# Effectiveness of Climate Mitigation and Adaptation Strategies Implementation in Enhancement of Livelihood Capital: Evidence from a Systematic Review

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## ABSTRACT

Climate change adversities such as floods, droughts and heatwaves have become among the threats to human development and livelihood sustainability in vulnerable communities. Many developing countries have policies such as National Climate policies, Nationally Determined Contributions (NDCs) and National Adaptation Plans (NAPs) to combat climate change through the implementation of both mitigation and adaptation strategies to achieve Sustainable Development Goals (SDGs) 1, 2, 3, 6, 7, 11 and 13, although evidence on the effectiveness of implemented strategies in generating tangible livelihood outcomes remains limited. A systematic literature review was conducted using the PRISMA to review secondary data on the extent to which climate change mitigation and adaptation strategies have enhanced the five livelihood capital (financial, social, human, natural and physical) in climate-vulnerable communities globally. The review suggests that various implemented strategies such as Community-Based Adaptation (CBA), Climate Smart Agriculture (CSA), renewable energy diversification, and disaster risk reduction initiatives have enhanced some livelihood capitals across various communities. Although few studies explicitly examine how these strategies enhance Sustainable Livelihood Framework capital, they report that adopting various climate strategies reduces poverty and improves livelihood sustainability. Findings also demonstrate evidence of maladaptation, donor dependency, inadequate scaling, weak institutional coordination and social inequities (gender-related exclusions). The review concludes that effective climate strategy implementation requires simultaneous application of complementary mitigation and adaptation approaches by integrating Indigenous Local Knowledge, comprehensive community involvement and stakeholder coordination. These findings carry important implications for policymakers, development partners and researchers seeking to strengthen the evidence base for scalable, sustainable climate action.

**Keywords:** Mitigation and Adaptation strategies; Effectiveness; Climate Project Implementation, Livelihood capital, Sustainable Livelihoods; Vulnerable Communities

## INTRODUCTION

Climate change through extreme weather events such as heatwaves, droughts and floods poses a threat to human livelihoods, ecosystems and socioeconomic systems worldwide, with its impacts and consequences felt by the poorest and vulnerable populations(IPCC, 2018, 2023). These climatic events disrupt livelihoods such as agricultural production, natural resources and community cohesion which directly affects the very foundations of sustainable development (FAO, 2022; World Bank, 2020). For developing countries, most communities remain vulnerable to climate change with limited adaptive capacity, which calls for sustained investment in both mitigation (reducing the drivers of climate change) and adaptation (building resilience to impacts).

The legal foundation for international climate cooperation was established in 1992 by the United Nations Framework Convention on Climate Change (UNFCCC) and subsequently advanced through the Kyoto Protocol and the Paris Agreement of 2015 in response to the growing climate crisis to coordinate collective

action (UNFCCC, 2015). The Paris Agreement introduced a universal climate governance model requiring countries to formulate and progressively strengthen Nationally Determined Contributions (NDCs) and National Adaptation Plans (NAPs) as the central instruments for national-level climate mitigation and adaptation strategies to generate tangible improvements in human well-being and resilience (Rogelj et al., 2016).

The Sustainable Livelihoods Framework (SLF), developed by the Department for International Development (DFID, 1999), which is operationalized across development programming, identifies financial, social, human, natural, and physical capital as the core assets upon which individuals and communities draw to construct resilient and sustainable livelihoods(DFID, 1999; Du et al., 2025). These five capitals provide a coherent and empirically grounded framework for assessing whether climate change mitigation and adaptation strategies are generating meaningful, lasting improvements in community well-being beyond policy compliance. They become conditions for climate resilience when they strengthen these capitals simultaneously, and also conditions for maladaptation, where interventions enhance one capital at the expense of others or fail to reach the most vulnerable (Eshun & Denton, 2022a; Hansen et al., 2025). Therefore, the ultimate goal of implementing climate mitigation and adaptation strategies is to improve livelihoods and reduce vulnerability to climate change. One capital that people use to attain resilience. Literature is evident that human, natural, social, physical, and financial capitals significantly build resilience capacity, improve well-being, and alleviate poverty among climate change-vulnerable communities (Al Maamari, 2024; Azhari et al., 2025; Du et al., 2025; Mobeen et al., 2026; Phuong et al., 2023). Various climate mitigation and adaptation projects are being implemented in both developing and developed countries across all sectors globally to make vulnerable communities resilient, although these projects record both success and failure stories, there is inadequate empirical evidence of their effectiveness and traces of maladaptation are increasing (Bertana et al., 2022; Hansen et al., 2025; Reckien et al., 2023).

