

EXPLORING THE AUTONOMOUS ADAPTATION TO FLOODING; THEORITICAL IN-SIGHTS FROM A SRI LANKAN CASE

IMASHI WICKRAMAPALA¹ & CHETHIKA ABENAYAKE^{2*}

^{1,2} Department of Town & Country Planning, University of Moratuwa, Sri Lanka

¹wickramapalaiaak.19@uom.lk, ²chethika@uom.lk

Abstract: A comprehensive understanding of the adaptation measures adopted by individuals and communities in developing countries is essential for identifying the challenges they face. The current state of knowledge regarding autonomous household adaptation processes and theories is inadequate, particularly in Sri Lankan context, highlighting a need for further exploration and analysis in this area. This study demonstrates the applicability of Thornton and Manasfi's eight universal human adaptive processes in Sri Lankan context. To achieve this, the study instrumentalized two in-depth urban riverine case studies from areas of Sinharamulla and Mewelle. The study employed a qualitative approach applying Thornton and Manasfi's eight adaptive processes supported by Adaptation, Niche, and Revitalization theories. Semi-structured household interviews with 30 respondents and direct observations in the flood-prone locality were employed as data collection method. Thematic analysis was performed on the eight themes: mobility, exchange, rationing, reserve, diversification, intensification, innovation, and regeneration. The results revealed that mobility, pooling, and exchange are dominant autonomous processes contributing to resilience among the case population. Results emphasized the importance of holistic approaches to climate resilience and the potential effectiveness of recognizing and upscaling autonomous-adaptive characteristics.

Keywords: *Flooding, Autonomous Adaptation, Community Adaptation, Theoretical Framework*

1. Introduction

The IPCC 2022 report marks a pivotal shift in understanding resilience, defining it as "the capacity for adaptation, learning, and transformation," emphasizing its dynamic nature (Schipper, 2022). This contrasts with earlier reports (1990, 1995), which focused primarily on physical aspects of climate change and lacked mention of resilience (Houghton, 1996). Over the past two decades, resilience has gained importance, reflecting the need for human systems to not only adapt to climate risks but also learn and transform in response to challenges (Cimato, 2022). Resilience is therefore inherently linked to adaptation, requiring an ongoing process to ensure a society's resilience. Adaptation strategies can be reactive, self-directed, or proactive, providing flexibility in addressing climate challenges (Bidwell, 2013; Fankhauser, 1999). Climate challenges are making the world more vulnerable to disasters like flooding, the most prevalent natural disaster globally, driven by extreme events (Perera, 2017). Residents in flood-prone areas often develop autonomous adaptation strategies, utilizing local knowledge to reduce damage, minimize vulnerability, and enhance coping capacity (RodimaTalor, 2012; Ryo Tsuchida, 2021). Autonomous adaptation refers to the spontaneous, self-initiated responses undertaken by individuals, households, or communities in reaction to experienced climatic events, without direct external policy or institutional intervention (Smit & Wandel, 2006; Thornton & Manasfi, 2010). Unlike planned adaptation, which is intentionally designed and implemented through formal governance or policy frameworks, autonomous adaptation emerges organically as communities learn, experiment, and adjust their practices in response to environmental stressors. These actions are often embedded in existing cultural norms, livelihood practices, and social networks, making them locally grounded and contextually relevant. Although often overlooked in broader discussions, autonomous adaptation is crucial for long-term resilience, contributing to the well-being of current and future populations (Ministry of Defence, 2022). Despite its importance, research on autonomous adaptation remains limited, with scholars like Thomas F. Thornton (2010), Nadia Manasfi (2010), and Anne Tallontire noting a bias towards planned adaptation in mainstream literature. This has led to a call for further research to explore the dynamics of autonomous adaptation, particularly in the context of climate change and disaster resilience (Ryo Tsuchida, 2021). In developing countries, where institutional capacities and financial resources are often limited, autonomous adaptation represents a crucial first line of defence against climate impacts (Abenayake et al., 2016). Its validity lies in its bottom-up and experiential nature-drawing upon local knowledge, community solidarity, and everyday coping mechanisms to reduce vulnerability and enhance resilience. In Sri Lanka, for instance, recurrent flooding has driven urban and peri-urban households to adopt self-devised protective measures such as elevating dwellings, diversifying income sources, and forming neighbourhood support networks long before formal adaptation plans were introduced. Recognizing and analysing these autonomous processes thus provides valuable insight into how adaptive behaviour naturally evolves in resource-constrained settings, informing more inclusive and grounded adaptation policy frameworks.

