

Original Article

Community-Based Approaches to Climate Change Adaptation

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Received: 01-04-2018

Revised: 01-25-2018

Accepted: 02-02-2018

Published: 02-04-2018

ABSTRACT

Climate change poses serious challenges, especially for vulnerable communities in developing regions, where traditional top-down adaptation approaches often fall short. This paper examines Community-Based Climate Change Adaptation (CBCCA) as an inclusive and participatory approach that integrates indigenous knowledge, local resources, and stakeholder engagement to enhance resilience. The study analyzes CBCCA models across coastal, rural, and urban settings, highlighting key factors such as community participation, policy support, and knowledge sharing. It proposes a framework combining quantitative and qualitative methods to assess vulnerability, adaptive capacity, and resilience, along with a composite index to measure effectiveness. Findings show that community-driven approaches significantly improve adaptation outcomes by strengthening local ownership and sustainability, though challenges like funding and scalability remain. The paper concludes by emphasizing the need to integrate CBCCA into broader climate policies and strengthen local governance and collaboration for long-term resilience.

KEYWORDS

Climate Change Adaptation, Community-Based Adaptation, Resilience, Vulnerability Assessment, Sustainable Development, Participatory Governance, Indigenous Knowledge.

1. INTRODUCTION

1.1. Background

The problem of climate change is an issue of global concern with various dimensions of complexities and numerous traits including global warming, changing rainfall distribution patterns, rise in sea level, and frequency and intensity of extreme weather events like floods, drought, and cyclones. The implications of these environmental changes extend far and wide in to natural ecosystems, economic systems and human societies, which have interfered with biodiversity and threatened food and water security as well as increasing social inequalities. The developing countries have been hit especially when they lack adaptive capacity, finances as well as overreliance on climatic sensitive industries like agriculture, fisheries and forestry. The natural resource in many of these places is directly connected to the livelihoods, and therefore community is very vulnerable to even slight changes in climate. Moreover, poor infrastructure, access to technology and instability of the institutional structures also increase their susceptibility. In the past, most of the climate adaptation approaches were based on top-down and centralized methods where the national or international level produces policies and interventions, with little regard to local settings. Although they might provide general solutions, they do not consume problems, priorities as well as socio-cultural dynamics of individual communities and thus result in ineffective implementation in translating solutions that lack sustainability over time. Contrary, community-based methods of climate adjustment have become recognized as an alternative, which is more inclusive and effective. Such practices focus on the value of localized solutions, community engagement, and incorporating indigenous and traditional knowledge regimes. Communities, via experienced life and generational expertise, have got a rich insight into the shift in environmental context and adjustive practices, which are quite pertinent to their settings. The utilization of such local knowledge and the development of a participatory decision-making boosts resiliency and makes interventions more acceptable, as well as contributing to the sustainable developmental outcomes of the community-based adaptation.

1.2. Need for Community-Based Adaptation



Fig 1 - Need for Community-Based Adaptation

1.2.1. Addressing Localized Climate Impacts

The effects of climate change are highly geographically dependent, as some regions all over the world are more affected than others depending on geography, climatic changes, and socio-economic status. These local differences are typically not included in the centralized adaptation approaches

causing ineffective or inappropriate interventions. The reason why community-based adaptation (CBA) is required is that it advocates local responses which directly solve the most vulnerable and risk circumstances that individual communities are exposed to. Through the participation of local stakeholders, the measures of adapting to the effects of climate become more pertinent, useful and viable in mitigating the risks that come with climate changes.

1.2.2. Utilization of Indigenous and Local Knowledge

The communities have a rich indigenous knowledge that was gained over the generations of interactions between the communities and the surrounding. These are the traditional agricultural methods, water conservation and the early warning signals using natural signs. Community-based adaptation takes advantage of this great knowledge, and combines it and approaches based on science techniques, to produce more powerful and situation-specific solutions. This combination will make adaptation strategies more effective and sustainable and also safeguard cultural heritage.

