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Article

Improving Housing Quality of the Bajo Tribe through a Self-Help Approach: A Case Study in Muna Regency, Indonesia

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Abstract: This study explains the living conditions of the coastal Bajo tribe in Muna Regency, Indonesia, and examines their potential for improving housing quality through a community-led self-help approach. Adopting a convergent parallel mixed-methods design, fieldwork was conducted across three purposively selected vulnerable settlements: Tapitapi, Lagasa, and Pasikuta villages (N = 259). Quantitative housing evaluation against PUPR/BPS standards reveals severe structural and environmental deprivation. Inadequate daylighting emerges as the most pervasive deficit (80.31%), followed by substandard roofs (55.98%) and walls (54.44%). Tapitapi Village exhibits the most acute vulnerability, where 40.17% of homes violate the minimum spatial allowance (<7.2 m²/capita). Economically, while 28.95% of households face severe housing deprivation under a lower income bracket (≤ IDR 4,000,000), a dominant majority (56%) maintain a baseline daily saving capacity of IDR 40,000. Qualitatively, the study identifies that the operationalization of four maritime social capital pillars—Sikamaseang, Situlu', Sipalele, and Sipagina'a—effectively eliminates external labor costs and reduces market dependency. However, this organic mechanism is constrained by seasonal physical burnout, economic strains, and macro-technical limits like pile erosion. The study concludes that the self-help approach should not be viewed as an autonomous solution, but as a localized coping mechanism requiring macro-institutional reinforcement. To achieve sustainable scaling, this study recommends a formalized collaboration (Modified Quadruple Helix Model) combining the Bajo community and customary institutions, local government, academics, and NGOs to integrate regulatory flexibility, eco-engineering blueprints, and disaster-resilient housing policies.

Keywords: Bajo tribe, housing deprivation, quadruple helix model, self-help approach, social capital

1. Introduction

The rapid inflation of the global population, coupled with finite land capacity, has generated a critical bottleneck in the availability of decent living environments (Takyi et al., 2021; Ekawati et al., 2023). The proliferation of slum areas stands as a primary manifestation of this contemporary housing crisis—a systemic vulnerability frequently exacerbated by deep-seated economic and social disparities worldwide, particularly within developing and underdeveloped nations. This crisis is further compounded by the state's constrained capacity to supply affordable, adequate housing for marginalized populations (Sabah, 2025). As observed by Patel et al. (2020), while diverse strategic interventions have been engineered to mitigate global housing shortages, no singular monolithic policy has proven universally capable of eradicating slum conditions across varied contexts. Consequently, addressing this multifaceted crisis necessitates a plurality of policy frameworks that guarantee diversified housing typologies and robust provision systems tailored to the heterogeneous needs of low-income cohorts across urban, coastal, and rural landscapes.

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To address these systemic structural deficits within domestic slum settlements, the Government of Indonesia initiated the *"KOTAKU"* (*Kota Tanpa Kumuh*—City Without Slums) program in 2015. Co-funded and supported by the World Bank, the Asian Infrastructure Investment Bank, and the Asian Development Bank, KOTAKU operates on a collaborative governance framework uniting central, provincial, and municipal authorities with local communities and external stakeholders, positioning municipal governments and community units as the primary operational actors. According to the World Bank (2016), the foundational objective of this National Slum Upgrading Project is to significantly improve access to core infrastructure and urban services within designated marginalized zones through five highly integrated operational components.

The first component targets institutional and macro-policy development, strengthening institutional frameworks and building capacity across central agencies, namely the National Development Planning Agency (*BAPPENAS*) and the Ministry of Public Works and Public Housing (*PUPR*), which oversee the program. The second component delivers integrated planning support and localized capacity-building across 154 target cities and districts. This component finances technical experts and community facilitators to guide local governments and grassroots communities in formulating localized Slum Improvement Action Plans (SIAPs) and Community Settlement Plans (CSPs) through tailored workshops, training, and inter-regional knowledge-sharing networks. Infrastructure investment and the optimization of urban service delivery constitute the third component. The fourth component provides comprehensive technical assistance and project management consulting for Project Management Units (PMUs) and Project Implementation Units (PIUs) spanning national, provincial, and municipal tiers. Finally, the fifth component establishes a disaster response contingency mechanism designed to mitigate Indonesia's high vulnerability to severe natural catastrophes, dynamically financing rapid response initiatives in accordance with established emergency operation protocols.

Empirical data underlines the scale of this structural challenge. According to World Bank (2024) metrics, approximately 19.4% of Indonesia's urban populace resided in slum conditions in 2023, translating to roughly 23 million individuals across 30.35 million urban households. Similarly, complementary data from Statista (2024) reveals that 7.72% of the nation's total 70.63 million households live in subpar settlements, signifying that nearly 17.61% of urban households (representing 21.3 million to 120.92 million individuals dynamically affected across sub-indicators) remain trapped in substandard living conditions.

At the regional tier, Southeast Sulawesi Province exhibits a disproportionately high concentration of substandard housing relative to the national baseline. Data from the Central Bureau of Statistics of Southeast Sulawesi (*BPS Sulawesi Tenggara*, 2023) indicates that out of 606,508 regional households, 27.2% (approximately 165,000 households, or 714,000 individuals) reside in uninhabitable dwellings and degraded environments. This systemic deprivation is acutely mirrored in Muna Regency. Within the same fiscal year, out of 48,628 localized households, 35.22% (representing approximately 17,000 individuals) continue to live in severe slum conditions, a demographic segment that heavily encompasses the indigenous Bajo tribe settlements distributed across both urban-suburban coastal zones and remote rural marine environments.

2. Literature Review

2.1. Conceptual Dimensions and Typologies of Slum Settlements

According to the *New Oxford Dictionary of English,* a slum is defined as "a run-down and overcrowded street or district inhabited by destitute people" or "a house or building that is unfit for habitation" (Nuissl & Heinrichs, 2013). Synthesizing this definition, UN-Habitat (2023) characterizes a "slum settlement" as housing marked by substandard quality and highly unsanitary conditions. Such environments often serve as hubs for marginalized or illicit activities—including crime and substance abuse—distinctly bifurcated from conventional socioeconomic benefits. Consequently, slums are theoretically synonymous with impoverished communities (Berki et al., 2017) and are delineated by substandard housing infrastructure and pervasive deprivation. The concept comprehensively encompasses diverse settlement patterns situated within regions characterized by socio-spatial and economic isolation, tenuous land tenure, and severely compromised sanitation and environmental standards (BPS-Sulawesi Tenggara, 2023; Nuissl & Heinrichs, 2013; Dutta, 2024). Morphologically, these areas are categorized based on spatial distribution, including 'slums in the center,' 'scattered slum islands,' and 'slums on the outskirts' (UN-Habitat, 2023; World Bank, 2024).

Wherever marginalized populations cluster in significant densities within structurally deficient housing, the locale is functionally designated as a slum (Berki et al., 2017; Payne, 1984). Although traditionally conceptualized as an urban pathology, slum settlements manifest heterogeneously across

rural, urban, and suburban perimeters globally (Obare, 2020). Crucially, the structural quality of housing and the severity of deprivation vary across developing and high-income nations, particularly regarding access to core public infrastructure (UN-Habitat, 2007).

Far from being mere collateral outcomes of population explosions, demographic shifts, or the impersonal mechanics of globalization, slum settlements fundamentally reflect institutional failures in housing policies, statutory frameworks, procurement mechanisms, and macro-urban planning (UN-Habitat, 2020). The systemic manifestations of these structural failures include an increased proliferation of shanties, overcrowded dwellings, deficient water supply networks, inadequate sanitation, heightened pollution, substandard transit systems, energy poverty, and structurally dilapidated residential edifices (Samuel & Olaoluwa, 2018). Such substandard housing conditions pose a severe threat to public health across urban, rural, and coastal landscapes (Laing, 2023). Empirical evidence demonstrates that the socioeconomic attributes of residents exert a profound, deterministic influence on housing quality across geographical spaces (Davis, 2017; Samuel & Olaoluwa, 2018). In essence, slum settlements constitute a structural product of socioeconomic and cultural systems that actively impede the physical, psychological, moral, and social development of their inhabitants (Ibem, 2014), with household income remaining the primary baseline metric for housing quality (Samuel & Olaoluwa, 2018).

2.2. Operational Definitions, Indicators, and Marginalization of the Bajo Tribe

Mitigating the vulnerabilities of slum populations remains a paramount international development challenge in the twenty-first century (Tripathi & Arora, 2023; Kamruzzaman et al., 2016). Deciphering the intricate political, economic, legal, and socio-cultural dynamics governing these spaces is exceptionally complex due to the interconnected nature of slum deprivation. To optimize the targeting of structural intervention programs, international expert panels have established an "operational definition" of slum areas focusing heavily on the physical and legal challenges faced by dwellers (World Bank, 2019). Grounded in UN-Habitat's formulation, a "slum household" is defined as a cohabiting group of individuals lacking one or more of the following essential living conditions: (i) access to safe water, (ii) access to improved sanitation, (iii) sufficient living space, (iv) structural durability of housing, and (v) security of tenure. Scholars note, however, that this baseline definition frequently omits critical domestic elements—such as access to dedicated kitchens, clean cooking fuel, private bathing spaces, and reliable energy grids (Fox, 2014; Mwamba, 2020)—amenities that are fundamentally absent in marginalized indigenous contexts, such as the settlements of the Bajo tribe.

