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Living on the Edge – The Nexus of Vulnerability and the Well-being

A case study on the impacts of water scarcity on the resettled community in Chennai, India

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Summary

The future of Chennai hangs in the balance, the question is no longer if but when often the city will run dry. Though its geography is also its weakness, the real villain for the city's water shortages is the poor management of resources. What was once manageable to do, has become an impending tragedy, fuelled by climate change and inefficient resource management. Climate change is accelerating globally, aggravating both acute and chronic hazards, especially with water. These severe climate consequences are wreaking havoc throughout the world, with countries coping with severe water shortages and worries about long-term water management, making Chennai, a stark example of the urgent need to address water scarcity before it's too late.

The study centres on the lack of water resources among resettled people, however additionally emphasises a lack of comprehension of how these populations perceive and deal with water shortages in their everyday lives. To bridge this gap while gaining a more nuanced understanding of vulnerability dynamics, this study uses exploratory research using qualitative data collection and intends to shed light on the complicated interactions and trade-offs between vulnerability and well-being. The objective aims to fill the information gap in the resettlement literature through the integration of well-being indicators with vulnerability assessments, resulting in more effective, evidence-based assessments.

The findings are broken down into three sections: the influence of external vulnerabilities, the consequences of interactions of the variables, and coping strategies and reactions. The findings show that external vulnerabilities primarily stem from the systemic failures of the resettlement interventions leading to affordability concerns and inadequate support and from the formal institutions trapping the residents into the cycle of resource scarcity, suggesting a larger failure in managing the community's fundamental demands effectively. As a consequence, the capacity to sustain well-being and cope with externalities are seriously constrained with all three well-being measures neglected. greatly reducing people's quality of life.

Focus on interventions and policies that are targeted at context-specific- bottom-up approaches and improved investments in local water management policies. In addition to that, in the context of Chennai, further research on the efficiency of economic incentives on water and per capita consumption metrics should be considered.

Keywords

Water vulnerability assessment, Capacity, Well-being, Resettlement, Perumbakkam

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Abbreviations

Abbreviation	Full form
CMA	Chennai Metropolitan Area
CMWSB	Chennai Metro Water Supply Board
HLRN	Housing and Land Rights Network
IHS	Institute for Housing and Urban Development Studies
IPA	Interpretative Phenomenal Analysis
IPCC	Intergovernmental Panel on Climate Change
IRCDUC	Information and Resource Centre for Deprived Urban Communities
NGO	Non-governmental Organisation
NITI	National Institute for Transforming India
RWA	Resident Welfare Association
STEP	Sewerage Treatment Plant
TNUHDB	Tamil Nadu Urban Habitat Development Board

Chapter 1: Introduction

1.1 Background and Relevance

The rapidly developing Chennai Metropolitan Area, a delta region in which modernity effortlessly blends with tradition, is distinguished by persistent sensitivity to catastrophic events triggered by changing climates. Beneath the devastating instance is a brutal and contrasting reality—a microcosm of urban displacement by disasters. Located in the southern state of Tamil Nadu, the city of Chennai which serves as the state's capital, stands among the cities grappling with acute water scarcity, as the city has encountered explosive and largely unplanned growth over the past 15 years. According to the Composite Water Management Index (NITI Aayog , 2019) , by 2020, about 100 million people in 21 Indian cities—including Chennai—may run out of groundwater. However, the CMA was into the league a year before and was declared "Day Zero" of water in June 2019, when reservoirs supplying water to over 7 million residents ran dry, even exhausting the deeper aquifers (ABC Asia, 2024), as the urban expansion has come at the cost of wetlands, crucial for water during drought historically in Chennai (Wetlands International, 2019). Water availability remained a concern for months, relying on commercially produced water trucks with spike in prices, despite being the world's most abundant and widespread resource, currently standing with the lowest per capita availability of water (Wetlands International, 2019). These are not historic catastrophes; rather, they have become recurring calamities for Chennai's 11 million residents during the previous seven years, where non-accountability with the multiplicity of responsibility among institutions is a critical cause. (T.E.R.I, 2021).

Studies suggest that extreme water events are closely associated with strains associated with supply, demand, and conservation behaviours (Sebastian, 2022). However, water scarcity has been a problem in recent years due to the mismanagement of the existing water resources (Saquib et al., 2022). With the consensus of this rapid urbanization, planning and development infrastructures were unable to keep up with the growth rate, instigating certain populations to live in informal areas or slums (Palakodeti, 2020), who are more affected due to these water crises, revealing the stark inequalities in social and environmental justice (Khalsa, 2022). To effectively manage this risk preventing its consequences, it is essential to understand how vulnerability is generated, how it increases, and how it builds up. (IPCC,2022). Moreover, here the understanding should be the vulnerability of the people and their livelihoods, socio-economic resilience, and well-being that have severely impacted the urban poor from both natural and man-made stress (Dolan et al., 2021). Consequently, it has become crucial to explore specific approaches that can save water resources and manage the growing water demand (Fielding et al., 2012). How best to meet and address the challenges in the face of changing climate and uncertain water supply-demand metrics with the overlap of social concerns requires research in all aspects of water to strengthen the economic and social resilience of the unempowered communities — thus, this study underlines the importance of identifying the vulnerability to assessing opportunities of capacity through the lens of exposure and capacity.

1.1.1 Why Perumbakkam in Chennai

From the 2004 Tsunami to Cyclone Vardah in 2019, a decade of forced eviction under the pretence of providing safer housing' has been undertaken, displacing thousands of families to ‘resettlement sites’, managed by the Tamil Nadu Urban Habitat Development Board, an example of disaster capitalism (Peter & Chaudhry, 2017) which culminated in the emergence of three significant resettlement sites in Chennai: Kannagi Nagar, Semmenchery, and Perumbakkam. The subject region Perumbakkam is not because of the culmination nor the

result of a singular set of such circumstances. As one of the largest resettlement sites, one of the criticalities here is assessing their water management strategies crucial for improved living conditions (IRCDUC, 2022), which is not represented sufficiently. How bad can it get? has been brought up by several violations of human rights related to proper housing, information, water, health, work/livelihood, during the relocation(HLRN ; IRCDUC, 2017) particularly acute with recent protests, where the residents of Perumbakkam, deprived of their already limited water supply, and peripheralized from the city centre (HLRN ; IRCDUC, 2021) are in a desperate plea for water on the streets as the supply for over 20,000 housed community was cut off. Out of six resettlement sites, Perumbakkam was identified with water being major concern with reports on access and quality being a major concern (IRCDUC, 2022).

Figure 1 : Perumbakkam residents on protests for water

Source: (The Hindu, 2023)

According to the report of the Comptroller and Auditor General of India, (HLRN ; IRCDUC, 2021, p. 5), construction of dwelling units per hectare has increased causing congestion prompting GoTN to shift almost 3,488 units from Perumbakkam. This has not only put them in danger but has also impacted their water supply as residents of Perumbakkam continue to grapple with inadequate water supply, with the present supply of water assured was 8 million litres /day but residents realized that the supply was 6 million litres/day (The Hindu, 2023) insufficient to the incoming populace, making it a critical case to study.

1.2 Problem Statement

Despite a growing body of descriptive research on extreme events in Chennai, a distinct gap exists in understanding the nature and extent of water vulnerability in resettlement communities. Knowledge about how people, property, infrastructure, goods, and the environment are exposed to potentially damaging events that have a severe impact on health, productivity, and well-being, worsening the lives of the urban poor (Palakodeti, 2020) is lacking in the context of Perumbakkam. The absence of views from affected communities has also widened the gap between the communities, the public, and the state, resulting in mistrust atop existing stigma and criminalization faced by these communities (Peter & Muraleedharan, 2021). Furthermore, Thaker et al (2016) underscore that a community's ability to establish developing adaptive behaviour among its members as one critical aspect of water conservation behaviour is the curtailment behaviour, highlighting the “daily efforts to save water” (Russell & Fielding, 2010), which is not studied in Perumbakkam. While studies in the existing literature provide insights focused on vulnerability and well-being measures individually (Cutter, Boruff, & Shirley, 2003; Adger W. N., 2006; Sumner & Mallett, 2013; Mcgregor,

Coulthard, & Camfield, 2015 Geels, 2019; Birkmaan, et al., 2021), the relationship between vulnerability assessment with the well-being of target group on water shortages is linked with capacity mechanisms, which includes the habitual behaviours and shared mindsets developed over time; user practices which are insufficient in the context of Perumbakkam. According to Raising Risk Awareness (2017, p. 3), one of their policy recommendations for resilience development in Chennai, was to reduce the vulnerability and exposure of socially and economically marginalised in city-disaster action plans in Chennai. While the definitions of vulnerability are still debated, recent bottom-up approaches to vulnerability assessments can better account for the specific context, time, and temporal nature of the vulnerability (Okpara, Stringer, & Dougill, 2017) that has never been assessed in the context of Perumbakkam.

1.3 Research Questions

To achieve this, in the exploratory study, the research question is:

What is the nature and extent of vulnerabilities influencing the well-being of the residents of Perumbakkam?

1) What are the external vulnerabilities affecting the households of Perumbakkam?
2) How do water shortages impact the well-being *(material-relational-subjective)* measures, mediating the vulnerabilities, in the households of Perumbakkam?
3) What are the challenges and opportunities existing within the community's relationship of coping with water shortages?

Sub-question 1 is crucial as it directly addresses the first part of the primary research question by identifying the external variables (exposure) that lead to water shortage and sheds insight into the nature of residents' vulnerability to water shortages.

Sub-questions 2 investigates how external vulnerabilities, impact residents' well-being measures. Well-being functions as a mediator, indicating how the pathway from impacts of external vulnerabilities on internal vulnerability outcomes is channelled through the shift in well-being, thereby linking external vulnerability (exposure) to internal vulnerability (capacity).

Sub-question 3 provides insights into challenges and opportunities influencing the community's capacity to cope with water shortages. Insights from this question are crucial in understanding how coping is developed or constrained within the community, vital for practical interventions or policy formulation

Chapter 2: Literature Review and Conceptual Framework

This chapter is composed of three major sections, namely the elaboration on the concepts of water scarcity to the context, defining the key parameters of this study - vulnerability and capacity; and concluding, with the presentation of the theoretical framework.

2.1 Water scarcity:

Water connects all aspects of life and is today at the heart of the climate problem (United Nations - Climate action, 2023). Scarcity, which happens when demand exceeds availability, is one of the most important variables influencing water security. Since water is inextricably

related to the region's social, political, and economic growth, water insecurity has a significant impact on people's public health financial growth, and societal stability (He, et al., 2021; Adom et al., 2023) Access to safe water and sanitation can translate challenges into opportunities, empowering people (Water.org, 2024). However, it is increasingly evident that the frequency and intensity of the scarcity, droughts, and water shortages are answers to the questions raised by climate change coupled with water mismanagement and overconsumption (Lai, 2022).

The Intergovernmental Panel on Climate Change (IPCC, 2022, pp. 551–712) anticipates that droughts would affect worldwide hydrology and water quality differently, posing a significant challenge to water supply for society, the environment, and ecosystems. On a consumption basis, according to Sivakumar (2011), the amount of clean water available per person globally has not been met, despite the progress. It is still decreasing due to an assortment of factors such as population growth, water contamination, insufficient planning and management of transboundary as well as shared water resources, and inefficient water supply and distribution systems.

2.1.1 Resource Mismanagement

It is always considered as mismanagement of resources in the water supplies of different contexts that leads to water scarcity. However, many governments do not have proper investments in infrastructures to deliver reliable water sources to those who need it most. Another perspective is that the planet is not facing a water crisis due to genuine physical water scarcity, but rather due to widespread and ongoing misuse of water (Biswas, 2006). This stems from the distribution of resources which accounts for the efficiency and quality of resources by the institutions, discussed in this subsection.

2.1.1.1 Efficiency of Water Resources

Allocative efficiency, one of the neoclassical economic notions of water, applies to current water situations, as the resource is finite with competing users and expresses the potential to retain its ecological functionalities (García, & Cecilia, 2014) , somewhere between the lexicon of "public good" and "private good,", Water must be handled as a "common good" with mutual dependence on consumption and non-excludability only until resources become few or its advantages to specific communities are waning (OECD, 2003). However, Peluso, (2022) emphasises that conservation behaviour starts on an individual level requiring human participation and investments, technically as 'efficiency behaviour' on an individual level as a solution to the water crisis. (Singha et al, 2022).

Unfortunately, water is now traded as a "commodity" sowing the seeds of fear that market dynamics in today's world can dramatically exacerbate the existing impacts of water stress and increase competition among the users or nations. (Lai, 2022). Extensive debates are going on about how water should be allocated and managed due to different definitions and perceptions of water, and most of them are rooted in the differences in how water is dealt with and the legal status of the countries facing the crisis. According to the United Nations Development Program (2006), India, with the limited amount of water that is either supplied or available through communal infrastructures such as taps and stand posts, is left to manage their sources from the myriads of sources such as water tankers/lorries, private water vendors and fetching water from long-distance sources eventually spending a substantial amount of money, time and labour. It was also reported that water supply through public infrastructures is cheaper than the water supplied by the vendors (UNDP,2006).

Policies consistently state that resources would be equally allocated through the water policies or regulations but, definitions of "equity" remain unclear. However, in reality, market trends

and economic efficiency persist to have a considerable impact on water distribution, frequently resulting in a preference for allocating to persons or businesses that can create the largest economic returns from the consumption of water (Mehta, 2006; García, & Cecilia, 2014). Although equity and efficiency are two different aspects in measuring water security, as extensive attention is given to matters of distribution of costs, benefits, or risks, it comes down to access and affordability, where equity can be achieved without compromising efficient water allocation (McDermott et al., 2013)

Another significant approach towards allocative efficiency is to focus on volumetric charges rather than fixed charges, the notion of "affordability" comes into play with the affluent depleting the resources and the poor pay significantly and lack resources (Horne et al., 2018). Affordability can be explained in terms of the prevailing level of charges imposed concerning the disposable income of consumers at all levels. From a consumer's perspective across all income groups (explained above), it differs across the groups from their "willingness to pay" to the "ability to pay", The concept of "affordability" in most regions is directly linked to pricing, as the supply is not met the demands requirements among the income groups or certain communities. It also explains the "micro" and "macro" sides of affordability, i.e., that for a given water usage, the water bill of a poorer household will represent a larger percentage of their income, but the water bill of a rich household will represent a smaller percentage of their income (OECD, 2003, p. 19). This has a significant impact on the consumption behaviour as affordability diminishes the chances of acquiring water (Dolan, et al., 2021).

2.1.1.2 Quality

According to Li & Wu (2019), to gain a perfect picture of how quality stands in sustainable water management is to identify the potential impacts on human health. Research on urban health conditions in emerging nations reveals notable differences between the affluent and the impoverished (Palakodeti, 2020). When communities do not have adequate water resources, the danger of consuming polluted drinking water grows dramatically. According to Water.org (2024), more than 1 million dies from lack of access to safe water with health impacts alone and identifies water crisis as a health crisis. Contamination and Sanitation are intrinsically linked with health risks, as the contamination can be both microbiological - chemical, and faecal is due to inadequate management of urban - industrial - agricultural wastewater depleting the groundwater resources (World Health Organisation, 2018). However, the most significant cause for the poor quality of water is the inadequate treatment of water (Li & Wu, 2019). Good quality of water also means that incurring medical costs is lesser, which eventually leads the people to be economically productive (World Health Organisation, 2018). However, the emotional impact of such sequences does not just lead to physical vulnerability but to social stigma and victimization impacting the emotional well-being of the individuals. (Juvonen & Graham, 2013)

2.1.1.3 Institutional Inertia

Institutions play a crucial role in the management of water as a "finite" source, by allocative efficiency among the competing user demands and withdrawals, protecting it from overuse and contamination. Secondly, it needs to address the market dynamics failures related to the notion of water as "public goods" tragically affecting "the commons" (OECD, 2003). However, these efforts are impeded as in most regions, institutional inertia persists. (Geels, 2019, p. 189) identifies this concept as "Institutional or Political lock-in" as existing regulations and policy networks favour incumbents eventually creating an uneven playing field for innovations. Secondly, vested interests of the existing political group or system that have a significant stake in maintaining the system. Institutional inertia, as described by (Rosenschöld & Rozema, 2019), refers to the reluctance or inability of established institutional frameworks to adapt to

changing circumstances. This inertia can perpetuate existing trends of inequity and injustice, particularly evident in resettlement initiatives where short-term gains often outweigh considerations of long-term sustainability (Loorbach, 2022, pp. 5-6)

Despite the availability of resources, the effectiveness of adaptation efforts in resource deficit triggered by climate change can be impeded by socio-political challenges within institutional and governance networks (Nelson et al., 2007; Preston et al., 2008). In the realm of water resources management, North (1990, p. 3) describes institutions as the "rules of the game" inside society, describing them as established limits that manage human interaction and impact the interchange of political, social, and economic incentives.

