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CONSTRUCTION WORKFORCE RESILIENCE CAPITAL CONFIGURATION IN DISASTER-PRONE AREAS: A PHENOMENOLOGICAL STUDY OF WORKERS IN POST-DISASTER CENTRAL SULAWESI

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Abstract
In a disaster-prone region such as Central Sulawesi, where earthquakes, tsunamis, and liquefaction are common, construction workers face a double risk: as both victims and key actors in reconstruction. Unfortunately, research on their resilience is still limited. This article aims to uncover the capital configurations that shape workers' post-disaster resilience. Through qualitative phenomenological research using in-depth interviews with 25 workers in Sigi, Donggala, and Palu, thematic analysis identifies four capital configurations: (1) Communal Social Capital (patron-client safety nets and cooperation); (2) Adaptive Cultural Capital (local knowledge and ritual adaptation); (3) Distributed Economic Capital (livelihood diversification and flexible payment); and (4) Symbolic-Spiritual Capital (cosmological meanings of disaster as a form of coping). The novelty of this research lies in the "Multidimensional Capital Configuration" framework that integrates the sociology of disaster with Bourdieu's theory. Through the lens of ISO 31000, this configuration is mapped onto a risk matrix to demonstrate the function of each capital as an organic mitigation mechanism against income uncertainty, safety gaps, and psychological distress. These findings offer a holistic perspective and highlight the need for contextualized worker training and protection programs that accommodate local wisdom.

Keywords: Construction, Risk Management, Sociocultural Capital, Disaster Resilience, Construction Worker Risk.

1. Introduction

Natural disasters have a holistic impact that penetrates the physical, psychological, and social aspects of human life (Huppert & Sparks, 2006). This reality is clearly illustrated in the massive earthquake and tsunami that struck Central Sulawesi on September 28, 2018, an event that reaffirmed the province's vulnerability to complex geological disasters (Abdullah & Abdullah, 2020). The tragedy not only destroyed infrastructure but also damaged 99,016 housing units in four main affected areas, namely Palu City (41,852 units), Donggala Regency (21,378 units), Sigi Regency (30,236 units), and Parigi Moutong Regency (5,550 units), with levels of damage varying from light to severe (Direktorat Jenderal Perumahan, 2021), (Andi Asnudin et al., n.d.). Moreover, disasters fundamentally change people's lifestyles and resilience. In the context of post-disaster reconstruction, construction workers occupy a critical and paradoxical position: they are victims who have lost their homes and livelihoods, but at the same time are the leading actors in rebuilding infrastructure (Amaratunga, D & Haigh, R, 2011), (Karki et al., 2022).

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Previous studies on construction workers in disaster areas tend to focus on technical aspects, such as skills capacity building, occupational safety and health (K3), and project management (Chang-Richards et al., 2017), (Soltanzadeh et al., 2022). Meanwhile, research from a socio-cultural perspective that investigates how construction workers survive, adapt, and make sense of their work in an environment of uncertainty remains rare. This gap is important to address, as a community's resilience is not built solely on physical infrastructure but also on its citizens' social and cultural capacities (Carmen et al., 2022), (Olanrewaju, 2025).

This article aims to fill this gap by exploring the configurations of capital mobilized by the construction workforce in Central Sulawesi to build resilience when working in disaster-prone areas. The research question posed is: How do configurations of social, cultural, economic, and symbolic capital shape the resilience of the construction workforce in Central Sulawesi post-disaster? This study adopts the ISO 31000:2018 framework as the primary analytical lens for structurally understanding and evaluating disaster risk. This standard offers a comprehensive approach based on the principles of value creation and protection, integrating risk identification, analysis, evaluation, and management into the organization's or, in this context, the worker community's decision-making. Table 1 shows the risk assessment based on the likelihood of occurrence and the magnitude of the resulting impact.

Table 1. Risk Value Matrix

Risk Category	**Very Light**	**Light**	**Moderate**	**Heavy**	**Very Heavy**
Probability	5	10	15	20	25
	4	8	12	16	20
	3	6	9	12	15
	2	4	6	8	10
	1	2	3	4	5

Source: (Andi Asnudin et al., n.d.), (Standards Australia/Standards New Zealand (SA/SNZ)., 2018)

AS/NZS ISO 31000 serves as the primary international standard for risk management, offering robust principles and frameworks to help organizations address a wide range of risks, including disaster risks. Its advantages include: (1) Establishing a comprehensive approach to organizational risk management, resulting in a more thorough risk assessment; (2) Adaptable to a wide range of organizations and contexts, thus encouraging effective and widespread implementation; (3) Providing appropriate guidance for understanding risk-related decisions, thereby increasing organizational responsiveness; and (4) Encouraging better stakeholder communication, accelerating collaboration, and proactive risk management (Standards Australia/Standards New Zealand (SA/SNZ)., 2018).