The Bajo tribe, historically designated as "sea gypsies" (Ellen, 1998), has navigated the maritime territories of Southeast Asia since the sixteenth century (Ellorin, 2015). Following their transition from a nomadic, boat-bound existence to sedentary life around 1905 (Syam et al., 2018), the Bajo began constructing wooden stilt-style dwellings (Madlan et al., 2014). Their contemporary settlements occupy coastal fringes, shallow marine waters, and sand islands, maintaining a direct spatial connection to the sea, which serves as their exclusive economic source through traditional fishing practices (Lahamendu et al., 2019).

Physically, Bajo settlements are structurally isolated from terrestrial communities, and this spatial segregation frequently operates as a barrier to macroeconomic integration (Samuel & Olaoluwa, 2018). Because these dwellings are often constructed from makeshift, rudimentary natural materials, native Bajo settlements are widely perceived by external observers as chaotic or squalid (Halim, 2024). Consequently, acute poverty has emerged as the most stark systemic differentiator separating the Bajo from non-Bajo populations (Madlan et al., 2014). Historically, their independent worldview and avoidance of artificial, terrestrial commodities rendered complex material goods unnecessary, as long as basic fishing and subsistence needs were met (Zacot, 2008). However, confined by this historically restricted mode of existence, the Bajo encounter severe survival challenges when forced into inland displacement; meanwhile, the rapid pressures of globalization and the advancing socioeconomic status of neighboring ethnic groups increasingly compound the Bajo tribe's structural marginalization in education and macroeconomic development (Ismail & Ahmad, 2015).

3. Materials and Methods

3.1. Mixed-Methods Structural Framing

The purpose of this research is to explain the living conditions of the Bajo tribe and to reveal their potential for improving housing quality through a self-help approach. This study adopts a convergent parallel mixed-methods design to examine the socio-spatial dimensions, housing deprivation, and policy accessibility of Uninhabitable Houses (RTLH). This design explicitly separates yet integrates quantitative and qualitative frameworks to maximize empirical validity. The fieldwork was executed

across three purposely selected coastal settlement sites characterized by a high concentration of housing vulnerability: Tapitapi village, Lagasa village, and Pasikuta village. By isolating the initial sample determination within a probability-based mathematical model and subsequently cross-stratifying the sample using qualitative socio-spatial filters, the research design effectively eliminates structural and epistemological contradictions while guaranteeing contextual depth.

3.2. Quantitative Sample Size Determination and Proportional Allocation

To establish a statistically rigorous baseline for the study, the minimum required sample size was calculated from a known, finite population. The total registered population of RTLH units across the three selected villages stands at (N = 447) units. To achieve a representative cross-section with high precision, the Yamane, (1967) formula was applied with a strict margin of error (e) of approximately 4% (0.04). The mathematical configuration is structured as follows:

$$n = \frac{N}{1 + N(e)^2} = \frac{447}{1 + 447(0.04)^2} = \frac{447}{1.7152} \approx 261$$

Based on Yamane's (1967) statistical formulation for a finite population (N = 447) at a 0.04 margin of error (e), an ideal baseline threshold of 261 respondents was mathematically established. To maintain geographical objectivity and mitigate spatial bias, this ideal target sample size was initially distributed among the three study sites using a proportional allocation method. This method weights the sample size of each village (n_i) against its specific sub-population of registered RTLH (N_i) relative to the cumulative population (N = 447). However, during actual fieldwork execution, strict contextual filtering and onsite access constraints yielded a final achieved sample of 259 respondents, representing a highly robust response rate of 99.23% relative to the ideal mathematical threshold. The distribution formula is operationalized as:

$$n_i = \left(\frac{N_1}{N}\right) \times n$$

This weight-based allocation (summarized in Table 1) ensures that villages with higher concentrations of housing deprivation receive a mathematically equitable level of representation.

Table 1. Proportional sampling frame, ideal target, and achieved baseline distribution

Village Name	Real RTLH Population (N_i)	Percentage of Pop. (%)	Ideal Yamane Calculation	Ideal Target (n_i)	Actual Achieved Sample (Fieldwork)	Response Rate (%)
Tapitapi	202 units	45.19%	(202/447) x 261	118	117	99.15%
Lagasa	165 units	36.91%	(165/447) x 261	96	96	100%
Pasikuta	80 units	17.90%	(80/447) x 261	47	46	97.87%
Total	447 units	100.00%	Target formula (n)	261	259	99.23%

As illustrated in Table 1, applying Yamane's (1967) formula mathematically established an ideal baseline target of 261 sample units to represent the heterogeneous socio-spatial strata across the three villages. Through proportional allocation, this ideal target was distributed into 118 units for Tapitapi, 96 units for Lagasa, and 47 units for Pasikuta. During the rigorous fieldwork execution, a final total of 259 sample units successfully completed the survey, yielding a highly robust overall response rate of 99.23%. The minor shortfall of two respondents (one in Tapitapi and one in Pasikuta) was strictly due to onsite field access constraints within the marginalized over-water stilt clusters and did not compromise the statistical depth of the collected data.

3.3. Socio-Spatial Stratification and Purposive Inclusion Framework

To ensure that the quantitative sample addresses the inherent heterogeneity of the study area, the selection of the 259 achieved housing units (from the ideal formulaic target of 261) was executed through a stratified purposive framework. Rather than relying on simple unstratified random mechanisms that might obscure localized vulnerabilities, respondents were systematically filtered based on precise socio-spatial criteria. This rigorous approach guarantees the capture of multi-dimensional housing realities

across the heterogeneous population. The dual parameters controlling the inclusion of informants and their corresponding structures are defined below:

(i) Spatial Morphology and Material Exposure (S-Criteria): Informants were systematically distributed across distinct settlement zones to deliberately contrast households located in the stable interior/land-based centers with those situated in highly vulnerable, climate-exposed peripheral or over-water stilt clusters. This spatial stratification captures varying degrees and manifestations of physical deprivation—specifically structural roofing, wall integrity, and foundation decay—as standardized by the Indonesian Ministry of Public Works and Public Housing (PUPR) criteria.

(ii) Socio-Institutional and Tenurial Stratification (L-Criteria): Households were cross-stratified to reflect socio-economic vulnerability (e.g., traditional sea-based artisanal fishers vs. land-based informal laborers) and institutional/legal land tenure profiles. This parameter specifically captures the operational divergence between mainland residents possessing formal land certificates and the marginalized Sama-Bajo communities residing over marine spaces, who face systematic legal exclusion and tenure insecurity due to a lack of recognized land-ownership documentation.

Table 2. Socio-spatial stratification matrix and theoretical saturation points

Village site	Sample size (*n*)	Spatial parameters monitored	Socio-tenure parameters monitore	Point of constant redundancy
Tapitapi	117	Land center vs. exposed stilt-water zone	Artisanal fishers; landless/uncertified tenure	Approx. 90th interview
Lagasa	96	Core village vs. isolated mangrove peripheral	Mixed informal laborers; customary rights	Approx. 75th interview
Pasikuta	46	Transition zone vs. fringe coastal border	Agricultural/coastal gatherers; non-tenure	Approx. 35th interview

Data was collected through field observations, structured questionnaires, and in-depth interviews. Observations aimed to gather data regarding the physical condition of the dwellings and existing social phenomena. Subsequently, questionnaires were employed to assess the community's perceptions of their housing quality, income levels, expectations, and personal ownership. In-depth interviews were conducted to gain insights into the history, traditions, and socio-cultural values of the Bajo tribe, as well as to enhance understanding of the research subject. Respondents for these interviews were selected based on specific criteria: (i) they were community or traditional leaders of the Bajo tribe; and (ii) they were over 60 years old. To further enrich the data, information was also collected from village heads in the research areas and administrators of formal local community organizations, including the Community Empowerment Institution [*LPM*] and the Village Consultative Institution [*BPD*]. This additional information focused on regional government interventions in the settlements, particularly those related to housing improvement programs, access to basic infrastructure assistance, and the effectiveness of these interventions.

Data collection and transcript analysis were conducted in iterative waves rather than as a single, simultaneous event. This allowed for constant comparative coding (open, axial, and selective coding). As illustrated in Table 2, theoretical saturation—defined as the point of conceptual and informational redundancy where further data collection yields no new codes, categories, or thematic dimensions—was actively monitored. In Tapitapi village, thematic paths regarding institutional barriers stabilized around the 90th interview; in Lagasa village and Pasikuta village, saturation was observed after the 75th and 35th interviews, respectively. The remaining interviews within the 259-sample frame were fully executed to empirically verify and confirm that the structural categories built around housing adaptation and structural exclusion were thoroughly robust, saturated, and validated.

3.4. Inclusion Criteria and Sampling Execution

To operationalize the socio-spatial framework within the established sample size, a rigorous purposive inclusion mechanism was deployed. Rather than assuming broad homogeneity, this approach ensures that the selected households precisely match the operational definitions of vulnerability required for this study (Andrade, 2021; Patton, 2015). To be included in the final achieved sample of 259 respondents, heads of households had to strictly satisfy the following predetermined inclusion criteria:

(i) Ethnic Identity: The respondent must be an original member of the indigenous Bajo (Sama-Bajo) tribe, ensuring the collection of culture-specific insights into marine-oriented residential adaptations.

(ii) Residency Status: The respondent must be a native or long-term resident of the designated research area, possessing deep experiential knowledge of local environmental and spatial transitions.

(iii) Housing Vulnerability: The respondent must be the designated head of a household currently residing in an uninhabitable house (RTLH). This condition was verified onsite based on physical and

socio-economic indicators standardized by the Regulation of the Indonesian Ministry of Public Works and Public Housing (PUPR, 2018) and the Regulation of the Ministry of Social Affairs (Permensos, 2017), as detailed in Table 3.

Table 3. Indicators and assessment criteria for substandard housing physical conditions based on Permen PUPR and Permensos.

