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RESEARCH PAPER

Factors Affecting Coastal Community Resilience: Role of Community Preparedness and Social Capital

Niranjana Haridas,[*] Sangeetha K Prathap[**]

Abstract: Coastal fishing communities are highly vulnerable to recurring hazards associated with extreme weather events that can lead to severe environmental degradation, cause loss of livelihoods, and even threaten human lives. It is essential to develop coastal populations' capacity to respond to and recover from such shocks. Community resilience has emerged as an important factor that enhances disaster response and recovery. This study uses primary data to examine community resilience amongst 528 households across three coastal districts in Kerala. Moderate community resilience was observed across these coastal districts, with less pronounced inter-district variations. The results further show that community preparedness and social capital are the strongest predictors of community resilience, followed by income diversification, education, and experiential factors such as age. The study advances the resilience literature by demonstrating that resilience is multidimensional, interaction-driven, and place-specific. The findings underscore the need for integrated, context-sensitive disaster risk reduction strategies that strengthen social networks, enhance preparedness, promote livelihood diversification, and expand educational opportunities to build resilient coastal communities.

Keywords: Coastal Community, Community Resilience, Social Capital, Disaster Preparedness.

[*] Research Scholar, Department of Applied Economics, Cochin University of Science and Technology, South Kalamassery, Kochi, India - 682022 (CUSAT); niranjana.haridas@cusat.ac.in ✉

[**] Associate Professor, School of Management Studies, CUSAT; sangeethakprathaap@cusat.ac.in

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1. INTRODUCTION

Coastal areas face the threat of sea-level rise due to climate change (Roy *et al.* 2023). The rise in sea level has intensified catastrophic coastal hazards, including cyclones, storm surges, and coastal erosion, putting coastal populations across the world at great risk (Karim and Mimura 2008). This has made them more vulnerable to climate change than non-coastal populations (Roy *et al.* 2023). Climate change projections indicate tremendous impacts on marine life, endangering the lives and livelihoods of fishing communities in India. India's extensive coastal exposure and increasing climate variability have led to reduced fishing days, declining catch sizes, and income instability, all compounded by limited adaptive capacity (Das *et al.* 2020; Maiti *et al.* 2015; Senapati and Gupta 2017; Sudhakaran and Varsha 2025). The marine fishing community frequently encounters rising sea surface temperatures, changes in precipitation patterns, and extreme events such as storms, coastal flooding, cyclones, and the El Niño phenomenon (Vivekanandan 2010). These challenges threaten communities that depend directly on natural resources for their subsistence as well as those living near disaster-prone areas (Saha *et al.* 2024). Adaptive management of natural hazards thus assumes critical importance in coastal communities.

Studies conducted across the globe have identified practices that can help communities reduce their exposure to disaster impacts and support long-term disaster recovery. Community resilience is recognized as a key factor that enhances the capacity of communities to respond to and recover from the aftermath of a disaster (Chandra *et al.* 2011). According to Pfefferbaum *et al.* (2007: 349), community resilience is defined as "the ability of community members to take meaningful, deliberate, collective action to remedy the impact of a problem, including the ability to interpret the environment, intervene, and move on". Dessavre *et al.* (2016) suggest that disaster resilience can help mitigate disaster risk and vulnerability among households.

A community's resilience in the face of disasters is determined by factors such as social capital, mitigation capacity, community preparedness, and information and communication systems (Aldrich and Meyer 2015; Cutter *et al.* 2008; Pfefferbaum *et al.* 2015). However, the contribution of these factors to augmenting resilience capacity varies by community type as well as geographical location, cultural beliefs, and social norms (Rapaport *et al.* 2018; Wardekker *et al.* 2023). It follows that gaining insights into the various aspects of resilience capacity—including, but not limited to, the present state and weights and strengths of contributory factors—across different locales will be useful in formulating appropriate policies.

Fishing communities in the Indian state of Kerala are highly dependent on natural resources for their subsistence and are, therefore, particularly vulnerable to environmental and economic shocks. Fishing, their primary source of income, is subject to price volatility, and livelihood diversification is limited (Brugere *et al.* 2008). As a result, many fisher households suffer from financial instability, with incomes being irregular, seasonal, and highly uncertain. This reflects the broader reality that fishing communities often depend on a single, highly vulnerable occupation and have limited scope for alternative employment (Islam *et al.* 2014). Consequently, any disruption—whether due to environmental change, overfishing, policy restrictions, or market fluctuations—can have immediate and severe impacts on household income and food security, further increasing the economic insecurity of fisherfolk (Rahman *et al.* 2021).