Despite the increasing frequency of floods in Sri Lanka, research has largely focused on planned adaptation measures at institutional or agricultural scales, leaving household-level and community-driven responses underexplored (Wijewardhene et al. 2023). In the Sri Lankan context, existing literature on self-adaptation to climate change particularly in relation to flooding at the household level reveals a significant research gap. Most research has primarily concentrated on the agricultural sector, with fewer studies addressing household-level adaptation (Esham & Garforth, 2012). This study addresses this critical gap by examining autonomous adaptation practices in urban riverine settlements within the Kelani

*Corresponding author: chethika@uom.lk

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River Basin. This study aims to bridge this gap by exploring the factors influencing household resilience to flooding. The primary objectives of this study are to identify local adaptations to flooding, explain the processes behind autonomous adaptation, and analyse the findings within a conceptualized theoretical framework. Using Grounded Theory, it interprets the lived experiences of affected households through the lens of Thornton and Manasfi's eight adaptive processes, supported by Adaptation, Niche, and Revitalization theories. By drawing on case studies from the selected flood affected areas (Figure 1), the research offers actionable insights into how these communities adapt and provides valuable lessons for improving climate resilience in similar contexts. Understanding the dynamics of autonomous adaptation at the household level is crucial for developing targeted interventions and strategies that enhance resilience in flood-prone areas. By focusing on how communities respond to frequent and extreme flooding, this research seeks to provide a comprehensive understanding of autonomous adaptation processes in Sri Lanka. It examines the local-level responses to flooding, identifying both the driving forces and practical constraints that influence the adaptation strategies of individuals and communities. The proposed theoretical framework to analyses these adaptation dynamics, providing a robust theoretical and empirical understanding of how communities navigate the challenges posed by climate change. This research offers a unique contribution by focusing on autonomous adaptation processes in select flood-prone communities in Sri Lanka. It enriches the broader discourse on climate change adaptation by providing valuable insights into the strategies employed by individuals and communities. Through interviews and questionnaires, the study gathers real world perspectives on the adaptive practices of residents, shedding light on how they cope with frequent flooding. This empirical data is critical for policymakers and practitioners who aim to develop more effective and localized interventions for flood resilience. The significance of this research lies in its contribution to understanding how low-income communities spontaneously adapt to recurrent floods, providing evidence to inform bottom-up resilience policies and community-based adaptation planning in developing countries.

2. Methods and Materials

2.1 METHODOLOGY

Qualitative approaches provide valuable insight into the complexity of 'real-life' situations by fostering a deeper understanding of factors implicit in the local context (Waller, 2016). Hence, this study opted for a qualitative approach; particularly based on the seven-step steps grounded theory by Glaser and Strauss (Glaser and Strauss, 2015). Grounded Theory is a qualitative re-search method that allows theories to be developed from the data collected. The seven-step strategy, as formulated by Glaser and Strauss, includes problem identification, research area selection, data collection, theme extraction, generalization postulation, taxonomy development, and theory or a conceptual framework creation (Charmaz, 2014).

2.2 METHODOLOGY

2.2.1 The Downstream of Kelani River Basin as the study focus

Flooding is a critical issue in Sri Lanka due to its frequent occurrence and widespread impact. The selection of the case study focuses on the Kelani River basin, considering the severity of impact on human life, property damage, and the number of affected individuals. The National Climate Change Adaptation Strategy highlights the vulnerability of rivers such as the Kelani, Kalu, Nilwala, Ging, Walawe, and Mahaweli to flooding. Notably, floods in 2016, 2017, 2019, and 2021 have had severe consequences on the Kelani River basin, resulting in loss of life, damage to houses, and substantial economic losses. Urban expansion into flood-prone zones down-stream of the Kelani River exacerbates environmental degradation, disproportionately affecting impoverished and agricultural communities. The Hydrologic Engineering Centre's estimation using HEC-HMS designates areas like Hanwella, Kaduwela, Kolonnawa, Biyagama, Kelaniya, and Colombo DS divisions as vulnerable with-in the Kelaniya river basin, with a specific focus on riverine household settlements.

2.2.2 Selection of two detailed case studies

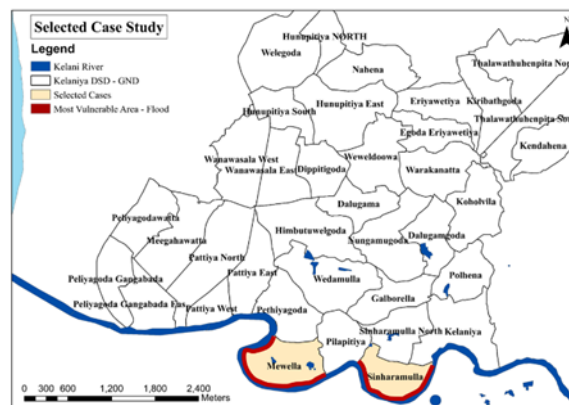


Figure 1: Selected Case Study Areas.
(Source: By Author)

This study narrows down to Mewella and Sinharamulla within the Kelaniya DS Division, which exhibit high flood inundation, significantly affected populations, substantial property damage, and a prevalence of in-formal households. Located in the

