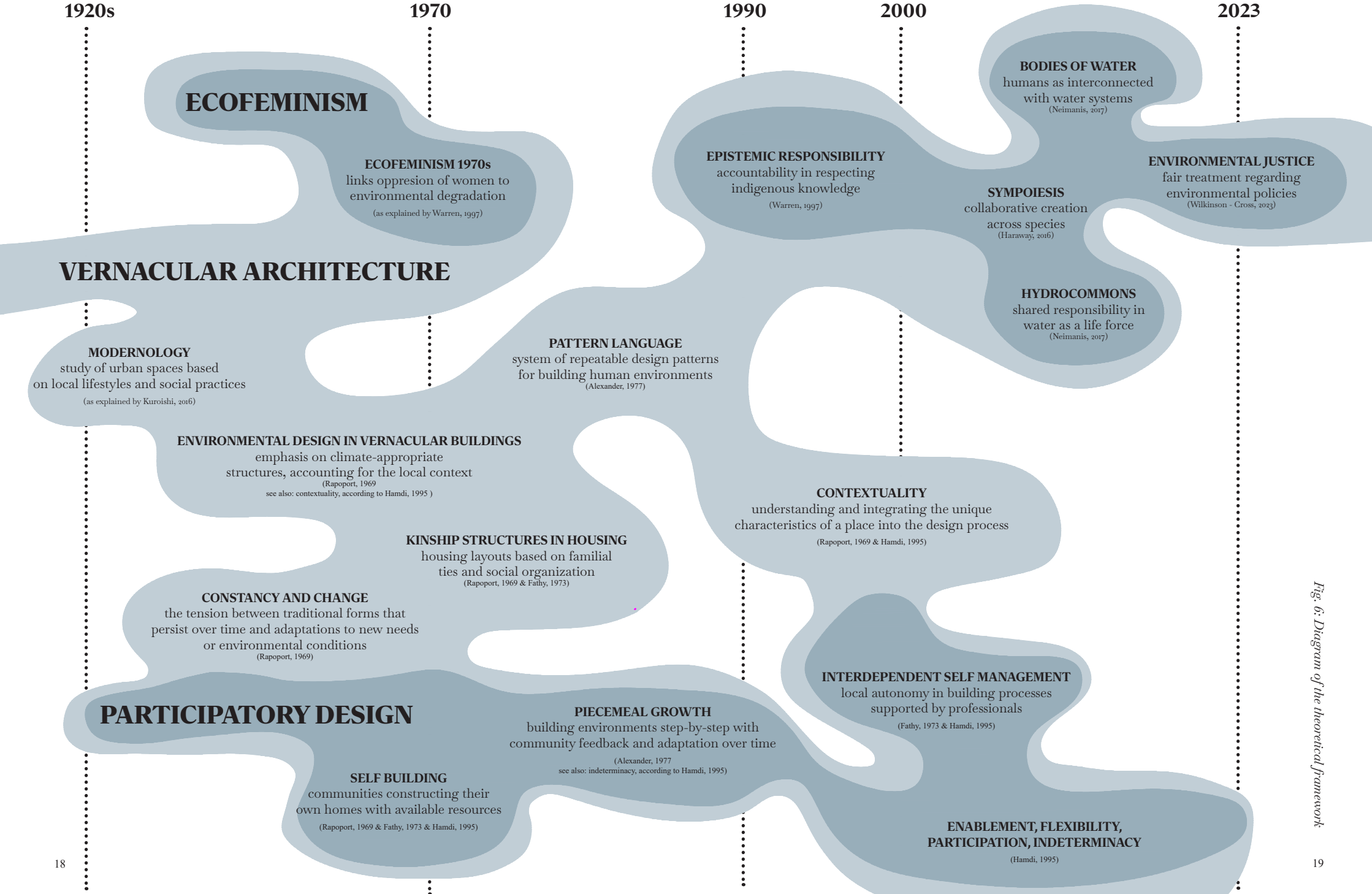

Fig. 6: Diagram of the theoretical framework

RESEARCH QUESTION

How can housing design, with the integration of water management systems, create safe and supportive environments that facilitate women's income generation and enhance their livelihoods in the face of climate change in Bangladesh?'

Sub - questions:

1. Holistic Understanding of Women's Embodiment and Environment
What are Bangladeshi women's specific embodied needs and how can they be addressed through housing design?

2. Incorporating Women's Knowledge
How can women's extensive knowledge of local resources, water management and agricultural practices be included in the design process?

3. Encouraging Women's Involvement in the Design Process
How can the concepts of participation, flexibility, enablement, indeterminacy and contextuality [1] be incorporated into the design process?

4. Facilitating Women's Income Generation
How can housing design create opportunities for women to generate income, while supporting and enhancing the initiatives that already exist [2] ?