1.2.3. Enhancing Community Participation and Ownership

The community-based adaptation requires one of the most important needs that are to make sure that local people are involved in the decision-making procedures. The communities involved in the process of planning and executing the processes of adaptation will embed the feeling of ownership and responsibility. The effect is an increased level of acceptance, overall improvement in the implementation of adaptation efforts making them sustainable in the long run. Marginalized groups are also empowered through participation and therefore, no one is left behind in terms of adaptation strategies.

1.2.4. Strengthening Adaptive Capacity and Resilience

CBA is an important element in developing the adaptive abilities of communities due to enhanced access to knowledge, resources, and skills. Communities can be informed and empowered through training programs, awareness campaigns, capacity building, etc., to predict occurrence, response, and recovery of climate related shocks. This enhances greater resilience and less dependence on external help in crises.

1.2.5. Promoting Sustainable Resource Management

It is vital to manage the natural resources sustainably to adapt well to the climate. Community based strategies promote the wise management and protection of resources including water, soil, and forests. CBA makes sure that the practices are sustainable to long-term ecological equilibrium by engaging the local communities in the decision-making of resources management, which helps adaptation and development efforts.

1.2.6. Bridging Policy and Implementation Gaps

The gap between implementation of climate policies at a national level and the local level is usually missing. Community-based adaptation can fill this gap as a way of bringing all policies into strategies that can be applied in communities. It enhances more effective coordination both at the local and governing levels therefore ascertaining that policies developed are well implemented and tailored to the local demands.

1.3. Approaches To Climate Change Adaptation

Adaptation to climate change covers a broad scope of options that aim at limiting the vulnerabilities and increasing the resilience to the effects of climate variability and extreme events.

These strategies are mainly divided into structural, institutional, ecosystem-based, and community-based strategies. Structural or engineering solutions are physical activities like building up of flood barriers, drainage systems, irrigation infrastructures and climate-resistant housing, which concentrate on shielding communities against the instant environmental risks. Institutional approaches are policy formulation, governance structures, and regulatory interventions that facilitate the adoption planning and implementation at the local, regional, and national levels. These are climate action plans, disaster reduction risk policies and capacity-building programs that enhance institutional effectiveness. Ecosystem-based adaptation (EbA) involves the application of natural systems like forests, wetlands and coastal ecosystems to cushion the effects of climate changes besides facilitating the conservation of biodiversity and the effective utilisation of resources. Evidently, mangroves can be planted to safeguard against storm surges along shores and also sustain the lives of individuals. Along with this, community-based adaptation (CBA) focuses on the involvement of local community in adjusting and organizing views and implementation of adaptation plans so that solutions can be customized to a particular socio-economic and environmental context. In this strategy, the local knowledge is combined with scientific practices, which improves their ease of application and sustainability. More modern adaptation strategies are also being increasingly relevant based on technological methods, such as climate information systems, early warning systems, and tools that are based on data-driven decision-making. All these methods come with advantages and constraints and in most cases, their performance is usually determined by the integration of the methods. It will require having a holistic framework of adaptation, integrating several strategies to address the intricate and compound issues of climate change, which is preconditioning the long-term resiliency and sustainable development.

2. LITERATURE SURVEY

2.1. Evolution Of Climate Adaptation Strategies

The early climate adaptation policies were mainly a response mode and encompassed to a great extent, large scale infrastructural and engineering interventions like flood control systems, dams, levees and irrigation networks. These methods aimed at safeguarding communities against any immediate climatic threats especially extreme weather such as floods and droughts. Although these actions provided a temporary alleviation and proved technically efficient, they failed to consider the socio-economic aspect of vulnerability such as poverty, inequality and access to resources. Gradually, scholars and policymakers started paying attention to the fact that no structural solutions alone could be considered effective in long-term resilience. This epiphany created a paradigm shift to more integrated adaptation strategies that take into account environmental sustainability, economic development and social inclusivity. Subsequently, participatory and community-based methods became more popular, with the focus on the engagement of the local stakeholders, integration of traditional knowledge, and the necessity of the context-specific solutions that will respond to the current risk and contextual vulnerability.