Kelaniya Divisional Secretariat, Gampaha District, Western Province, these two Grama Niladhari (GN) Divisions have been repeatedly identified as flood-prone zones within the lower Kelani River basin. According to the Kelaniya Development Plan (2019–2030) and Disaster Management Centre (DMC) records, recurrent floods particularly in 2016, 2017, and 2021 affected large portions of both GN divisions, inundating approximately 65–70% of residential areas and displacing over 2,000 residents during major flood events, compared with other GN divisions in the Kelani River basin. With 742 houses in Mewella and 488 in Sinharamulla, these areas accommodate a considerable slum and semi-formal housing population, highly exposed to flood hazards due to their proximity to the river and inadequate drainage infrastructure. The population growth rate between 1975 and 2015, peaking at +57.8% in Mewella and +59.8% in Sinharamulla, has further intensified land-use pressure and settlement expansion into floodplains. The high population density, combined with recurrent inundation and housing vulnerability, makes these GN divisions critical case areas for examining the socio-environmental dimensions of flood risk and adaptation within the Kelani River basin (JRC, 2023).

2.2.3 Socio-Economic Background of case studies

The residents of Mewella and Sinharamulla primarily belong to low- to lower-middle-income households, with average monthly incomes below LKR 60,000. The majority are engaged in informal employment, such as small-scale trading, manual labour, and casual services. Educational attainment is relatively low, with most adults having completed only secondary education. Housing structures are a mix of semi-permanent and temporary dwellings, often lacking proper drainage and sanitation. Social cohesion, however, remains strong, with kinship networks and neighbourhood associations playing a key role in mutual support during flood events. This socio-economic profile highlights the communities' vulnerability and limited adaptive capacity, making their autonomous adaptation strategies particularly significant for resilience-building.

2.3 DATA COLLECTION

Data collection was primarily based on direct observation and in-depth interviews with selected locals. Engaging in active dialogue, the researcher summarized and clarified responses, ensuring an accurate interpretation of key meanings. A combination of primary and secondary sources was used for data collection. Primary data involves direct observations and in-depth interviews with selected locals. A semi-structured questionnaire was employed to conduct in-depth interviews to discuss autonomous adaptation. A structured questionnaire data on planned adaptation dynamics at the institutional level. 30 respondents were selected as the ideal Sample Size in Qualitative Research and Based on studies, 30 seems to be an ideal sample size for the most comprehensive view (Insite, 2023). Snowball sampling, prevalent in qualitative research, relies on networking and referrals. Researchers start with initial contacts (seeds) meeting criteria, inviting them to participate. Those who agree suggest further participants, creating a chain-like progression. This method facilitates diverse participant selection by leveraging existing networks, enriching qualitative studies (Parker, 2019).

2.3.1 Interview Process and Structure

In-depth, semi-structured interviews were conducted with identified local communities. The semi-structured nature of the interviews enabled consistency in the topics covered by the interviews across the two case studies, and this was mainly to obtain information from the selected community and household regarding autonomous adaptation. Such an approach was useful in identifying relevant issues such as key risks and opportunities, resulting in avenues of investigation to follow. In total, 30 interviews were conducted with 32 participants across the case studies. Because the snowball sampling method was used, interviews were first established through the village officials of each area, who were affected by the flood and who know most of the residents in the area and then identify the other flood-affected communities. And facilitated interviews. Interviews were typically conducted at the participant's workplace or near home, lasting between 30 minutes and two hours. Most interviews were audio-recorded to allow the researcher to focus on developing the conversation. These recordings were transcribed with the permission of the interviewees. When necessary, the researcher contacted the interviewees by tele-phone after the initial interview to obtain further clarifications and further information.

2.4 THEORETICAL FRAMEWORK

2.4.1 Adaptation as a continuous process

Reactive and autonomous adaptation actions are the spontaneous ex-post interventions taken in response to an undesirable climate event. These actions are most often based on immediate and localized problem de-termination and require the right information, knowledge, skill, and incentives, which are necessarily cross-scaler and dynamic. (Fankhauser, 1999; Malik, 2010). On the other hand, anticipatory and planned adaptation actions are large-scale, prediction-based, and goal-specific ex-ante actions (Fankhauser, 1999; Smit, 2006). Both autonomous and planned adaptation emphasizes foresight and strategic preparedness, aiming to mitigate the negative impacts of climate change on multiple scales, from local communities to global eco-systems. (M. L. Parry, 2007).