Indicators	Criteria
Building durability	Roofing materials Wall materials Floor materials
Adequate living space	Minimum 7.2 square meters per capita
Building safety	Substructure Middle structure Upper structure
Health	Daylighting Ventilation

While the indicators outlined in Table 3 serve as the standardized regulatory baseline for the quantitative phase of this study, their rigid terrestrial parameters inherently overlook the vernacular architectural adaptations of maritime communities. To reconcile this, the operationalization of these state-centric metrics is analyzed through a critical socio-spatial lens, which is further contextualized in Table 4 below:

Table 4. Contextualized operational framework of substandard housing indicators for the Bajo stilt settlements.

Evaluation Components (the 6 variables)	Standard Terrestrial Criteria (PUPR / BPS)	Contextualized Bajo Operational Definition (marine & spatial vulnerabilities)
Piles/foundation	Concrete columns, brick masonry foundation, absence of structural cracks	Marine Stilt Durability: Substructure wooden poles embedded in seabed mud/coral. Classified as substandard if poles utilize untreated mangrove or local timber suffering from severe cross-sectional erosion caused by marine borers or high salinity, resulting in critical structural tilting.
Enclosure/walls and floor	Brick masonry walls and cement or tiled floors. Classified as non-permanent if using wood/thatch	Structural Envelope Permeability: Raised floors made of split bamboo (*salassa*) or loose timber planks; walls made of thatched nipa leaves. Classified as substandard if gaps between materials are wide enough to allow direct moisture or saline sea spray intrusion and fail to withstand high-velocity coastal winds.
Roof framework & cover	Clay tiles, asbestos, or corrugated zinc sheets over a stable structural framework without sagging	Corrosive Marine Exposure: Roof covers made of thin metal sheets (*seng*). Classified as substandard if sheets suffer from extreme salt-spray corrosion or if the underlying timber truss is weakened by high ambient humidity, making the roof highly susceptible to lifting forces during monsoons or tropical storms.
Daylighting	Clear window-to-floor area ratio of at least 10%	Floating High-Density Blocking: Due to the extremely close proximity between houses in overwater settlements, natural light paths are frequently obstructed. Classified as substandard if rooms must rely exclusively on specular light reflecting off the moving water surface underneath due to a severe lack of standard wall openings.
Natural ventilation	Open ventilation holes accounting for at least 5% of the total floor area	Wind-Driven Air Exchange: Classified as substandard if the floor plan lacks cross-ventilation mechanisms capable of cycling out the heavy ambient humidity and strong marine odors rising continuously from the underlying intertidal zone.
Minimum spatial allowance	A minimum interior living space of 7.2 square meters per person	Overwater Overcrowding: Classified as substandard if the indoor floor area per capita is less than 7.2 m². This threshold is frequently violated because expanding a house outward onto the open sea requires high capital for new structural piles, forcing multiple generations to squeeze onto a single platform deck.

Source: Field survey and contextual analysis adapted from The Ministry of PUPR and BPS guidelines.

To bridge national baseline standards with the localized environmental and spatial vulnerabilities of the study area, the assessment of housing quality operationalizes the guidelines stipulated by Ministry PUPR and BPS. The assessment evaluates six parameters: foundation/piles, walls and floors, roof framework and cover, daylighting, ventilation, and a minimum spatial density standard of 7.2 square meters per person. these metrics are contextually calibrated for a marine-stilted ecosystem. Rather than classifying organic materials (such as wood or bamboo) as inherently 'substandard'—as generic land-based metrics often do—this study measures structural degradation relative to coastal hazards. For example, piles conditions are evaluated based on structural tilting and marine borer erosion rather than masonry cracking, while wall materials dan floor materials are assessed on their capacity to block saline wind and moisture intrusion. Similarly, daylighting dan ventilation are analyzed through the spatial

configurations of high-density overwater settlements, where structural proximity often impairs natural ventilation and light penetration.

3.5. Inferential Statistical Analysis

The analysis technique employed a qualitative approach to explore the socio-cultural values that represent the local wisdom of the Bajo community, while household economic characteristics were analyzed quantitatively. Citing Creswell et al. (2022), this study emphasizes the intersection of quantitative and qualitative findings within an eclectic methodological framework. This combined approach aims to facilitate the drawing of conclusions.

Beyond basic descriptive statistics, this study utilizes inferential statistics within its quantitative framework to examine the systematic relationships between household demographics and specific dimensions of housing vulnerability across the 259 sampled units. Specifically, Pearson's Chi-Square (x^2) Test of Independence was conducted. This non-parametric test is mathematically appropriate as both the demographic independent variables (e.g., livelihood type: traditional fisher vs. land laborer; land tenure: certified mainland vs. uncertified marine space) and the dependent variables of housing vulnerability (categorized as: compliant vs. non-compliant based on PUPR criteria) are measured on nominal and ordinal scales.

The null hypothesis (H_0) posits that household demographic characteristics are independent of housing vulnerability types, while the alternative hypothesis (H_1)) states a significant association exists. The test statistic is calculated using the following formula:

$$x^2 = \sum \frac{(O - E)^2}{E}$$

where O represents the observed frequencies in each socio-spatial contingency cell, and E represents the expected frequencies. The statistical significance threshold was strictly maintained at $\alpha = 0.05$. All inferential calculations were executed using IBM SPSS Statistics software, providing a rigorous empirical foundation that precedes the qualitative thematic triangulation.

4. Theoretical Framework

4.1. Self-Help Housing Theory and State-Led Realities

Self-help housing for low-income populations is conceptually defined as a mechanism wherein economically marginalized individuals or families mobilize individual or collective labor voluntarily, typically without pecuniary compensation, to construct, expand, or upgrade their residential units (Ward, 2015). Within this paradigm, project participants may receive external interventions in the form of financial subsidies, technical oversight, building materials, specialized equipment, or community organizational frameworks. Such structural assistance is typically dispensed by non-governmental organizations (NGOs), state apparatuses, or through collaborative public-private partnerships (Arrigone, 1994).

Despite the historically low yield of successful state-administered housing models, numerous governments in developing countries have acknowledged the urgent imperative to accelerate housing production to keep pace with rapid demographic expansion and to regulate informal urban growth. Consequently, as a pragmatic compromise, states across the Global South are reorienting their structural approaches toward low-income housing delivery (Bredenoord et al., 2014). In this context, the doctrine of self-help has attracted significant empirical and policy attention as a viable, resource-efficient trajectory for addressing the shelter deficits of marginalized cohorts (Ntema, 2011).

International literature demonstrates that self-help housing operated as conventional institutional wisdom long before its formal conceptualization in the late 1960s and well before Turner formalized his landmark theoretical tenets (Ward, 2019). For instance, Harris (1998) and Harris and Giles (2003) document empirical precedents from Puerto Rico and India during the late 1930s and 1940s, illustrating that state-supported self-help initiatives were active prior to World War II. Nevertheless, it is widely accepted that the accelerating institutionalization of self-help policies across developing economies since the 1960s was profoundly catalyzed by Turner's seminal discourse.

Typologically, contemporary literature classifies self-help housing into three distinct operational paradigms, each varying by the degree of financial and labor capital contributed by individual or collective stakeholders (Ntema, 2017). The first paradigm, *pure self-help*—frequently designated as *laissez-faire* self-help—is characterized by an organic construction process entirely devoid of state intervention. This modality typically manifests either within high-income autonomous developments or

within deeply informal settlements where state apparatuses provide no infrastructural or legal remedies (Duncan & Rowe, 1993; Hardi & Ward, 1984; Harris, 1991).

The second paradigm is *aided self-help*, an institutional model wherein site-and-services schemes play a core operational role. Under this framework, the state assumes the primary fiscal and administrative responsibility for deploying macro-level public services, whereas individual households bear the micro-level burden of constructing their respective residential units. Hence, while preserving individual or collective autonomy over home design, the state functions as an enabler by provisioning affordable land, securing formal tenure rights, and installing vital municipal infrastructure such as clean water networks, sewage systems, and electrical grids (Ntema, 2011; 2017).

Scholarship highlights two primary systemic advantages inherent to aided self-help and site-and-services interventions. First, these schemes optimize public expenditure by widely distributing constrained state funds into large-scale infrastructural investments that yield high macroeconomic efficiency, while granting beneficiaries the agency to execute localized construction tasks autonomously (O'Connor, 1983). This operational flexibility renders site-and-services models highly attractive to municipal governments, civil society actors, international financial institutions like the World Bank, and the targeted beneficiaries. Crucially, within countries burdened by historical backlogs in public housing delivery, this framework relieves the state from heavy, fiscally unsustainable obligations to fully fund public housing. Consequently, Turner's theoretical defense of assisted self-help has secured extensive endorsement from global spatial practitioners and governments in developing nations, achieving profound fiscal contractions in state funds allocated for demographic infrastructure.

The third paradigm is *institutionalized self-help*, wherein residential construction is structurally mediated through formal organizations. This model typically involves the mobilization of localized self-help units formally incorporated as housing cooperatives (O'Connor, 1983; Keivani & Werna, 2001). These cooperatives operate as resource-constrained legal entities pursuing the shared objective of mitigating housing deficits through collective mutual assistance (Rathod et al., 2026). Housing cooperatives are distinguished by voluntary membership, democratic governance frameworks, and equitable capital contributions among members (Khurana, 2001). Furthermore, to optimize supply-side cost-efficiencies—particularly regarding procurement—cooperative members collectively harness localized skills to produce indigenous building materials. This mechanism structurally incentivizes low-income households to anchor sustainable socio-developmental hubs directly within their immediate communities (Ntema, 2017).