2.2. Community-Based Adaptation Models

CBA models have become an appropriate model of dealing with localized climate risks through incorporating the communities in planning and implementation of the strategies conducive to the climate risks. Participatory Rural Appraisal (PRA) is one of the models that are used widely to ensure community participation with the help of mapping, seasonal calendar, and focus group discussions aimed to help the local population to determine their vulnerabilities and resources. Another approach of high importance is the use of ecosystem-based adaptation (EbA) to help reduce the effect of climate change by using natural ecosystems like wetlands, forests and coastal systems to enhance the conservation of the biodiversity. Second, LDMs aim at ensuring that there is less reliance on climate-

sensitive sources of income by promoting alternative livelihoods, which help to strengthen economic resilience. The key principles that these models have in common entail decentralization, inclusivity, and sustainability, and they also point out the relevance of interventions to be divided into the local socio-cultural and environmental contexts. CBA models play an important role in resiliency and adaptive capacity through empowering communities and increasing collective decision-making.

2.3. Role Of Indigenous Knowledge

The systems of indigenous knowledge are an essential part of the climate adaptation since they are centuries old and are based on observation, experience, and integration with the natural environment. Such knowledge systems have a broad scope of practices such as the traditional farming practices, natural conservation practices, natural forecasting of weather as in the use of natural signs and the management of biodiversity. Contrary to the traditional scientific methods, indigenous knowledge is quite frequently holistic, specific and entrenched within the cultural and social life. It has been shown by many research works that methods of integrating indigenous knowledge and modern scientific approaches result in the possibility of conducting effective and sustainable adaptation strategies. In example there can be scientific innovation in agriculture through supplementary of traditional crop varieties that are drought resistant or flood tolerant. Moreover, the system of native governance, and communal ethics can make use of resources sustainably and act in unison, which is essential to resilience building. The acknowledgement and esteem of the indigenous knowledge do not only improve the adaptation outcomes, they also guarantee the cultural continuation and community empowerment of society.

2.4. Challenges Identified in Literature

Although there is an increase in the awareness of Community-Based Adaptation as a relevant practice, the literature notes that there are various challenges that have persisted and prevented its implementation and subsequent success. Lack of sufficient financial means is one of the biggest limiting factors as communities cannot apply and maintain adaptation projects. Implementation efforts are complicated by institutional barriers which include poor governance structures, inadequate coordination between agencies and technical inadequacy. Also, local adaptation efforts also tend to lack connection with national or regional policy frameworks, which makes the integration of policy ineffective and reduces scale. Community-based projects are mostly small projects which are unable to grow because of resource limitation and institutional support. There is also a risk of undermining the inclusiveness and efficacy of such approaches by issues like uneven participation, marginalization of the vulnerable groups and insufficient information access. The solution to these difficulties would be a concerted effort between policymakers and researchers and local populations to make sure that the adaptation policies receive sufficient funding, institutional backing, and application to various settings.

3. METHODOLOGY

3.1. Research Design

In this work, the mixed-method research design is followed as it has combined both qualitative and quantitative approaches to consider all aspects of community-based adaptation (CBA) strategies against the background of climate change. The justification of using a mixed-methods methodology is that it will be able to reflect on the complexity of the adaptation processes, as they are not only composed of quantifiable environmental and socio-economic factors but also context-specific perceptions, experience, and cultural practices. Structured surveys and statistical tests would be performed on the quantitative side to measure the major indicators including household vulnerability, adaptive capacity, and income diversification, and resource access. These data offer quantifiable

findings about the performance and effectiveness of different strategies of adapting in different communities. To supplement this, the qualitative methods used include semi-structured interviewing, focus group discussions and participatory observation to better understand the system of local knowledge, community perceptions, decision making and institutional dynamics. This qualitative aspect is vital especially in explaining how indigenous knowledge and social networks contribute to the development of adaptive behavior. When methods are integrated it is possible to conduct triangulation, which increases the reliability and validity of the results as a result of cross-checking the data obtained by multiple sources. Also, the research design is exploratory and descriptive, which does not only seek to assess current practice but also determine new trends, issues, and prospects of enhancing community-based adaptation. The study provides a comprehensive interpretation of how communities or society can respond to the risks of climate change and how the process of adaptation strategies can be made more inclusive, sustainable, and scalable by putting the numbers with two layers of contextual narratives. The full depiction of this design means that empirical evidence, as well as human aspects, will be sufficiently reflected in the analysis.