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2. Method

Make sure that work can be repeated according to the details provided. It contains technical information of the study presented clearly. Therefore, readers can conduct research based on the techniques presented. Materials and equipment specifications are necessary. Approaches or procedures of study together with data analysis methods must be presented.

This study uses a phenomenological approach to deeply understand the lived experiences and subjective meanings of construction workers in post-disaster areas (Knaack, 1984), (Pringle et al., 2011). This approach was chosen to delve into their lifeworld's, capturing the essence of how they experience, interpret, and give meaning to the reality of work amidst uncertainty, trauma, and post-disaster stress. The focus is not on statistical generalizations but on producing a rich description of the shared experiential structures of a group that is at the forefront of recovery but often overlooked. The research locations in Sigi Regency, Donggala, and Palu City were purposively selected based on the level of severe damage and the intensity of reconstruction after the 2018 disaster, to involve participants who face the dual dilemma of being both survivors and core reconstruction workers amid persistent vulnerabilities.

2.1 Research Population and Sample

The population in this qualitative phenomenological study was all construction workers involved in post-disaster reconstruction projects in severely affected areas of Central Sulawesi, specifically in Sigi Regency, Donggala, and Palu City. This population is heterogeneous, encompassing various roles in the construction work chain, with diverse experiences and backgrounds.

The research sample consisted of 45 participants. The sample composition was designed to reflect the population's heterogeneity and ensure a rich variety of experiences (maximum variation sampling) (Caroline Ochuko Alordiah & John Oji, 2024). Therefore, participants were selected from three main role categories.

a. Casual Workers: Workers with basic skills, precarious employment status, and the highest economic vulnerability.
b. Skilled Craftsmen: Workers with specific skills (carpentry, masonry, and ironwork) who typically have a more stable bargaining position and income. A foreman is a worker who plays a field supervisory role, acts as a liaison between contractors and workers, and often acts as a patron in the work social network.

The sampling technique used was snowball sampling, starting with key informants at the Construction Development Office of the Central Sulawesi Province Highways and Spatial Planning Department and the Public Works Office in Donggala and Sigi Regencies, as well as local contractors acting as gatekeepers. From them, researchers obtained recommendations and initial access to potential participants (such as foremen or skilled artisans). Each participant was then asked to recommend other colleagues who met the criteria. This chain process continued until the sample

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reached 30 individuals and data saturation was reached, the point at which new interviews no longer yielded new substantive themes but only confirmed existing patterns.

This technique is considered appropriate because the construction worker population, especially casual workers, is often difficult to reach using a random sampling frame. In contrast, the network of trust and recommendations from fellow workers is a more effective and ethical entry point for this in-depth, personal research.

2.2. Research Variables and Indicators

Table 2 details the core variables (often referred to in qualitative research as the research focus or phenomenological construct) along with the guiding indicators used to operationalize the interview and observation questions.

Table 2. Research Variables and Indicators.

Research Variables	Operational Definition	Guiding Indicators for Data Collection
Direct Experience of Disaster & Reconstruction	Participants' understanding of the disaster event and the reconstruction process they underwent (Silver & Grek-Martin, 2015), (Wang et al., 2011), (Kamani-Fard et al., 2013).	1. A narrative detailing experiences during the disaster, encompassing what was observed, felt, and done. 2. An account of how the disaster impacted personal life, family, and livelihood. 3. An explanation of the process and reasons behind the decision to participate in reconstruction work. Daily experiences and activities at the reconstruction project site.
Communal Social Capital	The network of relationships, norms, beliefs, and systems that workers use to support each other and thrive (Figley, 2014), (Nissen & Jarley, 2005)	1. Map of kinship relationships and regional origins with coworkers/supervisors. 2. Mechanisms for obtaining employment (role of recommendations, group ties). 3. Practices of mutual assistance (lending and borrowing, information sharing, and social security) among workers. 4. Roles and relationships between supervisors and local contractors. 5. Participation in post-disaster communal cooperation activities.
Adaptive Cultural Capital	Cultural knowledge, values, and practices (both local and modern) are adapted and applied within the context of reconstruction work to address challenges (Kaur et al., 2025), (Canagarajah, 2002).	1. Understanding local materials, environmental features, and spatial planning used in construction. 2. Adapting techniques or traditional wisdom in the construction process and ensuring occupational safety. 3. Combining modern skills with traditional knowledge. 4. Recognizing cultural beliefs and values that shape attitudes toward work and risk.