4.2. Institutionalization of Self-Help Housing in the Indonesian Context

Within the domestic framework of Indonesia, these international paradigms of aided and institutionalized self-help housing are formalised under Law No. 1 of 2011 concerning Housing and Settlement Areas. The state explicitly codifies self-help housing (*rumah swadaya*) as dwellings constructed entirely upon the initiative, capacity, and independent resources of the community. To operationalize this doctrine at scale, the state relies heavily on targeted social assistance instruments—primarily the Self-Help Housing Stimulus Assistance (*Bantuan Stimulan Perumahan Swadaya*—BSPS) administered by the Ministry of Public Works and Public Housing (*PUPR*), alongside the Social Rehabilitation of Uninhabitable Houses (*Rehabilitasi Sosial Rumah Tidak Layak Huni*—RS-RTLH) under the purview of the Ministry of Social Affairs (*Kemensos*). Under these state-led interventions, organic community actions are subsidized via building materials and technical oversight. However, these programs remain systematically monitored using standardized, terrestrial-centric parameters designed to evaluate structural safety, spatial alignment, and sanitation compliance.

4.3. The Epistemological Conflict: Standard Housing Metrics vs. Maritime Realities

However, the translation of international aided self-help principles into rigid, state-administered frameworks triggers a fundamental epistemological conflict when deployed across indigenous maritime architectures. The official evaluative metrics issued by the Ministry of PUPR and the Central Bureau of Statistics (*BPS*) rely on distinctively terrestrial, permanent-structural assumptions—such as concrete foundations, solid masonry walls, and formalized land deeds. Applying these metrics uniformly to the Sama-Bajo communities in the sampled villages systematically discounts the functional logic of their unique maritime lifestyle.

For the Bajo, wooden stilt structures erected over marine spaces using traditional timber are not indicative of mere macroeconomic deprivation; rather, they represent an ancestral socio-spatial and bioclimatic adaptation to tidal dynamics, maritime resource proximity, and marine microclimates. Structural features or material openings that state-level surveys classify as "substandard flooring or

walls" often serve critical ecological functions, such as maximizing wind-driven interior cooling and facilitating immediate, organic waste clearance through natural tidal flushing.

Consequently, this study embeds standard government indicators within its diagnostic framework not to pathologize the Bajo's vernacular living spaces, but to critique the institutional blindness embedded within contemporary public policy. By demonstrating how over-water housing structures structurally fail to satisfy rigid terrestrial criteria, this integrated framework highlights how standardized macro-policies transform cultural adaptations into bureaucratic disqualifications, thereby barring marginalized maritime groups from accessing vital state housing welfare.

4.4. Application of the Assisted Self-Help Framework to the Bajo Community

In light of these theoretical and contextual tensions, this study deploys an assisted self-help framework as a strategic mechanism to enhance housing quality within the Bajo community. This approach is conceptually superior for three primary reasons:

1. **Fiscal Constraints:** Public resources allocated for domestic housing are profoundly constrained, causing the aggregate low-income housing backlog to expand exponentially relative to state development funding.
2. **Asset-Based Development:** Communities inhabiting structurally inadequate settlements must be re-conceptualized as primary engines of organic housing growth rather than passive social pathologies.
3. **Socio-Cultural Alignment:** Monolithic, turnkey housing units provisioned by state agencies routinely fail to align with or accommodate the highly diversified cultural, social, and economic priorities of targeted indigenous groups.

Implicitly, these arguments necessitate that housing authorities fundamentally reorient their institutional roles—shifting away from direct turn-key provision toward functioning as structural enablers of the collective self-help housing process.

5. Results and Discussion

5.1. Demographic Profile of Respondents

A total of 259 respondents participated in this study, aged 25 to 60 years and representing a variety of educational backgrounds and income levels. Next, the characteristics of the respondents can be seen in Table 5 below.

Table 5. Demographic characteristics of respondents (N = 259)

Characteristic	Category	Frequency (n)	Percentage (%)
Age (Years)	25–30	10	4%
	31–35	21	8%
	36–40	34	13%
	41–45	52	20%
	46–50	67	26%
	51–55	52	20%
	56–60	23	9%
Total Age		259	100%
Educational Level	Elementary School	160	62%
	Junior High School	47	18%
	Senior High School	21	8%
	Others	31	12%
Total Education		**259**	**100%**

As illustrated in Table 5, the demographic profile of the respondents indicates that the largest age group falls within the 46–50 years bracket, accounting for 67 individuals (26%). This is closely followed by the 41–45 and 51–55 age categories, each representing 20% (n = 52) of the total sample. Conversely, the youngest cohort (25–30 years) constitutes the smallest proportion of the sample at only 4% (n = 10).

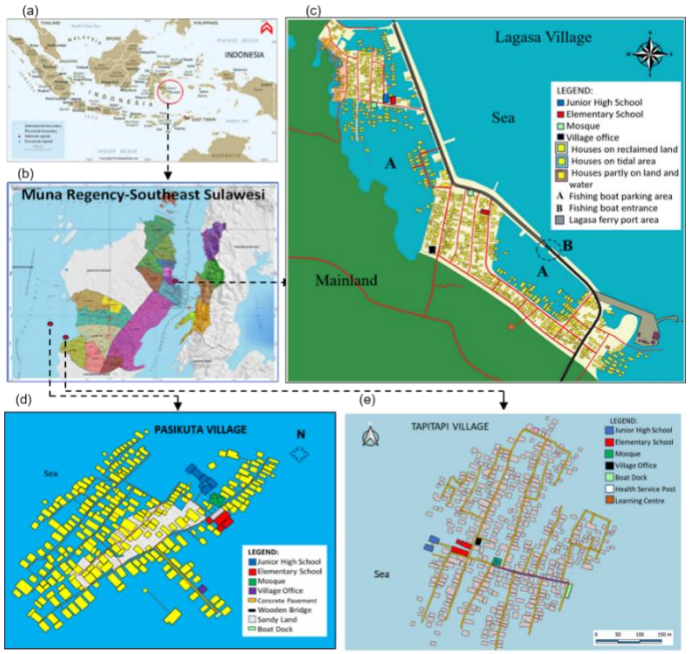
In terms of educational background, the vast majority of the respondents completed Elementary School as their highest level of education, representing 160 individuals (62%). In contrast, those with a Senior High School qualification comprise the smallest segment of the study population, totaling just 21 respondents (8%).

5.2. Overview of the Bajo Tribe Settlements in Muna Regency

In this study, we use the terms "Bajo" and "Sama-Bajo" to refer collectively to a group of maritime communities residing in various coastal and shallow sea areas of Muna Island. In much of the international literature, these communities are often referred to as "Bajau," "Sama-Bajau," "sea gypsies," or "Bajau Laut," among other names that may reflect the regions where they live.

Geographically, the Bajo settlements in Muna Regency can be categorized into three types: (1) coastal settlements in suburban areas, (2) coastal settlements in rural areas, and (3) settlements situated in the middle of the sea, occupying shallow waters and sand islands. Within the suburban coastal areas, these settlements are further divided into two zones based on physical environmental conditions: (i) the water zone, which represents the original settlement locations that have been preserved as residences in the tidal area, and (ii) the reclamation area, which consists of locations transformed into land due to local government interventions, namely the slum settlement environmental quality improvement project initiated in 2008 (Halim et al., 2023).

Differences in the geography of the locations of settlements significantly impact access to basic facilities. Bajo tribe settlements in suburban coastal areas or closer to urban centers typically enjoy better infrastructure and amenities compared to those in rural coastal regions. Field investigations indicate that the legality of residential space is a crucial factor in this disparity. Settlements in suburban areas often possess legal land ownership certificates, granting them access to essential infrastructure such as clean water services, electricity, local street lighting, waste management systems, and improved sanitation facilities. In contrast, settlements farther from urban areas, particularly those in marine spaces, frequently lack adequate infrastructure and basic amenities. For instance, residents depend on rainwater collected individually for bathing and washing, while they purchase water for cooking and drinking from communities on land. Electricity remains a significant issue; although some households have begun using solar panels with local government assistance, the number of these installations represents only a small fraction of the total. The map of the research areas is presented in Figure 1.



Source: (a) https://petacitra.blogspot.com/2012/08/download-peta-indonesia-terbaru-gratis.html
(b) https://petatematikindo.wordpress.com/2013/07/14/administrasi-kabupaten-muna/
(c, d, e) Adapted from a drone view.

Figure 1. Map of the study areas.

The lack of basic infrastructure support, absence of public facilities, bad spatial planning, and deteriorating building quality have become defining characteristics of nearly all Bajo settlements in Muna Regency, at least since this research was conducted. Various conditions of houses at the research locations can be seen in Figure 2.



Figure 2. Various conditions of houses and footbridge in the study areas

The lack of proper planning often exacerbates the situation in Bajo settlements, where houses develop organically. The proximity of these buildings makes the area appear crowded and stacked. As a result, the houses hinder each other's access to natural light and ventilation, leading to dark interiors even during sunny days. Moreover, Bajo tribe houses are typically constructed from makeshift natural materials, including wood, bamboo floors, wooden walls, woven bamboo wall, nipa wall, and thatch roofs, which do not meet necessary building resilience standards. The identification results of substandard housing components at the research location can be seen in Table 6.