However, these rules harm many individuals (who are already socio-politically marginalized) access to resources, limiting their capacity to wield influence over who owns their resources and the information and approaches they use to manage them. This weakens their capacity for adaptation. Stakeholder participation in decision-making processes is one area of water governance that needs to be carefully considered. To ensure that community members' various needs and viewpoints are considered, community engagement and involvement are essential components of good water governance (UN-Water, 2018). A water governance" transformation" is needed for improved management of water resources and services (Tropp, 2007, pp. 28-29)

2.1.2 A Changing Climate

A great deal of the consequences of the changing climate will be sensed most significantly through water. Millions of struggling households live where water supply is scarce, transitory, or unpredictable. They appear less capable of dealing with the consequences of climate change, such as severe temperatures, floods, and droughts (Water.org, 2024). A report by the United Nations on Disaster Risk Reduction stated that the Intergovernmental Panel on Climate Change (IPCC) has identified the changes in the frequency and intensity of water-related hazards, associated with drought regions, account for precipitation level that leads to extensive flooding (Sanahuja, 2011, pp. 3-14)

Extreme weather events aggravate water scarcity, uncertainty, and contamination, endangering sustainable development and biodiversity (ClimACT – INHAF, 2023). This highlights the profound interconnection between climate and water. Furthermore, the hydrological cycle is anticipated to strengthen as global temperatures rise, increasing the likelihood of excessive precipitation and flooding (Tabari, 2022). To address the effects of climate change, institutions have the power to generate or hinder the availability of resources and capacity-building (Rosenschöld & Rozema, 2019).

2.1.2.1 Impacts of Disaster-Induced Displacement and Resettlement

In recent decades, development-induced displacement has increased in scope and impact thanks to determinants such as rapid urbanization, rising populations, and changing climates. Forced displacement of populations and resettlement are among the world's most complicated and contentious development challenges. (Almira & van Eerd, 2022). Here, relocation is almost always a disaster, a breeding ground for unforeseen consequences and impoverished risks. Despite planning and regulations, resettlement strategies typically pertain to monetary compensation or the provision of new housing while disregarding other aspects of life (Cernea, 2003 ; 2006) as cited in (Vanclay, 2017, pp. 5-6). However, Satiroglu & Choi (2015), claim that whether the displaced consent, relocation, and resettlement will increase the risk of impoverished circumstances. It therefore depends on how this relocation and resettlement takes place. Moreover, under the ruse of resettling in the correct conditions, there will be a window

of opportunity for advancement and enhanced well-being. (Cernea, 2003 ; 2006). Forcibly resettling the disaster-affected communities to a disputed location is an ongoing perceived injustice with concerns about land use and economic reconfigurations (Mucherera & Spiegel , 2022). These disasters are considered as overlapping of time and space with a certain intensity – with a population exposed to its impact (Correa, Ramirez, & Sanahuja, 2011). However, (Ramírez, 2011, p. 16) highlights that the identified disaster risks are cumulative consequences of "historical deficiencies" in spatial and development planning, exposing the urban poor to risks.

2.2 Defining Vulnerability

The concept of vulnerability is multifaceted and context-dependent, leading to varying interpretations and assessment approaches. Different philosophical perspectives frequently cause disparities in the conceptualization of vulnerability, resulting in varying understandings across different settings (Weichselgartner, 2001). While vulnerability is commonly understood as hazard-specific (Birkmaan, et al., 2021), this study's scope is 'vulnerability is a function of exposure' (Cutter, et al., 2008) where exposure to physical hazards meets a community's or individual's ability to adapt to these difficulties at the local level (UNEP, 2002). According to (Brooks, 2003, p. 4), vulnerability is seen as a systemic state and stresses the risks themselves and the underlying social conditions and exposure causes. Exposure and the state of the environment within a system will be mostly socially determined. Exposure will depend on where populations choose to (or are forced to) live, and how they construct their communities and livelihoods (Adger et al., 2004). In the context of the urban water sector vulnerability can be identified as the susceptibility of the water resources system to damage (Adger, 2006, p. 270). This is largely drawn from the IPCC definition of vulnerability, which is the extent to which a system is highly reactive to and unable to cope with the negative consequences of the changing climate (McCarthy, Canziani, Leary, Dokken, & White, 2001).

All of the definitions stated above define three characteristics that explain vulnerability: (i) stress caused by system exposure; (ii) system reaction; and (iii) adaptive action capability. According to Adger (2006, p. 270), two key conventional research methodologies connect to this study: vulnerability arises when there is a lack of entitlements, and vulnerability is caused by natural disasters, as illustrated in Figure 1.

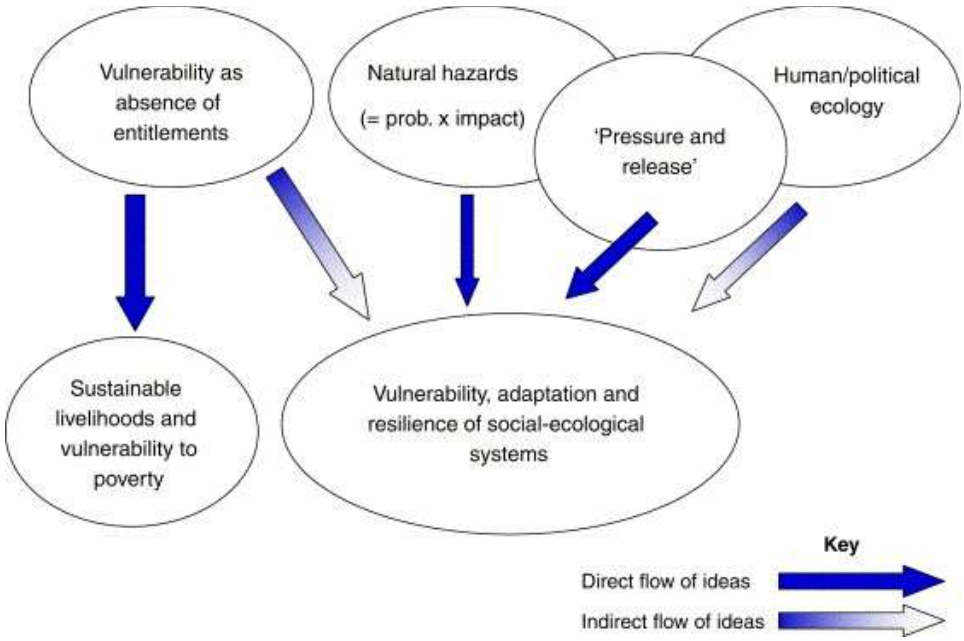

Figure 2 **Conventional research approaches to vulnerability and their evolutions**

Source: (Adger, Vulnerability, 2006)

Certain paradigms, such as those discussed by (Turner et al., 2003, p.10) identify vulnerability as featuring exposure and capacity to be wounded, (Cutter et al., 2003) as the combination of exposure; a social situation, and finally as the integration of exposures and a measure of societal resilience. Kelly & Adger (2000), identifies vulnerability as both a "starting point" and an "ending point," with the former representing a current incapacity of coping with external stresses or transitions and the latter being the conclusion of a series of assessments revealing adaptation alternatives.

To further clarify this, Plummer et al. (2012) provide five critical indicators for evaluating water vulnerability: social concerns, water resources, other physical environment, economy, and governance. According to Bohle (2001) vulnerability comprises two parts: external (or exogenous) aspects that exist outside of the vulnerable community or systems as a whole, and internal (or endogenous) factor that are inherent in the system or the latter.

2.2.1 The Double Structure of Vulnerability

(Bohle, 2001) developed an influential framework on vulnerability identifying them with external and internal sides to explain the vulnerable situation. The framework is illustrated as a double structure with the “external” side explaining the exposure to external stressors and an “internal” side explaining coping capacity mechanisms (Figure 2)

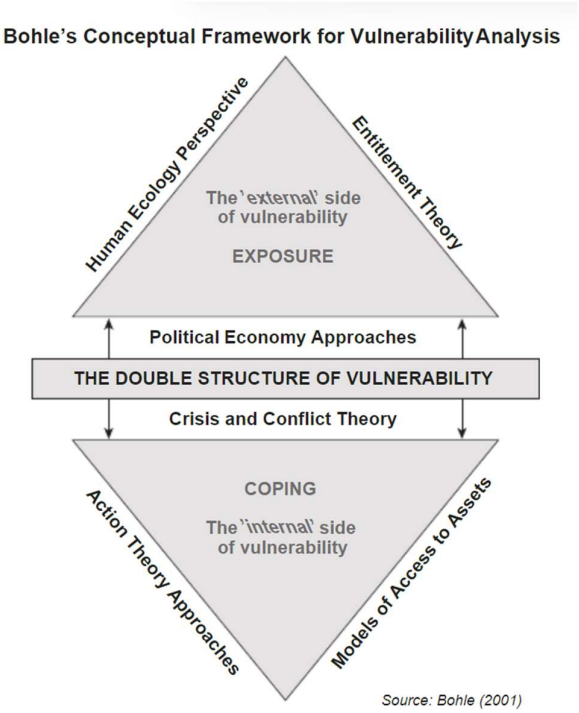

Figure 3 The conceptualisation of vulnerability's "double structure"

Source: (Bohle, 2001)

The external cluster is displayed in the top triangle, while the internal cluster is at the bottom. The external cluster discusses the exposure using human ecology, political economy, and entitlement theory. Here, exposure is the type and degree to which a system is subjected to environmental or sociopolitical stress. These stressors are characterized by their size, frequency, duration, and hazard region (Burton, Kates, & White, 1993).

The external cluster analyses how social inequalities and allocation of resources (political economy), population dynamics and environmental management (human Ecology), and economic restrictions (entitlement Approach) influence vulnerability. Internal clusters include resource management and conflict resolution (crisis and conflict theory), individual reactions to constraints (action theory), and enhancing resource access to lessen vulnerability (access to assets Model). The way that the external cluster here is seen affects the internal cluster as well as the dual approach to vulnerability as the internal cluster's components are direct responses to exterior clusters, which is adapted in this study. Moreover, the framework emphasizes that reaction capacity—behavioural responses (Singha & Eljamal, 2020) here defined as the internal side of vulnerability—must be taken into account to accurately characterize vulnerability. Institutional variables are argued to be crucial to comprehending the double structure of vulnerability, such as procedures that make people more defenceless, which increases vulnerability and decreases the capacity (Bohle, 2001).

2.3 Defining Capacity

As Bohle (2001), examined the double structure of vulnerability highlights one side of the equation, the other side which is the capacity, is considered as an individual component in this study. A notable framework by (Mcgregor et al., 2015), which is built on Sen's theory on interactions of beings, doings, and feelings (1999) suggests a comprehensive way of

understanding well-being as a pathway to achieve capacity mechanisms, emphasizing it through practical concepts of (i) needs to be met (what people have); (ii) meaningful acts (what people do), and (iii) satisfaction in achieving goals (how people feel) explaining that well-being is holistic (Sumner & Mallett, 2013). Capacity is acknowledged as a real opportunity (Sen, 2009) here, categorized into *Security* and *Ability* based on (Kimhur, 2022) dimensions in measuring capacity to attain the valued functionings. Significant and developing frameworks on well-being measures are been proposed, however currently they converge on acknowledging 'top-down' and 'bottom-up' patterns of measuring well-being. This study focuses on 'bottom-up' as well-being is perceived and constructed from the observations or engagement with the target group whose well-being was particularly concerned to acknowledge (Mcgregor et al., 2015) In addition to that, the capacity here is water conservation behaviour, as cited in (Singha et al.,2022), many studies have identified subjective and relational measures as key determinants of conservation behaviour. These behaviours are termed automated behavioural responses growing out as an outcome of the habitual response to certain conditions (Singha et al., 2022). The value of the 'conservation of resources' here is explained by the necessities that are required for survival. As Sen (1989) & Alkire (2002), emphasizes, when humans' capabilities (Singha et al., 2022), to acquire and protect resources to keep them going, certain emotional measures restrain them as individuals personally, household, and community levels (Holmgreen et al., 2017).

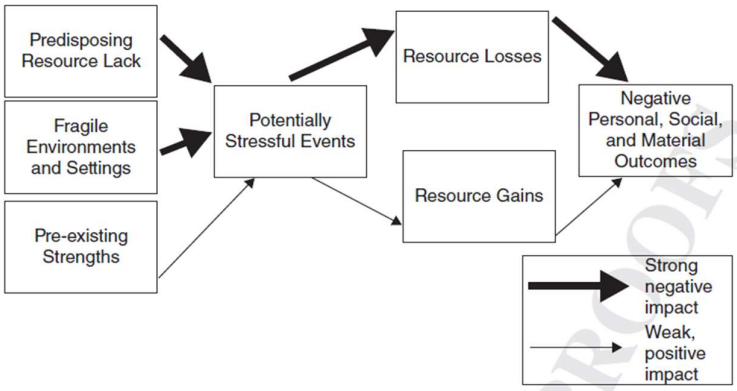

Figure 4 Disproportionate impact of lack and loss.

Source: (Holmgreen, Tirone, Gerhart, & Hobfoll, 2017)

Existing research highlights that these emotional measures are generally associated with losses and as mentioned in Figure 3. Moreover, a gain would show significant results in the stress response of an individual, when there is a significant and higher amount of loss, explaining the extent of the resource loss. Furthermore, capacity can be examined by assessing institution's role in resource management and its effectiveness and legitimacy (Adger, Brooks, Agnew, & Eriksen, 2004)

2.4 Associations and Interdependencies between the Parameters

Though Bohle (2001), identifies exposure and capacity as the double structure of vulnerability, this study adopts the framework yet establishes 'Vulnerability' and 'Capacity as two distinct concepts and related variables. As the IPCC (2001; 2022) states "Vulnerability is, among other things, the result of a lack of capacity" (p.72) acknowledging that vulnerability arises from

various factors, including limitations in capacity. The risk of exposing a 'system to vulnerability, should also know how the system deals with and reacts to risk; and what the outcomes from the risk (Sumner & Mallett, 2013).

Two important arguments emphasize the need to embody well-being as the key approach or framework in vulnerability assessments. First, well-being measures will guide the notion of 'vulnerability to what' identifying the varied entitled losses regardless of socio-economical-environmental and political dimensions (Sumner & Mallett, 2013). Second, measures of well-being have a significant mediating role in establishing the connection between exposure and capacity. Specifically, higher levels of well-being may improve a system's capacity to cope with exposure, lowering its vulnerability. Conversely, decreased well-being may reduce capacity, increasing the system's adaptability to the negative consequences of exposure (Adger, Brooks, Agnew, & Eriksen, 2004).