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Distributed Economic Capital	A variety of adaptable economic strategies and resources are essential for ensuring survival in the face of job uncertainty (Mousa & Arslan, 2026), (Fitrah Sari et al., 2025).	1. Livelihoods beyond construction, such as farming, trading, and fishing. 2. Systems and patterns of wages/salaries, including daily and piecework. 3. Strategies for managing income and savings during uncertain times. 4. Access to both informal and formal sources of credit or economic assistance.
Symbolic-Spiritual Capital	Religious and spiritual beliefs, values, and meanings provide a framework for understanding, motivation, and psychological strength when dealing with disasters and risky work (Hakkim & Deb, 2022).	1. The significance of disasters within the context of religious beliefs or local cosmology. 2. Rituals, prayers, or spiritual practices associated with work or safety. 3. The role of faith in coping with trauma, fear, and stress. 4. The meaning and value of reconstruction efforts beyond their economic aspects, viewing them as acts of worship, social responsibilities, or means of restoring balance.
Risk Perception and Strategy	How workers perceive hazards in disaster-prone work environments and the strategies they develop to manage them. (Marshall, 2020), (Teng-Calleja et al., 2024).	1. Awareness of potential hazards (such as aftershocks, work accidents, and project conditions). 2. Implementation of safety and preventive measures independently. 3. Understanding of safety equipment and formal K3 procedures. 4. Psychological and social coping mechanisms for dealing with stress and uncertainty.

2.3. Data Collection Methods

Data is collected via:

a. Semi-structured in-depth interviews (60-90 minutes per participant) will explore experiences during and after the disaster, coping strategies, social networks, cultural values, and risk perceptions.
b. Limited participant observation will be conducted at project sites and worker settlements to gain insights into work practices and daily interactions.
c. A document study will be carried out to analyze official reports and media coverage related to the reconstruction efforts.

2.4. Data Analysis Method

Data analysis was performed in two integrated stages: qualitative thematic analysis followed by interpretation through a risk management framework

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2.4.1. Thematic Analysis

Interview and observation data were analyzed using thematic analysis in an iterative manner (Braun & Clarke, 2006). The process began with transcription and familiarization, followed by coding and the identification and review of themes. This approach facilitated the emergence of themes related to resilience capital configurations, including both those aligned with the initial variables and more specific themes, such as "The Role of the Foreman as a Socio-Technical Liaison."

2.4.2. Interpretation through an ISO 31000 Lens

The resulting themes were then reinterpreted using the ISO 31000:2018 framework to contextualize them within the structured risk management discourse. Capital configurations were analyzed according to their functions within the risk management cycle

a. Risk Identification: The role of local knowledge and social networks in recognizing potential threats.
b. Risk Evaluation and Mitigation: The function of capital as an organic risk treatment, such as income diversification to reduce income volatility.
c. Risk Communication: The influence of cultural and spiritual values on the understanding and communication of risk within the community.

2.4.3. Risk Matrix Visualization

In summary, the research developed a contextual risk matrix (Table 3) that illustrates the relationship between key risks, based on their impact and likelihood, and the capital configurations used for mitigation. This matrix effectively connects qualitative findings with practical needs in policy planning and risk management.

3. Results and Discussion

Through data analysis, we identified four interconnected capital configurations.

3.1. Communal Social Capital

Kinship and patronage-based safety nets form a critical aspect of social capital. Workers often rely on family connections and patron-client relationships with contractors or supervisors from their home region to secure employment. Work groups, commonly referred to as crews, are frequently organized based on shared village origins, fostering solidarity and a system of mutual support. Informal credit mechanisms and cash assistance among coworkers act as safety nets during project lulls or in the event of disasters. This observation aligns with (Aldrich, D. P, 2012) findings on the significance of dense social networks for post-disaster recovery, but in this particular context, it takes on a distinct work structure.

