

Labor Resilience During the Climate Crisis: The Strategic Function of BPJS Ketenagakerjaan in the Informal Sector

Minkhaya Silviana Putri¹, Ardi Rifai²

¹BPJS Kesehatan, ²BPJS Ketenagakerjaan

Email: minkhaya.silviana@bpjs-kesehatan.go.id

Abstract

This study examines the strategic role of BPJS Ketenagakerjaan in strengthening labor resilience in the context of climate change, particularly among informal workers in Indonesia. The study employed a qualitative systematic literature review using a critical-interpretive synthesis approach to integrate national and international evidence on climate-induced labor risks, access to social protection, and institutional adaptability. The findings indicate that while BPJS Ketenagakerjaan has expanded its formal coverage, its capacity to address climate-related disruptions is limited by rigid regulations, fragmented governance, and a lack of climate risk integration. Informal and climate-sensitive workers remained the least protected, highlighting a gap between program design and actual climate-related risks. Comparative evidence from Bangladesh, Vietnam, and the Philippines shows that integrating climate risk analysis and adaptive benefit mechanisms can significantly enhance institutional responsiveness. The study finds that transforming BPJS Ketenagakerjaan into a climate-adaptive social protection institution requires integrating climate risk into policy frameworks, strengthening inter-agency coordination, and expanding coverage for informal workers. These reforms are crucial to ensuring equitable and climate-resilient employment protection in Indonesia's evolving labor landscape.

Keywords:

Adaptive Social Protection, BPJS Ketenagakerjaan, Climate Change, Informal Workers, Labor Resilience

Introduction

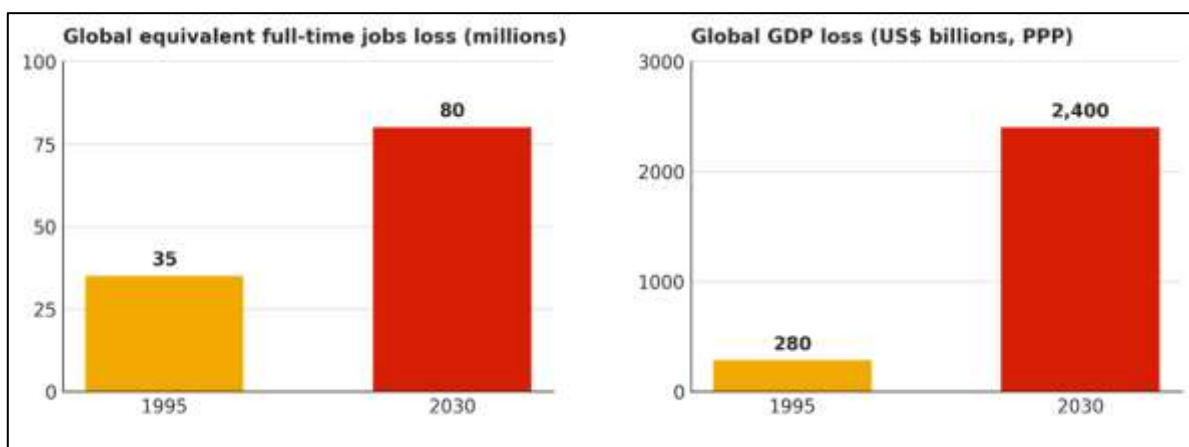
Climate change has emerged as one of the most pressing global challenges of the twenty-first century, exerting profound implications for food security, economic stability, and labor markets. The increasing frequency and intensity of extreme events such as floods, droughts, and heatwaves have disrupted agricultural production and industrial operations, thereby amplifying the vulnerability of workers, particularly those engaged in climate-sensitive and outdoor sectors (Hallegatte et al. 2018). For many developing economies, including Indonesia, this crisis is not merely ecological but fundamentally socio-economic, eroding livelihood sustainability and

weakening social protection systems designed to safeguard the most vulnerable segments of society.

Indonesia remains highly vulnerable to the impacts of climate change, including rising temperatures, sea-level rise, changing rainfall patterns, more frequent floods, and prolonged droughts, all of which threaten livelihoods, labor productivity, and socioeconomic resilience, particularly among workers in climate-sensitive sectors (World Bank 2025; Asian Development Bank 2021). Agricultural productivity has already shown signs of decline, threatening both rural livelihoods and national food security (Prasetya et al. 2025). These challenges are particularly pronounced among informal workers, who constitute more than half of Indonesia's labor force yet often lack adequate social protection and adaptive capacity (Muttaqien et al. 2021; Adisty et al. 2023). Without adaptive and inclusive social protection measures, the vulnerability of informal workers is expected to intensify, undermining income security, employment continuity, and overall socioeconomic resilience in the face of escalating climate-related risks.

Figure 1.

Global Job and GDP Losses due to Heat Stress, 1995 and Projected 2030



Source: International Labor Organization (ILO 2019).

Recent global reports have increasingly highlighted the linkage between climate change, labor markets, and social protection. The International Labour Organization (ILO 2019) projects that by 2030, heat stress alone could result in the loss of approximately 80 million full-time jobs worldwide, equivalent to an estimated USD 2.4 trillion in GDP losses measured in purchasing power parity terms (Figure 1). The impact is disproportionately borne by lower-middle- and low-income countries, projected to lose about 4% and 1.5% of their GDP respectively by 2030 (ILO 2019). This risk is expected to disproportionately affect workers in agriculture and construction, two sectors with significant informal employment. Similarly, Williams et al. (2023)

warns that without adaptive mechanisms, social protection systems risk being overwhelmed by the expanding scale of climate-induced vulnerabilities. These projections emphasize the urgency of integrating climate adaptation into Indonesia's employment social security framework.

Despite these global insights, BPJS Ketenagakerjaan continues to face persistent structural and institutional constraints. Enrollment among informal workers remains low due to financial barriers, limited awareness, irregular income, and administrative complexity (Muttaqien et al. 2021; Pasaribu et al. 2022; Adisty et al. 2023). Moreover, climate risk has not yet been systematically embedded in BPJS Ketenagakerjaan's program design, leaving many workers inadequately shielded from environmental disruptions (Marisa & Matroddji 2018; Wibisana 2013). This lack of integration creates a structural mismatch between the growing climate-related vulnerability of informal workers and the existing employment social security framework intended to protect them.

Table 1.
Summary of Previous Studies on Climate Change, Labor Impacts, and Social Protection

No	Title & Authors	Methods	Main Finding	Relevance to This Study
1	Climate Change and Occupational Heat Stress Risks and Adaptation Strategies of Mining Workers: Perspectives of Supervisors and Other Stakeholders in Ghana (Nunfam et al. 2019)	Concurrent mixed-methods using questionnaires, interviews, descriptive statistics, and thematic analysis	Climate-induced heat stress increases occupational risks and requires adaptive workplace strategies.	Demonstrates occupational climate vulnerability and supports the development of climate-responsive social protection policies.
2	Social impacts of occupational heat stress and adaptation strategies of workers: A narrative synthesis of the literature (Nunfam et al. 2018)	Narrative synthesis of existing literature	Heat stress has major social consequences; adaptation strategies insufficient.	Demonstrates how climate change impacts workers socially, aligning with informal worker vulnerabilities.
3	Occupational Heat Stress Profiles in Selected Workplaces in India (Venugopal et al. 2016)	Field measurements (WBGT) + questionnaires, 442 participants across informal sector	Heat stress significantly reduces productivity and health in informal sector.	Provides empirical evidence of risks to informal workers; strengthens rationale for BPJS Ketenagakerjaan adaptation.