[1] as introduced by Nabeel Hamdi in: *Housing without houses: Participation, flexibility, enablement* (1995)

[2] for example the cultivation of homegardens

Fig. 7: A woman stands inside her house, which was partially destroyed by Cyclone Mocha

DESIGN HYPOTHESIS

My hypothesis regarding the final product of this research is a housing proposal that incorporates water management solutions with the aim of reducing women's workload related to water collection, thus contributing to their safety and well-being. Moreover, as women's involvement in agriculture is prevalent within rural Bangladeshi societies, the final solution could include areas for small-scale food production, spaces for storing agricultural products, and facilities for small enterprises that allow women to contribute to household income. I would particularly like to integrate dedicated homegarden spaces into the housing proposal, as they are shown to be a vital source of livelihood for women (Akhter et al., 2010). Finally, as I believe that housing should be part of broader strategies that include education, skills training, and access to credit for women, the end project could potentially incorporate communal spaces for training and education programs, helping women gain new capabilities that enhance their workforce participation.

Fig. 8: A group of farmers, many of whom are women, receiving training

GOAL/AIMS

The main goal of the research project is to create housing solutions that enhance women's well-being through integrated water management in climate-vulnerable areas of Sylhet, Bangladesh.

To achieve this goal, the research aims of the project are:

1. Proper understanding of women's needs regarding safety, health and comfort, in the context of rural Bangladeshi society.

2. Thorough insight into how women's local knowledge can inform water management in housing.

3. Insight into effective participatory design approaches that integrate female perspectives.

4. Clarity on how housing design can support women's economic opportunities and livelihoods.

METHODOLOGY

1. What are women's specific embodied needs and how can they be addressed through housing design?

Methods: Literature | Site Visit | Interviews/ Workshops with local women
Outcomes: Pictures, Collages | Audio/Video Recordings

2. How can women's extensive knowledge of local resources, water management and agricultural practices be included in the design process?

Methods: Literature | Site Visit | Interviews with local women | Case Studies related to initiatives/cooperatives centering women and focusing on the management of water resources
Outcomes: Pictures | Audio/Video Recordings | Catalog/Design 'toolkit' of potential methods that could be incorporated in the design

3. How can the concepts of participation, flexibility, enablement, indeterminacy, contextuality be incorporated into the design process?

Methods: Literature | Case Studies of housing projects incorporating community participation
Outcomes: Catalog of existing methods (successful vs failed strategies)

4. How can housing design create opportunities for women to generate income, while supporting and enhancing the initiatives that already exist?

Methods: Literature | Case Studies of projects involving women-led initiatives with the aim of income generation | Interviews with local women
Outcomes: Pictures | Audio/Video Recordings | Catalog of existing initiatives in and around Sylhet

WHY?

This research aims to explore the ways in which housing design, with the incorporation of water management systems, can create supportive environments that facilitate women's income generation, enhance their livelihoods and build community resilience to climate change in Sylhet, Bangladesh. By focusing on the intersection of architecture, gender and water management, it seeks to contribute to the development of inclusive solutions that address the unique challenges faced by women in climate-vulnerable regions.

RESEARCH AIM

WHAT?

The **main goal** of the research is to create housing solutions that enhance women's well-being through integrated water management in climate-vulnerable areas of Sylhet, Bangladesh.

SUB-AIM	SUB-AIM	SUB-AIM	SUB-AIM
Proper understanding of women's needs regarding **safety, health and comfort.**	Thorough insight into how women's **local knowledge** can inform water management in housing.	Insight into **participatory design** approaches that integrate women's perspectives.	Clarity on how housing design can support women's **economic opportunities** and livelihoods.

RESEARCH QUESTION

WHAT?

How can housing design, with the integration of water management systems, create safe and supportive environments that facilitate women's income generation and enhance their livelihoods in the face of climate change in Bangladesh?

SUB-QUESTION	SUB-QUESTION	SUB-QUESTION	SUB-QUESTION
What are Bangladeshi women's **specific embodied needs** and how can they be addressed through housing design?	How can women's extensive knowledge of **local resources, water management and agricultural practices** be included in the design process?	How can the concepts of **participation, flexibility, enablement, indeterminacy and contextuality** be incorporated into the design process?	How can housing design create opportunities for women to **generate income**, while supporting and enhancing the **initiatives that already exist**?
HOW?			
-Literature review -Site Visit -Interviews & Workshops	-Literature review -Site Visit -Interviews -Case Studies	-Literature review -Case Studies	-Literature review -Interviews with local women -Case Studies
OUTCOME	**OUTCOME**	**OUTCOME**	**OUTCOME**
-pictures, collages -audio & video recordings	-pictures, collages -catalog/design 'toolkit'	-catalog of existing methods (successful or failed)	-pictures -audio& video recordings -catalog of initiatives

RELEVANCE

The integration of water management systems into housing design is particularly relevant in rural Bangladesh, where access to clean and reliable water is a constant challenge. Women's roles in managing household water resources make them important stakeholders in any intervention aiming to improve water security. Therefore, through the incorporation of water management systems into housing designs, such as rainwater harvesting, these interventions can significantly reduce women's time and effort spent on water collection, freeing up time for other productive or income-generating activities.