Over the past decades, these communities have experienced multiple stressors, including climate-related hazards and livelihood uncertainties (Pavithran *et al.* 2015). The literature on disaster resilience—though largely based on secondary data—identifies social capital and community disaster preparedness as critical factors that can enhance a community's ability to respond to and recover from disasters (Kapucu *et al.* 2013; Pfefferbaum *et al.* 2017). While previous studies examined these factors in relation to community resilience, their combined role in shaping community resilience at the household level has received relatively limited empirical attention, particularly with respect to coastal fishing communities in Kerala. This study addresses this gap. It also provides evidence-based insights that can inform policymaking to reduce disaster-related risks and help devise long-term, post-disaster recovery strategies for fishing communities..

2. REVIEW OF THE LITERATURE

The literature on coastal populations' resilience to extreme weather events traces a few common strands. The entry point to this literature is the twin principles of resilience and adaption in response to the impacts of natural hazards. Resilience pertains to a system's ability to adjust to unexpected disruptions, acknowledging them, and adapting through flexible processes and practices in order to ensure its long-term stability (Adger *et al.* 2005; Cutter *et al.* 2008).

A few studies address the question of what actions communities should take in response to catastrophes and which measures efficiently reduce disaster risk. For example, Arbon *et al.* (2016) emphasize that enhancing community resilience is essential to lower susceptibility to disasters and improve recovery outcomes. Meerow *et al.* (2016) contend that resilience

assessment frameworks help identify the elements that contribute to a community's capacity to endure and recover from disasters.

Several frameworks have been developed to measure community resilience across different contexts. These include the Baseline Resilience Indicators for Communities (BRIC) framework and the Disaster Resilience of Place (DROP) model.[1] These frameworks mainly rely on secondary data sources and macro-level indicators, such as socio-economic characteristics, infrastructure, institutional capacity, and environmental conditions, to evaluate resilience at the regional or national level (Cutter *et al.* 2008; Cutter *et al.* 2014). Although these methods offer important insights into institutional and structural aspects of resilience, they typically capture resilience at an aggregate level and do not account for the social dynamics and community perceptions that affect resilience locally.

The Communities Advancing Resilience Toolkit (CART) framework, in contrast, offers a multifaceted, community-based method of assessing resilience. CART was developed by the Terrorism and Disaster Center of the National Child Traumatic Stress Network (United States) and was formally introduced in 2013 to assess and strengthen community resilience in disaster contexts. It enables the evaluation of perceived community resilience across multiple domains, such as connections and caring, community resources, transformative potential, disaster management, and information and communication (Pfefferbaum *et al.* 2013).[2] This

[1] The BRIC framework was developed by Susan L Cutter, Kevin D Ash, and Christopher T Emrich in 2010. It was further elaborated in 2014 to provide a standardized, empirically grounded measure of community disaster resilience across geographic regions. It was designed to address the lack of consistent metrics for assessing resilience and to enable comparison across places using a composite index of multiple domains, such as social, economic, institutional, infrastructural, community, and environmental capacities. The framework has since been widely applied and adapted across different geographical contexts, including Australia (Singh-Peterson *et al.* 2014) and Norway (Scherzer *et al.* 2019), and in multiple global settings, as highlighted in a systematic review by Camacho *et al.* (2023). The DROP model was developed by Susan L Cutter, Lindell Michael, and Christopher T Emrich in 2008 to provide a conceptual framework for understanding how disaster resilience emerges from the interaction of social vulnerability, the built environment, and natural systems. The model was designed to address the need for an integrated, place-based approach that links pre-existing conditions (inherent vulnerability and resilience) with disaster impacts and recovery processes. The DROP model has been applied across different contexts, including Thailand (Siebeneck *et al.* 2015) and Zimbabwe (Mavhura *et al.* 2021), and has also been discussed in theoretical syntheses (Jones 2021).

[2] "Connection and caring" refer to community belonging and mutual support; "resources" denote the availability of diverse assets; "transformative potential" reflects the capacity for learning and adaptive change; "disaster management" encompasses preparedness, response,

multidimensional structure captures the social and behavioural dimensions of resilience, which may not be reflected in macro-level assessments such as those based on BRIC or DROP.