No	Title & Authors	Methods	Main Finding	Relevance to This Study
4	Non heat related impacts of climate change on working populations (Bennett and McMichael 2010)	Literature review	Climate change affects productivity and health of workers beyond heat related stress.	Expands the scope of climate risks faced by workers beyond thermal stress.
5	Climate Change Adaptation, Disaster Risk Reduction and Social Protection (Davies et al. 2008)	Qualitative analysis	Integration of social protection with climate change adaptation strengthens resilience.	Supports novelty of positioning BPJS Ketenagakerjaan as adaptive social protection.
6	Factors Influencing Informal Workers' Registration for Social Security (Adisty et al. 2023)	Comparative analysis Indonesia vs Taiwan	Informal workers face barriers in registration due to affordability and awareness issues.	Shows structural challenges in BPJS participation among informal workers; highlights coverage gap.
7	Why did informal sector workers stop paying for health insurance in Indonesia? (Muttaqien et al. 2021)	Survey + qualitative exploration	Ability and willingness to pay premiums strongly affects sustainability of participation.	Reveals financial vulnerability of informal workers; supports case for climate adaptive subsidies.
8	Efforts of BPJS Ketenagakerjaan in socializing programs to informal workers (Tambunan 2023)	Case study of BPJS outreach programs	Outreach efforts remain limited and ineffective in reaching informal workers.	Provides evidence of institutional barriers; key to novelty on strategic BPJS reform.
9	Social Protection Systems and the Future of Work (Behrendt et al. 2019)	Policy analysis of international models	Digital platform and informal workers require adaptive social protection frameworks.	Global state of the art (SOTA) reference; provides international benchmark for BPJS.
10	Enhancing gender responsive social protection (Mokomane et al. 2024)	Assessment of social protection in Sub Saharan Africa	Inclusive and gender sensitive frameworks improve social protection outcomes.	Adds comparative insight into equity aspects missing in BPJS climate adaptation.

Source: Authors' own compilation

As illustrated in Table 1, several studies examined the relationship between climate change, labor conditions, and social protection. International evidence indicates that

occupational heat stress is among the most immediate consequences of climate change, particularly for outdoor workers and those employed in climate-sensitive sectors. Empirical studies by Krishnamurthy et al. (2017) and Nunfam et al. (2018, 2019) show that prolonged heat exposure significantly reduces labor productivity while increasing occupational health risks. Beyond thermal exposure, Bennett and McMichael (2010) and Davies et al. (2008) further demonstrate that climate change contributes to broader occupational vulnerabilities, including chronic health problems and declining workplace safety standards.

In contrast, Indonesian-focused studies such as those by Adisty et al. (2023), Muttaqien et al. (2021), and Tambunan (2023) highlight persistent structural barriers to BPJS Ketenagakerjaan participation. Financial constraints, affordability issues, and limited outreach are identified as the main obstacles preventing informal workers from accessing formal protection schemes. Recent studies further reinforce these concerns. Madya (2024) highlights the ongoing challenges in extending social protection to informal workers in Indonesia, while Siregar (2024) identifies challenges in acquiring and retaining non-wage recipient workers, particularly in the context of economic instability experienced by informal workers. Such findings reveal a fundamental misalignment between the urgent need for social security in the informal economy and the institutional arrangements currently in place.

At the global level, Behrendt et al. (2019) and Mokomane et al. (2024) provide valuable state-of-the-art contributions by demonstrating adaptive and inclusive models of social protection. Their research highlights how advanced frameworks, ranging from digital platform-based protection to gender-responsive approaches, have successfully broadened coverage for vulnerable groups. These international benchmarks offer critical policy insights for Indonesia as it considers institutional reforms to strengthen BPJS Ketenagakerjaan's role.

However, this literature has generally developed separately. Existing studies have examined climate-induced labor risks, informal workers' barriers to social protection, and adaptive social protection frameworks as distinct areas of inquiry. Limited research has integrated these perspectives to examine how BPJS Ketenagakerjaan can be repositioned as a climate-responsive employment social security institution for informal workers in Indonesia. This gap is particularly important because BPJS Ketenagakerjaan differs from general poverty-targeted social assistance programs. As an employment-based social security institution, its adaptation to climate risks involves specific questions of contribution design, benefit responsiveness, institutional coordination, and inclusion of informal workers.

Taken together, the literature establishes a robust theoretical foundation yet exposes a crucial empirical and policy gap: while the occupational and structural dimensions of labor

vulnerability are well documented, few studies have examined how BPJS Ketenagakerjaan can play a strategic role in enhancing labor resilience during the climate crisis. The central research problem thus lies in the mismatch between the growing climate vulnerabilities of informal workers and the limited adaptive capacity of BPJS Ketenagakerjaan.

To address this gap, the present study critically assesses BPJS Ketenagakerjaan through the lens of Adaptive Social Protection (ASP). The research aims to reposition BPJS Ketenagakerjaan as an adaptive institutional actor, capable of evolving from a reactive administrative body into a proactive resilience mechanism for climate-affected workers. The study examines four interrelated aspects: climate-induced labor vulnerability in at-risk employment sectors, barriers to social protection access among informal workers, the institutional responsiveness of BPJS Ketenagakerjaan, and comparative adaptation strategies from other developing economies. By synthesizing international best practices and theoretical perspectives, this study contributes not only to academic discourse on labor resilience but also to policy innovation, offering actionable recommendations for transforming BPJS Ketenagakerjaan into a climate-responsive employment social protection system.

The novelty of this research lies in the application of Adaptive Social Protection to an employment-based social insurance institution, a context largely absent from existing ASP scholarship, which has focused predominantly on poverty-targeted social assistance. Drawing upon interpretive qualitative synthesis (Creswell and Poth 2018; Snyder 2019), the study places BPJS Ketenagakerjaan within the broader discourse on adaptive governance and institutional change (Patterson et al. 2019) and labor vulnerability (ILO 2019; Nunfam et al. 2018), bridging macro-level climate risks with micro-level institutional design.

By integrating theoretical insights and empirical evidence, this research not only fills a substantial theoretical gap in the application of ASP to employment-based insurance systems but also provides an actionable framework for policy transformation. The resulting Adaptive Transition Pathway for BPJS Ketenagakerjaan thus represents both an analytical and normative contribution, illustrating how a national labor institution can evolve to support inclusive and climate-resilient social protection in line with the Sustainable Development Goals, particularly SDGs 8 and 13 (Williams et al. 2023; ESCAP 2023).

Research Method

The methodological framework of this study directly stems from the main problem outlined in the Introduction, namely that Indonesia's labor system, heavily dominated by informal employment, faces intensifying climate-induced vulnerabilities, while the institutional

mechanisms of BPJS Ketenagakerjaan remain insufficiently adaptive. This study therefore operationalizes a macro-level concern of labor vulnerability under climate stress into a micro-level institutional analysis, examining the adaptive capacity of BPJS Ketenagakerjaan as the principal national employment social security agency.

This research adopts an interpretive qualitative paradigm (Creswell & Poth 2018), prioritizing the understanding of social meaning, institutional behavior, and policy transformation rather than quantitative measurement. Conceptually, the research is grounded in the Adaptive Social Protection (ASP) framework (Behrendt et al. 2019; Costella et al 2023), which reconceptualizes social protection as a governance mechanism capable of anticipating, mitigating, and transforming systemic risks arising from climate change.

This study analyzes the process of institutional transformation through a qualitative systematic literature review utilizing a critical–interpretive synthesis method (Snyder 2019; Torraco 2016). In contrast to conventional systematic reviews that focus on enumeration or effect-size aggregation, critical–interpretive synthesis emphasizes conceptual reinterpretation and cross-contextual comparison. This approach enables the study to examine how climate vulnerability, labor market instability, and institutional responsiveness are defined and implemented across academic and policy contexts, while assessing the adaptability and policy consistency of BPJS Ketenagakerjaan.

Guided by the ASP framework, the inquiry is organized into four interrelated analytical dimensions: climate-induced labor vulnerability, access to social protection, institutional responsiveness, and comparative adaptation strategies, as detailed in Table 2. These dimensions are not isolated, but iteratively connected, as institutional responsiveness both mediates and is shaped by labor vulnerability and access dynamics.

To ensure methodological rigor and analytical transparency, literature identification, screening, and selection were conducted through a systematic literature search guided by predefined inclusion and exclusion criteria, following the systematic review procedures proposed by Kitchenham (2004). The literature search was conducted across multiple academic databases, including Scopus, ScienceDirect, Google Scholar, and institutional repositories maintained by the International Labour Organization (ILO), Organisation for Economic Co-operation and Development (OECD), United Nations Economic and Social Commission for Asia and the Pacific (ESCAP), and the World Bank.