3.2. Adaptive Cultural Capital

The integration of local knowledge with modern techniques showcases the remarkable adaptability of workers as they combine contemporary construction practices, like the use of reinforcing steel and

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specific concrete mixtures, with traditional understanding of materials and the environment. For instance, the traditional methods for selecting house locations and orientations that help avoid areas susceptible to liquefaction stem from local wisdom. Additionally, rituals associated with welcoming new homes are adapted and combined with modern safety protocols, providing psychological support and marking transitions in risk management. This blending of cultural practices represents a strategy for resilience through cultural hybridity.

Table 3. Risks Faced by Construction Workers After Disasters and Strategies for Mitigating Financial Impact.

Key Risks (Context of ISO 31000)	**Sources and Consequences (Based on Findings)**	**Organic Mitigation Mechanism (Capital Structure)**	**Core Principles in the ISO 31000 Framework**
Economic Sustainability Risks	Projects have stalled, payments have been delayed, and the rainy season has arrived. The impact of these issues is significant: there is no income, leading to a collapse of household resilience	1. Distributed Economic Capital: Diversifying livelihoods (farming and trading) creates a buffer. Communal Social Capital: Safety nets are formed through informal loans and resource sharing within work groups.	These assets act as internal risk management tools. They improve organizational resilience at both individual and group levels by providing easily accessible alternative resources and contingency plans.
Safety and Health Risks	Hazardous work environments, weak adherence to formal occupational health and safety (OHS) procedures, and employee fatigue all contribute to increased risks in the workplace	1. Adaptive Cultural Capital: The adaptation of local techniques and safety rituals (mompo sao) enhances collective vigilance and awareness. 2. Communal Social Capital: Patron-client systems and group ties foster social responsibility for the safety of others.	These practices are culturally informed forms of risk communication, consultation, and monitoring. They address gaps where formal oversight systems fall short.
Psychosocial and Cultural Risks	Trauma, stress, and cultural dissonance arise from the demands of rapid reconstruction	1. Adaptive Cultural Capital: The adaptation of local techniques and safety rituals (mompo sao) enhances collective	This capital addresses a frequently overlooked aspect of risk assessment: establishing context,

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	projects conflicting with local rhythms and values	vigilance and awareness. 2. Communal Social Capital: Patron-client systems and group ties foster social responsibility for the safety of others.	which involves understanding the values of stakeholders. This is a critical measure for soft risk mitigation, promoting program sustainability and supporting employee mental health.

3.3 Distributed Economic Capital

Financial diversification and flexibility contribute to economic resilience by promoting livelihood diversification strategies. Beyond the construction sector, many workers engage in activities such as cultivating cocoa or coconut plantations, participating in small-scale trading, or working as seasonal farm laborers. This approach helps reduce reliance on a single income source. Additionally, a flexible payment system where some workers are paid daily, others receive rice or staple foods, and the remainder of the wages is saved by the foreman adapts to the uncertainties of project cash flows. Economic capital is not concentrated in one area but is instead redistributed across various activities and payment methods.

3.4. Modal Symbolic-Spiritual

The most significant finding is the identification of symbolic-spiritual capital as a source of resilience. For many workers and communities in the Palu, Donggala, and Sigi regions, the disaster often referred to as "Gumi" or "Tana Ntu Loa" by locals, which refers to landslides is viewed not merely as a geological incident, but as part of the cosmological relationship between humans, nature, and their ancestors.

The construction and reconstruction work following the disaster on September 28, 2018, is viewed as a moral and religious obligation to "restore balance" between humans and their disrupted environment. This process involves various practices, including prayers (modero/pakaja) before beginning any work, showing respect for local "guardians" or supernatural forces present at the project site, and conducting traditional rituals (such as those performed by the Kaili and Lore communities) to seek permission and ensure safety. These elements are integral to the construction process.

The belief that working with good intentions and following customary practices will provide protection from ancestors and the Creator serves as an effective coping mechanism for managing stress, trauma, and the fear of recurring dangers in this disaster-prone region, which is vulnerable to complex disasters such as liquefaction, tsunamis, and the Palu-Koro fault. This local cosmology

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transforms physical labor into a collective healing process that not only restores infrastructure but also rebuilds the social and spiritual networks affected by these disasters.