Social capital has emerged as one of the main factors that influence community resilience. It refers to the networks, relationships, trust, and norms that facilitate cooperation and collective action within communities (Putnam 2000). Social capital is recognized as a form of capital, alongside natural, human, and physical capital, and contributes to the sustainability of economic systems (Dasgupta 2008; Dasgupta and Serageldin 1999). Strong social networks can help communities mobilize resources, exchange information, and co-ordinate a collective response during a catastrophe. Consequently, it enhances community competence and the group's ability to respond to disasters (Norris *et al.* 2008). Aldrich and Meyer (2015) posit that social infrastructure, such as civic involvement and community networks, often plays a more important role in disaster recovery than expensive physical infrastructure. Communities with stronger social ties tend to recover more quickly because neighbours, family members, and local organizations often serve as first responders during disaster events.

Researchers also highlight the importance of community preparedness in strengthening community resilience (Cutter *et al.* 2014; Tierney *et al.* 2002) and enabling communities to reduce their vulnerability and enhance their adaptive capacity (Pfefferbaum *et al.* 2015). Preparedness refers to the activities and measures undertaken by individuals and communities to anticipate and respond effectively to disasters. Communities are better prepared to respond to catastrophes and recover faster when they participate in preparedness activities such as risk awareness programmes, emergency planning, and disaster exercises (Hyvärinen and Vos 2015).

Despite the growing body of literature on this subject, significant gaps persist. First, much of the existing research has examined social capital (e.g., Behera 2023; Panicker and Joseph 2025; Sanyal and Routray 2016; Visave and Aldrich 2025) and community preparedness (e.g., Lin and Lee 2025; Oktari *et al.* 2025; Rajeswari *et al.* 2025) separately, rather than exploring how these two factors interact to influence community resilience. Second, limited empirical research on social capital and disaster resilience has been conducted in developing nations, where socio-economic conditions and disaster management systems are heterogeneous and differ considerably

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recovery, and mitigation; and "information and communication" refer to the availability and reliability of timely information (Pfefferbaum *et al.* 2013; Pfefferbaum *et al.* 2015).

from those in developed contexts such as the US, Japan, and Europe, where most of the existing research has been performed.

3. RESEARCH DESIGN

This study addresses both the gaps identified in Section 2. It examines the combined influence of social capital and community preparedness on community resilience among coastal communities in Kerala using the CART framework. By employing a validated survey-based instrument, the study captures community-level perceptions and social dynamics, thereby offering a more comprehensive understanding of the social factors that shape resilience in disaster-prone coastal communities in developing countries.

Community resilience has been evaluated employing methodologies such as the analytic hierarchy process (Orencio and Fujii 2013), TOPSIS[3] (Elkady *et al.* 2024), the Relative Importance Index (RII) (Ahmad *et al.* 2024), among others. The present study uses the RII with the CART framework, following Pfefferbaum *et al.* (2015).

The objective of this study is trifold: (1) to identify the key determinants of community resilience among coastal households in selected locations in Kerala, (2) to analyse the influence of social capital and community preparedness on community resilience, and (3) to capture variations in community resilience across districts with varying levels of vulnerability.

Most of the concepts used in this study have been introduced earlier. These include community resilience, social capital, and community preparedness.

This study draws on the community resilience framework proposed by Norris *et al.* (2008), which conceptualizes resilience as a set of adaptive capacities, including social capital, information and communication, community competence, and economic development. Amongst these, social capital plays a crucial role in enabling communities to mobilize resources, share information, and co-ordinate responses during crises. Social capital, as defined by Putnam (2000), encompasses the networks, trust, and norms that facilitate cooperation within communities. Szreter and Woolcock 2004 further conceptualized social capital through three dimensions of social capital : bonding, bridging, and linking social capital. Bonding social capital consists of close ties within homogeneous groups, such as families and neighbours; bridging social capital connects individuals across different social groups; and linking social capital connects communities with

[3] Technique for Order of Preference by Similarity to Ideal Solution.

institutions and authorities. These forms of social capital collectively enhance access to resources, co-ordination, and collective action, thereby strengthening community resilience (Aldrich 2012).

Community preparedness encompasses the proactive actions and planning strategies adopted by individuals and households to enhance their capacity to respond to and manage disaster impacts effectively. These include developing emergency plans, preparing emergency supplies, and participating in awareness programmes. The relationship between preparedness and resilience can be explained using Bandura's self-efficacy theory (1977), which emphasizes individuals' belief in their ability to manage challenging situations. Individuals with higher self-efficacy are more likely to engage in proactive preparedness behaviours, persist in difficult conditions, and cope effectively with disruptions. In disaster contexts, such preparedness actions enhance response capacity and reduce potential impacts, thereby contributing to resilience (Hyvärinen and Vos 2015).