Based on Sen, (1989, p.6) 'capabilities' focus on understanding (i) the actual 'functioning of beings and doings and (ii) the extent of real opportunities to be and do what people (have reason to) value. Capacity here is discussed as the real opportunity to achieve the functionings a person values (Sen, 1999;2009) by satisfying the well-being. However, the capabilities theories (Sen, 1985) emphasize recognizing and respecting individuals' diverse beliefs and needs. They investigate how resources (means) are converted into valued results (ends), such as health, education, and satisfaction. This change is determined by several factors, including how well a person can use their resources to attain what they want. Following that, by rescaling analysis, (i.e.) taking both the individual and the community as the unit of analysis, and adopting the holistic lens of human well-being, it is possible to identify and make visible some of the "invisible impacts" of the compounding vulnerability, such as subjective wellbeing impacts (White, 2008).

2.5 A SEI Framework – Social -Economic - Institutional Framework

The SEI Framework, developed by integrating various subjects associated with water scarcity, depicts the complex interaction of external vulnerabilities, well-being measures, resource management, and coping strategies. External stresses influence well-being, impacting resource loss or investment, which changes how communities manage resources and respond to difficulties, impacting their conservation behaviour. As this study adopts a bottom-up approach as discussed in (section 2.3) this process's cyclical nature emphasizes the importance of comprehensive approaches to policymaking and governance to increase resilience, well-being, and sustainable resource management in vulnerable communities. The perceived relationships and their significance will be explored in the case study in Perumbakkam, Chennai, and can also be applied to similar contexts.

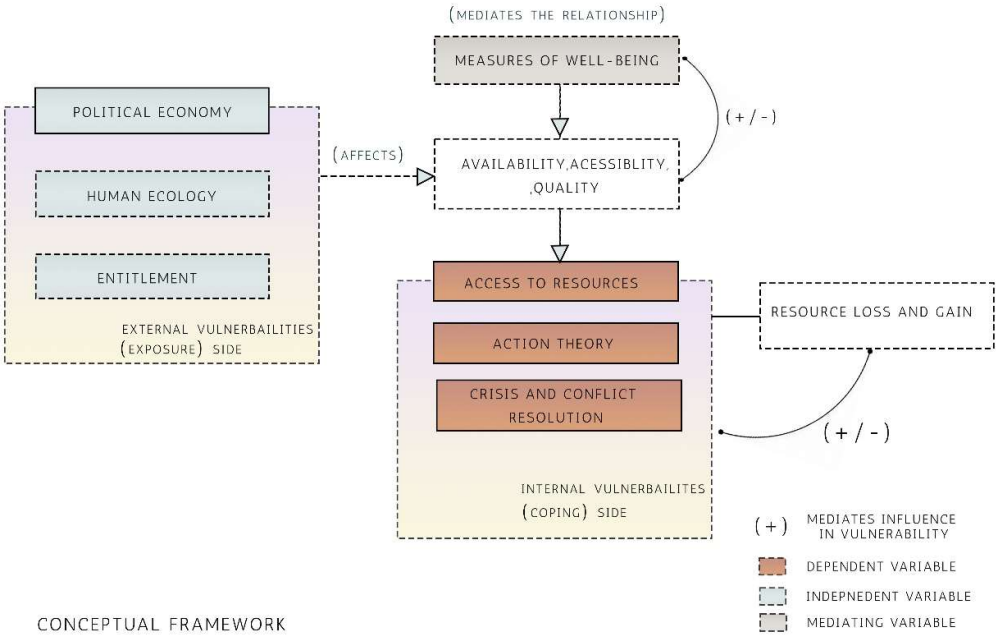

Figure 5 : Conceptual Framework.

Source: Author (2024)

Chapter 3: Research design, methodology

3.1 Research Objectives and Strategy:

The main objective of the research is to identify the external stressors influencing the community's vulnerability to water shortages and evaluate how these factors have shaped their capacity mechanisms, interacting or detracting with well-being in day-to-day life is the objective of the research. To do this, the research will explore,

- The nature of external vulnerabilities (exposure) that led to water scarcity in Perumbakkam and the extent to which it has impacted the resource loss in the community.
- The trade-offs and interactions between resource loss and measures of well-being, influenced by external vulnerabilities (exposure) and how well they impact the internal vulnerabilities (coping)

To achieve this, the research adopts a 'Case study approach' combined with Interpretive phenomenal analysis to study the nuances of resource loss and investments with measures of well-being influenced by external vulnerabilities. To investigate these research topics in light of the occurrences, the 'case study' approach is more suitable as they are "richly detailed and extensive descriptions of the phenomenon under study," and in some cases, a researcher can "arrive at an explanation of the research subject" (Van Thiel, 2014, p. 87).

3.1.1 IPA as Research Method:

As a research study that is participant-oriented, IPA provides researchers with the finest potential to comprehend the deepest reflections of study participants *'lived experiences'* (Alase, 2017, p. 1). According to Smith et al., (2009, p. 1) "*IPA is a qualitative research approach committed to the examination of how people make sense of their major life experiences"*. To ensure the collected data captures individuals' personal and social lived experiences on how they interpret and respond to challenges of water scarcity and its impact on well-being measures, IPA was adopted in analyzing the well-being measures mediating between external and internal vulnerabilities in the study.

3.2 Operationalization of the Variables:

This section translates the concepts presented in the theoretical structure into measurable indicators to assist in answering the study's questions. The operationalization table for each of the concepts is presented, which is associated with the three sub-research questions, eventually addressing the major research question, "What is the nature and extent of vulnerability influencing the well-being of Perumbakkam residents?" The operationalization is based on one or more indicators, each of which is linked to one or more interview questions that were used to indicate each variable. The following subsections explain the indicators for external (independent) and internal (external) vulnerabilities and well-being measures mediating the independent and dependent variables. This study explains internal vulnerability as the result of trade-offs that households make and the interactions between external vulnerabilities (independent) and their capacity to maintain well-being (moderating) variables.

3.3.1 Operationalization of the Variable – Exposure and Capacity

			INDEPENDENT & DEPENDENT VARIABLE
Double structure of Vulnerability (Bohle,2001)	Key Concepts of variable	Categorization of sub-variables	Indicators
External Vulnerability (Exposure)	Political Economy approaches	Household conditions and Built environment	Dilapidated houses - due to dampness or moisture exposure
			% of households with potential leakage in pipelines.
			Quality of water source
			Frequency and duration of the supply on the household level
			Availability of groundwater
			Availability of alternative water sources
			Consumption patterns on the individual/household level
			Distance and time to access water supply
		Infrastructure investments	Time taken to repair the damaged infrastructure by the officials
			Distance and time to access water infrastructures from households
			No inadequate/outdated infrastructure
			Adoption of rainwater harvesting at the household level
		Affordability of Water	Perceptions of water as a commodity
			Adequacy of current pricing structures
			Access to affordable resource options
			Existence of water policies on water allocation and infrastructure development
			Presence of any private organizations in the planning of developments and investments.

		Formal and Informal governance ties	No of visits by officials/technicians to monitor the performance of infrastructures installed.
			Density and types of informal networks
			The presence of any influential actors in the network
			Information flow and exchange
			Presence of external influences (NGO) on resource allocation or networking during disasters.
			Effectiveness of informal networks for resolving conflicts and disputes related to water access, use, or distribution
	Human Ecology Perspectives,	Population dynamics	No of resettled population every year
			No of aged persons 60 years and above
			No of people with disability
			No members in the household
			No outmigrants/ guests (if any)
		Environmental considerations	Regulations governing development - influencing availability (Document)
			Perceptions of living next to wetlands
	Entitlement theory	Water Budgeting Practices	Water expenditure as % of household income
			No households purchasing packaged drinking water
			Income proportion to purchasing water expenses
		Knowledge transmission	Level of awareness within the community about past water-related episodes
			Presence /Type of transmission mechanism (awareness/training; oral; narrative)
			Role of formal institutions (schools, local authorities) in transmission
			Impact of outmigration on traditional water management approaches
Internal Vulnerability (Coping)	Access to resources (Assets)	Economic/social/Infrastructure assets	Household income levels impact the capacity to acquire water.
			Availability of social support during water shortages
			Access to investment mechanisms in water infrastructure
	Action theory	Adaptive response to availability	Changes in consumption behaviour
		Empowerment	Level of autonomy in managing home water resources
			Participation rate in community water management meetings
	Crisis & Conflict theory	Crisis response capacity	Mechanisms and their effectiveness involved in crisis responses
		Conflict resolution	Frequency of resolved water-related conflicts
			Trust in local / institutions regarding resources

Table 1 Operationalization of the Independent and Dependent Variable (Author 2024)

3.3.2 Operationalization of the Variable – Well-being:

			MEDIATING VARIABLE
Well-being	**Rationale**	**Categorization of sub-variables**	**Indicators**
Well- Being [Synthesised from Copestake (2008), McGregor	needs to be met (what people have)	Material aspects	Income, wealth, and assets; Livelihood activities; Physical health; Access to services; Environment
	meaningful acts (what people do)	Relational aspects	Interpersonal relationships; Networks of support and obligation; Relation with institutions; Violence and Conflicts; Scope for personal and collective action.

(2007), McGregor and Sumner (2010), White (2008)]	satisfaction in achieving goals (how people feel)	Subjective aspects	Self-esteem; Hopes and Happiness; Fears; Sense of meaninglessness; Levels of (dis)satisfaction; Trust; Social Cohesion peace, harmony, good relations in the family/community; Freedom of choice

Table 2 Operationalization of the Moderating Variable (Author 2024)

3.3 Data Collection Methods, Sample Selection, and Size:

Given the larger population in the subject region and the initial reluctance of the samples, the study adopted a combination of Snowball and Convenience sampling. The pilot group discussion had participants of 3-5 who volunteered to participate. The initial samples were members of the Residents Welfare Association and were interviewed with questionnaires (Refer to Appendix 1.1) where questions were open-ended and had few guiding questions based on the indicators based on the sub-variables mentioned in section 3.3.1, Later, 12 in-depth interviews with the residents were done by snowball sampling to increase the participant base, based on themes and their experiences relevant to water scarcity circumstances. The list of residents and experts and their relevance to this study is explained below.

SUMMARY OF RESIDENTS PROFILE			
Respondent No	**Sex**	**Year of resettlement**	**Relevance to the study/ 0ccupation**
R01	Female	2021	IRCDUC fellow
R02	Male	2017	Maintenance team
R03	Male	2017	RWA member
R04	Female	2016	RWA member
R05	Female	2019	Grocery store owner
R06	Female	2018	Housewife
R07	Female	2016	College student
R08	Female	2017	Domestic Help
R09	Female	2019	RWA member
R10	Male	On rent	Housewife
R11	Male	2018	Plumber
R12	Male	2018	Security supervisor

Table 3 List of respondents from the community for the semi-structured interview method (Author 2024)

SUMMARY OF EXPERT PROFILE	
Respondent No	**Relevance to the study/ 0ccupation**
A	Ex-Chairwoman in Chennai Metro Water Supply Board
B	Architect – Worked in Perumbakkam
C	AN NGO – Working on livelihood opportunities for women in Perumbakkam
D	Counsellor of Kannagi Nagar – associated with Perumbakkam

Table 4 List of experts for the semi-structured interview method (Author 2024)

For this research, the study uses both primary and secondary data. The main data is extracted from the pilot group discussions to identify the ground indicators relevant to the local context and in-depth interviews. Subsequently, the variables underwent refinement based on the signs of ground reality, supported by qualitative observations. However, other primary data through focus group discussions and secondary data from observations, assessment documents, and academic databases are also used.

SECONDARY DATA SOURCES	
Data sources	**Relevance to study**
Rapid assessment on access to resettlement and rehabilitation (R&R) package in Perumbakkam: ICRERP	Compensations involved
Life on the Margins - Access to Basic Infrastructure Facilities in the Resettlement Sites of Chennai	Infrastructure audit explaining the access and investments
Policy perspectives on the existing urban development programs and its implications on the vulnerable sections - Tamil Nadu (IRCDUC)	Existing policies on resettled populations
Assessment report on the functioning of the Primary Health Center (PHC) in the resettlement of Perumbakkam, Tamil Nadu by IRCDUC	Infrastructure audit – Healthcare facilities

Table 5 List secondary data sources (Author 2024)

Field observation, which is also used as one of the primary data was conducted in May along with Interviews and Focus group discussions. The interviews collected were in Tamil, which is the local language of the subject region. The interview recordings were translated, transcripted, and analyzed with ATLAS.ti. the codebook is made based on Section 3.3 and onsite indicators extracted from the data collected.

3.4 Validity and Reliability:

The research ensures both internal and external validity, as the research project was done in the subject region" Perumbakkam" and used the collected data (qualitative) for analysis. The experiences and perceptions of the community members are context-oriented and specific to the socio-economic-environmental conditions of the region. Thus, the findings of the research based on the socio-economic-environmental conditions cannot apply to other resettlement programs in Chennai and a global context. However, the political dynamics explained in the study are significant and can apply to other similar settlements in Chennai and these findings are built upon the very few existing literature and have potential implications for similar cases.

Secondly, to ensure that internal validity is obtained, various methods such as Interviews with residents and experts, focus group discussions, field observations, and secondary reports obtained from the NGOs working onsite were used for data collection. This helped in triangulating the data and helped in improving the understanding of the study. A protocol was followed even when the existing works of literature did not support it in operationalizing the variables. An interview guide was prepared with questions to guide the interviews of participants from the existing literature, though the interviews were open-ended. All research-related data, interview recordings, and site photographs were maintained by the researcher promptly. All The interviews were conducted on the site, ensuring the participants were comfortable to build rapport with them to ensure the answers were genuine and transparent.

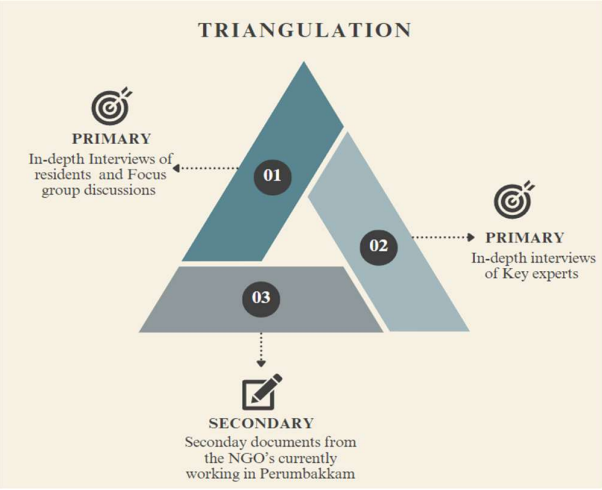

Figure 6 :Triangulation of sources (Author 2024)

3.5 Challenges and Limitations:

The study encountered a few significant challenges and limitations, which influenced the data collection procedure and findings. First, the theoretical concepts that were initially established indicated a discrepancy between theoretical understanding and reality as it exists, necessitating a pilot study through discussion with residents, and subsequent questionnaire revisions. Second, respondents were frequently hesitant to engage due to concerns about the confidentiality of their responses, which was compounded by widespread illiteracy; numerous reassurances were required to gain their trust. Adverse weather conditions shortened the fieldwork to a three-week timeframe, restricting the extent and depth of data collection. Furthermore, the presence of a large-scale drug mafia in the town raised safety concerns, demanding a careful approach that further limited the research.

Furthermore, my status as a native speaker of the regional language and an educated individual had both positive and negative repercussions. Building rapport and communicating with the participants was made easier with my language and cultural familiarity, but in the end, this raised expectations from the community to speak up for the ongoing difficulties, and a wide range of emotions were aired. This was outside the scope of the study and responses from participants varied according to what they considered to be my expectations, as the majority of them perceived me as a government official or authority. To overcome such bias, the situation required patience and sensitivity to ensure that the participants felt comfortable eliciting genuine responses regarding the water-related concerns, still retaining the confidentiality of the participants and their responses.