Table 2.
Analytical Dimensions of the Thematic Triangulation Framework

Analytical Dimension	Theoretical Anchor	Empirical Focus	Expected Analytical Output
Climate Induced Labor Vulnerability	Adaptive Social Protection (ASP); IPCC (2022)	Agriculture, fisheries, and construction sectors	Identify vulnerability patterns and adaptation gaps
Access to Social Protection	Social protection inclusion and behavioural barriers (Behrendt et al. 2019; Panda 2013)	BPJS Ketenagakerjaan registration, affordability, and trust	Evaluate exclusion factors within the informal sector
Institutional Responsiveness	Governance adaptability and institutional change (Patterson et al. 2019)	BPJS Ketenagakerjaan regulatory rigidity and data integration	Assess flexibility and policy learning capacity
Comparative Adaptation Strategies	Adaptive social protection frameworks and comparative climate-responsive social protection models (Costella et al. 2023; Bowen et al. 2020)	Bangladesh, Vietnam, and the Philippines	Derive reform pathways for BPJS Ketenagakerjaan transformation

Source: Authors' elaboration based on Behrendt et al. (2019); Costella et al. (2023); IPCC (2022); Patterson et al. (2019); Bowen et al. 2020)

The search process employed Boolean combinations of keywords such as social security, climate change, informal employment, BPJS Ketenagakerjaan, adaptive social protection, and labor resilience. Studies were considered eligible for inclusion when they met the following criteria: examined the relationship between climate change, labor market vulnerability, social protection, or institutional adaptation in developing-country contexts; were published as peer-reviewed journal articles, policy reports, or official publications issued by reputable international organizations; provided conceptual, empirical, or policy-relevant insights related to adaptive governance, institutional resilience, labor protection, or climate-responsive social protection; and were published between 2015 and 2025 and available in English or Bahasa Indonesia.

The exclusion criteria comprised duplicate records, editorials, opinion papers, conference abstracts, non-empirical publications, and studies lacking direct relevance to climate change, labor resilience, social protection, or institutional adaptation. Following the screening process, all selected references were categorized, annotated, and managed using Mendeley

reference management software. This procedure ensured systematic traceability, consistency in coding, and transparency throughout the interpretive synthesis process.

The selected literature was then analyzed through content analysis, thematic coding, and comparative institutional mapping, each validated through reflexive cross checking against the ASP framework. Content analysis identified recurring themes such as informal labor vulnerability, income instability, and institutional rigidity. Thematic coding organized findings into four code families (vulnerability, access, responsiveness, reform) derived from the ASP model, applying a hybrid inductive–deductive approach (Saldaña 2021). Comparative institutional mapping positioned BPJS Ketenagakerjaan relative to adaptive social protection models in Bangladesh (EGPP), the Philippines (4Ps), and Vietnam (community-based climate funds), from which reform pathways were synthesized. This process ensures both vertical contextualization (situating BPJS Ketenagakerjaan within Indonesia’s national framework) and horizontal benchmarking (comparing with global adaptive systems).

To facilitate comparative institutional visualization, the findings from the comparative institutional mapping were translated into a two-dimensional interpretive framework presented in Figure 3. The horizontal axis (Policy Adaptability) reflects the extent to which each social protection system incorporates climate-responsive regulations, adaptive benefit design, flexible financing mechanisms, and anticipatory governance. The vertical axis (Operational Responsiveness) reflects institutional capacity to implement adaptive policies through rapid benefit delivery, inter-agency coordination, adaptive targeting, and integrated information systems during climate-related disruptions. Each country was assigned a relative interpretive score on a ten-point scale based on comparative qualitative assessment of these institutional characteristics derived from the reviewed literature. The resulting coordinates are intended solely as analytical representations for cross-country comparison and do not constitute official quantitative measurements.

Reflexivity was integrated throughout the study process to address the researcher's positional awareness, influenced by previous involvement with Indonesian social protection organizations, through iterative reflection and triangulation of interpretations from various data sources. This corresponds with constructivist epistemology, which asserts that validity arises from transparency rather than detachment (Creswell & Poth 2018).

The interpretive systematic literature review offers profound conceptual understanding but is constrained by the lack of primary field data and potential biases in secondary reporting. However, these limitations are alleviated through methodological triangulation and the

incorporation of both academic and institutional viewpoints, thus enhancing analytical generality and theoretical validity (Kitchenham 2004).

The analytical procedures described above provide a transparent linkage between literature selection, thematic coding, comparative institutional analysis, and the interpretive findings presented in the Results and Discussion.

Results and Discussion

The findings of this study are provided based on the thematic synthesis of the selected literature using the Adaptive Social Protection (ASP) framework described in the Research Method. Rather than describing each study separately, the analysis integrates evidence across academic literature and institutional reports to identify recurring patterns related to climate-induced labor vulnerability, access to social protection, institutional responsiveness, and policy adaptation.

The discussion is organized into two major parts. The first synthesizes the key findings from the literature review by examining the impacts of climate change on vulnerable employment sectors, the relationship between climate vulnerability and social protection access, the responsiveness of BPJS Ketenagakerjaan, and comparative experiences from other countries. Based on these findings, the second part discusses institutional adaptation and policy reform to propose pathways for strengthening BPJS Ketenagakerjaan as a climate-responsive employment social security institution.

Key Findings from the Literature Review

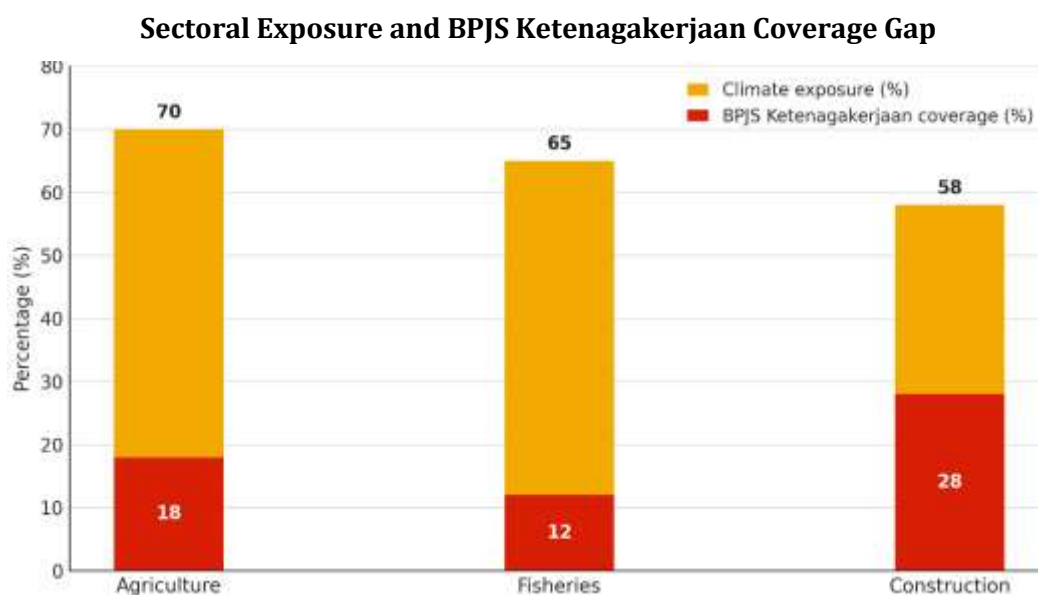
Effects of Climate Change on Employment in At-Risk Sectors

Climate change is causing significant disruption in labor-intensive sectors throughout Indonesia, especially agriculture, fisheries, and construction. Agriculturalists encounter increasing unpredictability as erratic precipitation, droughts, and elevated temperatures diminish crop yields, endangering household income stability and food security (Budiman et al. 2016; Ansofino et al. 2017). In the fisheries sector, ocean warming and changed current systems have transformed fish migration patterns, decreased catch yields, and compromised the economic stability of small-scale fishing communities (Islam et al. 2020; Rahman et al. 2021). Construction workers are additionally exposed to increasing heat stress, leading to decreased productivity and higher health hazards (ILO 2019). Collectively, these disruptions undermine job security, income stability, and access to social protection, particularly among informal and low-income workers.