Further, a critical evidence gap persists as limited studies provide evidence on mitigation and adaptation strategies using a unified framework centered on livelihood capital and outcomes. Existing literature also reveals implementation gaps which pose a challenge to the translation of strategies into effective, scaled and sustained action on the ground in many vulnerable communities, as most of them are pilot-scale, donor-driven, poorly monitored and insufficiently aligned with the lived vulnerabilities of target communities (Berrang-Ford et al., 2019; Ford et al., 2015; UNEP, 2021, 2025)

This systematic literature review provides evidence of the effectiveness of climate change mitigation and adaptation strategies in enhancing livelihood capital and generating actionable insights that can inform more coherent, equitable and scalable climate action in vulnerable communities.

# METHODOLOGY

## Research Design

This study conducted a systematic literature review through the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). This method was selected for its structured process of identifying, appraising and synthesizing evidence, which is transparent and replicable, thereby minimizing selection bias and enhancing the credibility and verifiability of conclusions(Higgins & Green, 2011; Islam et al., 2025; Knobloch et al., 2011)

## Identification, Screening and Eligibility

Databases such as Google Scholar(mainly), Scopus and Web of Science were used for a systematic search of peer-reviewed literature. Search strings were as follows ("climate mitigation" OR "climate adaptation") AND ("livelihood capital" OR "financial capital" OR "social capital" OR "human capital" OR "natural capital" OR "physical capital" OR "livelihood resilience" OR "sustainable livelihoods") AND ("implementation" OR "effectiveness" OR "outcomes") AND ("community" OR "vulnerable populations") AND ("livelihood" OR "resilience" OR "vulnerability"). This search applied across titles, abstracts, full text and keyword fields for words with a total of 4,847 records retrieved to which 1, 633 were duplicates. The remaining 3,214 records

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were subjected to title and abstract screening and 412 were retained for full-text and relevance assessment and 89 studies met all eligibility criteria and were included in the final synthesis. The primary reasons for exclusion at the full-text stage were on grounds of lack of full-text availability and thematic irrelevance, such as absence of livelihood capital outcomes, focus on exclusively emissions data without community-level evidence, and insufficient methodological detail. Additionally, studies were identified through citation tracking of key review articles and through reference list scanning of included primary studies.

### Inclusion and Exclusion

Studies included were eligible with criteria such as (i) peer-reviewed journal articles, systematic reviews and institutional reports (ii) English-language publications (iii) address the implementation, outcomes or effectiveness of climate change mitigation and/or adaptation strategies (iv) reporting outcomes attributable to one or more livelihood capitals (financial, social, human, natural, physical) or livelihood resilience (v) proper methodological rigor with documented implementation evidence. Those excluded included (i) grey literature without institutional authorship and conference abstracts without full texts, (ii) non-English publications, (iii) focused exclusively on climate change science without reporting implementation outcomes, (iv) no identifiable geographic context, (v) theoretical without empirical evidence.

### Data Extraction

Data were extracted and analysed using evidence of implementation effectiveness and was synthesised thematically across all capital dimensions.