2.4.2 Dimensions of Autonomous Adaptation

Thornton and Manasfi (2010) outline eight universal human adaptive processes mobility (movement to reduce risk), exchange (sharing or trading resources), rationing (controlled use of scarce resources), reserve (saving for future needs), diversification (spreading risk through varied activities), intensification (enhancing productivity), innovation (creating new solutions), and regeneration (restoring systems after disruption), which collectively deepen the understanding of adaptation within intellectual, social, and material contexts. Thornton and Manasfi (2010) emphasize that autonomous adaptation is not merely reactive but a dynamic socio-cultural process, shaped by human ingenuity, innovation, and cooperation. Its theoretical validity in developing-country contexts arises from its embeddedness within local socio-ecological systems,

where adaptation is both a survival mechanism and a cultural expression of resilience. Hence, understanding autonomous adaptation through frameworks such as Adaptation Theory, Niche Theory, and Revitalization Theory allows this study to link individual behavioural responses, ecological positioning, and collective cultural transformation—capturing the full spectrum of human adaptation under climate stress.

2.4.3 Developing a theoretical framework

This framework integrates three relatable theories for each dynamic and that represents the process of the adaption. Primarily, this research goes on through the adaption theory but with the help of Niche theory and Revitalization theory, this application becomes strong. Adaptation theory serves as a foundational framework for comprehending responses to environmental changes at individual, community, and institutional levels. Recognizing diverse adaptation forms and temporal dimensions, it provides nuanced insights into the multi-faceted adaptation process, addressing both climatic and non-climatic stressors (Thornton, 2010). Niche theory focuses on the ecological roles and adaptations of organisms in specific environments.

Table 1: Extended definitions of adaptation processes by Thornton and Manasfi, 2010
(Source: Nairobi Jessica Thorn, 2015)

Human dimensions of adaptation	Definition
Mobility	Seasonal movement or permanent migration to avoid risk or in search of better circumstances
Exchange	Flow of material and symbolic goods and services
Rationing	Controlling the circulation or consumption of limited or critical resources among members of a group, including rationing food, wealth or labour and storage across time and space.
Pooling	Sharing or linking of assets (wealth, labour, knowledge) across social groups, including pooling of care and space
Diversification	Increasing the variety of food, income production strategies, specialisation, etc. to enhance livelihoods, including facilitating market access
Intensification	Increasing the availability of resources by boosting their yield within a certain space or time.
Innovation	New, unplanned method or technique that arises to address a certain need. Creating the enabling environment to foster innovation and experimentation, including forward looking, flexible governance structures
Revitalisation	Organised reconfiguration of ideology and practices to reduce stress and create a more satisfying culture. This may include reconfiguration of assets like homes through a suite of incremental upgrades to increase robustness.

Applying this theory to human adaptation recognizes that individuals, communities, and institutions occupy specific niches within socio-ecological systems. Understanding and optimizing these niches can enhance adaptive capacity. For instance, individuals might adapt their behaviours within specific niches, and communities may find adaptive strategies tailored to their socio-cultural context. (Hutchinson, 1957). Revitalization theory underscores society's capacity to adapt through structured reconfiguration of ideologies, practices, and organization. This theory contributes by offering insights into how cultural shifts, guided by charismatic leaders, can lead to adaptive social change. It recognizes the importance of reformulating existing patterns and institutionalizing new adaptive codes. This is particularly valuable in fostering adaptive cultural practices within communities (Wallace, 1956).

In conclusion, this study integrates Adaptation Theory, Niche Theory, and Revitalization Theory into a unified framework to explain the dynamics of autonomous adaptation in flood-prone communities. Adaptation Theory explains the overarching Lense for comprehending how individuals, communities, and institutions respond to environmental changes through cognitive, behavioural, and structural adjustments (Thornton, 2010). Niche Theory situates these responses within specific socio-ecological contexts, showing how residents optimize their roles to maintain stability and resilience (Hutchinson, 1957; Mittelbach, 2001). (Mittelbach, 2001). Revitalization theory complements this by addressing gaps related to cultural shifts and the need for structured reconfiguration in response to environmental stress. (Thornton T. F., 2012) highlighting collective transformations in beliefs and practices that sustain long-term adaptation (Wallace, 1956; Thornton, 2012). Together, these theories form an integrated framework to depict adaptation as a multi-layered process—linking individual behavioural change, ecological context, and cultural transformation—thereby offering a comprehensive explanation of community resilience in Sri Lanka's flood-affected urban settlements.

2.5 CONTENT ANALYSIS

Thematic coding followed the eight adaptive processes identified by Thornton and Manasfi (2010), allowing inductive categories to emerge from household narratives. The eight themes are: mobility, exchange, rationing, pooling, diversification, intensification, innovation, and revitalisation. The Thornton and Manasfi's framework were preferred due to its importance in providing a comprehensive perspective on human adaptation and its relevant to the case study area. By

incorporating a wide range of processes, the framework enables researchers and practitioners to simultaneously consider multiple dimensions of adaptation. Its versatility and applicability across different contexts and scales make it a valuable tool for understanding adaptation strategies amid diverse environmental challenges. The interconnected nature of the processes identified forms a network of strategies, underscoring the complexity of adaptation and the need to simultaneously address multiple dimensions.

3. Results

Ways and means of autonomous adaptations explored during the case study has been documented as per the eight-themed content analysis.