These sectoral vulnerabilities are further exacerbated by Indonesia's labor market structure, where informal employment accounts for approximately one-half of total employment, increasing workers' exposure to climate-related risks due to limited social protection coverage (ILO 2019; OECD & ILO 2019). While several studies have recognized climatic shocks as a significant factor contributing to income instability, few have empirically investigated how social protection organizations, particularly BPJS Ketenagakerjaan, mitigate these sectoral risks. Research on Adaptive Social Protection (ASP) highlights the imperative of merging social safety measures with environmental adaptation (Fitritinia & Matsuyuki 2023), yet Indonesia's employment-based insurance system remains predominantly unchanged, providing minimal resilience to environmental disturbances.

The urgency of these challenges is further demonstrated by recent projections from the International Labour Organization (ILO 2019) and the Intergovernmental Panel on Climate Change (IPCC 2022). Southeast Asia is expected to witness the most rapid regional rise in heat-related productivity losses, with Indonesia alone forecasted to forfeit the equivalent of 4.5 million full-time jobs by 2030 as a result of heat stress. This poses both an economic difficulty and a significant social policy dilemma. Agricultural and construction workers who lack adaptive technology and institutional protection experience compounded vulnerabilities that cannot be alleviated only by reactive welfare measures.

Figure 2.



Source: Authors' synthesis based on ILO (2019), OECD & ILO (2019), ESCAP (2023), and BPJS Ketenagakerjaan (2024)

Figure 2 provides an interpretive synthesis illustrating the relative disparity between climate exposure and BPJS Ketenagakerjaan coverage across Indonesia's major climate-sensitive labor sectors. Rather than presenting official statistical estimates, the figure summarizes the comparative patterns identified in the reviewed literature.

Agriculture and fisheries consistently emerge as the sectors with the highest climate exposure (respectively about 70% and 65%) while exhibiting relatively low participation in BPJS Ketenagakerjaan (respectively about 18% and 12%), whereas construction demonstrates comparatively lower climate exposure (58%) and relatively higher institutional coverage (28%). These patterns indicate that workers facing the greatest climate-related risks remain among those least protected by employment social security. Collectively, the reviewed literature suggests that this imbalance is associated with structural barriers including affordability constraints, limited outreach, irregular employment, and low awareness among informal workers (ILO, 2019; OECD & ILO, 2019; BPJS Ketenagakerjaan, 2024).

Overall, the reviewed evidence shows that climate change has evolved from an environmental challenge to a structural employment risk, highlighting the need for a more adaptive employment social security system capable of protecting workers before climate shocks lead to long-term livelihood losses. In this context, these findings suggest that BPJS Ketenagakerjaan needs to shift from a compensation-dominated approach to gradually incorporating anticipatory schemes, including climate risk assessments and early warning systems. These steps will strengthen institutional preparedness and improve the resilience of climate-exposed workers.

Connection Between Climate Vulnerability and Access to Social Protection

The literature consistently indicates that access to social protection in Indonesia remains uneven and exclusionary, particularly for informal workers who face the greatest climate-related risks. Although BPJS Ketenagakerjaan was designed as a universal labor security mechanism, numerous barriers ranging from affordability constraints and limited awareness to procedural complexity have restricted participation among vulnerable groups (Adisty et al. 2023). The exclusion is most severe in agriculture and fisheries, where fluctuating incomes and low digital literacy hinder sustained contributions. This pattern suggests that climate vulnerability and limited access to social protection are mutually reinforcing, as workers facing the highest levels of environmental risk are often those least protected by formal employment insurance schemes.

Beyond structural barriers, behavioural and economic factors further limit participation in employment-based social protection schemes among informal workers. OECD and ILO (2019) argue that irregular earnings, employment insecurity, and limited contributory capacity constrain enrolment in formal social protection systems, while Panda (2013) emphasizes that affordability and perceived value influence participation decisions. These constraints are further reinforced by low institutional trust and recurring climate-related income shocks. Consequently, adaptive social protection should incorporate flexible contribution mechanisms, targeted subsidies, and climate-responsive financing to improve coverage among vulnerable workers (Bowen et al. 2020 ; Costella et al. 2023; ESCAP 2023).

Experiences from other countries demonstrate that many of these barriers can be addressed through climate-responsive social protection policies. For example, adaptive targeting mechanisms, integrated social registries, and shock-responsive delivery systems have been shown to improve the inclusiveness and effectiveness of social protection programmes in climate-vulnerable settings (Bowen et al. 2020; Costella et al. 2023). For Indonesia, this implies the need to reconfigure BPJS Ketenagakerjaan enrolment mechanisms to reflect context-specific vulnerability profiles, particularly within the informal economy. These comparative findings suggest that expanding social protection coverage requires institutional arrangements that are responsive not only to labor market conditions but also to climate-related vulnerabilities.

Overall, the reviewed literature indicates that climate vulnerability not only increases workers' exposure to livelihood risks but also widens existing gaps in access to employment social protection. Addressing these barriers requires enrollment mechanisms that are sufficiently adaptive to the socioeconomic characteristics of informal workers, thereby strengthening the inclusiveness of BPJS Ketenagakerjaan.

Responsiveness of BPJS Ketenagakerjaan

BPJS Ketenagakerjaan's responsiveness to climate-related labor risks remains constrained by its institutional design and regulatory orientation. The reviewed literature consistently indicates that the organization has successfully expanded employment social security coverage and strengthened administrative governance; however, its operational framework continues to focus primarily on conventional employment risks, including occupational accidents, death benefits, old-age savings, pensions, and job-loss insurance. Existing studies further suggest that climate-induced labor disruptions, such as income instability, temporary work interruption, and livelihood losses resulting from floods, droughts,

and extreme weather events, have not yet been systematically translated into programme design or adaptive benefit mechanisms specifically intended to protect climate-vulnerable workers (ILO 2023; Costella et al. 2023).

Although BPJS Ketenagakerjaan has incorporated climate-related risks into its institutional risk management and sustainability reporting, the reviewed evidence indicates that these considerations remain concentrated at the organizational governance level rather than being operationalized into climate-responsive social protection instruments for program participants (BPJS Ketenagakerjaan 2024; ILO 2023). Consequently, adaptive mechanisms such as climate-sensitive eligibility criteria, temporary contribution adjustments, shock-responsive benefit triggers, and anticipatory protection schemes have not yet become integral components of Indonesia's employment social security system.

The literature also indicates that existing administrative arrangements remain predominantly oriented toward post-event claims administration rather than proactive climate-risk anticipation. While BPJS Ketenagakerjaan has established enterprise risk management procedures to strengthen institutional governance, current evidence suggests that these mechanisms have not yet been integrated with climate vulnerability assessments, early warning information, or adaptive response systems designed to identify workers facing escalating environmental risks before livelihood disruptions occur (BPJS Ketenagakerjaan 2024; Costella et al. 2023).

Furthermore, institutional coordination between employment authorities, disaster management agencies, environmental institutions, and social protection providers remains fragmented. Comparative studies on Adaptive Social Protection emphasize that effective climate-responsive social protection depends on interoperable data systems, cross-sector governance arrangements, and coordinated institutional responses capable of linking social protection with climate adaptation policies (Behrendt et al. 2019; Costella et al. 2023; ESCAP 2023). In the Indonesian context, the absence of such integrated governance arrangements limits BPJS Ketenagakerjaan's ability to anticipate climate-related labor vulnerabilities and to deliver timely support for workers in climate-sensitive sectors.

International experience further demonstrates that institutional responsiveness can be substantially strengthened through the integration of climate vulnerability indicators, adaptive financing mechanisms, automatic benefit triggers, and cross-sectoral information sharing. Experiences from Bangladesh, the Philippines, and Vietnam illustrate that adaptive social protection systems become more effective when social insurance is linked with disaster preparedness, climate-risk information, and anticipatory governance mechanisms (Bowen et al.