Additionally, the emphasis placed by the research on ecofeminist principles highlights the need for a transformative approach to housing design, which transcends technical solutions and addresses underlying gender inequalities. By creating spaces that are safe, supportive, and conducive to women's participation in the workforce, housing design can become a tool for social change, challenging traditional norms and empowering women to take on more active roles in their communities.

This study aims to bridge the gap between gender, climate change, and housing by proposing an integrated approach that uses water management systems to create environments that support women's livelihoods and enhance their resilience to climate impacts. The findings will have significant implications for policy and practice, providing a framework for developing suitable and gender-inclusive housing solutions in Bangladesh and beyond.

DEFINITIONS

Ecofeminism: the theoretical framework according to which the dominant anthropocentric model enforces a division between 'humans' and 'nonhuman nature', thus sustaining patriarchal power structures that oppress both women and nature.

source: Warren, K. J. (Ed.). (1997). Ecofeminism: Women, culture, nature.

Enablement: the concept according to which people can take control of their housing development. It includes providing access to resources, technical assistance, and legal frameworks that support community-led housing initiatives.

source: Hamdi, N. (1995). Housing without houses: Participation, flexibility, enablement.

Flexibility: flexibility in housing design allows for incremental development, where communities can adapt their housing environments over time according to their changing needs and resources.

source: Hamdi, N. (1995). Housing without houses: Participation, flexibility, enablement.

Homegardens: small-scale, often family-managed gardens that provide essential resources such as food, timber, and medicine. In rural Bangladesh, homegardens play a crucial role in food security and income generation, particularly for women.

source: Akhter, S., Alamgir, M., Sohel, M. S. I., Rana, M. P., & Chowdhury, M. S. H. (2010). The role of women in traditional farming systems as practiced in homegardens: A case study in Sylhet Sadar Upazila, Bangladesh.

Intersectionality: an intersectional approach to climate change explores how gender, race, class, and geographical location influence individuals' experience, focusing mainly on the ways it affects women and marginalized communities.

source: Alston, M. (2015). Women and climate change in Bangladesh

Modernology: a descriptive approach to urban studies focusing on the observation and analysis of everyday life and spatial practices. It contrasts with traditional urban planning by being more perception-oriented and rooted in observing the lived realities of people in urban spaces. The original research was conducted by Japanese architect Wajiro Kon, between 1925-30 and inspired many other architects in later years.

source: Kuroishi, I. (2016). Urban survey and planning in twentieth-century Japan: Wajiro Kon's "Modernology" and its descendants

Multispecies Flourishing: the state where humans and nonhumans co-shape each other's futures. This involves recognizing the entanglement of species and working towards shared survival amidst environmental crises.

source: Haraway, D. (2016). Staying with the trouble: Making kin in the Chthulucene.

Participation: the practice of involving local communities and future residents in the planning and design of housing projects. This aims for the designs to be more culturally appropriate, socially acceptable and responsive to the needs of the people. It also builds social capital, empowers marginalized communities and enhances local governance.

source: Hamdi, N. (1995). Housing without houses: Participation, flexibility, enablement.

Pattern Language: a system of repeatable design patterns for building human environments.

source: Alexander, C., Ishikawa, S., Silverstein, M., Jacobson, M., Fiksdahl-King, I., & Angel, S. (1977). A pattern language: Towns, buildings, construction.

Self-Building: a method of construction where local communities, especially the poor, participate directly in building their homes, often under the guidance of an architect. Fathy emphasized this approach as a way to empower local communities and reduce housing costs.

source: Fathy, H. (1973). Architecture for the poor: An experiment in rural Egypt.

Socio-Cultural Factors: these are the influences of cultural, social, and behavioral practices on the design and use of buildings. Rapoport argues that cultural preferences are as important as environmental or technological factors in determining house forms.

source: Rapoport, A. (1969). House form and culture.

Sympoiesis: sympoiesis (or making-with) emphasizes collaborative processes among humans and nonhumans.

source: Haraway, D. (2016). Staying with the trouble: Making kin in the Chthulucene.

Vernacular Architecture: buildings created by people without formal architectural training, reflecting the local environment, materials, and cultural values of a community. Vernacular architecture is distinguished from "grand design" or monumental architecture, focusing instead on everyday living spaces.

source: Rapoport, A. (1969). House form and culture.

Fig. 9: A woman cutting bricks by hand in Dhaka. Brick is a material widely used in Bangladesh.

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