3.1.1 Mobility

In line with the theme of mobility, residents described temporary relocation to river embankments, religious institutions, and acquaintances who reside flood-safe locations as proactive responses to rising floodwaters, demonstrating spatial flexibility as a key coping strategy. Residents of flood-prone houses in Sinharamulla evacuate to the river embankment or other public places on higher ground, depending on the height and lag time of the flooding event. For example, in the Mewella area, residents temporarily re-locate to designated evacuation sites or river embankments, whichever close and safe. "In 2016 and 2018, floodwaters rose as higher as this switch [showing an electrical switch on a wall which is about 7 feet in height], otherwise, it comes up to 4 feet during heavy rains. Either way, this house experience inundation... when the water level in the river is rising, households secure essential belongings and valuables... and reach the river embankment and put up the tent. prolonged rainfall often compromises temporary shelters. If so, households seek refuge in the nearby temple. Nevertheless, households with waterproof shelters re-main on-site rather than seeking shelter for refuge" (Respondent 01 – Sinharamulla)

"...When the water level rises, we go to the houses of our relatives in Peliyagoda [a non-flood-prone neighbourhood]. However, if the duration in evacuation exceeds two days, we return to river embankment because otherwise we would not get the flood relief from the government." (Respondent 04 – Mewelle) During major floods (2016, 2018, 2021), residents in Mewelle and Sinharamulla primarily sought refuge in river embankments, emphasizing community reliance. As indicated in Table 2, interviewees underscored how residents were grappling with evacuation with flood height over 6 feet during the 2016, 2018 and 2021 flooding incidents, exhibiting a complex interplay of coping strategies. The river embankment serves as a primary refuge, with approximately 60% evacuate there during flooding. However, challenges arise with prolonged rainfall, compel-ling residents to move to designated areas such as Kirula Academy and Kelaniya Siwurugala Temple.

Table 2: Temporary accommodation during the major flood (2016,2018,2021).
(Source: Field Survey, 2024 by author)

Evacuation during the major floods (2016,2018,2021)			
Temporary accommodation	Mewelle	Sinharamulla	percentage of respondents
Designated evacuation center	9	11	29.85%
Acquaintances' residents in flood-free neighborhoods	2	5	10.44%
friends' home	5	2	10.45%
In house (upper floor)	2	3	7.46%
River embankment	12	16	41.79%

3.1.2 Exchange

Reflecting the theme of exchange, community members engaged in reciprocal sharing of goods, services, and labour—sharing boats, food, and essential supplies—to ensure mutual support during and after flooding events. In both case studies, it was possible to note from the interview that there is a practice material exchange during the flooding.

" We store several household items and supplies in the upper room in advance. We carry those stored food supplies when we are evacuating to the river embankment, residents collectively organize shared meals" – (Respondent 02, Sinharamulla). Residents who own fishing boats have a practice of helping others to distribute goods among community members. In Sinharamulla area, local youth groups volunteer to patrol the flooded neighbourhood ensuring home safety from burglaries. "During previous evacuation times, there were burglaries reported. Thieves were from outside localities, so the residents, particularly male youth, jointly petrol partly-inundated houses by boats at night " – (Respondent 03, Sinharamulla).

The exchange of goods and services within the community illustrates the profound impact of human cooperation, resourcefulness, and mutual support. Through collective efforts, individuals demonstrate a shared commitment to meeting collective needs, fostering social bonds and cooperation. The use of existing resources such as boats by their owners for distribution purposes emphasizes the adaptability and ingenuity of community members to meet challenges and maximize opportunities. This exchange is not only for practical purposes but also strengthens the interconnectedness and inter-

dependence among community members, fostering a sense of belonging and togetherness that is essential for thriving communal life. The persistence of exchange networks underscores the importance of social capital as an adaptive asset. Through mutual exchange, residents transform vulnerability into collective strength, showing that informal cooperation can compensate for institutional gaps and enhance the self-organizing capacity of urban slum-dwelling communities.

3.1.3 Rationing

Consistent with the theme of rationing, households adopted strategies to manage scarce resources—such as limiting food consumption, storing dry rations, and redistributing supplies among families—to sustain themselves throughout the inundation period. Residents use a combination of temporal and spatial rationing by leaving their homes and distributing goods to different locations. The limited food and clothes are being shared among communities in a more equitable manner. Rationing reflects an internalized system of resource governance at the household level, where scarcity management becomes both a survival strategy and a cultural norm. This indicates that adaptation is not only structural but also behavioural and ethical, grounded in fairness and reciprocity during crisis periods.

3.1.4 Pooling

Aligned with the theme of pooling, residents demonstrated collective organization by sharing shelter, childcare, and safety responsibilities, reflecting a strong sense of social cohesion and interdependence in times of crisis. Notably, neighbours of these sites play a crucial role in pooling care for their children, demonstrating a sense of agency and community responsibility. This reflects a generalized system of reciprocity within the community, where mutual support and assistance contribute to overall resilience.