## FINDINGS AND DISCUSSIONS

### Enhancing Financial Capital

The reviewed literature collectively highlights that many strategies have been implemented in communities(Alves et al., 2020; Omala, 2023; Otto et al., 2025), among them being community-based adaptation (CBA) strategies. Studies suggest that CBA significantly improved financial capital through an observed increase in community income by beneficiaries, as well as empowering local communities with resilience and sustainability(Niu et al., 2023; Pan et al., 2023). Setiawan (2025) observes that during extreme weather events, the presence of community-based insurance schemes can reduce farmers' potential losses by up to 50%. The effectiveness of these approaches was attributed to the integration of local social, cultural, environmental, and economic community norms (Pan et al., 2023).

Findings also demonstrate that social protection programs that provide cash for poor households in vulnerable communities in exchange for community labour have a direct short-term improvement of financial capital by meeting their basic needs. These communities are able to invest proactively in preparation for natural disasters (Fitrinitia & Matsuyuki, 2022). Additionally, the strategy finds that membership in microfinance organizations is associated with lower social vulnerability to climate change and positively contributes to financial capital by helping households in regular saving through promoting participation in social groups (Nuruzzaman et al., 2025)

### Enhancing Social Capital

There is a broad consensus in the literature that various mitigation and adaptation strategies have improved community social capital through participation in disaster risk reduction initiatives by collaborating efforts, developing their leadership abilities, and developing skills that make them resilient to climate change(Andoh et al., 2024; Ncube & Arthur, 2021; Niboye & Farai, 2020; Owen, 2020). Kopytko, (2018) and Setiawan,(2025), suggest that organizations implement strategies such as the creation of cooperatives among community members in climate-vulnerable regions, which build networks, develop a sense of ownership and capacity for resilience by collaborative decision-making, community-based seed rotation, creating collective savings groups and sharing physical and informational resources(Arias et al., 2016; Fitrinitia & Matsuyuki, 2022; Nuruzzaman et al., 2025; Owen, 2020). Additionally, a study in Senegal and Mali, which explored the social

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capital impacts of a pilot community-based adaptation project, highlights that the project increased the likelihood of future collective action in the community and provided help to other community members (Patnaik & McPeak, 2023). Although Fanadzo et al. (2021) argue that social networks do not go beyond nuclear members to benefit communities at large. Likewise, even though strategies such as the construction of dams and implementation of community forests carbon project in Zambia have improved living standards through better water availability, employment creation, infrastructure like boreholes and schools, it is argued that socially, it has caused displacement, erosion of social cohesion, social inequality, disrupted livelihoods, and raised gender-related challenges(Mubiana, 2024; Mushimbei, 2025; Sripathi, 2025). This could be explained by the exclusion of other community members from initiatives and the eviction of community members from their land for project implementation, which could lead to land disputes. Similarly, while REDD+ is primarily intended to prevent forest loss and reduce emissions through land use change, issues of social justice and equity. Evidence suggests that communities are poorly served, and that REDD+ activities have been narrow rather than broad-based, driving inequalities and gender differentiation (social capital), as evidenced by expressed community disempowerment and disregard through continued deforestation and traditional charcoal production in project areas (Manda & Mukanda, 2023). However, the study's qualitative methodology, which relied solely on key informants to inform its conclusions, may cast doubt on its findings. A survey with the community may inform a different perspective on the findings.

**Enhancing Human Capital**

Most scholars agree that various strategies, such as training programs on water management, early weather warning systems, access to human health care and sanitation, well-being, skills development and organic farming techniques, have been implemented through community-based services and farmer groups (Niboye & Farai, 2020; Semien & Nance, 2022; Setiawan, 2025; Wright et al., 2024).

Studies that examine climate mitigation training, based on the Knowledge, Attitude, Preparedness, Skills(KAPS) approach, serve as a form of community capacity building that enables individuals to develop coping skills and knowledge to be resilient, directly improving human capital in vulnerable communities (Mishra, 2024; Niboye & Farai, 2020; Semien, 2022; Semien & Nance, 2022). Further, within agrarian communities, evidence highlights that farmers' capacity to utilize climate information reduced the risk of crop failure by up to 40%(Setiawan, 2025). This is attributed to training and warning sign systems that improved human capital. Wright et al., (2024) and Ncube & Arthur, (2021) agree that adaptive knowledge of climate risks and green urban drainage systems can enhance human capital through improved human health and sanitation.