Integrating these perspectives, this study posits that social capital and community preparedness jointly shape community resilience. Strong social networks facilitate information sharing, resource mobilization, and collective action, while preparedness behaviours enhance the ability of households and communities to respond effectively and recover from disasters. Together, these factors reinforce the adaptive capacity of coastal communities and contribute to improved resilience outcomes.

4. METHODOLOGY

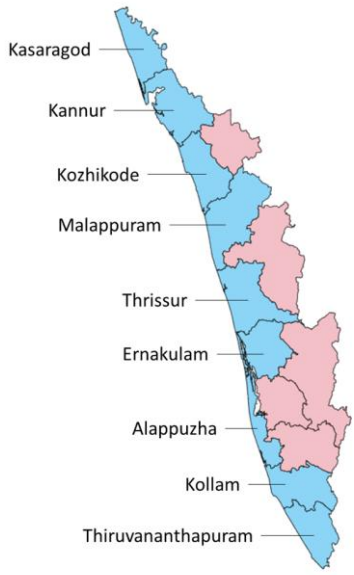
4.1. Sampling

Kerala's coastline is 590 km long (Sreelekshmi *et al.* 2021) and is divided into the southern zone (consisting of Thiruvananthapuram, Kollam, and Alappuzha, spanning approximately 197 km), the central zone (Ernakulam, Thrissur, and Malappuram, 170 km), and the northern zone (Kozhikode, Kannur, and Kasaragod, 223 km) (see Figure 1). To capture the variations in climate-related risk across Kerala's coastal districts, a stratified sampling framework was employed.

The sample districts were selected using the Composite Vulnerability Index (CVI) (DoECC 2022) (Appendix A). The CVI categorizes districts according to their relative exposure and sensitivity to climate-related hazards. Based on this classification, the coastal districts were grouped into three vulnerability categories: high, moderate, and low. One district was randomly selected from each vulnerability category using simple random sampling to ensure representation across different levels of climate-related

risk. Accordingly, Kozhikode (high vulnerability), Thiruvananthapuram (moderate vulnerability), and Ernakulam (low vulnerability) were selected for the study.

Figure 1: A Map of the Coastal Districts of Kerala



Source*:* Created by authors

In the second stage, five marine fishing villages in each district were selected randomly based on the official list of fishing villages from the *Marine Fisheries Census 2016* (DoF and CMFRI 2020). Further, 600 households were selected randomly from each of the sample villages across the three districts. In Thiruvananthapuram District, the selected villages included Bheemapally, Kovalam, Cheriyathura, Kuzhithura, and Kochuveli. Beypore, Marad, Kampuram, Thoppayil, and Vellayil were selected from Kozhikode District. Chellanam, Saudi, Ayyampally, Cheriyakadavu, and Fort Kochi were selected from Ernakulam District. A detailed account of the sample is provided in Appendix B.

The final survey covered 600 households (200 from each of the three districts). After screening the data and eliminating incomplete or inconsistent answers, the final sample consisted of 528 households along the coastline in the three districts. The surveys were conducted using structured schedules from June 2023 to November 2023.

4.2. Measurement Scales

The survey instrument was organized into three sections. The first section captured demographic and socio-economic characteristics, including age, household size, education, and income diversification. The second section assessed community resilience, covering infrastructure resilience, early-warning systems, response effectiveness, recovery processes, institutional co-ordination, and disaster impacts. The third section examined social capital, including trust, social networks, community participation, institutional linkages, and collective action. Together, these sections

provided a comprehensive basis for analysing the determinants of community resilience amongst fishing households.

Community resilience was measured using CART. A 24-item scale was adapted to capture five domains: connection and caring; resources; transformative potential; disaster management; and information and communication. Social capital was measured using the three dimensions of bonding, bridging, and linking social capital (Szreter and Woolcock 2004), with a nine-item scale mapped across these dimensions. Community preparedness was assessed using 10 items covering four indicators, material preparedness, special needs preparedness, awareness, and participation, adapted from Thomas *et al.* (2015). All the variables were measured using a 5-point Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree").

4.3. Data Analysis

The respondents' opinions about community resilience, social capital, and readiness across the chosen districts were initially analysed using mean score analysis. Composite scores were calculated by averaging responses across the indicators that constituted each construct.

RII was employed to analyse the respondents' perceptions of selected variables, and multiple regression analysis was conducted to understand the factors influencing community resilience among coastal households. RII is widely used in studies involving Likert-scale data to determine the relative importance of factors (Rooshdi *et al.* 2018). It has been used in disaster management contexts and in sustainability studies to evaluate the key determinants of various outcomes (Sodangi *et al.* 2014). The RII method converts Likert-scale responses into a standardized index ranging between 0 and 1, thereby enabling comparison across different variables.