2020; Costella et al. 2023; ESCAP 2023). Compared with these adaptive models, BPJS Ketenagakerjaan remains predominantly reactive, relying on conventional benefit administration after employment shocks have occurred rather than preventing climate-induced labor vulnerability before it escalates.

Overall, the reviewed literature suggests that BPJS Ketenagakerjaan has established a solid institutional foundation for employment social security but has not yet fully incorporated climate responsiveness into its governance, programme design, or operational mechanisms. Strengthening institutional responsiveness therefore requires not only expanding programme coverage but also embedding climate-risk assessment, adaptive governance, integrated institutional coordination, and anticipatory social protection mechanisms capable of enhancing labor resilience under increasing climate uncertainty.

Comparative Analysis of Global Adaptation Strategies

Cross-national experiences provide valuable insights into how employment-related social protection systems can be adapted to address climate-induced labor risks. In the Philippines, the Pantawid Pamilyang Pilipino Program (4Ps) incorporates shock-responsive social protection mechanisms that enable rapid cash transfers during climate-related disasters and extreme weather events. Supported by adaptive targeting and integrated beneficiary databases, the program enhances the capacity of vulnerable households to recover from climate shocks while maintaining access to essential social assistance (Bowen et al. 2020; Costella et al. 2023).

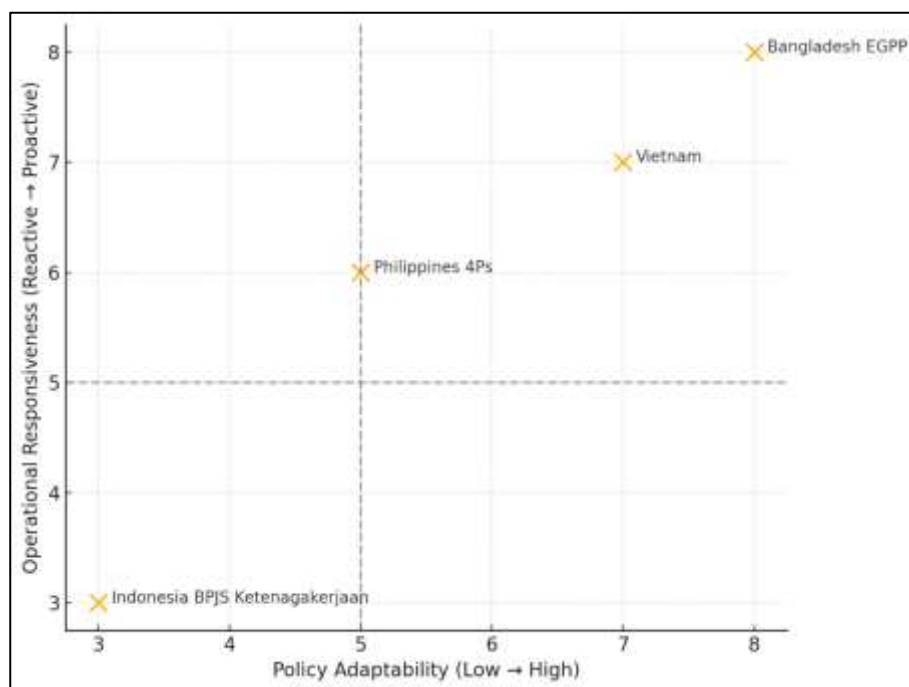
Bangladesh has adopted a complementary approach through the Employment Generation Program for the Poorest (EGPP), which provides temporary employment opportunities during periods of seasonal unemployment and climate-related disruptions. Rather than relying solely on post-disaster compensation, the program combines employment generation with income stabilization, thereby reducing livelihood vulnerability before climate shocks develop into prolonged economic hardship. This experience demonstrates how labor-oriented social protection can function as an anticipatory adaptation mechanism for climate-sensitive workers (Bowen et al. 2020; ESCAP 2023).

Vietnam has strengthened adaptive social protection by integrating community-based governance with locally coordinated climate adaptation initiatives. Decentralized implementation and collaboration between local authorities and social protection institutions enable more flexible program delivery and improve the responsiveness of social protection systems to climate-related risks. These institutional arrangements illustrate the importance of

linking social protection with local adaptive governance and community resilience (Behrendt et al. 2019; ESCAP 2023).

Collectively, these international experiences demonstrate that adaptive social protection extends beyond conventional benefit provision by incorporating anticipatory governance, adaptive targeting, flexible financing, and stronger institutional coordination. Compared with these approaches, BPJS Ketenagakerjaan continues to operate primarily as a reactive employment social security institution, highlighting the need to integrate climate-risk assessment, adaptive benefit mechanisms, and cross-sectoral coordination into its institutional framework.

Figure 3.
Institutional Responsiveness Framework Four Quadrant Model Comparing



Source: Authors' interpretive institutional mapping based on ESCAP (2023), Bowen et al. (2020), Costella et al. (2023), and Behrendt et al. (2019)

Note: The coordinates represent relative interpretive scores derived from qualitative synthesis and are intended for analytical comparison rather than official quantitative measurement.

Figure 3 presents a comparative institutional mapping derived from the interpretive scoring framework described in the Research Method. The figure compares employment-related social protection systems using two analytical dimensions: policy adaptability and operational responsiveness. The results reveal that Bangladesh's EGPP and Vietnam's adaptive

social protection model occupy the high adaptability-proactive quadrant, indicating their capacity to adjust benefit structures and deploy rapid response mechanisms during climate crises. The Philippines' 4Ps program is positioned in the moderate adaptability zone due to partial integration of climate response mechanisms, whereas BPJS Ketenagakerjaan remains in the low adaptability reactive quadrant.

These cases demonstrate that institutional adaptability requires not only regulatory reform but also fiscal innovation. Costella et al. (2023) emphasize that adaptive social protection must include climate risk financing mechanisms that allow resource reallocation during crises. Indonesia could adopt similar fiscal safeguards within BPJS Ketenagakerjaan's operational design, ensuring continuity of benefit delivery even under budgetary pressure induced by climate disasters.

This positioning highlights the empirical and institutional gap that constrains BPJS Ketenagakerjaan from functioning as a climate responsive social protection system. Compared to its regional counterparts, Indonesia's system still relies heavily on reactive benefit distribution without integrating climate early warning or contingency financing mechanisms (ESCAP 2023; Bowen et al. 2020; Costella et al. 2023). Strengthening BPJS Ketenagakerjaan institutional flexibility and policy innovation capacity will therefore be central to advancing Indonesia's transition toward adaptive and climate resilient labor protection.

Institutional Adaptation and Policy Reform for Climate Responsive Social Protection

The analysis underscores that Indonesia's employment social security system particularly BPJS Ketenagakerjaan remains constrained in its institutional capacity to respond proactively to the growing threats posed by climate change. The framework of Law No. 24/2011, which governs BPJS Ketenagakerjaan, was not designed to anticipate climate-related contingencies or dynamic labor disruptions, resulting in a system that remains rigid and reactive rather than adaptive (Wibisana 2013).