Literature also demonstrates that strategies such as Ecosystem-based Adaptation (EbA) and agroforestry offer long-term solutions for conserving and restoring nature in vulnerable communities by addressing immediate climate change impacts, and enhancing human capital through improved health, education, and livelihoods (Vikas et al., 2023; Wangmo et al., 2025). Additionally, agrees that Regenerative agriculture (RA), which involves agroforestry, the practice of crop diversification, and crop rotation in India, plays a significant role in reducing multidimensional poverty (MDP) by improving access to education, healthcare, and living standards, thereby enhancing household human capital(Khosla et al., 2025)

**Enhancing Natural Capital**

Various implemented Nature-based Solutions (NbS) and Community-Based Conservation (CBC), such as reforestation, crop diversification and Reducing Emissions from Deforestation and Degradation (REDD+) have enhanced natural capital as observed by studies(Griscom et al., 2020; Manda & Mukanda, 2023; Mushimbei, 2025; Setiawan, 2025; Zafar et al., 2023).

(Guja & Bedeke, 2024; Niu et al., 2023) demonstrate how effective Community-Based Adaptation (CBA) strategies are in enhancing natural capital by reporting the restoration of 600 hectares of biodiversity and a 90% increase in water quality, while Nwankwo, (2025) adds that community-led reforestation and afforestation initiatives are effective in rehabilitating degraded lands, conservation of biodiversity contributes to enhancing natural capital. Land conservation efforts have been carried out through the implementation of

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terracing systems and reforestation as part of a flood risk mitigation strategy, together with agroecology and crop diversification, which have proven effective in enhancing resilience and increasing biodiversity (Setiawan, 2025). On the contrary, in Zambia, evidence suggests that climate initiatives such as the construction of dams affected biodiversity, disrupted the ecosystem, and raised sustainability with regard to water flow and land use (Sripathi, 2025)

In Ghana, projects like the Ghana Shea Landscape Emission Reductions Project (GSLERP) in northern Ghana aim to mitigate climate change by reducing carbon dioxide emissions from deforestation and forest degradation caused by overgrazing, bushfire, and illegal logging, among others, indicating an improvement in natural capital through forest increase from 1992 to 2020(Andoh et al., 2024). Likewise, in Zambia, the Luangwa community forests project contributed to forest conservation for the host community, thereby enhancing natural capital(Mushimbei, 2025). A common theme emerging from the literature on agroforestry highlights that the initiative enhances natural capital by improving soil fertility and resilience of local communities through the integration of crops and trees and optimizing land use through ecological cycles(Keprate et al., 2024; Wangmo et al., 2025). Despite evidence of improvement in natural capital, findings Manda & Mukanda, (2023) and Mubiana, (2024) suggest that strategies, which are primarily intended to prevent forest loss and reduce emissions through land use, are poorly served to communities, as natural capital is disrupted through continued deforestation, loss of forest resource control, and exploitation despite the existence of this initiative.

**Enhancing Physical Capital**

Most scholars agree that strategies such as provision of microfinance loans, construction of dams, markets, bridges, drip irrigation systems, solar- powered pumps, and extension services improve physical capital in areas with high climate vulnerability (Laudien et al., 2025; Nuruzzaman et al., 2025; Setiawan, 2025; Sony et al., 2023). However, literature presents conflicting evidence regarding disaster risk reduction (DRR) strategies, while Sony et al., (2023) suggest that physical structure such as dams, walls, cyclone shelters, roads, transport, and food storage facilities, enhance physical capital in coastal areas, Sultana & Luetz, (2022) argue that despite the presence of physical structures to support climate hazards in villages of coastal island, structures do not effectively support adequate physical asset transformation for climate change adaptation. This may be attributed to the limited extent/scale of implementation of physical climate strategies, such as cyclone shelters, improving drainage systems, and coastal water infrastructure.