Table 6. Aggregated distribution of substandard housing indicators across surveyed villages

Housing Evaluation Components (PUPR/BPS Standards)	Village 1: Tapitapi (n = 117)	Village 2: Lagasa (n = 96)	Village 3: Pasikuta (n = 46)	Total Sample (N = 259)
Substandard Substructure (stilts)	48 (41.03%)	18 (18.75%)	17 (36.96%)	Total 83 (32.05%)
Substandard Midstructure (building body)	55 (47.01%)	29 (30.21%)	15 (32.61%)	Total 99 (38.22%)
Substandard Walls	79 (67.52%)	34 (35.42%)	28 (60.87%)	Total 141 (54.44%)
Substandard Floors	77 (65.81%)	26 (27.08%)	17 (36.96%)	Total 120 (46.33%)
Substandard Roof Structure	81 (62.23%)	38 (39.58%)	26 (56.52%)	Total 145 (55.98%)
Substandar Roof	81 (69.23%)	38 (39.58%)	26 (56.52%)	Total 145 (55.98%)
Inadequate Daylighting	103 (88.03%)	72 (57.00%)	33 (71.74%)	Total 208 (80.31%)
Inadequate Natural Ventilation	40 (31.19%)	11 (11.46%)	6 (13.04%)	Total 57 (22.01%)
Overcrowded Spatial Allowance (<7.2 m²)	47 (40.17%)	9 (9.38%)	14 (30.43%)	Total 70 (27.03%)

Table 6 presents the aggregated distribution of substandard housing indicators across the three surveyed villages based on PUPR and BPS evaluation standards ($N = 259$). The empirical data reveals widespread structural and environmental deficiencies within the studied settlements. Cumulatively, inadequate daylighting emerges as the most pervasive vulnerability, affecting 80.31% ($n = 208$) of the total sampled housing units. This critical environmental deficit is followed closely by substandard roof

structures and roof materials, both recorded at 55.98% ($n = 145$), and substandard wall conditions at 54.44% ($n = 141$). Conversely, inadequate natural ventilation represents the least prevalent issue globally, though it still impacts nearly a quarter of the sample at 22.01% ($n = 57$).

A comparative spatial distribution analysis highlights Tapitapi Village ($n = 117$) as the area with the most acute housing vulnerabilities, consistently registering the highest deficit percentages across all nine evaluated components (Table 6). Notably, an alarming 88.03% of households in Tapitapi suffer from deficient daylighting, while approximately two-thirds exhibit substandard walls (67.52%) and floors (65.81%). Furthermore, 40.17% ($n = 47$) of its residential units fail to meet the minimum standard spatial allowance of <7.2 m² per person, indicating a severe domestic overcrowding issue compared to Pasikuta (30.43%) and Lagasa (9.38%).

In contrast, Lagasa Village ($n = 96$) demonstrates relatively superior physical and spatial indicators. This is particularly evident in its spatial allowance metrics, where only 9.38% ($n = 9$) of homes are classified as overcrowded (Table 6). Despite these relative advantages, daylighting remains a major localized concern in Lagasa, impacting 57.00% of the households. Meanwhile, Pasikuta Village ($n = 46$) occupies a middle tier but exhibits pronounced structural vulnerabilities in lighting (71.74%), wall integrity (60.87%), and roof quality (56.52%). Taken together, the findings detailed in Table 6 underscore the need for targeted housing interventions, with immediate policy urgency directed toward infrastructural and spatial rehabilitation in Tapitapi Village.

5.3. Comparative Analysis with Regional and International Frameworks

To elevate the empirical findings of this study from a localized case analysis to a broader macro-theoretical discourse, the self-help housing outcomes of the Bajo community must be contextualized within wider global settlement paradigms. Evaluating the socio-spatial and structural realities of overwater stilt housing alongside regional maritime precedents and global human settlement mandates exposes systemic institutional patterns. Accordingly, Table 7 provides a critical comparative framework linking the verified field outcomes of this study with regional water settlement dynamics across Southeast Asia and global development benchmarks established by the United Nations.

Table 7. Comparative analysis with regional and international frameworks

Comparative Dimension	Verified Bajo Swadaya Outcomes (This Study)	Regional Southeast Asian Context (Sama-Bajau/Water Settlements)	Global Institutional Frameworks (UN SDGs/UN-Habitat)
Housing Sufficiency & Spatial Rights	Evaluated via six PUPR/BPS parameters. Hindered by rigid terrestrial tenure that excludes overwater houses from national aid (BSPS). Spatial density violates the 7.2 m² per capita threshold due to capital-intensive seaward deck expansion.	Similar landlessness and structural exclusion confront the Sama-Dilao in Sabah (Malaysia) and Zamboanga (Philippines), where water settlements are classified as illegal squats despite deep indigenous roots (Sathar, 1977; Clifton & Majors, 2012; Winoto et al., 2025).	Directly challenges SDG 11.1 (universal access to adequate, safe, and affordable housing) and Paragraph 31 of the UN-Habitat New Urban Agenda, which mandates upgrading informal settlements without displacing cultural identities.
Economic Mobilization Mechanics	Financed predominantly within the IDR 4–4.5 million income bracket. Bypasses external labor costs by activating four organic communal pillars: *Sikamaseang*, *Situlu'*, *Sipalele*, and *Sipagina'a*.	Mirrors the *Magsuku-suku* (communal solidarity) system of the Southern Philippines Bajau, where mutual boat- and house-building mechanisms substitute for formal financial capital markets (Obie, 2018; Ailsa & Bhanuwati, 2026).	Exemplifies the UN-Habitat Asset-Based Community Development (ABCD) framework, proving that indigenous bonding social capital can successfully mitigate a lack of formal financial liquidity.
Climate & Environmental Adaptability	Dwellings suffer from substandard foundation piles (*tiang*) vulnerable to marine borers and corrosive roofs, creating an unsustainable path dependency on raw mangrove logging.	Compares to the floating villages of Tonle Sap (Cambodia), where communities navigate climate-driven water level fluctuations while lacking access to resilient, eco-friendly material alternatives.	Aligns with SDG 13 (Climate Action), highlighting that state-led climate resilience policies must shift from forced terrestrial relocation toward *in-situ* climate adaptation for maritime communities.

When contextualized within broader global paradigms, the self-help housing outcomes of the Bajo tribe reveal deep systemic alignments with both regional maritime struggles and international human settlement frameworks. The socio-spatial friction identified in this study—where rigid land-centric legal frameworks exclude overwater structures from receiving state aid (BSPS) and cause overcrowding below the 7.2 m² per capita threshold—directly echoes the structural marginalization of the Sama-Bajau across

Sabah, Malaysia, and the southern Philippines. In these regional contexts, state-led housing policies consistently suffer from a 'terra-centric bias' that misclassifies traditional water settlements as illegal encroachments rather than indigenous space. In these regional contexts, state-led housing policies consistently suffer from a 'terra-centric bias' that misclassifies traditional water settlements as illegal encroachments rather than legitimate indigenous spaces. This institutional phenomenon aligns with recent findings by Winoto et al. (2025), who argued for a dedicated legislative framework to protect the unique overwater living spaces of the Bajo people from structural displacement caused by rigid land-based zoning laws."

However, the Bajo community's capacity to bypass these limitations through *Sikamaseang, Situlu, Sipalele*, and *Sipagina'a* offers a profound empirical contribution to global development theory. This organic resource circulation embodies the core tenets of the UN-Habitat New Urban Agenda, which advocates for in-situ, community-led informal settlement upgrades that honor local cultural topographies over forced land resettlement. By substituting financial capital deficits (the dominant IDR 4–4.5M income bracket) with robust bonding social capital, the Bajo tribe offers a highly scalable model for SDG 11 (Sustainable Cities and Communities). Nevertheless, as international frameworks under SDG 13 (Climate Action) increasingly demand strict coastal climate-resilience standards, the verified technical bottleneck of substandard tiang (pile degradation) highlights a critical vulnerability. The comparative analysis underscores that international sustainable housing cannot be achieved through generic global engineering standards alone; instead, it requires macro-institutional assistance—such as the specialized 4-Actor framework proposed in this study—to inject modern eco-engineering blueprints directly into the community's existing social safety nets.

5.4. Institutional Barriers and Land-Tenure Demands in Public Housing Programs

Housing finance policies and structural programs in Indonesia have been extensively deployed since 1976, yielding at least six primary policy frameworks with diverse financing schemes implemented by the state to date. Among these macro-level interventions, two targeted social programs specifically aim to facilitate residential rehabilitation for economically marginalized populations. The first mechanism, the Self-Help Housing Stimulus Assistance Program (*Bantuan Stimulan Perumahan Swadaya*—BSPS), was launched in 2016 under the auspices of the Ministry of Public Works and Public Housing (*PUPR*). This program provides targeted state subsidies to low-income communities to incentivize and enhance organic self-reliance in upgrading *swadaya* housing, systematically transforming structurally deficient dwellings into habitable units. These activities are mobilized through grassroots community initiatives, executed either individually or collectively, and encompass the construction of new self-help homes alongside the development of core infrastructure, facilities, and public utilities.

In 2017, the Ministry of Social Affairs (*Kemensos*) initiated the second major programmatic instrument: the Social Rehabilitation of Uninhabitable Houses (*Rehabilitasi Sosial Rumah Tidak Layak Huni*—RS-RTLH). This program focuses explicitly on mitigating the vulnerabilities of impoverished households through the group-based physical rehabilitation of roofs, floors, walls, and basic sanitation facilities. However, accessing these competitive state welfare programs requires compliance with strict administrative prerequisites, including the possession of a family card (*Kartu Keluarga*), a national identity card (*KTP*), and a formal, legally certified land title. Consequently, land-bound impoverished communities possess significantly greater institutional pathways to secure these state subsidies compared to the indigenous Bajo communities, whose over-water residences intrinsically lack terrestrial land-ownership documentation.