Chapter 4: Results, analysis, and discussion

The following section presents, evaluates, and discusses the data that was gathered in the context of discussing the case study. First off, the background data of the context are discussed with the theoretical framework as explained in Chapter 02, and then an overview of the external vulnerabilities resulting in water shortages from the collected data is presented. Following that, the second section of this chapter discusses the qualitative interpretations of the findings with variables of the theoretical framework.

4.1 The Context

Chennai has a track record of experiencing disasters extensively, from the 2004 tsunami to the most recent floods in December 2023. The location of the city on the east coast of India makes it a receptor of average rainfall ranging from 6 to 213 mm as it is placed in a rain-shadow region however, according to Gopakumar (2012) three aspects result in scarcity in Chennai; highly variable precipitation patterns; high evaporations and seepage losses from the overflowing seasonal precipitations depleting the surface water in reservoirs; and lack of proximity to riparian systems. As discussed in (Section 2.1.1.2), inertia in the institutions in Tamil Nadu arises from their lock-in mechanism as explained by Geels (2019), their sustained history of cultural mobilization of the Dravidian politics alienates them from the alternative mobilizations and oppositional energy from the national parties. Given this degree of political autonomy, the intentional limitation of the local power to national policies, despite the concept of decentralization prevailing in the state, makes the local government financially dependent and imposes legislative restrictions (Gopakumar, 2012). Yet, the innovations are generic, highlighting the 'historical deficiencies' in planning and development in the city as discussed in section (2.2.1.1) This cacophony of fragmented institutional settings disrupted the water supply, and dependence on the peripheralization of water sources has led to demand and dependence on packaged drinking water.

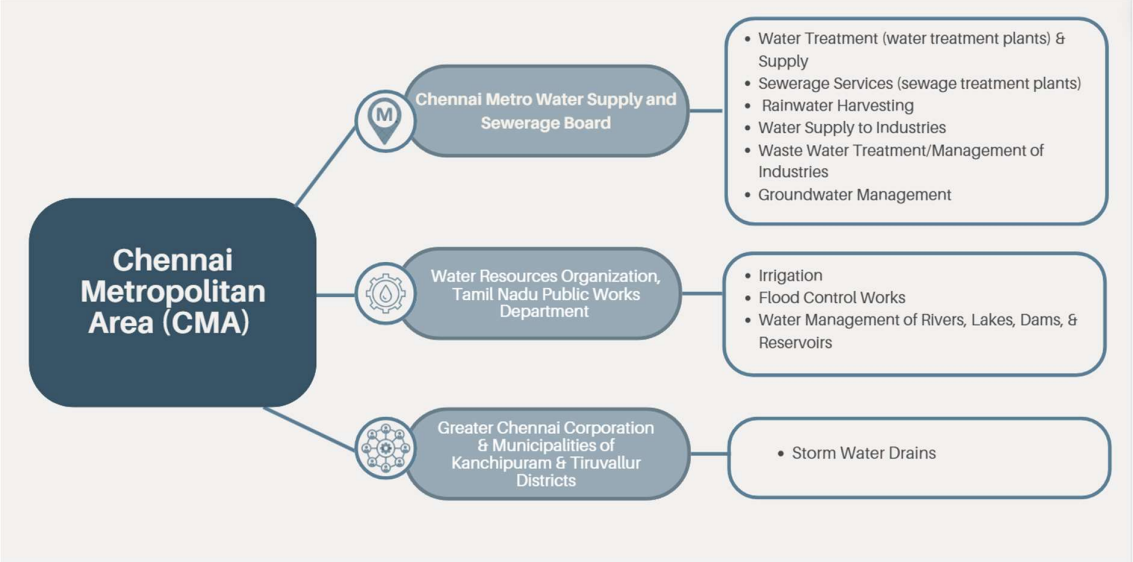

Figure 7 : Institutional framework for the water sector in CMA (Author 2024)

The research location for this research is Perumbakkam, a suburb in the Chengalpattu district of Chennai, just outside the CMA border. The study area focuses on both the first and second phases of Perumbakkam: old and new Perumbakkam. Perumbakkam has housed 20,376 residences in 192 blocks during the last 9 years, ranging in height from mid-rise to high-rise. Since its construction, the housing complex's design has been under criticism since it appeared that the infrastructure was intended to confine those displaced by floods rather than to help them recover. The geographic assessment was not even considered as the housing complex is almost 30 km from Chennai.

4.1.1 Resettlement Planning and Policies in Chennai

Resettlement policies in Chennai were for a long time considered a band-aid solution to move people and families devastated by disasters, or they served as slum clearance drives till 2014 when 16,000 families were relocated under the emphasis on river eco-restoration and city beautification (Coelho 2017, Jain et al. 2017). The government's Tamil Nadu Slum Areas Act (Improvement and Clearance) created the Tamil Nadu Slum Clearance Board in 1971 (TNSCB), another state-defined policy, now known as Tamil Nadu Urban Habitat Development Board (TNUHDB) to protect informal settlers from being forcibly removed, as well as to guarantee their right to housing or environment conditions to improve their standard of living. Though, in the case of Perumbakkam, was compensation to affected families due to collateral damage by the floods (HLRN ; IRCDUC, 2017). However, in practice, it was found to be the upgrading of in-situ slums with high-rise structures at the peripheries of cities lacking adequate infrastructure. The situation worsened when flood-affected families from various Chennai neighborhoods were relocated to these resettlement sites which were constructed on the marshlands in the following years<inset reference>. The implications of the resettlement schemes in Perumbakkam were considered to be one of the major causes of the water shortage which is attached in Appendix 1.4.

4.2 Outcomes, Analysis, and Discussion

The co-occurrence table comprises the codes based on the sub-variables from (section 3.3.1). Table 6 shows the results of the co-occurrences between the codes, where there is a strong relationship between the external vulnerabilities and well-being measures. The co-occurrence between household and built environment; formal ties; and all measures of well-being are more than 10, highly significant. 'Household and built environment' has a strong relationship with the 'action theory' variable with 14 occurrences. On the other hand, *Internal vulnerability* variable, action theory, and access to resources have no relationship with formal governance ties and a weak relationship affordability which is the significant *external vulnerability* variable

	Affordability	Environment	Formal ties	Household & built	Informal ties	Infrastructure	Knowledge	Population	Water budgeting	Material	Relational	Subjective	Access to resources	Action theory
Affordability	0	1	11	14	8	4	0	2	8	6	7	4	4	0
Environment conditions	1	0	2	2	1	1	0	0	0	2	3	0	1	1
Formal ties	11	2	0	14	5	5	1	3	1	2	11	14	2	
Household& built	14	2	14	0	2	11	0	5	7	19	19	14	2	14
Informal ties	8	1	5	2	0	0	0	1	1	2	4	7	0	1
Infrastructure	2	1	5	11	0	0	0	0	0	2	4	2	1	1
Knowledge	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Population	2	0	3	5	1	0	0	0	1		2	3	0	0
Water budgeting	8	0	1	7	1	0	0	1	0	1	1	1	0	4
Material	6	2	2	19	2	2	0	1	1	2	0	12	0	6
Relational	7	3	11	19	4	4	0	1	0	3	12	0	1	9
Subjective	4	0	14	14	7	2	0	3	1	7	1	2	0	5
Access to resources	4	0	2	2	0	1	0	0	0	0	1	0	0	1
Action theory	0	1	0	14	1	1	0	0	4	6	9	5	1	0

Table 6 : Co-occurrence table based on ATLAS.ti (Author 2024)

4.2.1 Research Outcomes: External Vulnerabilities

This subsection gives a broad overview of the external vulnerability factors based on Bohle's Vulnerability framework which is the exposure to resource loss within the community in this study. The identified sub-variables are generated based on the operationalization table in section (3.3.1). With the three main exposure components developed, each of the subsections delves into a distinct theme that contributes to resource loss-gain and investments. The codes and sub codes along with citations are in Appendix 2.

	Affordability	Environment conditions	Formal ties	Household & built	Informal ties	Infrastructure investments	Knowledge transmissions	Population dynamics	Water budgeting
Affordability	0	1	11	14	8	4	0	2	8
Environment conditions	1	0	2	2	1	1	0	0	0
Formal ties	11	2	0	14	5	5	1	3	1
Household& built	14	2	14	0	2	11	0	5	7
Informal ties	8	1	5	2	0	0	0	1	1
Infrastructure	2	1	5	11	0	0	0	0	0
Knowledge	0	0	1	0	0	0	0	0	0
Population	2	0	3	5	1	0	0	0	1
Water budgeting	8	0	1	7	1	0	0	1	0

Table 7 : Co-occurrence table of the variables of the external vulnerabilities based on ATLAS.ti (Author 2024)

Table 7 is the co-occurrence table, showing the number of citations on the variables of external vulnerabilities based on the operationalization table in section (3.3.1). The table explains that exposure to water stress in the context of Perumbakkam is due to the poor housing and built environment conditions in 113 citations; with lack of formal governance ties being referred to in 64 citations; and affordability in 43 citations.

The co-occurrence here discloses that three sub-variables, housing and built environment conditions, affordability, and formal governance ties, are of significance since they co-occurred 14 instances together in citations, leading to the formulation of the core themes. The combination of these elements can be interpreted as a lack of effective 'formal governance ties' leads to poor 'housing and built environment conditions', which eventually increases the 'affordability' of access to water supplies (Refer Table 8) which will be explained through the anecdotes of the interview responses. Based on this, the sub-variables are categorized into three themes:

- Resettlement interventions,
- Socio-economic disparities
- Role of institutions

Here, the sub-variable 'household and built environment conditions' is identified as the main category with 133 citations, 'infrastructure investments' with 7 occurrences, and 'population dynamics' with 4 occurrences have a notable relationship which is themed as resettlement interventions; 'water budgeting practices' and affordability are closely linked which is themed into Socio-economic disparities as they are highly related with investments done to navigate through resource loss and gain as mentioned in Section (2.3) ; Role of Institutions as a third theme. Though the category codes and sub-codes of all three themes are interrelated, their

findings are discussed individually to emphasize the role of each theme in leading to water stress in Perumbakkam.

Other sub-variables of environmental conditions and knowledge transmissions have lesser significance when co-occurred, yet have a potential impact when dealt with and analyzed individually. Citations of the sub-variables are in Appendix 2.

4.2.1.1 Resettlement Interventions

As highlighted in Table 5, household and built environment conditions with 133 citations is the most significant and pressing cause of water stress in the community, explaining the substandard housing conditions and existing regulations imposed as mentioned in Figure 8. The sub-codes were generated and coded based on the observed relationship that leads to the stress.

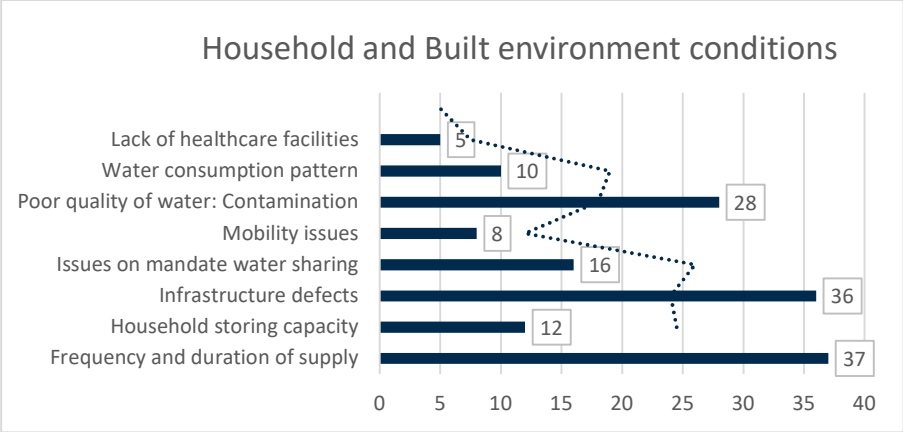

Figure 8 : List of subcodes of Household and Built environment conditions and their frequency based on ATLAS.ti (Author 2024)

Out of the 8 subcodes, the frequency and duration of the supply (Refer Box 1) with 37, and infrastructure defects with 36 citations have been identified as significant contributors that pose an obstacle to the availability and accessibility of water. Eleven out of Twelve respondents stated that the frequency of water supply has been decreased to twice a week, with each supply lasting around one hour. Nine out of Twelve respondents have answered that infrastructure defects (Refer Box 2) have highlighted the internal conditions of the households with consistent dampness and broken or cracked walls and flooring citing persistent leaks, pressure fluctuations, and airlocks within the faucets, which eventually lead to inadequate frequency of water access within the households, emphasizing that they are also not promptly fixed from the beginning.

Box 1 Selected citations about the frequency and duration of supply affecting water availability and accessibility.

Water is the problem now. They used to supply water one day after another. Now they supply water twice a day. Currently, it's been 3 days. They supply water once every 3 days. On top of that, they supply is also not sufficient enough, if they just give us once every three days and don't supply us enough, what will we do? How can we use it properly? The quantity of the supply is very bad, initially, the supply was for 2 hours, now they have reduced it to 1 hour

7:16 ¶ 14 in Respondent H

Initially, it was 4 days a week and then it changed to daily access. Sometimes they would switch it on in the mornings or the evening. It depends on the sump's capacity, that's what they say. But now, we get 6-7 pots of water every day.

4:4 ¶ 26 in Respondent A

They only turn on the water once in the morning and evening in a day. No, they don't give twice in a day. Before there was enough water and they would open whenever the tank was filled. Over time, it has become once in two days.

8:14 ¶ 56 in Respondent F

Box 2 : Selected citations about the infrastructure defects and conditions of the housing affecting the water availability and accessibility.

"It takes about 1 hour to fill up the water tank. Sometimes it reaches fast and at times it takes too long due to pressure and airlocks within the pipelines. But it takes a maximum of 15 minutes to reach us."

4:3 ¶ 20 in Respondent 01

"Yes, the walls are wet. The water is been dripping and leaking from the roofs and walls. It was like this from the beginning"

8:4 ¶ 16 in Respondent 06

"Yes, I have water in my pipes. These were not installed now. It has seen a hot and rainy season after all. So, it's quite problematic. Some people use it lightly. Some people use it with a lot of pressure. Yes. Either it is repaired or broken"

5:2 ¶ 21 in Respondent 02

No, no. All the pipes were there from the beginning. They gave us this house 7 years back. And they didn't fix them properly. They are working on citations that they have received. and they have replaced all the good pipes but they haven't replaced the repaired ones

1:48 ¶ 48 in Respondent 03

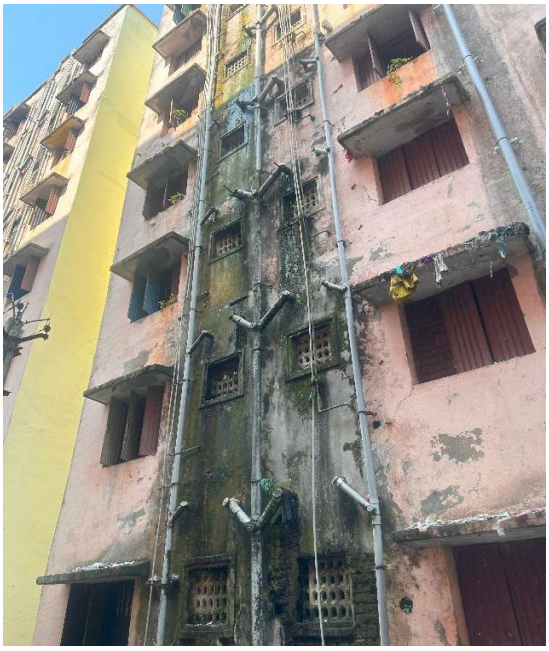

Figure 9 : Conditions of external structures (Author 2024)

Figure 10: Conditions of internal structures (Author 2024)

Secondly, one of the most often stated by all twelve respondents is the existence of poor-quality water, rendering it unfit for consumption The contamination occurs from two separate perspectives. First, there has been a shift in the quality of the water supply, since several respondents said that it was good a few months ago. Two respondents also said that the water source was switched from 'lake' to 'sea' water. Second, biological contaminants in the overhead tanks, such as fungal and bacterial propagation (Figure 11), as well as poor exterior environments (Figure 9). In addition, species such as molluscs and snake worms have been pictured and reported on by the residents to media outlets. They responded that the contamination at both internal and external conditions had a significant influence on their consumption patterns and health, prompting them to seek alternative water supplies (Refer 3).