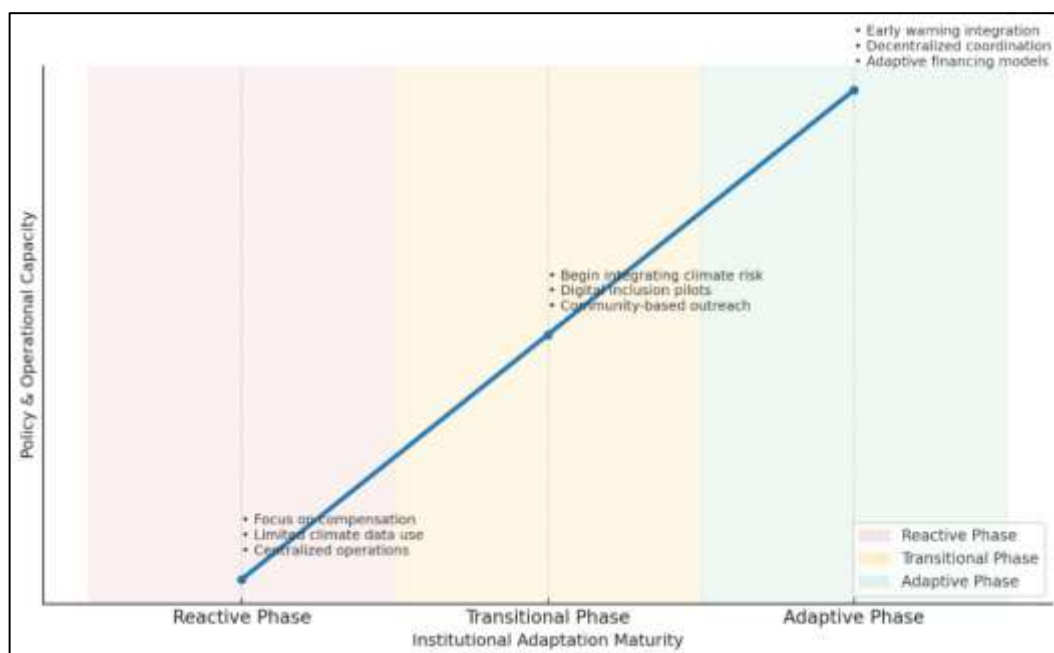
From a governance perspective, the literature consistently emphasizes that effective adaptive social protection requires strong institutional coordination, integrated governance arrangements, and interoperable information systems across employment, social protection, and climate-related sectors (Behrendt et al. 2019; Costella et al. 2023; OECD 2024). Such institutional fragmentation may delay policy coordination and constrain the flexibility of social protection institutions in reallocating resources or adapting benefit schemes during climate-related shocks (Bowen et al. 2020; Costella et al. 2023). Existing studies further suggest that

stronger inter-ministerial coordination is essential for integrating climate risk management into labor resilience and social protection policies (ILO 2019; OECD 2024).

In contrast, comparative evidence from countries such as Bangladesh, the Philippines, and Vietnam suggests that integrating shock-responsive social protection mechanisms, including automatic benefit triggers linked to early warning systems, can substantially enhance institutional resilience and improve response effectiveness (Bowen et al. 2020; Costella et al. 2023). These systems exemplify how social protection can evolve from a static compensation tool into a dynamic risk prevention instrument. By comparison, BPJS Ketenagakerjaan remains predominantly reactive, focusing on post-event claims rather than pre-emptive mitigation. This contrast illustrates the empirical gap identified earlier in the introduction: while international social protection systems have begun operationalizing climate adaptation, Indonesia's framework still views social protection as an isolated mechanism rather than a central pillar of national climate resilience.

Figure 4.

Adaptive Transition Pathway for BPJS Ketenagakerjaan



Source: Author's synthesis based on ILO (2019), Williams et al. (2023), and ESCAP (2023)

Figure 4 depicts the Adaptive Transition Pathway, illustrating BPJS Ketenagakerjaan's progressive shift from a reactive social insurance model toward an adaptive and climate responsive social protection system. The pathway shows three progressive phases that reflect increasing levels of institutional adaptability and resilience. Initially, BPJS Ketenagakerjaan

operates reactively, addressing post-event claims without integrating climate risk indicators. The transition is driven by policy learning, cross-sectoral coordination, and the integration of adaptive governance mechanisms, ultimately positioning BPJS Ketenagakerjaan as an anticipatory institution aligned with climate adaptation strategies. This conceptual pathway underscores the study's central argument that adaptive social protection must move beyond compensation to become a proactive governance mechanism fostering labor resilience amid environmental change (Costella et al 2023; Bowen et al. 2020; ESCAP 2023; ILO 2019; Williams et al. 2023).

Based on these findings, this study advances the argument that strengthening BPJS Ketenagakerjaan's climate responsiveness requires a paradigm shift from reactive social insurance to adaptive social protection. The findings of this study suggest that such a transformation would require three interrelated reforms: (1) embedding climate risk assessment in benefit design and policy planning, (2) enhancing inter-agency coordination for data and resource integration, and (3) expanding coverage mechanisms tailored to informal and climate vulnerable workers. By repositioning BPJS Ketenagakerjaan as an adaptive institution capable of anticipating rather than merely responding to climate shocks, Indonesia can move closer to achieving equitable and resilient labor protection in a changing environment. This recommendation aligns with global calls for smart climate social protection systems that combine labor security, disaster preparedness, and community-based resilience (Costella et al 2023; ESCAP 2023).

Overall, the proposed adaptive transition pathway illustrates how employment social security can evolve beyond conventional compensation mechanisms towards a more integrated, climate-responsive, and resilience-oriented system.

Conclusion

This study concludes that Indonesia's employment social security framework, represented by BPJS Ketenagakerjaan, remains insufficiently adaptive to the dynamic challenges posed by climate change. While BPJS Ketenagakerjaan has made commendable progress in expanding formal coverage and improving administrative efficiency, its institutional design continues to reflect a reactive and compensatory orientation, inadequately aligned with the systemic risks and uncertainties generated by the climate crisis.

The findings demonstrate that the absence of climate risk integration within BPJS Ketenagakerjaan's policy design, coupled with rigid regulatory structures and fragmented inter-agency coordination, constrains the institution's capacity to safeguard informal and climate

sensitive workers, the demographic most exposed to environmental and economic shocks. Consequently, there exists a structural misalignment between Indonesia's growing labor vulnerabilities and the institutional mechanisms intended to protect them.

Comparative evidence from countries such as Bangladesh, Vietnam, and the Philippines underscores the transformative potential of adaptive social protection (ASP) frameworks that proactively anticipate climate-related disruptions. These models demonstrate that integrating climate risk assessment, fiscal flexibility, and real-time benefit triggers within social protection systems significantly enhances institutional responsiveness and equity. Therefore, this research contributes both analytically and normatively to the discourse on labor resilience in the Global South by illustrating how a national social protection institution can evolve to address the intertwined challenges of climate change and informality. It emphasizes that adaptive governance within labor institutions is not only desirable but essential for sustaining equitable growth amid environmental transformation.

Based on these findings, several policy implications emerge for strengthening BPJS Ketenagakerjaan as a climate-responsive employment social security institution. These implications should be viewed as complementary strategies that support a gradual transition toward adaptive social protection.

1. Institutionalize Climate-Sensitive Risk Targeting

As demonstrated by the Philippines' Pantawid Pamilyang Pilipino Program (4Ps), social protection systems become more responsive when vulnerability identification is linked to shock-responsive targeting mechanisms. BPJS Ketenagakerjaan should therefore integrate climate vulnerability indicators into its enrollment and protection framework, particularly for workers in agriculture, fisheries, and construction. Such integration would enable the institution to move beyond uniform coverage approaches and prioritize workers facing the highest exposure to climate-related livelihood disruptions. This recommendation represents the initial step of the Transitional Phase in the Adaptive Transition Pathway.

2. Develop Adaptive Financing and Temporary Income Protection Mechanisms

The experience of Bangladesh's Employment Generation Program for the Poorest (EGPP) demonstrates the importance of flexible financing instruments and temporary income support during climate-related crises. BPJS Ketenagakerjaan should explore adaptive financing arrangements that allow temporary contribution subsidies, premium adjustments, or emergency income protection for affected informal workers during periods of environmental disruption. Such mechanisms would strengthen institutional flexibility and reduce the risk of participant exclusion during climate-induced income shocks.

3. Strengthen Community-Based and Decentralized Protection Systems

Lessons from Vietnam indicate that community-based climate funds and locally embedded governance structures enhance both participation and responsiveness. BPJS Ketenagakerjaan should expand collaboration with local governments, worker associations, cooperatives, and community organizations to improve outreach among climate-vulnerable informal workers. Decentralized engagement mechanisms would help overcome information barriers, increase institutional trust, and ensure that social protection interventions reflect local vulnerability conditions.

4. Establish an Adaptive Governance and Policy Learning Framework

Comparative evidence shows that adaptive social protection systems continuously evolve through institutional learning, cross-sectoral coordination, and evidence-based policy adjustments. Accordingly, BPJS Ketenagakerjaan should establish a formal policy learning mechanism involving climate agencies, labor institutions, and disaster management authorities. Pilot programs, periodic evaluations, and integrated data-sharing platforms would facilitate the transition from reactive administration toward anticipatory governance. This recommendation corresponds to the Adaptive Phase of the Adaptive Transition Pathway, where BPJS Ketenagakerjaan functions as a proactive institution capable of anticipating climate risks and protecting workers before vulnerabilities escalate into crises.