RII was calculated using the following formula:

$$RII = \sum W/A*N \qquad (1)$$

where

W = the weight assigned to each factor by the respondent, ranging from 1 to 5;
A = the maximum possible weight (i.e., 5 in this study); and
N = the total number of respondents.

The RII values were interpreted using the classification used in previous studies, such as Ahmad *et al.* (2024). RII values range from 0 to 1: values closer to 1 indicate that households assign higher relative importance to a given factor in shaping community resilience, while values closer to 0

indicate lower importance. This index measured respondents' perceptions of the relative importance of social capital, community preparedness, and community resilience.

To examine the factors influencing community resilience, multiple linear regression analysis was employed. Community resilience was treated as the dependent variable, while age, household size, educational attainment, income diversity, community preparedness, and social capital were included as independent variables. Regression analysis was used to estimate the strength and direction of the relationships between the explanatory variables (age, education, income diversity, household size, social capital, and community preparedness) and community resilience.

5. RESULTS AND DISCUSSION

To investigate the determinants of community resilience among coastal households in Kerala, the study examines the demographic and socio-economic profile of the respondents, followed by an analysis of the major study variables and regression results. The analysis provides insights into the factors influencing community resilience.

5.1. Demographic Profile

Table 1 outlines the demographic and socio-economic profile of the respondents. It may be noted that the majority (72%) of the respondents were in the age category 31–60 years, and 50% of them belonged to families with six or more members. Further, most of the families (75%) had more than one source of income.

Table 1: Demographic Indicators of the Respondents

Indicator	Frequency	%
Age class (years)		
18–30	126	23.9
31–45	242	45.8
46–60	136	25.8
Over 60	24	4.5
Household size (no. of members)		
2	119	22.5
3–4	144	27.3
5–6	148	28.0
More than 6 (joint family)	117	22.2
Highest education level		
Below secondary	125	23.7
Above secondary	151	28.6

Graduate	147	27.8
Postgraduate and other	105	19.9
Family's income diversity		
No other income source	132	25.0
One additional income source (full-time)	131	24.8
One additional income source (part-time)	124	23.5
Two or more income sources	141	26.7

Source*:* Based on primary survey data compiled by the authors

Table 2 presents the distribution of the mean scores of the variables. As shown in the table, of the 528 respondents, 42.6% perceived community preparedness as a very important factor. The disaggregated percentages place Thiruvananthapuram at the top (48.3%), followed by Ernakulam (43.2%) and Kozhikode (36.4%). Further, 41.5% of the respondents reported high social capital, with only marginal variation across the three districts.

Kozhikode recorded the highest resilience (RII 0.645), followed by Thiruvananthapuram (0.630) and Ernakulam (0.604), indicating spatial variation in resilience levels. However, the RII analysis is descriptive in nature and does not establish causal relationships between variables. Therefore, regression analysis was performed to identify the factors contributing to community resilience.

Table 2: RII and the Distribution of Mean Scores (MS) of Selected Variables

District	**MS: 1–2 (%)[a]**	**MS: 2–3 (%)[a]**	**MS: 3–4 (%)[a]**	**MS: 4–5 (%)[a]**	**RII**
Community preparedness					
Kozhikode	23.9	21.6	18.2	36.4	0.569
Thiruvananthapuram	13.6	18.2	19.9	48.3	0.663
Ernakulam	21	19.9	15.9	43.2	0.608
Total	19.5	19.9	18	42.6	0.613
Social capital					
Kozhikode	19.9	19.3	18.2	42.6	0.602
Thiruvananthapuram	18.8	17.6	22.7	40.9	0.610
Ernakulam	27.3	9.7	22.2	40.9	0.592
Total	22	15.5	21	41.5	0.601
Community resilience					
Kozhikode	5.7	26.7	43.2	24.4	0.645
Thiruvananthapuram	13.6	21.6	35.2	29.5	0.630
Ernakulam	18.8	19.9	23.9	37.5	0.604
Total	12.7	22.7	34.1	30.5	0.626

[a] Percentage of total respondents (n = 528).

Source*:* Authors' analysis, computed from the primary data

5.2. Regression Analysis

Multiple linear regression analysis was performed to examine the influence of the selected independent variables on community resilience, the dependent variable in this study. Based on the theoretical model proposed by Norris *et al.* (2008), economic development (proxied by socio-economic indicators), social capital, and community preparedness were included as independent variables.