**Enhancement of Financial, Social, Physical, Natural and Human Capitals/Assets**

A consistent pattern emerging from the literature is that various mitigation and adaptation strategies globally reduced vulnerability and improved the livelihoods of both rural and urban areas where these strategies were being implemented as a result of enhanced capitals(Financial, Social, Physical, Natural, and Human), which provided resilience to climate change shocks (Archer et al., 2020; Islam et al., 2025; Kurniawan et al., 2024; Loehr et al., 2022; Mathews et al., 2018; Muzorewa & Chitakira, 2022; Oduro et al., 2024; Ogola & Ouko, 2021)

For example, Wangmo et al. (2025) suggest Agroforestry, a system that offers multifunctional benefits by integrating trees, crops, and livestock to enhance both climate resilience, reduce vulnerability and livelihood security as a nature-based solution among farmers, strengthening natural and human capital by mitigating climate change through retention of soil carbon, improving microclimate stability, and enhancing year-round forage availability(Wangmo et al., 2025; Woroniecki et al., 2023). However, there was a persistent gap in human, financial and physical infrastructure capital development. Even though (Guja & Bedeke, 2024) critically note in their systematic review of articles about adaptation strategies such as crop, livestock, land/soil management, conservation agriculture, and climate smart agriculture improve productivity and production, which can be associated with enhancement of financial, physical and human capital for smallholders (enhanced livelihoods).

Climate Smart Agriculture (CSA) is one of the most widely implemented climate mitigation and adaptation strategies, particularly in rural areas around the world, especially in Africa, where most of the population

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depends on agriculture for their livelihoods. Studies suggest that over 60% of vulnerable community members adopt CSA practices with notable success in poverty reduction and sustainable livelihoods (Defe & Matsa, 2021; Kayula et al., 2022; Ngoma et al., 2024; Tilahun et al., 2023). CSA's effectiveness goes beyond just agriculture, Karimi & Ataei, (2024) add that it enhances education levels, hygienic facilities, type of housing, social cohesion and recognition, access to community facilities, cultivation area, road connections, new marketing opportunities, water resources, improved nutrition and cooking facilities(Vernooy, 2022), all associated with financial, physical, social, human and physical capital. In Zambia, literature suggests that despite the devastating effects of climate change, Eastern Province remains one of the areas where CSA is commonly practiced, thereby increasing crop productivity and yields among smallholder farmers (Nanyangwe & Tembo, 2024; Petros et al., 2024). Such an increase in Zambia is seen in the 2024/2025 maize production yields, where Eastern Province emerged second among ten provinces with 535,743.18 metric tonnes (ZamStats, 2025). On the contrary, it is argued that CSA increases deforestation rates and is rendered ineffective at building natural capital(Ngoma et al., 2021), results which Martinez-Baron et al., (2024) challenge by highlighting that CSA farmers show an inclination to adopt soil-improving practices acquired from social networks, thereby enhancing their natural capital (Martinez-Baron et al., 2024). The differences in the results could be as a result of different CSA practices investigated in different farming areas.

Scholars likewise agree that diversification in energy, such as solar and wind, enhances livelihood capital and reduces economic vulnerability (Cooray et al., 2025; Koutsoukos, 2025; Li et al., 2026; Nyoni et al., 2025). Evidence shows how several communities adopted renewable energy initiatives in Fiji to combat climate change risks through a grid-connected secondary school with rooftop solar PV and biogas, an off-grid community with solar home systems, and a farm that used solar PV for irrigation. Results suggest an increase in absorptive, adaptive, and transformative capacities for these communities with human, social, financial, natural and physical assets enhanced(Prasad et al., 2025). These findings are further supported in Zambia's southern province by Mweemba et al., (2025) observes that implemented solar-powered boreholes ensured year-round water access for domestic use, livestock, and irrigation, which significantly improved drought resilience, food security and reduced reliance on unclean water sources for 86% of the people.