Figure 2: Pooling resources – blocks and bricks / metal sheet – Mewelle
(Source: By Author - Extract data from interview and observation data)

" Families engage in cooperative childcare during dis-placement because children are prone to environmental diseases during flooding. Two or three families take care of all small children when residents are in the river embankment. It is convenient because most of us are blood-relatives." (Respondent 05 – Sinharamulla). In Sinharamulla, a resident who lives there over 30 years reported, "It resembles a shared local knowledge network during torrential rains. The community members coordinate to share local knowledge about emerging floods. Early warning is communicated through in-formal neighbourhood alerts. It's a shared understanding that allows us to act promptly and a communal warning that helps us evacuate to safer location together". The community-based approach to early warning involves pooling knowledge about flood status, particularly when the lower areas are getting inundated, the residents evacuate to the river embankment while warning the neighbours in upper areas about the possible threat. In the Mewella and Sinharamulla areas, residents unite to share and pool their resources (Figure 2), knowledge and efforts to mitigate the effects of such events. This collective effort is exemplified through resource pooling, where labour, space, and even plots of land are shared among community members to ensure equitable access and resilience. Knowledge pooling is another critical component as residents share experiences and insights about flood patterns, enhancing the community's ability to make informed decisions and respond effectively. The pooling of efforts is evident in the coordinated actions of residents to monitor, warn and protect against flood threats, developing a sense of communal responsibility and cooperation. Overall, the pool dimension emphasizes the collective strength and resilience of these communities, as they come together to face and overcome common challenges, ensuring their well-being and sustainability in the face of adversity. The pooling of care, knowledge, and space demonstrates the emergence of collective resilience mechanisms rooted in kinship and neighbourhood ties. These practices represent an informal form of adaptive governance, where community-level coordination substitutes for formal disaster management, enhancing both trust and cooperation.

3.1.5 Diversification and Intensification

In accordance with the theme of diversification, affected households sought alternative livelihood options such as small-scale trading, home gardening, and waste collection to compensate for income losses during flood disruptions. In relation to the theme of intensification, community members enhanced existing practices to increase protection and productivity, including reinforcing house foundations, elevating floors, and strengthening embankments using locally available materials. In the face of property loss, livelihood challenges, and adverse health impacts, residents affected by floods in Mewella and Sinharamulla autonomously diversify their sources of income. This adaptive strategy involves the cultivation of alter-native

crops or the adoption of new cultivation practices for urban agriculture. Based on the observations, it was noted that they grow Bael fruit (*Aegle marmelos*) and Banana (*Musa acuminata*). This not only aids in the adoption of new cultivation practices for urban agriculture but also helps prevent soil erosion and flood-blocking along the Kelani riverbank. This diversified approach helps mitigate the impact of flooding on livelihoods, ensuring a more resilient and sustainable economic foundation. Elevating their houses using sandbags, stones, or cement barriers is another measure that intensifies protection against floods. This elevation helps minimize the risk of water entering the homes during a flood, providing a tangible defence against inundation. Then, the diversification and Intensification dimensions in the Mewella and Sinharamulla areas unfolds as a multifaceted strategy used by residents to cope with the challenges posed by floods. Faced with property loss, livelihood disruptions and health risks, households diversify livelihood strategies.

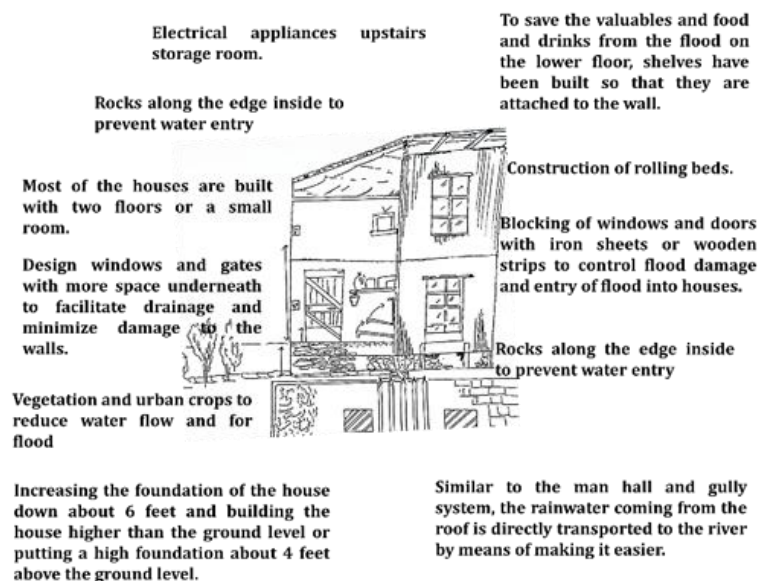


Figure 3: Composite illustration of physical and built environment adaptations in selected areas.
(Source: Author constructed based on the findings of the study)