The functional form of the regression model is specified as follows:

$$CR = \beta_0 + \beta_1 AGE + \beta_2 EDU + \beta_3 ID + \beta_4 HHS + \beta_5 CP + \beta_6 SC + \varepsilon \quad (2)$$

where
CR = community resilience (the dependent variable);
β_0 = the intercept term;
$\beta_1 - \beta_6$ = regression coefficients of the respective independent variables; and
ε = the error term.

The independent variables incorporated into the model are as follows:

Age (AGE): It is the respondent's age expressed in years. It serves as a proxy for life experience, including prior exposure to disasters, which may influence resilience.

Educational attainment (EDU): This is the highest level of education attained by any member of the household. Education is expected to boost awareness, access to information, and adaptability.

Income diversity (ID): This is a measure of the household's income sources. Increased income diversification is expected to reduce vulnerability and enhance economic resilience.

Household size (HHS): This refers to the number of members in a household. It indicates the household's supply of human resources as well as its dependency burden.

Community preparedness (CP): It is the state of the household's preparedness for a disaster event, calculated as a composite index based on preparedness-related indicators such as awareness, planning, and participation.

Social capital (SC): The extent of social connectedness, trust, and networks in the community, measured in terms of bonding, bridging, and linking social capital indicators.

This model allows the determination of cause–and–effect relationships between both the explanatory variables and the dependent variable

(community resilience). The model explains 26% of the variance in community resilience. The F statistic (29.79) is significant at $p < .001$, confirming that the model predicts community resilience significantly. The variance inflation factor values are <2, indicating low multicollinearity. The Durbin–Watson statistic shows a value of 1.9, indicating that there is no autocorrelation among the variables.

Table 3 presents the results of the multiple regression analysis. All the variables are statistically significant ($p < .01$). Community preparedness and social capital have the highest coefficients ($B = 0.296$ and 0.265, respectively), indicating that they are the strongest predictors of community resilience. Income diversity ($B = 0.215$), age ($B = 0.181$), and education ($B = 0.168$) also play substantial roles, implying that experience and economic and knowledge resources enhance resilience. Household size ($B = 0.146$) shows a positive but relatively smaller effect. The findings reveal that community-based and demographic factors significantly influence resilience levels.

Table 3: Results of the Multiple Regression Analysis (Dependent Variable: Community Resilience)

Variable	***B***	Standard error	***T*** value	Significance level
(Constant)	–0.155	0.263	–0.587	.557
Age	0.181	0.055	3.314	<.01***
Highest education attained by the family member(s)	0.168	0.042	3.976	<.01***
Income diversity (no. of income sources)	0.215	0.039	5.463	<.01***
Household size	0.146	0.042	3.486	<.01***
Community preparedness	0.296	0.038	7.770	< .01***
Social capital	0.265	0.037	7.085	<.01***

*** Significant at the 1% level.

Source*:* Authors' analysis, computed from the primary data

6. DISCUSSION

The distribution of the mean scores and RII values indicates that although a significant percentage of the respondents reported higher levels of community preparedness and social capital, levels of community resilience are largely moderate across the three coastal districts. This implies that an increase in perceived levels of individual elements does not necessarily lead to greater resilience, which further supports the argument that resilience is a multidimensional construct modulated by the relationships amongst various capacities rather than by a single factor (Cutter *et al.* 2008; Norris *et al.* 2008). The differences in RII values among the districts further demonstrate the influence of the local socio-economic and environmental context on community resilience, which is also place-based, as observed in previous studies (Adger 2003).

A key finding of this study is the relatively higher resilience observed in Kozhikode despite the lower levels of community preparedness. This pattern can be explained by the high level of social capital, which appears to function as a compensatory mechanism. Social capital, understood as trust, social networks, and reciprocity norms, plays a crucial role in facilitating collective action, information sharing, and mutual support during disaster events (Aldrich and Meyer 2015). Empirical evidence suggests that communities with strong social ties are better equipped to respond to and recover from disasters, even if they lack robust formal preparedness systems (Aldrich 2012; Nakagawa and Shaw 2004). This is particularly relevant in the context of Kerala's fishing communities, where long-standing social cohesion and collective practices enable rapid mobilization of support during crises. Studies of disaster-affected communities have similarly demonstrated that bonding and bridging social capital enhance adaptive capacity and recovery outcomes significantly (Pelling and High 2005).