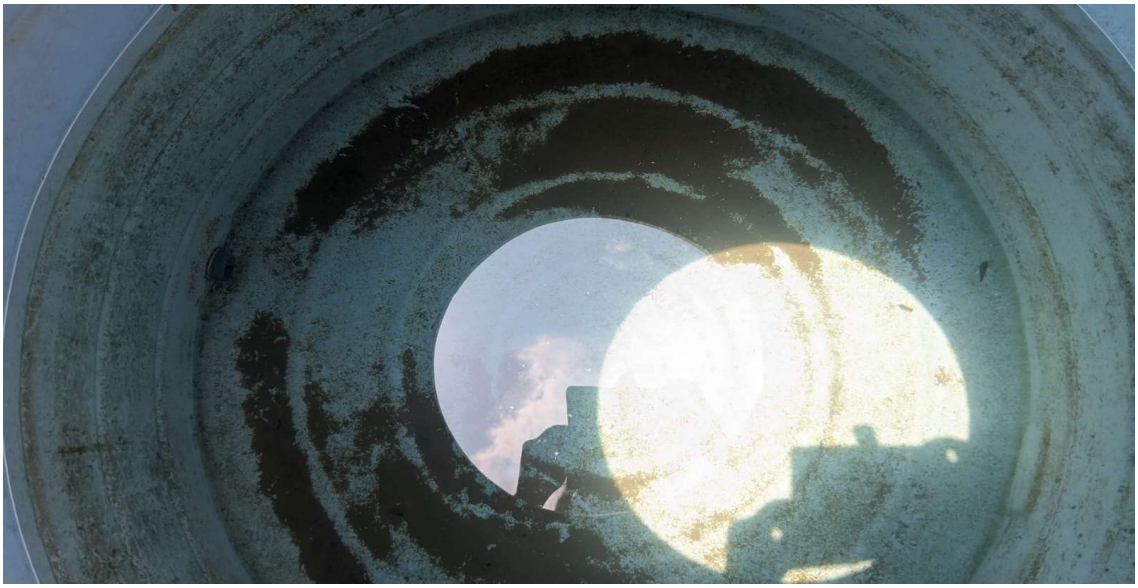

Figure 10 : Picture of the overhand tank from Block 1 in Old Perumbakkam (Author 2024)

Box 3: Selected citations on the poor water quality affecting the consumption patterns

"I have been using the can water since I came here. Before I used to cook food in this water. Now, I don't cook in this water anymore. I just boil the rice. That's it"

4:18 ¶ 80 in Respondent 01

"We can't use our food in that water. If we use the corporation water, the food will stay for only 1 hour. The food will get spoiled immediately if we add water while cooking. That is salt water, right?"

1:36 ¶ 70 in Respondent 03

"We use canned water for drinking. We also use canned water for cooking. Cooking in this water will spoil the food. That too, this summer, it will taste bad. But if we cook in canned water, the food will last until evening. So, we mostly cook with canned water."

13:5 ¶ 35 in Respondent 04

We took a photo of it and gave it to the newspapers. When it became an issue, the tanks were sterilized and everything was well for the next few days. Later, it returned to its usual state of being stressful. We used to get fever. It's not just insects; chlorophyll organisms and molluscs are also in the water. Since then, nothing has changed.

13:11 ¶ 41 in Respondent 04

"It was salty before. Even while washing the dishes, the salt content in the water ruins the surface. Also, while bathing with that water, the water is viscous and sticky."

8:5 ¶ 24 in Respondent 06

Following that, the respondents cited issues on 'mandatory water sharing' decreasing the household's 'storing capacity' as they are interrelated. Eight out of twelve respondents stated that they are required to engage in water sharing, which entails them sharing water with households either the residents directly above or below them (Refer Box 4). The other four respondents didn't have to share, as they cited that the houses directly above or below them are either locked or vacant. The responses cited that this forced sharing with neighbours exacerbates the already insufficient water supply, as it highlights the limitations in maintaining the water for their households, which directly impacts the household storing capacity. The responses also highlighted that while sharing, the residents engage in verbal conflicts, and resource access based on their availability at home leading to their perceptions of inequities while resource sharing, which again directly determines the household capacity (Refer Box 4).

Box 4: Selected citations about the mandate water sharing and household storing capacity affecting the water availability and accessibility.

"At first, when we came here, we had a few problems Our neighbors belong to North India They'll fill most of the water. So, we cannot ask or argue with them. Also, they don't know or speak Tamil. When we go to work, we cannot fill water. Also, we will just let them fill because that's how we are"

4:8 ¶ 44 in Respondent 01

"We have a lot of fights because of that. If they open the water tanks, my flow will decrease. They'll keep receiving water, but I can't. So, I'll tell them to reduce or adjust the valves, so that I can at least get some water. and it won't be a regular conversation since they won't be concerned about me not having water, which will eventually lead to a fight"

13:25 ¶ 56 in Respondent 04

"I won't say that it is very difficult to get water. The problem here would be that they give us water every once in 2-3 days That makes it very difficult. Also, the water has been shared between the two houses. So, it's either they get water or we get the water. That's why it's difficult to get water."

9:3 ¶ 12 in Respondent 07

"So, we have to share the water that comes in that 1 hour, if I am home, I will get water. If not, then I will not have water till they switch on the supply after 3-4 days."

7:20 ¶ 14 in Respondent 08

Household & Built Environment Conditions and Infrastructure Investments:

Based on Table 7, 10 out of 12 respondents acknowledged that there are no communal infrastructures (wells, hand pumps) to get water if there's no supply with 10 citations. To contradict this statement, 4 respondents have cited the presence of communal infrastructures (i.e.) sump shared by three blocks (Refer Box 5). However, this is linked to mobility concerns, one of the sub-codes in Housing and Built Environment listed in Figure 8, as they are located in various parts of the community, which consists of 192 blocks.

Box 5 : Selected citations about the status of the communal infrastructures

"No, we don't have or use any other water sources than the pipes in our homes. We just use the water that comes from home."

6:20 ¶ 38 in Respondent 05

There is nothing like that here. The sump you're asking about is near the 130th block, not here. If the pump is not there, how can we get water? There are also sumps closer to block 103, close to the PHC over there. So, we can't go fetch water from there to our block.

7:12 ¶ 36 in Respondent 08

But there is only one sump. One sump is shared between three blocks: D, E, and F blocks. If we use the morning sump for our block, only by the afternoon, the sump can be used for the other block. (i.e.) the E block. Similarly, the F block can use it in the evening. So, this is how we take turns to get water from that sump. We cannot use it for all three blocks at the same time.

13:16 ¶ 47 in Respondent 04

Household & Built environment conditions and Population dynamics:

According to Peter & Chaudhry (2017), yearly since 2016, over 10,041 families from 41 informal settlements have been relocated to the community of Perumbakkam as the city faces monsoon flooding every November and December. Residents cite that there's an increasing population along with the construction of the blocks. Though not highly significant with just 4 citations, it has co-occurred significantly with household and built environment conditions (Refer Table 7) limiting the residents' access to existing resources, as the water's flow has been reduced from the existing blocks and diverted to the new blocks (Refer Box 6).

Box 6 : Selected citations about the increasing population leading to a lack of frequent access to water

In the past, they used to give us regular water for 26 buildings Now, because of the increasing population, we are not getting enough water. Our water is being transferred to other blocks. That is why we are not getting enough water.

1:17 ¶ 34 in Respondent 03

It depends on how the water is filled in the overhead tanks. It doesn't come to us alone. There are 9 buildings and 9 sumps. It comes to us only after the water is sent to the 9 sumps.

5:5 ¶ 27 in Respondent 02

"It runs for an hour. The region in question consists of roughly 250 blocks. So, everyone will just have to fill the water within that one hour, no matter what"

12:4 ¶ 16 in Respondent 12

Interpretations of the findings:

As discussed in Section (2.1.2.1), the ruse of resettling under proper conditions did not occur in Perumbakkam, and resettlement interventions come under crucial stress here, as the findings show that the consequences of poor housing conditions lead to inconsistent accessibility to water. Furthermore, the ongoing inflow of new residents has pressured the community's already irregular availability, resulting in decreased supply and duration and stirred agitation among the residents as they feel that they don't have adequate resources already. In addition, mandatory sharing between households diminishes the inadequate resources to no resources, defining the household's capacity and leaving no place for water but conflicts. The remaining resources are polluted, indicating a shift in water quality that necessitates the use of alternative water resources by the residents. As discussed in Section (2.2), from the definitions identified in this study, vulnerability here explains the stress through the exposure of the system.

4.2.1.2 Socio-economic considerations

Based on Table 7, higher significant relationships of sub-variables that affect the affordability metrics are discussed in the following sub-sections. The Affordability and Water Budgeting practices have a causal relationship here, as the sub-codes of Affordability tend to have an impact on the water budget at the household level, which is explained in section (4.2.1.1) The codes and sub-codes of the below-mentioned sub-variables is in Appendix 7.

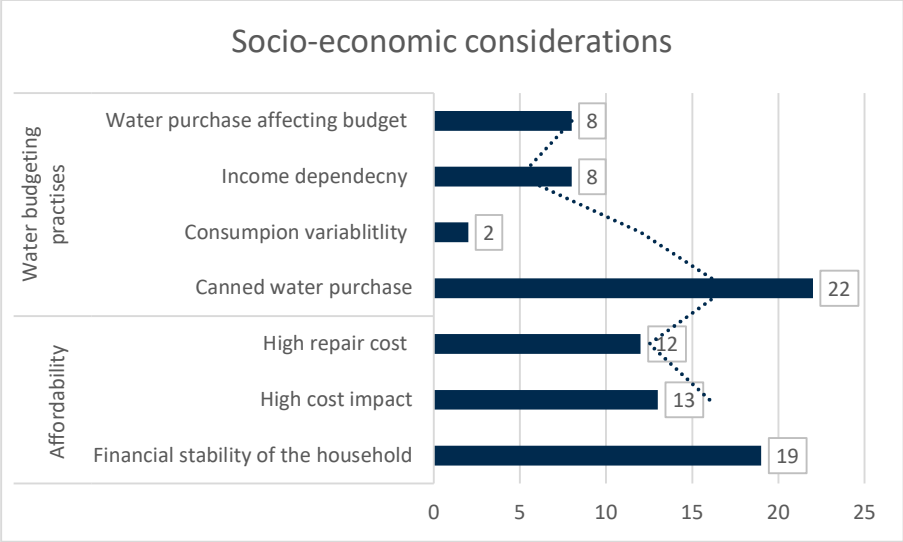

Figure 11 : List of subcodes of Socioeconomic considerations and their frequency based on ATLAS.ti (Author 2024)

Affordability and Water Budgeting Practice:

It has been established based on Figure 11, that large resources are being invested in alternate water supplies in the community. There are 22 citations from all 12 responders that use canned water as a supplementary water source due to poor quality of water as discussed in section (4.2.1.1.1). This practice puts additional financial hardship on households that are already vulnerable to unpredictable revenue streams. As a result, the economic cost of ensuring adequate water supply exacerbates these households' pre-existing struggling monthly expenses, which is highlighted in (Box 7).

Box 7 : Selected citations about the Canned water purchase affecting the financial instability of households

For a week, we spend 7 cans of water. There are 5 of us in the house. For a day, we almost spend 1 can of water. I am saying this along with usage for cooking. For a day, we spend 1 can of water. For a week, we spend 7 cans of water. It seems like we are spending a lot of money for just water in our monthly budget

13:8 ¶ 37 in Respondent 04

"Yes, it won't be enough. Still, we have to run the family with whatever income we have, right? So, we'll just stick to two cans per week. If our income is only this much, we have to save money for that."

6:7 ¶ 34 in Respondent 05

Since we are paying for the canned water, it's destabilizing the household's finances. To be honest, we are left with no money to meet other basic needs as we are spending it on the water itself.

9:18 ¶ 68 in Respondent 07

Yes. If I had that money, I could get tomatoes and onions, and I could cook food for my kids without feeling bad about not giving them an adequate amount of food. Instead of buying a can for 30 rupees, I can buy 1 kg of tomatoes and 1 kg of onions. So, it is difficult to spend monthly expenses.

7:9 ¶ 26 in Respondent 08

"It is difficult. It is difficult to run a family as we buy a can of water every month. We spend 3000 to 4000 rupees a month to buy a can of water."

3:4 ¶ 39 in Respondent 11

Furthermore, according to the Rapid Assesment on Access to Resettlement and Rehabilitation (R&R) Package in Perumbakkam (2024), residents have lost employment owing to the distance between their workplace and the resettlement site. The affordability of canned water purchases every week has worsened the circumstances of those who are already struggling with low or no income. Responses also highlight the opportunity costs involved, sacrificing the other expenses for water.

Affordability and Informal Governance Ties:

Figure 11 depicts the sub-code 'High repair costs' with 15 citations and states the conditions of investments made aside from purchasing alternative water sources. Residents cited the commute expenses and loss of pay they would face if they had to file a complaint with TNUHDB at their office as the cause of doing repairs themselves, as mentioned in (Box 8).

Box 8 : Selected citations about the poor housing conditions leading to high investments in repairs

Also, I did the repairs at my own expense too. They are still leaking.

1:8 ¶ 24 in Respondent 03

"Initially, everything was done perfectly, but they still have not done everything as intended. And it's barely a year since the inspection, there are already cracks in the floor and holes in the walls. The worst part now is that we'll have to fix it ourselves at our own expense."

13:30 ¶ 60 in Respondent 04

Yes. Since we did take care of all the connections when we came here. We don't have any. Also, they asked to file a complaint in the office. But we took care of it ourselves as we didn't want to go that far to complain.

6:18 ¶ 16 in Respondent 05

However, most of the investments done for the repairs are streamlined through the RWA association under the 'Nam kudiyurppu Nam urimai' scheme launched in 2022, which is identified as a conservation program by the community that was initiated by TNUHDB to recover and maintain the resources they lack, which mainly include provisions and maintenance of water supply services and other infrastructure repairs. TNUHDB collects maintenance costs of Rs. 750 /month, which are substantially higher than other resettlement sites since Perumbakkam have lifted as it is predominantly a high-rise (Life on the Margins-Access to Basic Infrastructure Facilities in the Resettlement Sites of Chennai, 2022). As mentioned in Box 9, the maintenance fee arrears also have an impact, as Respondent 04 who's a RWA member cited that residents who fail to complete the payment arrears will have no water until they are been cleared off.

Box 9 : Selected citations about the funding process involved in RWA for infrastructure repairs

We didn't have any water. The sump got submerged in the water. After that, we cleaned the tanks. People from these three blocks came and cleaned the sump. We collected 2,000 rupees from these three blocks and then did the cleaning process. So, it was 6000 in total we had. After that, we switched on the motor to fill the sump.