This includes growing alternative crops such as bale fruit and bananas, as well as exploring non-agricultural avenues such as waste recovery and small-scale informal trade activities. Furthermore, residents demonstrate resource diversification by adopting new cultivation practices, including strategic bamboo planting along riverbanks to reduce flooding and soil erosion. Through these adaptation measures, residents not only strengthen their economic resilience but also contribute to sustainable resource management and community well-being. By expanding economic activity across sectors and embracing innovative approaches, the communities of Mewella and Sinharamulla demonstrate their ability to adapt and thrive amidst the dynamic challenges of their environment. In the face of recurring floods, the resilient communities of Sinharamulla and Mewella have embraced innovative measures to intensify protection against the adverse impacts on their homes and well-being. These efforts showcase a proactive approach, providing a tangible defence against inundation and contributing to the overall resilience of the communities. Furthermore, a system known as 'manhole and gully' has been employed to efficiently transport rainwater directly to the river, reducing the risk of inundation. By diverting rainwater directly to the river through a network of manholes and gullies, it reduces the accumulation of water in the immediate surroundings. This pro-active drainage system helps prevent flooding by channelling rainwater away from vulnerable areas. Diversification reveals how adaptation extends beyond immediate flood responses to include livelihood transformation and risk spreading. By engaging in multiple income generating activities, residents actively reduce exposure to single point failures, contributing to economic resilience and long-term sustainability. The intensification of protective measures, such as strengthening housing structures, reflects a technological and experiential adaptation trajectory, where incremental improvements accumulate over time. This illustrates the iterative nature of resilience-building, linking practical knowledge with material transformation in the built environment.

3.1.6 Innovation and Revitalization

Consistent with the theme of innovation, residents devised creative, low-cost solutions such as using improvised drainage systems, floating devices, and water-proofing methods to mitigate flood impacts and ensure continuity of daily life. In line with the theme of revitalization, community recovery extended beyond physical rebuilding to include renewed social organization and cultural practices, such as the reactivation of local business networks and collective clean-up campaigns that fostered solidarity and renewal.

Following property losses from floods, Mewella and Sinharamulla communities showcase a distinctive revitalization adaptation, surpassing individual efforts. Incremental changes in homes and communal initiatives aim at restoring stability and bolstering resilience. Collaborative actions, including weather forecasts and flood warnings, illustrate the communities' dedication to thriving amidst challenges. Sinharamulla's flourishing business community ensures resource availability during floods, fostering a collective response that not only enhances resilience but also revitalizes local cultures. Temporary

pedestrian bridges constructed by residents exemplify the community's holistic commitment to restoring connectivity, portraying a vivid picture of resilience and revival. " After the 2016 flood, the business communities came together and worked together. Through this, they arranged the things we needed to eat and drink.... Even that had continued for about a week, sustaining operations was challenging in the absence of external assistance. " (Respondent 01, Sinharamulla). Although the contribution of this business community can be seen as Sinharamulla, there was a lack of engagement as a Mewelle community because it was not possible to know about such social societies through interviews. This breakdown illustrates how individuals and households in Mewelle and Sinharamulla engage in various adaptive processes in response to the challenges posed by flooding. Each process contributes to their resilience and ability to cope with recurrent flood events. Innovation in flood mitigation illustrates the community's capacity for experimentation under constraint. Such bottom-up ingenuity challenges the assumption that technological adaptation must come from formal systems, highlighting how localized creativity and learning-by-doing can yield contextually appropriate solutions. Revitalization embodies the social and cultural regeneration that follows disturbance, showing that adaptation is not only about recovery but also about renewal. By restoring livelihoods and rebuilding social order, the community demonstrates transformative resilience, turning repeated adversity into an opportunity for reorganization and growth. Together, these eight themes reveal that autonomous adaptation in Mewella and Sinharamulla operates as a multi-dimensional resilience system, where physical, economic, and cultural strategies reinforce one another. The findings confirm Thornton and Manasfi's assertion that adaptation is a dynamic interplay of learning, co-operation, and innovation embedded in daily life.