Despite extensive research and evidence about the effectiveness of mitigation and adaptation strategies, others report that adaptation and mitigation initiatives are deemed ineffective and unsustainable, with communities left to shoulder the burden of reviving failing adaptation projects without proper sustainable plans (Eshun & Denton, 2022a; Mills-Novoa, 2023; Ngcamu, 2023). While on one hand strategies are celebrated for their benefits, such as improved income and agriculture. On the other hand, their sustainability is questioned when communities are faced with climate shocks. Factors such as poor scaling by both public and private implementers, inadequate funding and failure to collaborate have been highlighted in literature. For example (Appau et al., 2024; Eshun & Denton, 2023) suggest that, in urban areas, even though some public and private institutions collaborate in initiatives that aim to build physical, social, financial, human and natural capitals, such as providing potable water, education on crisis prevention, tree planting, improvement of drainage facilities, offering interest-free loans to support during crises, providing financial support, building affordable houses, and creating jobs. Initiatives are neither frequent nor sufficient, as well as not meeting or targeting the needs of vulnerable urban communities. Similarly Hansen et al. (2025) and Schuurman et al., (2022) adds that where adaptation strategies are not effective, it is possible that the target, adaptation strategy, and the scale of the action taken may be insufficient to address the degree of climate change impacts, which may cause maladaptation, with Eshun & Denton, (2022b) warning that enhancing assets in poor communities should be linked to the type of vulnerability experienced. This is mainly attributed to the misalignment of what the communities need as compared to what implementing institutions focus on, which may not be their main focus due to donor requirements.

However, evidence suggests that effective implementation of strategies requires a combined and collaborative effort by stakeholders such as community members, donors and project designers and implementers through the process of equity and accountability to maximize positive impacts on social, natural, human, financial, and physical capitals(Ullah & Bavorova, 2024). Further, Pacillo et al., (2024) observe that effective adaptation interventions require a combination of multiple factors, such as sustainable project management, improved institutional coordination and scalability of interventions, and improved innovation to interplay (Pacillo et al.,

2024). Most projects can only remain sustainable by allowing local-institutional partnerships, volunteerism, embedded leadership, national alignment, locally tailored livelihoods, perceptions of fairness and inclusion, and long-term community enthusiasm (Robinson et al., 2026). Additionally, (Guja & Bedeke, 2024) observes that the effectiveness of strategies increases with the simultaneous application of complementary mitigation and adaptation practices as well as proper application of practices and technologies, even as Dorji et al., (2024) and Filho, Wolf, et al. (2023) highlight that Indigenous Local Knowledge must be integrated with modern climate change adaptation strategies to anticipate more effective climate change responses for both urban and rural communities.

## CONCLUSION

A review was conducted on the effectiveness of climate change mitigation and adaptation strategies in enhancing livelihood capital, generating actionable insights to inform equitable and scalable climate action in vulnerable communities. Although various strategies implemented globally have shown improvements across the five livelihood capitals, literature suggests mixed findings. The findings highlight the significant contributions of these strategies to improving resilience and reducing vulnerability while also highlighting persistent gaps and challenges that require attention.

Community-based adaptation strategies, microfinance initiatives and social protection programs have demonstrated measurable success in improving financial capital with evidence showing increased community income and reduced losses for farmers during extreme weather events. Microfinance organizations have also empowered households to save regularly, thereby reducing social vulnerability. However, the sustainability of these financial gains remains contingent on long-term funding and scaling mechanisms.

Mitigation and adaptation strategies have fostered social cohesion, leadership development and collective action. Cooperatives and community-based initiatives have strengthened networks and facilitated collaborative decision-making. However, challenges such as displacement, social inequality and gender-related issues have been reported in some cases, particularly in large-scale projects. These findings highlight the need for inclusive and equitable approaches to avoid exacerbating social disparities.