These recommendations envision a progressive transformation of BPJS Ketenagakerjaan from a conventional social insurance provider into an adaptive social protection institution. Rather than focusing solely on post-event compensation, the institution would progressively develop the capacity to anticipate climate-related risks, support vulnerable workers during periods of disruption, and contribute to long-term labor resilience in an increasingly uncertain environmental context.

Finally, strengthening BPJS Ketenagakerjaan through adaptive social protection is not only important for improving institutional responsiveness but also for supporting more inclusive, resilient, and climate-responsive labor protection in Indonesia. This study is based on a qualitative synthesis of the existing literature and therefore does not empirically assess the feasibility or effectiveness of the proposed institutional reforms. Future studies may complement this conceptual analysis by empirically evaluating the implementation and effectiveness of adaptive social protection mechanisms in strengthening employment social security under climate-related risks.

References

- Adisty, M. Rhesa, Jono M. Munandar, and I. Made Sumertajaya. 2023. "Factors Influencing Informal Workers' Registration for Social Security: A Comparative Analysis Between Indonesia and Taiwan." *Jurnal Aplikasi Bisnis dan Manajemen* 9(2):523–535. <https://doi.org/10.17358/jabm.9.2.523>
- Ansofino, Mahdi, Farida, Afrital Rizki, Frauke Lindenstruth, and Yolamalinda. 2017. "Assessing the Climate Change Impact on Farmers Household Welfare According to West Sumatra Agro-Ecological Zone." *International Journal of Applied Business and Economic Research* 15(5):593–606. https://osf.io/preprints/inarxiv/gw5x9_v1
- Asian Development Bank. 2021. *Climate Risk Country Profile: Indonesia*. Manila: Asian Development Bank. Retrieved from <https://www.adb.org/sites/default/files/publication/700411/climate-risk-country-profile-indonesia.pdf>
- Behrendt, Christina, Quynh Anh Nguyen, and Uma Rani. 2019. "Social Protection Systems and the Future of Work: Ensuring Social Security for Digital Platform Workers." *International Social Security Review* 72(3):17–41. <https://doi.org/10.1111/issr.12212>
- Bennett, Charmian M., and Anthony J. McMichael. 2010. "Non-Heat Related Impacts of Climate Change on Working Populations." *Global Health Action* 3(1):5640. <https://doi.org/10.3402/gha.v3i0.5640>
- Bowen, Thomas, Carlo del Ninno, Colin Andrews, Sarah Coll-Black, Ugo Gentilini, Kelly Johnson, Yasuhiro Kawasoe, Adea Kryeziu, Barry Maher, and Asha Williams. 2020. *Adaptive Social Protection: Building Resilience to Shocks*. Washington, DC: World Bank. <https://doi.org/10.1596/978-1-4648-1575-1>
- BPJS Ketenagakerjaan. 2024. *Integrated Report 2024: Strengthening Sustainable Protection Through Adaptive Governance*. Jakarta: BPJS Ketenagakerjaan. Retrieved from https://www.bpjsketenagakerjaan.go.id/assets/uploads/laporan_tahunan/BPJS_Ketenagakerjaan_IR_2025_-_Landscape.pdf
- Budiman, Ibnu, Takeshi Takama, Laksmi Pratiwi, and Erwin Soeprastowo. 2016. "Role of Microfinance to Support Agricultural Climate Change Adaptations in Indonesia: Encouraging Private Sector Participation in Climate Finance." *Future of Food: Journal on Food, Agriculture and Society* 4(3):55–68. Retrieved from <https://thefutureoffoodjournal.com/manuscript/index.php/FOFI/article/view/80>
- Costella, Cecilia, Maarten van Aalst, Yola Georgiadou, Rachel Slater, Rachel Reilly, Anna McCord, Rebecca Holmes, Jonathan Ammoun, and Valentina Barca. 2023. "Can Social Protection Tackle Emerging Risks from Climate Change, and How? A Framework and a Critical

Review." *Climate Risk Management* 40:100501.
<https://doi.org/10.1016/j.crm.2023.100501>

Creswell, John W., and Cheryl N. Poth. 2018. *Qualitative Inquiry and Research Design: Choosing Among Five Approaches*. Thousand Oaks, CA: Sage.

Davies, Mark, Bruce Guenther, Jennifer Leavy, Tom Mitchell, and Thomas Tanner. 2008. "Adaptive Social Protection: Synergies for Poverty Reduction." *IDS Bulletin* 39(4):105–112. <https://doi.org/10.1111/j.1759-5436.2008.tb00483.x>

Economic and Social Commission for Asia and the Pacific (ESCAP). 2023. *Social Outlook for Asia and the Pacific: Protecting Our Future Today – Social Protection in Asia and the Pacific*. Bangkok: United Nations ESCAP. Retrieved from <https://repository.unescap.org/server/api/core/bitstreams/27224ede-c0ca-4067-a792-3b63e45f6a3f/content>

Fitritia, Irene Sondang, and Mihoko Matsuyuki. 2023. "Social Protection for Climate Disasters: A Case Study of the Program Keluarga Harapan Cash Transfers for Smallholder Farm Household in Indonesia." *Progress in Disaster Science* 17:100278. <https://doi.org/10.1016/j.pdisas.2023.100278>

Hallegatte, Stéphane, Marianne Fay, and Edward B. Barbier. 2018. "Poverty and Climate Change: Introduction." *Environment and Development Economics* 23(3):217–233. <https://doi.org/10.1017/S1355770X18000141>

Intergovernmental Panel on Climate Change (IPCC). 2022. *Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge, UK, and New York: Cambridge University Press. <https://doi.org/10.1017/9781009325844>

International Labour Organization (ILO). 2019. *Working on a Warmer Planet: The Impact of Heat Stress on Labour Productivity and Decent Work*. Geneva: ILO. Retrieved from https://www.ilo.org/global/publications/books/WCMS_711919/lang-en/index.htm

International Labour Organization (ILO). 2023. *Social Insurance and Climate Change in Indonesia: Implications for Adaptive Social Protection Ambitions*. Jakarta: ILO. Retrieved from <https://www.ilo.org/publications/social-insurance-and-climate-change-indonesia-implications-adaptive-social>

Islam, Mohammad Mahmudul, Naimul Islam, Ahasan Habib, and Mohammad Mojibul Hoque Mozumder. 2020. "Climate Change Impacts on a Tropical Fishery Ecosystem: Implications and Societal Responses." *Sustainability* 12(19):7970. <https://doi.org/10.3390/su12197970>