This structural disconnect subjects the Bajo tribe to a profound, complex dilemma regarding spatial and tenure rights. Contemporary statutory frameworks do not provide Indonesian citizens with mechanisms to secure formal, alienable property deeds over marine spaces utilized as permanent residential areas. Although the Bajo continue to inhabit intertidal and offshore waters, they lack the legal instruments required to formalize, register, and certify their domestic spaces.

On one hand, the Bajo actively strive to preserve their ancestral, sea-centric socio-spatial lifestyle against the dual pressures of climate change and aggressive modernization, both of which threaten the sustainability of their vernacular architecture. On the other hand, the Sama-Bajo face intensifying structural pressures from state apparatuses aimed at enforcing terrestrial settlement and socio-cultural assimilation into land-based economies.

Compounding this marginalization, the Bajo tribe frequently encounters external misconceptions and deep-seated institutional stigma. Historically rooted in a maritime oral tradition, only a small fraction of traditional Bajo mariners are literate. A significant portion of the Sama-Bajo population, particularly within the older demographic cohorts, lack official civil registration documents—such as birth certificates or recorded ages—as their traditional lifestyle historically rendered formal state documentation obsolete.

However, within modern systems defined by rigid geopolitical boundaries, the systemic restriction of state aid programs exclusively to populations possessing civil identity documents and recognized land deeds compels the vast majority of the Sama-Bajo to survive strictly by relying on their own social networks and internal adaptive capacities.

5.5. Endogenous Social Capital Capacities and Socio-Economic of the Bajo Tribe

The intersection of structural constraints and geographic isolation necessitates a comprehensive evaluation of the internal capacities embedded within the Bajo community. While traditional top-down development paradigms often pathologize informal over-water settlements by focusing strictly on infrastructure deficits, an asset-based development approach reveals that the Sama-Bajo possess significant internal resilience. This capacity is dual-faceted, driven by a highly integrated system of non-market communal assets and evolving household economic structures. To systematically unpack how these resources function as alternative developmental mechanisms, the following subsections analyze the community's capacity across two primary structural axes: first, the activation of dense socio-cultural networks acting as informal social safety nets, and second, the microeconomic mobilization of household income driven by recent agrarian and aquaculture diversification.

5.5.1. Endogenous Socio-Cultural Values as Bonding Social Capital

For centuries, the Bajo tribe has been recognized as a traditional maritime society characterized by highly cohesive collective structures and an absolute economic reliance on marine resources. Within contemporary anthropological literature, these communities are frequently distinguished as unique cohorts capable of mastering and surviving within marine environments by deploying localized ecological knowledge grids. They conceptualize the marine space as both their primary residential habitat and exclusive economic domain. Historically, these nomadic "sea gypsies" navigated maritime expanses aboard traditional watercraft (*perahu*), typically clustering in small mobile units of five to ten households. Structurally, the Bajo adhere to a cognatic kinship system that recognizes lineage symmetrically across both paternal and maternal lines. This kinship framework ensures that collective units are comprised of densely interwoven familial networks, including siblings, direct offspring, and affinal relations.

This cultural framework is distinguished not merely by specialized artisanal fishing practices, but by an enduring commitment to communal living that persisted through their twentieth-century transition toward sedentary lifestyles. This institutionalized collectivism functions as a core structural mechanism, generating systemic resilience against the hazardous socio-ecological realities of marine environments. The Sama-Bajo derive a distinct collective identity from their self-classification as the "sea tribe," actively preservation-mining ancestral traditions that position communal cohesion as a primary form of social capital. This cultural inheritance fosters robust, multi-tiered social bonds both within localized kinship cells and across broader inter-group networks.

Regardless of their geographic dispersion across fragmented archipelagic zones, members of the Bajo tribe maintain active, high-affinity socio-spatial connections. These horizontal bonds are governed by a foundational normative axiom: "Wherever they are, the Sama-Bajo are essentially brothers." This ancestral ethos of absolute collectivism has historically enabled the tribe to cultivate autonomous systems of mutual aid and survival, largely independent of formal state intervention. Consequently, this collective brotherhood operates as an essential safety net, mitigating the systemic risks inherent to maritime livelihoods.

In Muna Regency, this communal infrastructure is explicitly underpinned by four foundational socio-cultural principles that dictate daily social mechanics. The first principle, *Sikamaseang* (mutual affection), embodies transcendental ethical values that are deeply socialized into individual subjectivities. The Sama-Bajo operationalize *Sikamaseang* beyond the nuclear domestic unit, extending empathetic networks to the wider community. As a structural consequence of this normative constraint, overt intra-communal disputes and destabilizing social conflicts are virtually nonexistent within the sampled settlements.

The second principle, *Situlu* (mutual assistance), represents the operational core of Bajo collective mobilization. The community rejects scenarios wherein individual households confront socio-economic shocks or structural vulnerabilities in isolation. Instead, they deploy coordinated collective labor to execute complex communal tasks, ranging from macro-level residential construction to the organization of lifecycle rituals and traditional ceremonies. This deeply socialized solidarity actively translates abstract notions of brotherhood into high-functioning social empathy and collective agency.

The third principle, *Sipalele* (mutual giving), conceptualizes a continuous economy of sharing that functions as a spiritual, social, and emotional nexus. Within the Bajo worldview, the act of giving is understood as a reciprocal mechanism wherein the donor simultaneously accumulates social credit; they

operate under the ontological assumption that benevolent acts initiate a self-sustaining cycle of generalized reciprocity. This continuous circulation of material and emotional support reinforces horizontal ties across households. At the micro-level, *Sipalele* manifests as an institutionalized daily obligation among neighbors, irrespective of direct kinship ties. This includes the routine sharing of food, collective participation in childcare rituals, and the provision of mutual financial and material gifts during lifecycle events, effectively strengthening communal cohesion through structured generosity.

The fourth principle, *Sipagina'a* (mutual complementarity), explicitly acknowledges human interdependency within highly volatile ecological spaces. For the Sama-Bajo, internal socio-demographic diversity constitutes an invaluable asset; it allows individual actors to depend on specialized collective skillsets rather than requiring each household to master the entire matrix of survival mechanisms. This structural distribution of traditional knowledge and artisanal skills has historically secured the long-term socio-ecological viability of the Sama-Bajo.

Cumulatively, these four principles—which encapsulate the localized wisdom of the Bajo tribe—should be analytically classified as potent forms of **bonding social capital**. These endogenous assets possess significant latent capacity for deployment in housing rehabilitation programs, allowing self-reliant community units to systematically upgrade the structural quality of their vernacular dwellings. By strategically leveraging this internal socio-cultural infrastructure, public housing interventions can move away from deficit-based models that pathologize slum environments. Instead, they can actively empower the indigenous potential of the Bajo, facilitating the co-production of structurally secure, culturally aligned, and humane maritime settlements.

Socio-Cultural Dynamics in Bajo Self-Help Housing Interventions

To move beyond a descriptive overview of indigenous values, a qualitative thematic mapping was conducted to critically evaluate how these deep-rooted socio-cultural metrics operationally impact structural self-help housing interventions among the Bajo community.

Table 8. Thematic mapping of socio-cultural dynamics in Bajo self-help housing.

Core Socio-Cultural Values	Manifestation & Field Evidence	Operational Housing Impact	Analytical Typology
Sikamaseang	Community empathy toward severe housing damage post-storm	Accelerates mutual social safety nets for vulnerable households	Facilitator (+)
Situlu'	Key case: Entire community mobilizes to harvest raw materials and erect stilt house structures collectively	Eliminates 100% of external labor costs (zero-labor-cost)	Main facilitator (+)
Sipalele	Voluntarily sharing wood planks or tools with neighbors building a house	Reduces dependency on expensive land-based material markets	Facilitator (+)
Sipagina'a	Intergenerational consensus on stilt positioning and maritime spatial orientation	Preserves vernacular wisdom but may slow down modern eco-engineering standards	Dual nature (+ / -)

Source: Field interview and qualitative analysis.

As mapped in Table 8, the socio-cultural fabric of the Bajo tribe actively intervenes in the physical and financial execution of self-help housing. For instance, when a household head decides to construct or rehabilitate a stilt house, the entire village collectively participates, spanning from the initial material-seeking phase in coastal areas to the final structural erection on the water. Analytically, this collective mobilization acts as a financial capital substitution mechanism that offsets the economic constraints typically faced by low-income fishing communities.

By institutionalizing values of *Situlu* (mutual aid) and *Sipalele* (mutual sharing), the community effectively drives down external labor operational costs and logistical expenses to zero. In conventional *self-help* housing models, labor and material transport represent up to 40–50% of the total construction budget. The Bajo communal framework circumvents this market dependency by substituting liquidity with robust bonding social capital.

This non-monetary resource circulation explains the socio-economic paradox observed in the earlier inferential analysis: despite a significant portion of households earning below or near the regional baseline (as confirmed by the Chi-Square correlation between demographic income brackets and structural vulnerability), the community avoids widespread housing collapse. However, while this vernacular network serves as a powerful economic facilitator for basic structural survival, it

simultaneously functions as a latent structural constraint. The strong cultural reliance on unmonetized, collective material harvesting (such as cutting local mangrove poles) often creates a path dependency that resists transitioning toward standardized, engineered, disaster-resilient building technologies. Consequently, any external housing improvement intervention by the state must not displace this organic social safety net, but rather leverage it by introducing assisted self-help (assisted self-build) schemes that integrate modern engineering parameters into the existing collaborative framework.