In contrast, Thiruvananthapuram exhibits higher levels of community preparedness alongside comparatively low social capital; yet it maintains relatively high resilience. This suggests that preparedness plays a critical role in strengthening immediate disaster-response capacity through improved awareness, planning, and risk reduction measures. Community-based preparedness initiatives, such as cyclone shelters, disaster management training programmes, local volunteer networks, and early-warning response systems, have been widely recognized as essential components of resilience-building and vulnerability reduction (Patel *et al.* 2017). However, the findings also indicate that preparedness alone cannot fully explain resilience outcomes, as resilience depends on the interaction of social, economic, and institutional dimensions, and the absence of strong social capital may limit

the long-term sustainability of resilience despite high levels of preparedness (Twigg 2009).

In Ernakulam, moderate levels of both preparedness and social capital correspond to lower resilience compared with other districts; this further underscores the multidimensional nature of resilience. The findings suggest that resilience outcomes are strongest when multiple capacities reinforce one another, whereas moderate or weak levels of key determinants result in comparatively lower adaptive capacity. This aligns with the systems-based understanding of resilience, which emphasizes that resilience emerges from the interaction of interdependent components rather than from isolated factors (Cutter *et al.* 2008).

Place-based and socio-institutional theories of resilience can help us better understand these district-level differences. Local socio-economic growth patterns, governance systems, and cultural settings all have an intrinsic impact on disaster resilience, as they influence the formation and use of various capacities (Cutter *et al.* 2008). Districts with comparatively higher institutional development and administrative capacity frequently display stronger formal preparedness mechanisms (Tierney 2014), since their infrastructure, early-warning systems, and disaster management programmes are typically better organized and efficient. This could account for the comparatively higher levels of readiness seen in Thiruvananthapuram, which benefits from its centrality to administration and governance. At the same time, variations in social capital can be linked to differences in social organization and livelihood structures. Coastal communities such as those in Kozhikode often feature strong kinship ties, shared occupational identities, and long-standing community networks, which enhance trust, reciprocity, and collective action.

In contrast, Ernakulam can be understood as a more urbanized and economically diversified context, where both social capital and preparedness exist but are less pronounced than in the other two districts. Urban and peri-urban regions often exhibit weaker bonding social capital due to the populations' greater heterogeneity, higher mobility, and reduced dependence on traditional community networks, while their reliance on formal institutions may not fully reach communities at the local level (Granovetter 1973). As a result, resilience in such contexts tends to be low, reflecting neither strong community-based cohesion nor exceptionally high institutional preparedness. Additionally, diversified livelihood structures may reduce dependence on collective coping mechanisms, thereby moderating the role of social capital (Allison and Ellis 2001). Thus, the district-level differences observed in this study reflect distinct configurations in resilience capacities, where resilience emerges from

different combinations of social, institutional, and economic factors operating within specific local contexts.

To further explore these relationships, multiple regression analysis was conducted to identify the determinants of community resilience. The results reveal that community preparedness and social capital are the strongest predictors of resilience, followed by income diversity and educational attainment. The strong influence of social capital is consistent with existing research findings that highlight its role in enhancing cooperation, trust, and collective action within communities (Aldrich and Meyer 2015). Similarly, the significant effect of community preparedness supports the argument that preparedness enhances resilience by improving readiness and reducing disaster impacts (Patel *et al.* 2017). Income diversity emerged as a key determinant, indicating that households with multiple income sources are better able to withstand shocks and recover from disasters—consistent with the livelihood diversification framework proposed by Ellis (2000).

Age is another significant factor influencing community resilience. Adults tend to exhibit higher levels of awareness, preparedness, and trust in institutions than younger groups. Additionally, older individuals' accumulated experience, skills, and knowledge contribute to higher disaster response and recovery capacities. Thus, the findings suggest that age positively influences community resilience. This is identical to the conclusions of Lin and Chen (2022), Ullah *et al.* (2025), and others.

Household size also plays an important role in shaping resilience among coastal households, as it determines the availability of labour, opportunities for income diversification, and internal support systems. This is in tune with the findings of Wu *et al.* (2026) that larger households can enhance resilience through shared resources and collective coping mechanisms.

Education was also found to have a significant positive influence on resilience, as higher levels of education can improve awareness, access to information, and the ability to adopt appropriate coping strategies. This finding is supported by Muttarak and Pothisiri (2013), who found that education improves risk perception and decision-making, enhancing disaster preparedness and response.