- Kitchenham, Barbara. 2004. *Procedures for Performing Systematic Reviews*. Keele University Technical Report TR/SE-0401. Keele, UK: Software Engineering Group, Department of Computer Science, Keele University; and Empirical Software Engineering, National ICT Australia. Retrieved from https://www.researchgate.net/publication/228756057_Procedures_for_Performing_Systematic_Reviews
- Krishnamurthy, Manikandan, Priscilla Ramalingam, Kumaravel Perumal, Latha P. Kamalakannan, Jeremiah Chinnadurai, Rekha Shanmugam, Krishnan Srinivasan, and Vidhya Venugopal. 2017. "Occupational Heat Stress Impacts on Health and Productivity in a Steel Industry in Southern India." *Safety and Health at Work* 8(1):99–104. <https://doi.org/10.1016/j.shaw.2016.08.005>
- Madya, Sidiq Hari. 2024. "Jaminan Sosial Pekerja Informal: Studi Webnografi." *Jurnal Jamsostek* 2(2):118–140. <https://doi.org/10.61626/jamsostek.v2i2.27>
- Marisa, Lubis and Mustafa Matrodji. 2018. "The Effect of Non-Performing Loan, Capital Adequacy Ratio, Loan to Deposit Ratio and Operating Expenses to Operating Income on Deposit Portfolio of BPJS Ketenagakerjaan (2015–2017)." *Russian Journal of Agricultural and Socio-Economic Sciences* 76(4):150–160. <https://doi.org/10.18551/rjoas.2018-04.17>
- Mokomane, Zitha, Laurel Grzesik-Mourad, and Jody Heymann. 2024. "Enhancing Gender-Responsive Social Protection among Informal and Traditionally Uncovered Workers in Sub-Saharan Africa: An Assessment of Access to Maternity Protection." *International Social Security Review* 77(4):79–101. <https://doi.org/10.1111/issr.12373>
- Muttaqien, Muttaqien, Hermawati Setiyaningsih, Vini Aristianti, Harry Laurence Selby Coleman, Muhammad Syamsu Hidayat, Erzan Dhanalvin, Dedy Revelino Siregar, Ali Ghuftron Mukti, and Marten Olivier Kok. 2021. "Why Did Informal Sector Workers Stop Paying for Health Insurance in Indonesia? Exploring Enrollees' Ability and Willingness to Pay." *PLOS ONE* 16(6): e0252708. <https://doi.org/10.1371/journal.pone.0252708>
- Nowell, Lorelli S., Jill M. Norris, Deborah E. White, and Nancy J. Moules. 2017. Thematic Analysis: Striving to Meet the Trustworthiness Criteria. *International Journal of Qualitative Methods* 16(1):1–13. <https://doi.org/10.1177/1609406917733847>
- Nunfam, Victor Fannam, Eddie John Van Etten, Jacques Oosthuizen, Kwadwo Adusei-Asante, and Kwasi Frimpong. 2019. "Climate Change and Occupational Heat Stress Risks and Adaptation Strategies of Mining Workers: Perspectives of Supervisors and Other Stakeholders in Ghana." *Environmental Research* 169:147–155. <https://doi.org/10.1016/j.envres.2018.11.004>

- Nunfam, Victor Fannam, Kwadwo Adusei-Asante, Eddie John Van Etten, Jacques Oosthuizen, and Kwasi Frimpong. 2018. "Social Impacts of Occupational Heat Stress and Adaptation Strategies of Workers: A Narrative Synthesis of the Literature." *Science of the Total Environment* 643:1542–1552. <https://doi.org/10.1016/j.scitotenv.2018.06.255>
- Organisation for Economic Co-operation and Development (OECD), and International Labour Organization (ILO). 2019. *Tackling Vulnerability in the Informal Economy*. Development Centre Studies. Paris: OECD Publishing. <https://doi.org/10.1787/939b7bcd-en>
- Organisation for Economic Co-operation and Development (OECD). 2024. *Climate Change Adaptation: Policies for a Resilient Future*. OECD Net Zero+ Policy Papers No. 3. Paris: OECD Publishing. <https://doi.org/10.1787/8f29a387-en>
- Panda, Architesh. 2013. "Climate Variability and the Role of Access to Crop Insurance as a Social-Protection Measure: Insights from India." *Development Policy Review* 31(2):57–73. <https://doi.org/10.1111/dpr.12039>
- Pasaribu, Andri Ronaldo, Tanti Novianti, and Dominicus Savio Priyarsono. 2022. "Pengaruh Jangkauan terhadap Keberlanjutan Keuangan BPJS Ketenagakerjaan." *Jurnal Aplikasi Bisnis dan Manajemen* 8(3):868–878. <https://doi.org/10.17358/jabm.8.3.868>
- Patterson, James J., Douwe L. de Voogt, and Rodolfo Sapiains. 2019. "Beyond Inputs and Outputs: Process-Oriented Explanation of Institutional Change in Climate Adaptation Governance." *Environmental Policy and Governance* 29(5):360–375. <https://doi.org/10.1002/eet.1865>
- Prasetya, Kadek Aris, Ida Ayu Nyoman Saskara, and Putu Ayu Paramitha Purwanti. 2025. "Analisis Spasial Pembangunan Ekonomi Inklusif di Indonesia Tahun 2019, 2020 dan 2021." *Jurnal Ekonomi Kuantitatif Terapan* 18(1):19–39. <https://doi.org/10.24843/JEKT.2025.v18.i01.P02>
- Rahman, Moh. Shadiqur, Hery Toiba, and Wen-Chi Huang. 2021. "The Impact of Climate Change Adaptation Strategies on Income and Food Security: Empirical Evidence from Small-Scale Fishers in Indonesia." *Sustainability* 13(14):7905. <https://doi.org/10.3390/su13147905>
- Resosudarmo, Ida Aju Pradnja, Luca Tacconi, Sean Sloan, Fitri Arini Ulfah Hamdani, Subarudi, Iis Alviya, and Mohamad Zahrul Muttaqin. 2019. "Indonesia's Land Reform: Implications for Local Livelihoods and Climate Change." *Forest Policy and Economics* 108:101903. <https://doi.org/10.1016/j.forpol.2019.04.007>
- Riantini, Maya, Maesti Mardiharini, Saptana, Bedy Sudjarmoko, Eka Kasymir, Lestari Gita Nur'aini, Salsa Hentia Anindita, Mat Syukur, Armen Zulham, Budi Wardono, I. Ketut Ardana, Chandra Indrawanto, and Agus Wahyudi. 2024. "Livelihood Vulnerability of

- Fishermen Households Due to Climate Change in Lampung Province, Indonesia." *PLOS ONE* 19(12):e0315051. <https://doi.org/10.1371/journal.pone.0315051>
- Saldaña, Johnny. 2021. *The Coding Manual for Qualitative Researchers*. 4th ed. Thousand Oaks, CA: Sage.
- Siregar, Denny Jeremia. 2024. "Akuisisi dan Retensi Kepesertaan BPU: Mempertahankan Jaminan Sosial Ketenagakerjaan." *Jurnal Jamsostek* 2(2):163–184. <https://doi.org/10.61626/jamsostek.v2i2.20>
- Snyder, Hannah. 2019. "Literature Review as a Research Methodology: An Overview and Guidelines." *Journal of Business Research* 104:333–339. <https://doi.org/10.1016/j.jbusres.2019.07.039>
- Tambunan, Riana. 2023. "Efforts of BPJS Ketenagakerjaan in Socializing of an Old-Age Security Program to Informal Workers in the City of Medan." *DIA: Jurnal Administrasi Publik* 21(1):338–353. <https://doi.org/10.30996/dia.v21i01.7980>
- Torraco, Richard J. 2016. "Writing Integrative Literature Reviews: Using the Past and Present to Explore the Future." *Human Resource Development Review* 15(4):404–428. <https://doi.org/10.1177/1534484316671606>
- Venugopal, Vidhya, J. S. Chinnadurai, Rebekah A. I. Lucas, and Tord Kjellstrom. 2016. "Occupational Heat Stress Profiles in Selected Workplaces in India." *International Journal of Environmental Research and Public Health* 13(1):89. <https://doi.org/10.3390/ijerph13010089>
- Wibisana, Andri. 2013. "A Critical View on Indonesia's Legal Responses to Climate Change." in *Regulating Disasters, Climate Change and Environmental Harm: Lessons from the Indonesian Experience*, edited by M. Faure and A. Wibisana. Cheltenham, UK: Edward Elgar. <https://doi.org/10.4337/9781781002490.00014>
- Williams, Asha, Gracia Hadiwidjaja, Rabia Ali, and Imam Setiawan. 2023. *Adaptive Social Protection, Human Capital, and Climate Change: Identifying Policy Priorities for Indonesia*. Washington, DC: World Bank. Retrieved from <https://documents1.worldbank.org/curated/en/099022524232011138/pdf/P1772451bb33750361b4e2165a9e625af4d.pdf>
- World Bank. 2025. *Climate Risk Profile: Indonesia*. Washington, DC: World Bank Group. Retrieved from [https://climateknowledgeportal.worldbank.org/sites/default/files/country-profiles/17254-WB Indonesia-Country%20Profile-WEB.pdf](https://climateknowledgeportal.worldbank.org/sites/default/files/country-profiles/17254-WB%20Indonesia-Country%20Profile-WEB.pdf)