5.5.2. Economic Mobilization Potential and Household Income Dynamics

Field investigations reveal that a household head or adult male within the Bajo community of Muna Regency generates an average of IDR 250,000 to IDR 300,000 from a single traditional gillnetting (*set nets*) expedition, typically requiring a 4-to-5-hour operational cycle. Since the 2000s, the Bajo population has actively pursued livelihood diversification strategies beyond capture fisheries, most notably via the adoption of seaweed cultivation (*Eucheuma cottonii*). This economic transition demonstrates that the Bajo are increasingly shifting away from purely hand-to-mouth subsistence practices toward a deliberate focus on asset accumulation and upgrading their long-term quality of life.

Seaweed aquaculture functions as a highly inclusive alternative livelihood, optimizing intra-household labor by mobilizing all family members. This cultivation is structurally synchronized with seasonal climate variations, operating as a primary safety net during high-wave monsoonal periods when traditional marine capture is rendered ecologically unviable. Seaweed farming is economically appealing due to its low entry barriers, minimal specialized technological demands, and low capital requirements. Furthermore, the biological maturation cycle is highly compressed, requiring an average of only 35 days before harvesting occurs. From a market perspective, commercial yields remain highly lucrative: a smallholder seaweed farmer generates an average dry-weight yield of 200 kg per harvest cycle, commanding farmgate prices between IDR 20,500 and IDR 23,000 per kg. Consequently, households capture a net income ranging from IDR 3,500,000 to IDR 4,000,000 per harvest, translating to a daily income baseline of IDR 100,000 to IDR 145,000.

5.5.2.1 Household Income Distribution and Inferential Vulnerability Correlation

The microeconomic profile of the 259 sampled households reveals a highly concentrated income architecture. Descriptive analysis indicates that the single largest cohort of respondents is positioned within the mid-high income bracket of >IDR 4,000,000 to IDR 4,500,000 per month (44%, $n = 114$). This is followed by the >IDR 4,500,000 to IDR 5,000,000 bracket (19%, $n = 49$), and the >IDR 3,500,000 to IDR 4,000,000 range (18%, $n = 47$). The remaining segments comprise minor cohorts occupying the lower and upper bounds of the local economic spectrum: 7% ($n = 18$) earn between IDR 3,000,000 and IDR 3,500,000; 4% ($n = 10$) reside in the extreme lower bracket under IDR 3,000,000; and 8% ($n = 21$) attain a monthly income exceeding IDR 5,000,000.

To move beyond elementary descriptive statistics and map the structural drivers of housing inequality, a Pearson's Chi-Square (x^2) Test of Independence was executed. This inferential test rigorously evaluates the socio-economic correlation between a household's monthly income classification and the severity of their physical housing deprivation, with the latter categorized as Severe RTLH (*Rumah Tidak Layak Huni*) versus Moderate RTLH based on the building integrity indices mandated by the Ministry of Public Works and Public Housing (PUPR). The resulting bivariate cross-tabulation, critical values, and inferential testing parameters are systematically detailed in Table 9.

Table 9. Chi-Square Cross-Tabulation: Household income vs. housing deprivation severity

Monthly Income Bracket (IDR)	Severe Housing Deprivation (n)	Moderate Housing Deprivation (n)	Total Households (n)	Percentage (%)
Lower Bracket (≤ 4,000,000)	55	20	75	28.95
Moderate Bracket (> 4,000,000)	62	122	184	71.05
Total Sample	117	142	259	100.00

- Pearson Chi-Square (x^2) Value: 32.22
- Degrees of Freedom (df): 1
- Asymptotic Significance (p-value): < 0.001

The inferential results demonstrate a highly significant statistical association between household monthly income and housing vulnerability, rejecting the null hypothesis ($\chi^2(1) = 32.22$, $p < 0.001$). Households falling within the lower income bracket (≤ IDR 4,000,000) display a significantly higher

propensity to suffer from severe structural housing deprivation (73.3% within their bracket) compared to those in the moderate bracket (33.7%).

Crucially, from a socio-spatial perspective, this economic bottleneck dictates the boundaries of assisted self-help housing. Even though traditional maritime adaptation models allow incremental repair using local timber, households locked in the lower income bracket lack the financial surplus needed to purchase critical, state-approved permanent materials. This baseline quantitative correlation validates the qualitative findings regarding why a disproportionate number of low-income, uncertified water-space dwellings remain structurally vulnerable over extended generations.

5.5.2.2 Capital Accumulation Capacity and Socio-Spatial Land Tenure Correlations

Beyond baseline income, the financial capacity of households to engage in incremental self-help housing rehabilitation is dictated by their daily saving ability. Descriptive metrics from the $n = 259$ sample indicate that the absolute majority of respondents have a daily saving capacity concentrated at IDR 40,000 (56%, $n = 145$). Smaller groups are distributed across lower capacities, such as IDR 30,000 (10%, $n = 26$) and IDR 20,000 (5%, $n = 13$), or moderate capacities, including IDR 50,000 (19%, $n = 49$), IDR 60,000 (6%, $n = 15$), and IDR 70,000 (4%, $n = 11$).

To provide a sophisticated statistical analysis that evaluates how this saving capacity varies across socio-spatial configurations, a Pearson's Chi-Square (x^2) Test of Independence was performed. This test examines the relationship between a household's daily saving bracket and their housing tenure status (Certified Mainland vs. Uncertified Over-Water Space). The structural cross-tabulation parameters are illustrated in Table 10.

Table 10. Chi-Square Cross-Tabulation: Daily saving capacity vs. socio-spatial tenure status

Daily Saving Bracket (IDR)	Certified Mainland Tenure (*n*)	Uncertified Over-Water Tenure (*n*)	Total Households (*n*)	Percentage (%)
Marginal Accumulation (≤ 40,000)	42	142	184	71.04%
Active Accumulation (> 40,000)	51	24	75	28.96%
Total Sample	93	166	259	100.00%

- Pearson Chi-Square (x^2) Value: 46.18
- Degrees of Freedom (df): 1
- Asymptotic Significance (p-value): < 0.001

The inferential calculation demonstrates a highly significant association between a household's capacity for capital accumulation and their socio-spatial living environment, rejecting the null hypothesis ($x^2(1) = 46.18, \rho < 0.001$). A striking 85.5% of the over-water, uncertified community units are trapped within the marginal saving bracket (≤ IDR 40,000/day).This quantitative correlation provides an empirical foundation for the qualitative findings. While the institutionalized assisted self-help housing framework (such as PUPR's BSPS scheme) assumes that beneficiary communities can co-finance housing improvements through voluntary labor and personal savings, the sea-dwelling Bajo community is structurally constrained. Their daily savings are largely absorbed by the high transactional costs of maritime livelihood maintenance and water-space survival. Consequently, the statistical intersection of marginal daily savings and lack of legal tenure acts as a compounding barrier, preventing over-water residents from accumulating the financial baseline required to transition their homes from temporary, substandard structures into state-approved habitable dwellings.

6. Conclusion

This study demonstrates that the community-led self-help (*swadaya*) approach remains a vital socio-economic vehicle for housing preservation within the coastal Bajo stilt settlements. By operationalizing the four pillars of maritime social capital—*Sikamaseang, Situlu', Sipalele*, and *Sipagina'a*—the community effectively minimizes market dependencies and eliminates formal construction labor costs. However, the scalability of this organic self-help mechanism faces critical structural limitations. The reliance on community volunteerism encounters significant thresholds, including seasonal physical burnout from repetitive storm reconstructions, emerging financial strains within the lower-income bracket, and severe spatial overcrowding that violates minimum spatial allowance standards. Volunteer-

driven labor alone cannot overcome deep-seated macro-technical vulnerabilities, such as the severe structural pile erosion induced by the harsh marine environment.

Therefore, rather than viewing *swadaya* as an autonomous, infinitely scalable solution, it must be conceptualized as a localized coping mechanism that requires macro-institutional reinforcement. Sustainable scaling can only be achieved through the proposed modified Quadruple Helix model, which formalizes strategic linkages among four interconnected actors: the Bajo community and customary institutions, local government, academia, and NGOs. Within this integrated framework, the local government must inject regulatory land-tenure flexibility and essential public utilities, academics must supply climate-adaptive eco-engineering blueprints, and NGOs must provide sustained grassroots field companionship. This collaborative synergy effectively transforms fragile community coping mechanisms into a formalized, disaster-resilient coastal housing policy framework.

7. Recommendation

In implementing housing quality improvements through an assisted self-help approach, collaboration among various stakeholders is essential. By leveraging the expertise and resources of these different parties, the modified Quadruple Helix Model, which modifies the framework formulated by Halim (2024) and is shown in Figure 3, can facilitate the development of more effective, efficient, and sustainable solutions.

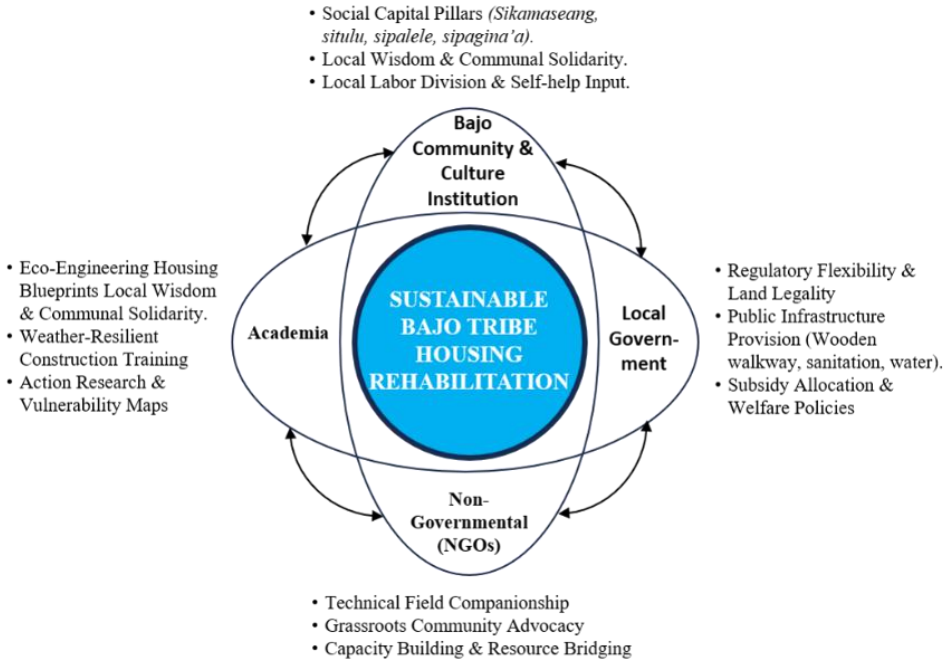


Figure 3. Quadruple Helix Model for upgrading Bajo tribe's housing quality in Muna Regency.