8:23 ¶ 86 in Respondent 06

That's how it is. If they haven't completed the payment, the head office would give me the list of arrears and I would put them on the notice board and would stop the water supply till they complete the arrears

13:70 ¶ 124 in Respondent 04

For all these repair works, they are paying 750 rupees for maintenance, but under the "Nam kudiyurppu Nam urimai "scheme We deposit that money in our association's account. We can only spend money which is within 30,000 rupees limit through our association. If it exceeds the 30,000 rupees limit, then we have to get authorization order copies from the authorities.

1:23 ¶ 50 in Respondent 03

To be honest, there are few elderly individuals living alone in my block. It would be irrational to ask them for maintenance payments when they are already struggling to satisfy their basic requirements.

13:41 ¶ 71 in Respondent 04

"Since we are the ones collecting the money, we have become the villains when the water supply is inadequate,"

From interview excerpts of RWA members conducted by the IRCDUC team (For The Hindu Newspaper)

Box 10 : Selected citations about residents' opinions on the maintenance charges.

No, it will be difficult for everyone. 750 rupees is a big amount. If it was reduced, people would have been happy. Even for people with money and without money, it is really difficult to pay the 750 rupees

1:50 ¶ 54 in Respondent 03

"So, for people who have already been paying rent in a previous location, these charges on s Rs.750, it's not a big deal for them. But for me, it's a big deal. "

13:74 ¶ 126 in Respondent 04

RWA members pointed out that the residents' incapacity to pay the maintenance costs has harmed their work ethics since it disrupts the rapport between the members and the residents who don't pay. Moreover, residents vent their discontent on RWA members, who have assumed the responsibilities that TNUHBD is expected to carry out, harming the association's seamless functioning. Ultimately, the responses have a causal relationship between the water supply provisions and maintenance fee as the concerns highlighted that this fee collected has become a direct financial burden for the people regardless of whether it's a very minimal charge imposed. (Refer Box 10).

Interpretations of the findings:

As stated in Section (2.1.1.1), affordability may not be an issue even when a community or region is experiencing relative rather than absolute poverty. However, in Perumbakkam, affordability becomes a concern since the implications of resettlement initiatives emphasize the poor quality of supplied water, resulting in water expenses, where the residents are forced to invest in purchasing canned water, which accounts for a bigger percentage of household income, and some households have low or no income owing to the move, having a substantial impact on the household budgets. In addition to that, the situation in Perumbakkam highlights the focus on prices/charges imposed more than the income involved as they mediate with economic signals that these water charges acquire the least essential services which was supposed to be part of the resettlement pact.

4.2.1.3 Role of Institutions

Based on Table 7, sub-variable 'formal governance ties' directly address the lack of support of institutions for the community. The local authority to the region of Perumbakkam and the resettled population in Chennai is the TNUHBD. The sub-codes were generated and coded based on the observed relationship addressing the lack of institutions' role and significant variables based on Table 7 are discussed in the following sub-section. The detailed relationship between the sub-variables discussed is in Appendix 7.

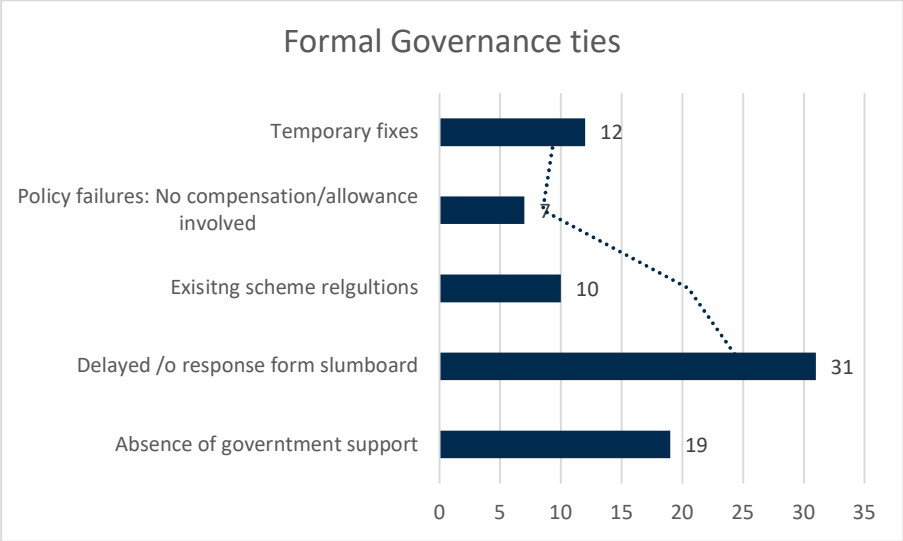

Figure 12 : List of subcodes of Formal Governance ties and their frequency based on ATLAS.ti (Author 2024)

Formal Governance Ties and Household & Built environment conditions:

The most reported concern from the residents is the delayed or inadequate response from the local authorities from the Tamil Nadu Urban Habitat Development Board to repair the damaged infrastructures within and around the households and communal zones. Even after multiple complaints, they are not promptly fixed. Out of 65 citations on Formal governance ties, 31 citations were delayed, and no response from the TNUHDB regarding the infrastructure defects which was again a significant citation in the housing and built environment indicator based on Figure 10. The majority of the respondents stated that the government-provided housing was

not sufficiently maintained from the very beginning. However, frequent complaints regarding infrastructure issues turned into either the response being delayed or denied.

Box 11 : Selected citations about the lack of institutional support for poor housing conditions

"Initially, everything was done perfectly, but they still have not done everything as intended. And it's barely a year since the inspection, there are already cracks in the floor and holes in the walls. The worst part now is that we'll have to fix it ourselves at our own expense.
13:30 ¶ 60 in Respondent 04

We complained to the Slum board office. They fixed it, but still, the water is leaking.
1:4 ¶ 20 in Respondent 03

Why do you ask? (Feels nervous) So far nothing has been done from their end. Since we did take care of all the connections when we came here. We don't have any. Also, they asked to file a complaint in the office. But we took care of it ourselves as we didn't want to go that far to complain.

6:11 ¶ 52 in Respondent 05

However, the in charges don't provide us with enough. They have reduced the supply to 1 hour, which was supposed to be for 2 hours

7:18 ¶ 14 in Respondent 08

"Till now we are writing letters asking them to change the damaged ones, but they haven't taken any action on that.

(From FGD excerpts of RWA members conducted by the Author)

The recorded responses from the residents also highlight the inadequate water supply, reporting that the water in-charges from the slum board have intentionally reduced the duration to 1 hour, due to the increasing resettled populations as discussed in section (4.2.1.1)

Formal Governance Ties and Affordability:

According to Table 7, formal governance ties co-occurred ten times with affordability, indicating the second significant association among formal governance ties with other sub-variables. Based on Figure 12, the absence of government support with 19 citations and policy failures with 10 citations explains that residents stated that their affordability metrics have been compromised by current convictions and restrictions through existing policy failures and lack of support through formal ties. The policy failure here is the absence of compensation to vulnerable populations, who are as follows,

- Elderly women, abandoned by their children who are the original allotees.
- Disabled population, who are mostly visually impaired.
- Single women, abandoned by their husbands.

These groups were listed by the RWA members from their blocks, as they have been closely working with them in securing resources and compensations for them. In general, the resettled population did not receive their shifting and subsistence allowance which was part of the resettlement pact. According to Rapid Assessment on Access to Resettlement and

Rehabilitation (R&R) Package in Perumbakkam (2024), the report identified that the resettled families even after 5 years of resettlement are still yet to receive the allowance based on the government order (GO) passed in 2013. These allowances though do not directly affect the entire population in Perumbakkam, but as discussed in section (4.2.1.2), people with low or no income suffer significantly to acquire resources as they have unstable financial support.

Box 12 : Selected citations about the absence of allowances for vulnerable populations by members of RWA.

She tried 4-5 times. She didn't get a pension. Also, she did not get the monthly allowances for ration.

8:29 ¶ 102 in Respondent 06

Yes. The money that the government gives to disabled people and women abandoned by their husbands is not received by many people here.

1:29 ¶ 58 in Respondent 03

In my block, there are about 20 elderly women who live alone. and they are living in the houses assigned to their children. The children of the elderly do not find this environment suitable And, just a few people get the pension, not everyone which is what keeps them alive so they can eat. They buy food from a ration shop.

13:46 ¶ 79 in Respondent 04

Box 13 : Selected citations about the inability of residents to pay maintenance charges affecting the water accessibility

Most of the people here are blind and handicapped, women abandoned by their husbands Only if they have income, they can pay the 750 rupees.

1:25 ¶ 54 in Respondent 03

We have tried talking to them, and the authorities have already released the notices to the houses that haven't cleared the outstanding arrears. That is from the slum board. If you don't pay it, they will check it. The head office will offer you a maximum of one year to repay the outstanding balances. If you don't pay it within a year, they will release notices, that explains that if you don't pay it, we will close the house

13:72 ¶ 126 in Respondent 04

A little tampering with the prices has also been suggested to the slum board to reduce the maintenance fee as most of the residents don't find them anywhere nearer to the situation of paying the fee.

While addressing the role of policies in the government's actions, the commodification of water explained in section (4.2.1.2) is critical. Though not explicitly involved, the institutions have an indirect influence in transforming the freely available public good into a commercial by-product leading to pricing, privatization, and commercialization, making it a dead-end for low-income communities like Perumbakkam.

Expert A, Ex-Chairwoman of CMWSB, expresses her opinion on how few authorities (whom she mentions as Humpty Dumpty fellows) promote the privatization of water, which is becoming a popular trend in India, creating an illusion that the local metro water is not good enough which would eventually lead the people to buy water at any cost fearing health

concerns. She has also highlighted the raids she has conducted in the packaging companies and has identified there have been worse conditions than the metro water itself, where people complain about the metro water quality and buy even more contaminated water. There's also clear dictation on the adequacy of water policies in Chennai, through grandeur projects with intense budgets across different levels ignoring localized and feasible solutions through policies.

Box 14 : Selected citations about the commodification of water and its quality – Expert's opinion

"So, people are spending more money on water, partly because of the marketing of water as a commodity that is purified and packaged"

"I have done many raids of these packaging companies. They are much worse than metro water. They are highly contaminated."

"And everybody thinks that unless I get RO water, I am not getting good enough water."

Expert A – Ex-Chairwoman of CMWSB

Formal Governance Ties and Informal Governance Ties:

Based on Table 7, however, the co-occurrence of formal and informal governance is moderately significant, the absence of formal governance ties within the community has led to the popularity of informal governance networking, as the responses from members of RWA (Refer Box 15) points out, that established assistance is absent once the responsibilities from the TNUHDB were taken over by RWA, and they have also answered that they have taken the responsibility for the damages as there is no strong backing from the authorities.

Box 15 : Selected citations about the lack of institutional support for RWA responsibilities

Even if it is more than 30,000 rupees, the slum board is asking us to take care of it. They won't take the responsibility for it. They'll say "You take care of it." and will leave it as it is.

1:45 ¶ 37 in Respondent 03

"As they would argue, RWA has taken over the responsibilities, thus we are no longer liable for these issues, they also said that we fixed it initially or during the inspection, and so we are not liable for any damages you cause. they also constantly emphasize that they have either repaired or modified the toilet fixtures, sinks, or water fittings within the buildings, claiming that is why we can't do it"

13:34 ¶ 60 in Respondent 04

No, they didn't. They just gave us the responsibility through the association. They didn't follow us after that. They didn't even tell us how to manage this. The Auditing team came and gave us the money. They told us that we had to run this, and gave instructions. But after that, no one asked us about the updates or said anything.

1:38 ¶ 76 in Respondent 03

However, there's been an imposed limit to the funding collected as maintenance fee, where the association members can spend for the repairs and damages to 30,000 rupees and if the expenses exceed the limit, they have to wait till authorities from TNUHDB to permit them to further proceed if required. This has been a hindrance for the association to have timely and spontaneous responses to the plight of the residents.

Box 16 : Selected citations about the absence of institutional support in repairs and maintenance

"That aforementioned process occurs, and they will disregard us simply for a straight six months. After the rigorous demands stated, they will resume doing their tasks for a while. They don't do anything for the next 6 months. They do their job when the complaint comes. We have to go through this all the time."

13:56 ¶ 90 in Respondent 04

Two respondents highlighted the presence of NGO workers helping them during the flooding was also stated in responses who were *'friends'* of RWA members in the community (Refer 17).

Box 17 : Selected citations about the role of NGOs in the community

"Yes. They bring food. They bring food once the water gets drained out. Before the government helped us, the NGOs came out to the rescue by giving us the essentials. also, owners from the department store nearby. They helped us with food during the flood."

13:60 ¶ 98 in Respondent 04

Few NGOs support them (elderly and single mothers) and give them some money

1:30 ¶ 58 in Respondent 03

When the flood came, 2-3 NGOs came and helped us. They didn't come directly but through a friend's circle. But we don't know their names. They came and helped us. They helped us with food, water, everything.

1:32 ¶ 60 in Respondent 03

Interpretations of the findings:

In most situations, the problem arises within the system as a result of trigger events like climate change. However, in Perumbakkam, the challenges can be traced back to policy problems better identified as the organizational problems from the government's actions. As discussed in section (2.1.1.3), though the commodification has affected the general populace in the city, there are significant impact on those who are socio-politically marginalized like Perumbakkam, limiting their capacity to wield the resources. This is intensified by the existing policies failing to address the consumption norms and conservation efforts on a city level, but has a direct impact on communities like Perumbakkam which are at the tail ends, lacking the consideration of the internal heterogeneity of the populations. Furthermore, marginalized populations within the communities are identified as they are unable to buy additional water resources highlighting the inequities as existing regulations and practices are more concerned with setting and collecting bills on services than the financial capacity of the residents.

4.3 Analysis and Discussion:

This subsection gives an in-depth analysis of how the three well-being measures moderate external and internal vulnerability. Though categorized based on the interactions and trade-offs between the external and internal sides, the assessment would involve three aspects based on Sen's capability measures (1989): Valued functionings; Assessment of deprivations and opportunities as discussed in Section 2.4 . Subsequently, the outcomes of internal vulnerability are also discussed here. The Co-occurrence table for all three measures is in Appendix 4.

4.3.1 Interactions between External Vulnerabilities and Measures of Well-being impacting Capacity

From identifying systemically from Section 4.2.1.3, it is evident that there are no equal efforts from all actors. Though resettlement itself was considered the externality causing water shortage circumstances here, the lack of support after the resettlement from the government highlights the disconnect between the priorities of the resettled and those in the decision-making as mentioned in Section 2.1.3. According to *Expert A*, this deliberate intervention is well-intentional, leading to social disharmony, where the residents find it difficult to trust each other. Without strong social networks in such circumstances, cooperative behaviour is unlikely found, as most of the residents find it difficult to share water resources as discussed in Section 4.2.1.1. This also validates one of the existing literatures mentioned in Section 2.3, as well being measures needs to be built from "bottom-up" from the target group of who's been approached, whereas in Perumbakkam, the approach was more of" top-down", as the lack of autonomy in securing resources is partially lacking.
A more specific domain that would define the capacity here is the strength of social networks and the quality of interpersonal interactions. The ability of residents to mobilize resources here entirely depends on the quality of social networks as lack of formal governance is identified as one of the externalities as mentioned in Section 4.2.1.4. The inability of institutional government mechanisms to meet the requirements of relocated communities has moved the responsibility of resource management to informal social networks. The deprivations here are more of invisible barriers imposed by the existing schemes and regulations as instances were also recorded (mentioned in Box 14), that respondents have expressed emotions on relying on an external network of support (Refer Appendix 3) which has mixed opinions on being helpful and helpless. Moreover, these invisible barriers don't stop with the schemes but are a direct consequence of contaminated water to varied and visible health concerns. However, these networks are fragmented due to resettlement interventions as discussed in Section 4.1.1, with resettled populations coming from different backgrounds and incomes where the opportunity turns into deprivation.