3.5 Using Capital Configuration as a Tool for Risk Mitigation

Analysis Using the ISO 31000 Framework. To link the phenomenological findings to structured management practices, the identified capital configurations were further examined through the ISO 31000 risk management principles, particularly in the context of risk assessment. This analysis is not meant to replace formal processes; rather, it aims to show how the resilience logic developed by workers naturally aligns with and can enhance conventional risk management frameworks

Three main risks were consistently identified for construction workers post-disaster in Central Sulawesi.

a. Economic Sustainability Risks (Income Volatility & Livelihood Disruption): There is uncertainty regarding the duration of projects, potential payment delays, and the seasonality of available work.
b. Occupational Safety and Health Hazards: Workers face vulnerabilities due to environmental factors such as aftershocks and unstable buildings, as well as a lack of adequate personal protective equipment (PPE) and the physical and mental exhaustion that comes with the job.
c. Psycho-Social and Cultural Distress: Many individuals are dealing with unresolved trauma from past disasters, experiencing pressure to rebuild while still in recovery, and facing conflicts arising from work demands.

Matrix Discussion: This analysis shows that the identified capital configurations are not just coping strategies; they represent an integrated risk management system that evolves with its context. Each type of capital functions as a risk treatment for one or more key risks. Most importantly, this system is proactive and adaptive, aligning with the fundamental principles of ISO 31000. For instance, livelihood diversification (Economic Capital) serves as a countermeasure against the risk of project delays, while safety rituals (Cultural Capital) effectively communicate and internalize awareness of danger.

Configuration and Transformation: The four forms of capital symbolic-spiritual, social, cultural, and economic are interconnected rather than existing in isolation. In the immediate aftermath of a disaster, communal symbolic-spiritual and social capital are often the first to be mobilized, providing essential meaning and support. As the process of reconstruction continues, adaptive cultural and distributed economic capital start to take precedence. Notably, capital can undergo transformation; for instance, a skilled craftsman may earn a good reputation (symbolic capital), which can then lead to greater access to lucrative projects (economic capital) and establish trust in a new role as a foreman (a shift in social position).\

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3.6. Theoretical and Practical Implications

3.6.1. Theoretical Implications

This research advances resilience theory by incorporating the often-overlooked dimension of symbolic-spiritual capital into asset-based analyses. The proposed framework, "Multidimensional Capital Configurations," provides a more comprehensive and dynamic understanding of the resilience of grassroots actors in disaster ecosystems.

3.6.2. Implications for Policy and Practice

a. Contextual Training: Construction worker capacity-building programs should incorporate and integrate existing local knowledge instead of completely replacing it with standardized modules.
b. Network Strengthening: Governments and NGOs can facilitate the formation or strengthening of community-based construction worker cooperatives or associations to enhance their social and economic capital.
c. Inclusive Social Protection: Social security schemes, such as BPJS Ketenagakerjaan, and microinsurance should be designed flexibly to accommodate irregular and distributed work patterns.
d. Culturally Sensitive Risk Communication Approaches: Occupational Health and Safety (OHS) and disaster mitigation materials should be communicated using narratives that align with local cosmologies to enhance acceptance and compliance.
e. Integration of Participatory and Contextual Risk Management Systems: Governments and primary contractors should adopt a more inclusive risk management approach aligned with the spirit of ISO 31000. The risk assessment process should participatively map and acknowledge existing organic mitigation mechanisms, such as social support networks and safety rituals. The results of this mapping can then be integrated into the Project Risk Register as complementary controls rather than being overlooked. OHS training and the socialization of procedures should build on existing local knowledge and reinforce it with modern techniques instead of replacing it.

4. Conclusion

Construction workers in disaster-prone areas of Central Sulawesi build resilience through a dynamic combination of four types of capital: communal social capital, adaptive cultural capital, distributed economic capital, and symbolic-spiritual capital. This combination illustrates that resilience extends beyond individual technical skills; it encompasses the ability to mobilize and transform diverse resources within context-specific socio-cultural networks. The distinctive role of spiritual and symbolic capital, rooted in local cosmology, offers new insights into labor and disaster management studies.

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Further research is necessary to test this framework across various disaster scenarios and cultural settings, as well as to investigate how broader institutional factors influence workers' capital configurations. Additionally, by mapping capital configurations onto an ISO 31000-based risk matrix, this study outlines a clear pathway for translating academic findings into practical applications in project management and policy. It demonstrates that building resilience involves not only adding external resources but also recognizing, respecting, and strengthening the risk management systems already present and functional within workers' communities.

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