The structural configuration of this modified Quadruple Helix model is visually illustrated in Figure 3. However, to prevent this model from appearing as a purely normative administrative framework, its relational pathways must be contextualized within the specific constraints of the study area. Therefore, Table 11 explicitly maps each institutional connection and actor role directly to the verified legal bottlenecks, economic poverty constraints, and physical housing vulnerabilities identified during the fieldwork.

Table 11. Empirical collaboration matrix for sustainable Bajo housing rehabilitation.

Helix Actor	Verified Field Vulnerability & Constraints (Empirical Data)	Targeted Collaborative Action & Institutional Role
Bajo Community & Customary Institutions *(Cultural/Grassroots Helix)*	High physical deprivation: daylighting deficits (80.31%), substandard roofs (55.98%), and walls (54.44%). Spatial allowance violations $< 7.2\ m^2/capita$ in 40.17% of homes in Tapitapi. Under-bracket income ($\leq$ IDR 4,000,000) limits material purchasing power.	Mobilize traditional maritime social capital pillars (*Sikamaseang, Situlu', Sipalele, Sipagina'a*) to eliminate construction labor costs. Aggregate daily communal saving capacity (from the 56% majority saving IDR 40,000/day) into localized *swadaya* housing pools. Allocate customary land spatial layout arrangements to optimize spatial density.
Local Government (Public/Regulatory Helix)	Severe external environmental degradation. Absense of secure land tenure/ legality on coastal waters. Lack of essential public utilities (wooden walkways, communal sanitation, clean water, and electricity).	Provide regulatory flexibility and special zoning permits for stilt housing settlements over water. Fund and construct public infrastructure that exceeds community capacity (communal sanitation, grid electricity, clean water). Allocate targeted fiscal subsidies and materials (e.g., weather-resistant roofing) to households below the poverty line.
Academia (Knowledge/Technical Helix)	Lack of community technical skills to construct weather-resistant coastal structures. High risk of macro-technical limits, specifically severe structural pile erosion due to marine environment.	Design localized, affordable *eco-engineering blueprints* for modern, disaster-resilient stilt structures. Transfer technical knowledge through hands-on technical training workshops for community builders. Conduct continuous action research, structural pile material testing, and GIS vulnerability mapping.
Non-Governmental Organizations (NGOs) (Civil/Advocacy Helix)	Limited number of community volunteer companions leading to low program sustainability. High risk of community seasonal burnout and economic strain during self-help execution.	Provide long-term, structured grassroots field companionship to maintain community momentum. Act as an institutional bridge/mediator to advocate for community spatial rights to the Local Government. Assist in transparent financial management of the community's swadaya saving pools.

As systematically mapped in Table 11, the transition from an autonomous *swadaya* mechanism to a structured modified Quadruple Helix model shifts the paradigm of coastal housing rehabilitation from a romanticized view of community resilience to a pragmatically supported institutional framework. While the rich social capital pillars—*Sikamaseang, Situlu', Sipalele,* and *Sipagina'a*—demonstrate that the Bajo tribe possesses immense organic capacity to eliminate labor overheads, the empirically verified structural deprivation (such as severe daylighting deficits and micro-technical pile erosion) underscores the hard upper limits of community-led efforts. Therefore, the interlock between the cultural grassroots helix and the macro-institutional actors (government, academia, and NGOs) serves as the critical bridge to scale up these localized coping mechanisms. By matching the community's daily saving capacity and

cultural solidarity with the government's infrastructure provision, academia's eco-engineering blueprints, and NGOs' grassroots advocacy, the structural and legal bottlenecks of marginalized coastal communities can be systematically dismantled.

Ultimately, this study concludes that housing rehabilitation in marginalized coastal zones cannot rely solely on the precarious economic resources of vulnerable households. Sustainable scaling demands that local governments move beyond passive recognition of indigenous resilience and instead actively leverage the community's socio-cultural potential while simultaneously supplying the vital public infrastructure—such as communal sanitation, green electricity, and clean water networks—that the community cannot independently secure. This shift aligns with the critical understanding that sustainability in planning practice is not a fixed concept but a fluid and negotiated discourse, a reality that carries significant implications for policy coherence, democratic accountability, and the legitimacy of planning decisions (Batchelor & Bremner, 2026) in marginal spaces. Implementing this modified Quadruple Helix model not only safeguards the unique cultural identity of the Bajo tribe but also establishes a replicable, empirically grounded policy blueprint for achieving long-term climate-resilient and socially inclusive housing adjustments across maritime Southeast Asia.

While Table 11 establishes the institutional matrix and operational boundaries of each helix actor, the execution of these collaborative roles cannot be performed simultaneously. Implementing a comprehensive housing rehabilitation program requires a structured roadmap that prioritizes immediate structural hazards before integrating macro-institutional infrastructure and policy scaling. To operationalize the matrix into a structured temporal sequence, Table 12 details the phased implementation guidelines tailored to the verified economic capacities, technical constraints, and cultural rhythms of the Bajo community.

Table 12. Phased implementation guidelines for the tailored Bajo housing collaboration framework.

Phase & Timeline	Strategic Objective	Action Steps & Technical Sub-Activities	Lead Helix Actors
Phase 1: Immediate to Short-Term (Months 1–12)	Emergency Structural Remediation & Baseline Pooling	Deploy immediate self-help labor to replace decayed roofs (55.98%) and walls (54.44%) using community-led builders. Implement architectural retrofitting to address the critical daylighting deficit (80.31%) through optimized window placements. Formalize localized communal housing micro-savings pools, capitalizing on the 56% majority household capacity (IDR 40,000/day).	Bajo Community & Customary Institutions NGOs (Field Companionship)
Phase 2: Medium-Term (Years 2–3)	Macro-Infrastructure Integration & Technical Upgrading	Install essential public utilities that exceed community capacity, including wooden walkways, communal sanitation, and clean water networks. Conduct technical training workshops on climate-adaptive construction to resolve seasonal physical burnout and macro-technical limits. Introduce eco-engineering housing blueprints tailored specifically to combat severe structural pile erosion in maritime zones.	Local Government Academia
Phase 3: Long-Term (Years 4–5+)	Institutional Scaling, Land Tenure, & Policy Formalization	Alleviate critical spatial overcrowding vulnerabilities (e.g., the 40.17% spatial allowance violation in Tapitapi) through planned village expansion and customary land zoning Establish special maritime zoning regulations and land-tenure flexibility certificates for stilt houses over water Formalize the Modified Quadruple Helix as a permanent municipal policy framework for resilient coastal housing scaling	Local Government Academia NGOs Bajo Customary Institutions

In summation, the phased implementation guidelines outlined in Table 12 translate the empirical matrix into an actionable, time-bound roadmap that respects both the immediate survival needs and the long-term structural viability of the Bajo settlements. By breaking down the intervention into sequential phases, this framework ensures that the community's organic socio-cultural momentum is not overwhelmed by premature institutional demands. Instead, it allows for a gradual and strategic capacity building where the immediate physical deficits—specifically roofs, walls, and daylighting—are mitigated through grassroot solidarity before transitioning into heavy macro-infrastructure integration and permanent land-tenure policy formalization. Ultimately, this phased execution ensures that the modified Quadruple Helix model operates not merely as a temporary post-disaster response, but as a sustainable, institutionalized vehicle for long-term climate adaptation and housing equity in marginalized maritime communities.

Ethical considerations and informed consent

The study was conducted in accordance with the Declaration of Helsinki. Ethical clearance was reviewed and officially approved by the Institutional Review Board (IRB) / Research Ethics Committee of Halu Oleo University (Ethical Clearance Number: 1807a/UN29.20.1.2/PG/2024). Prior to data collection, all participants were fully informed about the study's objectives, procedures, potential risks, and their right to withdraw at any stage without penalty. Given the participants' demographic and cultural background, written informed consent was obtained from those who were literate, while verbal informed consent was documented for participants with limited literacy, in compliance with ethical guidelines. To maintain participant confidentiality and anonymity, all personal identifiers were removed, and data were coded and securely stored.

Author contributions

The authors' contributions to the study are as follows: conceptualization, H. and A.F; methodology, H. And A.A.I; Falidation, A.A.I. and A.B; formal analysis, H. and A.F; investigation (field survey), A.A.I., A.F, A.B; data curation, H. and A.A.I.; writing original draft preparation, H.; writing, review and editing, A.F., A.B., and A.A.I. All authors have read and agreed to the published version of the manuscript.

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Conflicts of interest Statement

The authors declare that there is no conflict of interest regarding the publication of this article.

Availability of data and materials

The datasets supporting this study are presented within the text and figures of the manuscript. Additional data may be obtained from the corresponding author upon reasonable request.

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