Based on Table 9 in Appendix 7, conflicts is one of the relational measures that explain the weakness within the community. However, this stems from the diminished interpersonal interactions of emotional distress due to shared water resources which has led the residents to choose conflicts over calmness. Inadequate water on the household level has led to circumstances, where residents are forced to prioritize immediate needs over collective good by filling water in pots, which is also considered as an adaptive response to the available resources. One of the relational measures that has the consensus of improving capacity is the trust, that all actors involved should possess towards each other. As discussed in Box 4, issues on mandatory water sharing, explains how scarcity drives selfish behaviour diminishing the trust and cooperation among the residents. However, in Networks of Obligations, where the

resident's forced reliance on external networks (i.e.) formal institutions, as Expert B's observation on formal institutions are not investing in small-scale solutions that would be practically feasible for communities like Perumbakkam, as localized and dispersed solutions are acknowledged as activities led by other non-governmental organizations where these are not even part of the conventional policies, but an addition considered when things go out of hand, which further highlights the gap in capacity building. The lack of practical interventions and support to RWA, as they have taken over responsibilities as mentioned in Section 4.2.1.3.3, there are responsibilities without resources with certain limitations for the members of RWA to proceed with funds, and they are left to navigate on their own, further straining the social networks.

Box 18 : Selected citations about relational measures: Conflicts- Perceived inequities in sharing resources

"At first, when we came here, we had a few problems Our neighbors belong to North India They'll fill most of the water. So, we cannot ask or argue with them. Also, they don't know or speak Tamil. When we go to work, we cannot fill water. Also, we will just let them fill because that's how we are"

4:8 ¶ 44 in Respondent 01

"We have a lot of fights because of that. If they open the water tanks, my flow will decrease. They'll keep receiving water, but I can't. So, I'll tell them to reduce or adjust the valves, so that I can at least get some water. and it won't be a regular conversation since they won't be concerned about me not having water, which will eventually lead to a fight"

13:25 ¶ 56 in Respondent 04

We have to think about it. You know, the water concerns have already instilled a sense of selfishness among us, especially those very close to us.

13:27 ¶ 56 in Respondent 04

Yeah, and we also get into problems with them frequently.

9:4 ¶ 14 in Respondent 07

Blocks nearer the sump will receive water first, so even if there is water, we have to adjust with whatever is left.

7:13 ¶ 36 in Respondent 08

Cohesion was fairly observed from the respondents working in RWA mentioning the concerns towards the disabled population, single women abandoned by their husbands, and elderly population, have subsidized the maintenance charges for them (Refer to Box 12), as most of them don't have an income in the first place and also have raised concerns to the TNUHDB about the pension scheme for the elderly, to stabilize them with some sort of income. However, since most of the residents are illiterate, the opportunity for cooperation and participation is invisible, as they are not aware of the process and easily get angry with the RWA members as the authorities take too much time to process their applications. This mistrust has weakened ties within the community and increased emotions of abandonment and neglect. This has led to mistrust among the community itself as most of the residents started picking fights with RWA members from their block, by not paying the maintenance fees and assuming that these fees were going into the pockets of the RWA members, but in reality, it's been used to pay the

salaries of the maintenance workers involved or deposited in the association's account for further occasions on repairs and damages.

4.3.2 Trade-offs between external vulnerabilities and Measures of well-being affecting capacity

When priorities of people are discussed, another aspect of measuring of capacity is that the value of resources lies in access to those resources and it needs to be evaluated on what people have to survive as discussed in Section 2.3. The valued functionings of the residents here are the '*accessibility and availability to safe and sufficient water'* without compromising the '*financial stability'* of the households. Here in the context, valued functionings are critical, as the resettlement from the urban city center to the periphery of the city has disturbed the functionings (i.e.) Income and assets, which were already been available to them. However, what people have now is insufficient and subpar conditions and resources so additional investments are made to get sufficient and clean drinking water to the existing realities prioritising water over other needs.

Based on the responses from the residents in Box 14, the real opportunities to access the resources are cut off as residents started drawing comparisons of having a decent lifestyle with independence before resettlement and now it's just that everything comes with a price and predisposition. The dependency here is financial dependency, as they indirectly connect to the institutions failing to keep up with schemes and regulations to provide sufficient water. The sense of insecurity as investments done are *'additional'* expenses here, as residents expressed their concerns on '*paying extras'*, forcing them to use their limited assets from their pockets. This is supported by Resident H's mentioned in section (4.2.1.2.1) highlighting the opportunity cost of choosing between essential needs, prioritizing water at any cost, and sacrificing food for her children, highlighting the trade-offs the residents have to make significantly to get their hands on drinking water. Another instance here is the grievance of being daily wage labourers who are forced into a situation to compromise allocating a certain budget and continuously struggle to just meet their daily ends.

These diminished opportunities due to high costs to achieve the valued functionings have restricted freedom, reflecting the internalization of the constraints with emotions of guilt and frustration to attain a well-rounded quality of life, as mentioned in Box 17.

Box 19 : Selected citations about material measures: Wealth &Assets and Access to Services

Over there, spending just 5 rupees for water has increased to 40 rupees just for a can of water for a day. Look at the difference between spending 5 rupees and 40 rupees daily, there is a huge difference. That itself is very difficult for us. We have to allocate a certain amount for buying water, only then we can deal with it.

13:9 ¶ 37 – 38 in Respondent 04

"We are in a situation where everything comes with a price. We have to pay for everything"

(From FGD excerpts of RWA members conducted by the Author)

Here, the opportunity costs explain that they have limited financial resources as they are unable to meet both sufficient water and adequate water. In addition, achieving well-being is not just about resource access, but about achieving the actual needs to be met through actual freedom and opportunity. Here, the residents' inability to meet these valued functionings is a critical shortfall in their capabilities which eventually leads to deprivations in their capacity

development. The more specific question on how these assets is managed is based on the individual's freedom to acquire the resources as they have mentioned the funds are limited in Box 11.

Another critical trade-off and one of the metrics of material measures is physical health (Refer to Appendix 3), which is significant in household and built environment conditions, with poor water quality, lack of healthcare facilities, and infrastructure defects being the key contributors. Though health concerns are more of consequences of material assets, the fear of loss of health was one of the major concerns every respondent had as they have witnessed people affected by skin diseases, with no means to cure as the community's health facilities are *"just buildings with no equipment"*. This involves residents reflecting on the valued outcome (Mcgregor, Coulthard, & Camfield, 2015), where being healthy is a response to earning enough for the household, where one fundamental valued functioning 'Health' (Sen, 1989) is severely compromised, reducing their opportunities for coping.

Box 20 : Selected citations about material measures: Health concerns

"I have got an infection. I have got an infection where I urinate. That's why I have to go to the hospital. There is no other way."

13:76 ¶ 130 in Respondent 04

"because of the water, it gets itchy always. Yes, itchiness and children fall sick often."

8:6 ¶ 26 in Respondent 06

"Yes, I get red spots on my skin. It is very itchy. Since the water is salty, I can't even take a bath."

9:19 ¶ 74 in Respondent 07

"Yes, my body's itchy all the time. It was okay before. Now they have mixed salt water in it for 2 months. My body screams with pain, due to the itchiness."

7:5 ¶ 18 in Respondent 08

Ironically, material deprivation in water has a cascading effect on other well-being measures too as the residents lack personal freedom – repercussions cannot decide freely when or how often to bathe due to risks with poor water quality (Refer Box 19). Loss of opportunities to invest freely or maintain one's health has severe and immediate consequences on emotional and social measures one of the respondents said that there is profound emotional distress connected with health issues as she recounted her daughter's experience with skin allergy from using the water they get, felt embarrassed to scratch her skin at school, and subsequently was a target for bullying by her peers. Another prime instance was when a respondent described her experience with constant leaks in her household, which caused her children to fall sick frequently. Her spouse was angered by the hospital and travel expenses, as the community lacked healthcare services, forcing inhabitants to travel to Chennai for care. This has had an extended negative impact on her psychological well-being because her spouse frequently argues with her, and the water issue remains unaltered, causing her to gradually lose hope for a change.

Box 21 : Selected citations about the impact of health concerns on subjective measures

Yes, the metro water they give lot of skin problems. Many people have itching issues. Some people were also affected by fungal diseases. They have people affected by fungal diseases in every block. If you drink the water, your body will get itchy. Even in this house, there are people with skin problems. The allergy is now spreading throughout the body. They are working hard in the sun every day. So, they have to shower with this water which aggravates the allergy. There are about 10 people in this block with these similar conditions.

8:24 ¶ 88 in Respondent 06

"Yes. I have to go outside for work, and when I get back, I want to use the restroom, but I'm scared to do so. The saltwater itches my entire body. so, I have stopped taking showers once I come back from work. See, I am old too, even in this searing heat. I'm afraid to take showers even if I want to. I just wash my hands and feet 3 times a day. I will just go around 7 in the night to take a short shower"

7:10 ¶ 28 in Respondent 08

4.3.3 Convergence of Opportunities, Deprivations, and Capacity

Despite missed opportunities deteriorating relational and subjective well-being potential deprivations are to withstand the lack of valued functioning, demonstrating capacity mechanisms. As discussed in section 2.3, to evaluate the capacity here, security and the ability (Kimhur, 2022) to achieve the valued functionings play a critical role.

Access to resources is considered as a *security* measure as the substantive freedom one has to utilize the existing opportunities that are practically feasible for them. Residents are limited to certain opportunities and are adjusting to existing reality fearing that they might lose whatever they are having now. Instances of conflicts over sharing water, though diminishing the relational and subjective measures, still are considered as an opportunity to secure the valued functionings (i.e.) sufficient water. Another deprivation-turned-opportunity is canned water purchase which is likely to be a greater barrier in choosing or acquiring other resource options than water, still, it secures the valued functioning of the residents (i.e.) Clean drinking water. However, action theory is defined as the *ability* here is about making use of the available opportunities wisely, with knowledge and understanding of the concerns. Developing the ability to independently fix the existing repairs, and acknowledging the defects and mechanisms involved in repairs is considered to be one of the proactive abilities on an individual level of assessment. Moreover, ability is not opportunity of the people but also about the empowering environment, presence of RWA has empowered the residents on an individual level, as one of the sub-variables - Knowledge transmission (Refer Appendix 1.3) highlights that RWA members are associated with NGOs, and information is transmitted to them on how to access alternative resources or approach the media outlets to secure the resources. This ability is been formulated within the community by RWA being proactively involved in sustaining the resources and effective representation and advocacy from the members towards the community. In addition, the ability to claim the right for the valued functioning even when the opportunities are not in place, should count as the ability of freedom to secure what is needed (McCarthy, Canziani, Leary, Dokken, & White, 2001). This ability is evident in responses from a few residents about the arrangement of water tanker lorries for residents, from the savings they made from the maintenance charges of Rs.750 and they have also pooled money from the residents from those blocks to pay the lorries. These proactive behaviours of the RWA members to go beyond their responsibilities to sustain the community needs to reflect their ability to act on opportunities available, owing to the challenging circumstances. However, considering this as an opportunity does not guarantee an effective capacity

mechanism, but still makes room for conditions shaping their capacity behaviour. In some instances, the capacity mechanisms have a significant degree of negative impact, emphasizing the residents are forced to take up as an adaptive measure to existing conditions that they do not want or add any value to them.

Concluding this, socioeconomic disparities with affordability and water budgeting practices have restrained the household's capacity to cope with, diminishing the subjective measure, as the variables have co-occurred significantly with the other two themes, which is explained in the synthesis table.

Themes	Empirical Findings	Opportunities	Deprivations	Impact on coping
Resettlement Interventions	- 11 out of 12 respondents cited inadequate water supply duration, exacerbated by leaky pipelines and roofs. - All respondents were compelled to use canned water due to contaminated water. -Mandatory sharing diminishes the already scarce water supply, limiting household storage capacity.	- Opportunity to mobilize resources through repairs - Invest in alternative water sources, crucial for health. - Practice of sharing inculcates mutual support on resource distribution	- Forced to cope with investments for repairs and canned water, straining the limited household finances. -Inadequate frequency of supply leads to inequities while sharing leads to conflicts.	Moderate coping capacity, characterized by deprivation, has a considerable influence on subjective and relational metrics, due to financial constraints with a more significant effect on available opportunities. .
Socioeconomic disparities	- Poor water quality leads to high cost - canned water consumption, destabilizing household finances. - Poor home conditions result in high out-of-pocket repair expenditures. - Maintenance charges strain resources and jeopardize resident-RWA relationships, who are collecting it.	-Independent repairs to address issues foster collective action. -Maintenance charges if managed effectively, can ensure the upkeep of infrastructures for improved water supply.	-Extensive investments in water purchase and repairs lead to opportunity costs. - Lack of transparency and support from TNUHDB, leads to failure to failure of payments, resulting in cutting off the supply.	Reduced overall capacity with economic constraints since the community substantially lacks financial stability and most of the coping strategies involve expenses to achieve the valued functioning.
Role of Institutions	-TNUHDB's delayed response to resident repair requests, as reported in over half of the citations. -Failure of promised government allowances has exacerbated financial hardship for vulnerable groups. -Privatisation has raised costs of water, leaving low-income households with expensive and low-quality choices.	- Increased RWA responsibilities for resident-members lead to enhanced efforts to access water. - Improved access to clean water when the primary supply is contaminated, though privatization is a market-based solution.	-Delays have direct consequences on residents' safety and well-being. -Failed compensations significantly impact the vulnerable groups limiting their access to essentials. -Privatization emphasizes the inadequacy of institutional interventions on affordability and equal access.	Moderate coping capacity with potential opportunities exists through RWA to access clean water, enabling the community to cope with water shortages themselves. However, socioeconomic disparities diminish the overall capacity.

Table 8 : Synthesis table (Author 2024)

Chapter 5: Conclusion

This study draws on Weichselgartner's (2001, p. 86) suggestion to reconsider the concept of vulnerability to natural disasters. It recognizes that vulnerabilities are closely interwoven with social, economic, and institutional circumstances, rather than just exposure to external risk. According to Melamed (2011), there are typically considerable gaps between impoverished people's viewpoints and goals and those participating in development decision-making. Mcgregor et al., (2015) argue that the right aid to help people comes from the value of the resources which is chosen by the people who are affected. This imbalance might result in initiatives that fail to meet the true needs and priorities of the marginalized communities they seek to assist

'Good society' works, when all actors' (government-citizen-organizations responsible) efforts are put together – which is considered to be one of the critical indicators in measuring the well-being (Mcgregor, Coulthard, & Camfield, 2015). One of the key reflections is the realization of capacity, as discussed in Section 4.2.2, which extends beyond mere resource access despite the external vulnerability that arises from various factors, the findings of the research highlight those existing strengths and capacities on individual and household levels which was a spontaneous response to long-term factors of vulnerability weakening the resident's ability to cope, making it consistent with the definitions of existing studies. With the lack of other household members that have similar behaviour or values, an individual's commitment to water conservation is unlikely to have a major impact on overall household water use, is consistent with the findings. (Singha & Eljamal, 2020), as cited in (Singha et al., 2022).

Overall, water vulnerability assessments are generally done top-down based on the existing indicators to identify interventions that suit the region. Such studies require more empirical data and must go through trial and error in methodology with reiteration to contextualize the data. However, this study though the framework was chosen from existing vulnerability studies, the methodology incorporates a bottom-up pattern prioritizing the needs of the target group and contextualizing the indicators. This study would be one of the first in the community of Perumbakkam, to work on the lived experiences of the residents on water scarcity moderated and explored through well-being measures.

5.1 Answering the Research Questions

To understand the relationship between external and internal vulnerabilities with well-being measures, the study incorporated exploratory questions which is discussed in this section.