4. Discussion

In summary, the examination of adaptive dimensions in Sinharamulla and Mewelle sheds light on prominent strategies employed by communities facing recurrent floods. Mobility stands out as a proactive measure, with residents strategically evacuating to higher grounds. Community-based pooling and re-source exchange efforts are crucial for enhancing overall resilience. While rationing is mentioned, it appears less prominent in comparison. Both areas exhibit innovation, with residents implementing measures to protect against floods. Sinharamulla uniquely showcases a revitalization adaptation in its business community, whereas Mewella residents' engagement in revitalization is less evident. The autonomous adaptive characteristics in these areas align with Thornton and Manasfi's dimensions, emphasizing adaptability, innovation, creativity, and collaboration at the community household level. Resilient communities, exemplified by Mewelle and Sinharamulla, choose to stay despite recurrent floods, showcasing a unique form of auto-adaptation. Based on the comprehensive analysis of adaptive strategies in the flood-prone regions of Mewelle and Sinharamulla, it becomes evident that the actions taken by the residents cannot be neatly categorized into distinct dimensions such as mobility, exchange, diversification, or intensification. Instead, a nuanced picture emerges where various adaptive measures intersect and complement each other, forming a cohesive response to the recurrent challenges posed by floods. For instance, while mobility stands out as a prominent strategy in both areas, it intertwines with other dimensions such as exchange and pooling. Residents strategically relocate to higher ground or river embankments during floods, demonstrating mobility as a proactive measure. However, this mobility is not isolated; it involves collaborative efforts within the community. Residents exchange essential resources such as food and materials, pooling their knowledge and efforts to enhance overall resilience. This collaborative exchange extends beyond material goods to encompass social support systems, where neighbours come together to monitor home security or care for each other's children during flood events.

Moreover, the adaptation strategies in Mewelle and Sinharamulla showcase elements of both diversification and intensification. Residents diversify their sources of income by exploring alternative livelihood options such as urban agriculture or small-scale entrepreneurship. For example, growing crops like Bael fruit and bananas not only provides economic opportunities but also helps prevent soil erosion and flood-blocking along riverbanks. Simultaneously, intensification measures such as elevating houses or employing innovative drainage systems demonstrate a concerted effort to enhance protection against floods and minimize property damage. Additionally, the revitalization dimension emerges prominently, particularly in Sinharamulla, where the business community plays a crucial role in orchestrating collective responses to floods. Through collaborative actions, such as organizing food supplies or make-shift bridges, the community revitalizes local cultures and strengthens social bonds. This revitalization is not merely about recovering from the impacts of floods but also about fostering resilience and sustainability in the face of adversity.

Overall, the adaptive actions observed in Mewelle and Sinharamulla exemplify the resilience of communities in adapting to their environment. While these actions may not neatly fit into predefined categories, they reflect a dynamic interplay of strategies that enable residents to survive and thrive amidst recurrent floods. This nuanced understanding underscores the importance of considering the multifaceted nature of adaptation in addressing the complex challenges of environmental change. This finding resonates with A. S. Romer's perspective, suggesting that evolutionary changes often maintain existing lifestyles. The example of fish evolving limbs to navigate between ponds illustrates the parallel of maintaining aquatic habits amid environmental challenges. Romer's rule implies that maintaining existing patterns can catalyse adaptation, highlighting the importance of recognizing and understanding auto-adaptation dynamics in the face of environmental threats. Romer's rule, refers to the idea that evolutionary changes in organisms primarily occur to better maintain their existing patterns of life rather than facilitating the adaptation to entirely new lifestyles. In other words, new adaptations are enabled by changes that were initially selected to enhance the organism's ability to thrive in its current ecological niche or lifestyle. Essentially, Romer's rule implies that evolutionary changes serve to maintain and optimize existing life patterns rather than being a deliberate, forward-looking process. Romer's rule suggests that maintaining existing patterns may eventually serve as a catalyst for adaptation (Allaby, 2004). The synthesis of these research findings underscores the

importance of adopting a holistic approach to climate resilience. Recognizing autonomous-adaptive characteristics and upscaling them are essential steps toward promoting autonomous adaptation strategies. By doing so, policymakers and practitioners can develop more comprehensive and effective approaches to climate change challenges, fostering a resilient and sustainable future for communities worldwide.

5. Conclusion

The findings from Mewella and Sinharamulla illustrate that autonomous adaptation emerges through inter-linked processes of mobility, exchange, pooling, diversification, and revitalization, which collectively reinforce community resilience. The study demonstrates that while physical measures such as house elevation and crop diversification mitigate exposure, social capital and collective action manifested through resource pooling and shared knowledge are the true drivers of sustained adaptation. This study's qualitative scope and sample size (30 households) limit the generalizability of findings beyond the two study areas. Future research could employ mixed-method approaches, integrating spatial data and quantitative vulnerability indices to validate and scale the conceptual framework across other flood-prone urban contexts. These results highlight the need for policy frameworks that recognize and integrate community-led initiatives into formal disaster management planning. Authorities should prioritize micro-scale support mechanisms, such as livelihood diversification grants, improved drainage infrastructure, and participatory early-warning systems. Strengthening local governance capacity to collaborate with community-based organizations would further enhance resilience and ensure that adaptation efforts are contextually grounded and socially inclusive. Overall, the study provides empirical evidence that bottom-up adaptation processes can complement top-down interventions, reinforcing the broader goal of climate-resilient urban development in Sri Lanka. These findings align with global priorities under the Sendai Framework and SDG 13, emphasizing the integration of locally driven adaptive practices into formal disaster management policies. Recognizing autonomous adaptation as an endogenous resilience mechanism can guide both national and municipal authorities in co-producing climate-resilient development strategies.

6. References

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