Overall, the findings show that community resilience is a multidimensional construct shaped by the interaction of social capital, preparedness, and socio-economic capacities. Due to the variations in reliance observed across districts, it is crucial to employ context-specific strategies for disaster risk reduction rather than relying solely on uniform policy interventions. Thus, building resilience among Kerala's coastal populations requires strengthening social networks, boosting community-based preparedness,

encouraging livelihood diversification, and broadening educational opportunities.

7. CONCLUSIONS AND LIMITATIONS

The present study identified the key determinants of community resilience among coastal households in Kerala, emphasizing that resilience is shaped through the dynamic interaction of social capital, economic resources, and institutional capacities. RII values were found to be moderate across the three coastal districts studied, and inter-district variations in community resilience, social capital, and community preparedness were not pronounced. The regression results show that community preparedness and social capital can predict resilience. Minor variations in RII at the district level indicate that resilience is context-specific and depends on local socio-economic structures and systems of governance.

Income diversity and educational level were identified as important determinants, highlighting the role of economic stability and knowledge in enhancing community resilience in coastal Kerala. Having multiple income sources can help a household withstand economic shocks, while education enhances preparedness and awareness. These results indicate that achieving community resilience necessitates localized and context-specific policy responses that aim to enhance social networks, preparedness programmes, livelihood diversification, and education.

Despite its contribution to the research literature, the study has some limitations. The cross-sectional nature of the data limits its ability to establish causality or capture changes in resilience over time. Future studies can be longitudinal, use mixed methods, cover a wider area, and include additional variables—such as the quality of governance and environmental indicators—to offer a more comprehensive view of community resilience.

At the policy level, disaster preparedness in India is guided by frameworks developed by the National Disaster Management Authority, with state-level implementation by state disaster management authorities. While these provide a structured top-down approach, the findings of this study highlight the importance of local factors, such as social capital and community preparedness. This suggests the need to better align existing policy frameworks with local contexts by incorporating grassroots-level inputs, thereby improving the effectiveness of disaster preparedness and resilience strategies.

Author Contribution: NH conceived the study, conducted the data analysis and drafted the manuscript. SKP supervised and revised the manuscript.

Ethics Statement: We hereby confirm that this study was conducted in accordance with all applicable ethical requirements and standards for research.

Consent to Participate: Informed consent was obtained from all respondents before the survey, ensuring their voluntary participation, with assurance of anonymity and confidentiality.

Consent for Publication: Consent for the publication of the research findings in a journal was obtained from all participants.

Data Availability Statement: The data have been anonymized and are not publicly available to ensure the privacy and confidentiality of the respondents.

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APPENDIX A

Table A1: CVI Classification of Districts in Kerala

Vulnerability class	Vulnerability drivers	Districts
High	1. High percentage of the inherently sensitive population (below six and over 60 years of age; people living with disabilities) 2. Fewer healthcare professionals 3. Fewer relief shelters available relative to the district's population 4. Fewer households with treated water supply 5. High incidence of communicable diseases 6. Poor irrigation coverage 7. High population burden on healthcare facilities 8. Poor spread and coverage of local meteorological monitoring stations 9. Limited groundwater availability 10. High percentage of the population living below the poverty line	Wayanad, Kozhikode, Kasaragod, Palakkad, Alappuzha, Idukki, Kannur, Malappuram, Kollam
Medium	1. Poor irrigation coverage 2. High percentage of the inherently sensitive population 3. Fewer relief shelters available relative to the district's population 4. High population density 5. Limited groundwater availability 6. Poor air quality 7. Poor surface water quality	Thiruvananthapuram, Kottayam
Low	1. Fewer relief shelters available relative to the district's population 2. High percentage of the inherently sensitive population 3. Poor irrigation coverage 4. Poor spread and coverage of local meteorological monitoring stations	Thrissur, Ernakulam, Pathanamthitta

Source*:* DoECC (2022)

APPENDIX B

Table B1: Sample Selection Design

District	Village	Total no. of households	Final sample size
Thiruvananthapuram	Bheemapally	939	75
	Kovalam	60	5
	Cheriyathura	412	35
	Kuzhithura	175	14
	Kochuveli	410	34
	Subtotal	1,996	163
Kozhikode	Beypore	662	62
	Marad	480	45
	Kampuram	252	23
	Thoppayil	295	28
	Vellayil	285	27
	Subtotal	1,974	199
Ernakulam	Chellanam	975	80
	Saudi	240	20
	Ayyampally	239	20
	Cheriyakadavu	324	27
	Fort Kochi	225	19
	Subtotal	2,003	166
Total		**5,973**	**528**

Source*:* Primary survey data, compiled by the authors