The First Sub-Question

The first sub-question is answered as exposure variables in vulnerability assessment (Bohle, 2001), adjusted to the context of Perumbakkam. The findings suggest that seven out of nine external vulnerability variables (based on section 3.3.1) were significantly associated with well-being measures toward water consumption behaviour, eventually affecting the capacity of the community to cope. With a shift in the availability and accessibility of water supplies, the community has surpassed it carrying capacity-based threshold with the influx of new residents with already lesser frequency and duration of supply. This is in line with Bao and Fang (2007), that there is a "water resources constraint" when the amount of water supplied is insufficient to accommodate additional population restraining the development of the region. The lack of

formal institutional support has led to the evolution of informal social networks within the community, where there is still a great deal of adaptive response to securing the water resources by informal showing that every respondent had the same composition of developing capacity through informal networks or independently. with the absence of institutional support, individuals might overuse or mismanage the water supply leading to further vulnerabilities. The dependence on expensive alternatives has put the residents in precarious circumstances, where the 'ability to pay' as discussed in section (2.1.1.1) is severely constrained. Households who have less income, and feel a stronger emotion of resigned acceptance of living with financial instability, are more likely to adopt compromised water conservation behaviours. These findings validate OECD (2003, p. 19) in section (2.1.13), as a tragically affecting 'the commons'.

The Second Sub-Question

According to White (2008, p. 3), one of the key aspcts of well-being revolves around an individual's priorities and perspectives. Looking at this dimension, the priorities in this study go beyond resource access and availability, but the deprivations of social and economic circumstances aggravate the existing vulnerabilities. Materially, limited yet poor water supply has a significant impact on health aspects. The necessity to share resources on the household level hurts relational aspects disrupting the capacity to access water resources, which is highlighted by Mcgregor, Coulthard, & Camfield (2015), from a well-being perspective, the relational dimension must be the one defining capacity as it is what helps oneself to achieve the functionings. According to Sen (1989) & Alkire (2002) discussed in section 2.3, deprivations of capability occur when certain emotions restrain them from translating the resources into valued functioning, is validated here through findings of well-being highlight that more than the vulnerabilities due to disasters, findings suggest that subjective measures are dimnished, by stress and uncertainty, with limitations to mediate through resource loss and gain, which is in line with existing studies mentioned in section 2.3

The Third Sub-Question

Examining the challenges and opportunities within the community, which is the last sub-question, emphasizes the '*ability*' and '*security'* as capacity measures. Findings state that the capacity to cope with strategies is 'bottom-up', as the residents' coping opportunities are very limited yet the *'ability'* to use available opportunities to empower them by claiming the right for the valued functioning even when the opportunities are not in place, should count as the ability of freedom to *'security'* what is needed (McCarthy et al., 2001). However, the exposure factors are causes of 'top-down' approaches, emphasized by (Mcgregor et al., 2015) as the capacity of urban areas to manage these issues largely depends on governance at a multitude of levels and sufficient awareness of local underlying vulnerabilities in the environment, (Gasper, Blohm, & Ruth, 2011) which generally is lacking in the three variables of *'internal vulnerability'* within the community as they have no relationship based on Table 6. However, *capacity to cope* is the immediate response to stress by households which is an adaptive response to *exposure* overlooking the measures of well-being. Altogether, the results illustrate that the residents of Perumbakkam are only moderately able to cope with the consequences of external vulnerabilities with limited opportunities, mostly due to competing concerns is itself a challenge identified to cope with.

Answering the Main Question

With the combination of the responses of the three sub-questions, the main question answers that the resettlement community of Perumbakkam is exposed to social-economic-institutional vulnerabilities that collectively reduce the household's capacity to cope and maintain well-being significantly less which exacerbates their vulnerability through various factors, somehow

validating the IPCC's (2022) definitions of *"vulnerability arises from various factors, including limitations in capacity"*. Holmgreen, et al., (2017) highlight the critical role of resource investments to substantially maintain the balance between loss and gain, to protect – recover – gain resources. These investments are heavily identified in health loss or impacts of huge resource loss, which confirms empirical findings as residents navigate between loss and gain through investments, where these investments itself is a vulnerability limiting the household capacity to access water.

From a well-being perspective, the extent beyond the resource access and loss, where the capacity to translate the opportunities into valued functionings (Sen,1989; Alkire,2002), explains the extent of vulnerabilities being profound. Also Summer & Mallet's (2013), postulations are in line with the findings as the well-being measures guiding the 'vulnerability to what' notion. Another postulation from Adger et al., (2004) explains that dimnished well-being reduces the capacity, eventually, with the system adapting to the negative consequences of exposure, which is evident from the coping strategies of the residents' consumption behaviour and dependence on expensive alternatives are a direct response to negative consequences of inadequate resource availability, explaining how exposure factor interlinked with their coping strategies.

In conclusion, the vulnerabilities converge to severely impact the residents 'capacity to cope 'emphasizing that opportunities exist through community-based networks, and substantial challenges exist in achieving the desired resource access and living conditions.

5.2 Implications of the research

Perumbakkam, being the subject region for the study, presents context-specific insights, which cannot be applied to other resettlement contexts in Chennai or India, with the implications of the research towards the policy formulations and practice. While addressing the policy formulation, general insights on the commodification of water on subsidies or tiered pricing and existing resettlement policies regarding the compensation and allowances associated with the policies can be applied. Moreover, institutional insights from the findings are also similar and can be applied to other resettlement contexts in Chennai.

Further research can be done on the effectiveness of the economic instruments and incentives on water and how this can be streamlined with a bottom-up approach prioritizing the tail ends, and examine the per capita water consumption and how well this aspires to inform adequacy and equity in resources, as external conditions change and new policies are implemented for both instances.

5.3 Policy recommendations

Recognizing in-situ participatory approach – to introduce water policies as the aim of SDG6, water scarcity and contamination of resources across all sectors need to prioritize a comprehensive understanding of strategies based on availability, accessibility, and quality at the local level. Better planning and coordination, as well as improved investment and technology innovation, can address these difficulties (World Economic Forum, 2022) . To effectively address this, a multi-tiered approach integrating city-community level interventions are crucial. At the city level, incentives for sustainable water use must be implemented by monitoring the per capita water consumption effectively. These city-level interventions are interlinked to the context of Perumbakkam, as the institutional failures such as failed monitoring of per capita consumption have resulted in the mismanagement of water resources, which is also diagnosed by Expert A (2024), *"The adequacy is skewed, with water being taxed without metering"*. However, at the local community level, the development of policies on

educating and training the communities about the management and sustainable use of resources to the community will enhance the role of RWA, which has been responsible for helping the community cope with the water shortages. By formalizing these networks, which is already under the government scheme 'Nam kudiyurppu Nam thittam', the association's role can collectively enhance the responsibilities and living conditions of the community.

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Appendix 1: Interview and Focus Group Guidelines

Appendix 1.1: Questionnaires

Household's conditions:

- Do you currently experience any issues with your household infrastructure such as leaked roofs, damp walls, or damaged flooring?
- Are there any pipelines in your household that leak, restricting your water usage and accessibility? Are these leaks treated or untreated water sources?
- Have you faced any challenges or difficulties in keeping up with water bill payments, resulting in arrears?

Communal Infrastructures:

- Is there adequate water infrastructure available in our community to meet the needs of all residents?
- Have there been any conflicts or challenges related to accessing water?
- Are there any outdated water infrastructures present in our community? If so, can you provide examples and describe how they impact water accessibility and quality?
- In the event of damaged water infrastructures, how long does it usually take for repairs to be completed?

Water Accessibility and Distribution:

- How often do you encounter challenges in accessing a consistent water supply in your household?
- Have you experienced any conflicts or disputes related to the distribution of water among different households or blocks in the community?
- Are there specific times or days when water supply is particularly scarce or unreliable?

Infrastructure Maintenance and Repairs:

- Can you describe the process or timeline for repairing damaged water infrastructures in our community?
- What challenges, if any, do you face in reporting or addressing issues with water infrastructure maintenance?
- How do you perceive the responsiveness of local authorities to community concerns and grievances?
- Can you elaborate on the bureaucratic hurdles and lack of accountability you've encountered in addressing infrastructure issues like lifts and roads?

Alternative Water Sources and Quality:

- Do you rely on any alternative water sources besides the main pipeline? If so, what are they?
- How would you characterize the quality of the water supplied to our community? Are there any concerns about its safety or cleanliness?
- Have there been any efforts to improve or supplement the existing water sources in the community?

Financial Implications and Affordability:

- How does the cost of water impact your household budget?
- How much of your household budget is allocated to water expenditures?
- Are there households in the community struggling to afford clean water, especially considering the expenses associated with alternative water sources?
- Have there been any discussions or initiatives aimed at addressing the financial burden of water expenditures for residents?

Advocacy and Impact:

- Can you describe any instances where community advocacy or media intervention has led to positive changes or outcomes?
- How do you believe advocacy efforts can be strengthened to address systemic issues and hold officials accountable?
- What role do you see community organizations and individuals playing in advocating for improved public services and infrastructure?
- Have there been any efforts or initiatives to address these hygiene and sanitation issues in schools, and if so, what has been their effectiveness?

Infrastructure Challenges and Government Schemes:

- What are the specific challenges you've encountered without rainwater harvesting systems in your locality?
- Could you elaborate on the alleged corruption and negligence you've observed in the implementation of infrastructure projects by engineers?
- How do you think government schemes could be better utilized to address infrastructure challenges in your community?
- What steps do you believe are necessary to increase awareness among professionals like painters and plumbers regarding infrastructure development?
- Can you explain further the parallels you drew with a movie to illustrate your frustration with infrastructure issues?

Appendix 1.3 Implications of the Resettlement Policies in Perumbakkam

Following each catastrophe, people were relocated to these three locations annually. Under the pretense of offering post-disaster rehabilitation, people were shipped off from the banks of the Cooum River under the authority of ICRERP and CRRT as part of river restoration initiatives. But in reality, the rehabilitation turned out to be a ravaged existence that the people weren't expecting. Around 85–90% of the people living in settlements were evacuated without their consent or prior notice, according to Vanessa Peter, the founder of IRCDUC, an NGO organization active in Perumbakkam.

The neglect of people even before population resettlement has been highlighted by the harsh and inhumane resettlement, which has had a substantial adverse effect on their quality of life.

"We were shipped off in a garbage truck from our former area. There were 4 families in each truck. In addition to that, once we get into the trucks with our belongings, they will just demolish the buildings in front of our eyes, and all we can do is just watch"

(Mercy, RWA member, 2024)

A report by IRCDUC and HLRN in 2014, as mentioned in Section 1.1, has cut off the basic rights of resettled, which includes water. This has cultivated a sense of hopelessness and uncertainty in their lives fearing that they will end up homeless if they don't adapt to their new homes. According to assessment reports by IRCDUC, which conducted a safety and infrastructure audit in the Month of (March-May,2024), have identified that the design entirely lacks safety as the residents have to take a 600 m detour to the homes from the bus stand, where there are no lights and proper infrastructures within and around housing colony, which makes the residents prone to theft, and murder. A few residents also reported that the theft and murder were by people with a high influence on drug use.

"Do you think the government did not acknowledge that it was supposed to be a buffer space or a marshland? I think the government knew about this. Because when a private builder approaches the same year for putting up a house. They throw 100 hurdles at you. This is not there, that is not there. You are in CRZ and you are in this. So, for the government when it came to their own project, they just closed their eyes."

(Expert B, An Architect who worked in Perumbakkam, 2024

The relocation was triggered by the high cost of real estate projects in those neighborhoods. Depending on the development project that results in the eviction, the government's current resettlement and rehabilitation programs vary widely

Appendix 2: Coding Scheme

Variables	Sub-Variables (Codes)	No of sub-codes	Number of Citations
External Vulnerability (Exposure)	Affordability	3	42
	Environmental conditions	2	11
	Formal governance ties	5	64
	Household Conditions and Built Environment	8	133
	Informal governance ties	5	21
	Infrastructure Investments	2	16
	Knowledge transmissions	2	8
	Population dynamics	2	11
	Water budgeting practices	4	35
Well-being Measures	Material Well-being	4	41
	Relational Well-being	9	55
	Subjective Well-being	6	54
Internal Vulnerability (Coping)	Access to resource	2	11
	Action theory	2	28

Table 9: The main codes and the number of citations (Author 2024)

Appendix 3: Data Analysis

3.1 External vulnerabilities:

Out of nine external vulnerability variables, seven variables were found to significantly co-occur, yet two variables possess individual significance – Knowledge transmissions and Environmental conditions (Refer to Appendix 3), underscoring the importance of knowledge and awareness about their living conditions, which is entirely lacking in the community.

Box 22 : Selected citations on respondents' knowledge on the rainwater scheme in Perumbakkam

> *"I know the details. But there is no process here. The scheme is either active here"*
> *13:63 ¶ 106 in Respondent 04*
>
> *"No, we didn't do anything like that. You know, nobody has made an effort to do something about this, for us to follow it in our block"*
> *8:31 ¶ 108 in Respondent 06*
>
> *No, since it's impossible here to implement that on a household level. I think they haven't done that. You are new in this village*
> *8:30 ¶ 104 in Respondent 06*
>
> *"Yes, I am aware of it, but it isn't available here. The majority of them are also unaware of this. The pipe from the terrace is here, but it just flows outside. The water isn't being stored there"*
> *12:14 ¶ 44 in Respondent 11*

Box 23 : Selected citations on respondents' knowledge on the rainwater scheme in Perumbakkam

> *I would say the quality is moderate. You cannot say it's extremely bad. You also have no right to complain because this is the kind of quality you should expect in such environments. So, it's not good or poor; it's of normal quality.*
> *12:6 ¶ 22 in Respondent L*
>
> *Yes, it is. But in Chennai, everyone is using canned water*
> *12:9 ¶ 28 in Respondent L*

3.2 Well-being Measures

	Affordabilit... 45	Environmen... 11	Formal gov... 64	Household... 135	Informal go... 26	Infrasturctu... 20	Knowledge... 8	Population... 11	Water budg... 35
Material measures: Access to services :... 13	1	1		4		2			3
Material measures: Environment : Lack... 3	1		1		1				
Material measures: Physical Health : Hea... 20		1	1	15				1	
Material measures: Wealth and Assets :... 6	4				1				4

Table 10 : Co-occurrence table of the material well-being and external vulnerabilities based on ATLAS.ti (Author 2024)

	Affordabilit... 45	Environmen... 11	Formal gov... 64	Household... 135	Informal go... 26	Infrasturctu... 20	Knowledge... 8	Population... 11	Water budg... 35
Relational measures: Conflicts : Perceive... 13	1			9		3			
Relational measures: Conflicts: Challeng... 8	1			5		1			
Relational measures: Interpersonal skills:... 4	1			2					
Relational measures: Lack of social cohe... 0									
Relational measures: Networks of Oblig... 12	2		6		1			1	1
Relational measures: Networks of supp... 10	1	1	2	2	1				
Relational measures: Scope for collectiv... 11	1	2	3	3	2				
Relational measures: Scope for individu... 3				2					

Table 11 : Co-occurrence table of the relational well-being and external vulnerabilities based on ATLAS.ti (Author 2024)

	Affordabilit... 45	Environmen... 11	Formal gov... 64	Household... 135	Informal go... 26	Infrasturctu... 20	Knowledge... 8	Population... 11	Water budg... 35
Subjective measures: Aspirations : Perso... 5				2	1				1
Subjective measures: Cohesion measure... 22	1		10	1	6	1			
Subjective measures: Fear: Concerns on... 5			1	2					
Subjective measures: Levels of (dis) sati... 2	1								
Subjective measures: Levels of (dis)satis... 13	1		2	5					1
Subjective measures: Meaninglessness :... 9			1	6	1	1		1	
Subjective measures: Trust : Absence of... 5	1								

Table 12 : Co-occurrence table of the subjective well-being and external vulnerabilities based on ATLAS. (Author 2024)

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