Training programs, early warning systems and ecosystem-based adaptation strategies have significantly improved human capital by enhancing skills, knowledge and health outcomes. For example, climate information training has reduced crop failure risks while regenerative agriculture and agroforestry have contributed to reducing multidimensional poverty by improving education, healthcare and living standards.

Nature-based solutions such as reforestation, agroforestry and conservation initiatives have restored ecosystems, improved water quality and increased biodiversity. However, some initiatives have disrupted ecosystems and raised sustainability concerns, particularly in projects involving large-scale infrastructure like dams. Investments in physical infrastructure such as solar-powered pumps, drip irrigation systems and cyclone shelters have improved physical capital in vulnerable areas. Nevertheless, the limited scale and inconsistent implementation of these strategies have hindered their broader impact.

This review contributes to the growing body of evidence on the benefits of climate change mitigation and adaptation strategies. It highlights the importance of integrating local knowledge, fostering community ownership and ensuring equity in project design and implementation. The findings also highlight the need for a holistic approach that simultaneously addresses all livelihood capitals to build resilience effectively.

## RECOMMENDATIONS

1) To enhance the effectiveness, equity and scalability of climate change mitigation and adaptation strategies, it is essential to strengthen financial sustainability. This can be achieved by expanding access to community-based insurance schemes that protect against climate shocks, as these programs have been shown to significantly reduce potential losses. Supporting the establishment of microfinance organizations encourages savings and reduces social vulnerability, while developing sustainable financing mechanisms ensures long-term support for ongoing projects, reducing reliance on short-term donor funding.

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2) Fostering social inclusion and equity is another critical priority. Project designs must adopt inclusive approaches that ensure all community members, including marginalized groups, are involved in decision-making processes to avoid social exclusion and inequality. Gender-sensitive approaches should be integrated to mitigate the adverse impacts of climate strategies on women and other vulnerable groups. Additionally, strengthening cooperatives and community-based organizations can enhance social cohesion and collective action.

3) Enhancing human capital development requires scaling up capacity-building initiatives that focus on climate risk management, organic farming and ecosystem-based adaptation. Combining traditional practices with modern adaptation strategies can enhance the effectiveness of interventions, while investments in education and healthcare infrastructure are needed, particularly in rural areas, to support improved outcomes.

4) Prioritizing ecosystem restoration and sustainability is essential for long-term resilience. Promoting nature-based solutions such as reforestation and agroforestry enhances natural capital and biodiversity but thorough environmental and social impact assessments must be conducted for large-scale projects to minimize ecosystem disruption and displacement. Supporting community-led conservation initiatives ensures local ownership and long-term sustainability.

5) Scaling up physical infrastructure is necessary and investments in renewable energy projects such as solar and wind power enhance resilience and reduce economic vulnerability while improving disaster risk reduction infrastructure like cyclone shelters, drainage systems and water infrastructure, which addresses climate hazards. Infrastructure development must prioritize underserved and highly vulnerable communities to ensure equitable access.

6) Promoting integrated and collaborative approaches requires enhancing institutional coordination among stakeholders, including governments, NGOs and local communities to ensure alignment of objectives and resources. Adopting multi-sectoral strategies that combine complementary mitigation and adaptation practices maximizes their effectiveness and projects should be designed with scalability in mind to ensure broader impact and sustainability.

7) Monitoring and evaluation systems must be established to track the impact of strategies on livelihood capitals over time. Regularly engaging with communities to assess their needs and adapt strategies accordingly is crucial and creating platforms for knowledge exchange helps document and disseminate successful approaches and lessons learned.

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**(ii) Disclosure of conflict of interest**

The author declares that he is not aware of any competing financial interests or personal relationships that may have influenced the work described in this document.

**(iii) Statement of ethical approval**

This study is a review of published literature and did not involve human or animal subjects. Therefore, ethical approval was not required.

**(iv) Statement of Informed Consent**

Due to the nature of this work (secondary analysis of peer-reviewed published data), informed consent is not applicable.

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