3.2. Data Collection Methods

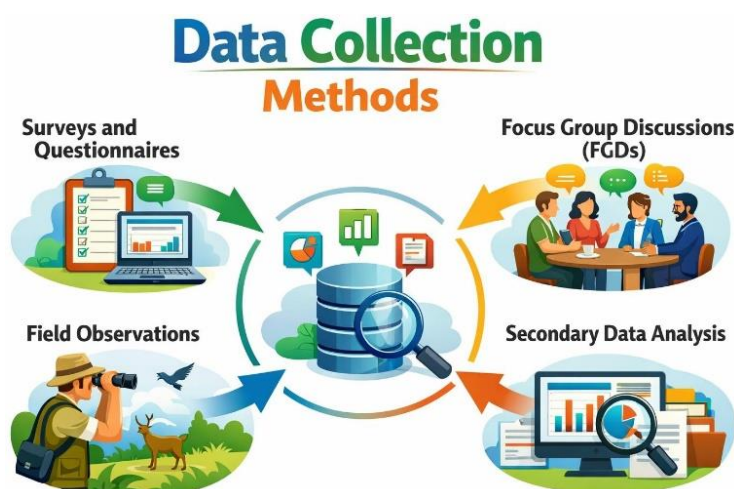


Fig 2 - Data Collection Methods

3.2.1. Surveys and Questionnaires

The primary quantitative instruments that will be employed include surveys and questionnaires that will help gather structured data on the household and community members exposure to climate risks, adaptation practices, and socio-economic factors. These tools will be shaped to be closed-ended and Likert-scale to allow easy analysis and with comparability among the respondents. Among the variables that are measured with the help of the surveys are income levels, the resources access, the awareness of the climate change, and the adoption of the adaptation strategies. This way is used to give statistically reliable examples of the activities and tendencies of community-based adaptation by addressing a representative sample of the population.

3.2.2. Focus Group Discussions (FGDs)

The qualitative approach used in this project is focus group discussions that help to collect the in-depth information on the perceptions, experiences, and decision-making patterns of community members towards climate adaptation. FGDs are usually conducted in small groups, with the members being of a variety of backgrounds, which promotes the development of dialogues and the sharing of

ideas. The approach can be used especially in the context of social dynamics, cultural practices, and local priorities, which shape the methods of adaptation. It is also used to determine community level problems, conflicts, and opportunities which might otherwise be missed in the structured surveys.

3.2.3. *Field Observations*

Field observations: These entail first hand in the field assessment of environmental conditions, infrastructure and practices observed by the community in the region in regard to their adaptation to climatic conditions. Physical evidence that is recorded and observed by the researchers includes water conservation systems, agricultural methods, housing, and the ecology state. This approach will give a practical confirmation of the information gathered in the surveys and interviews that states that the practices reported are similar to the real implementation. The field observations as well can be used in determining context-specific adaptation measures and environmental changes that might not be reported by the participants directly.

3.2.4. *Secondary Data Analysis*

Analysis of secondary data involves accessing and scrutinizing the available data sources including government reports, academic sources, climate databases, policy documents and NGO reports. The approach offers a bigger picture of the study as it gives historical trends, regional climate data, and details of approaches to adaption that have been previously used. It assists in the comparison of primary results with research as well as detecting gaps or consistency in the literature. Also, the secondary data makes the study more credible as it will support primary data with the proven and recognized sources of information.

3.3. **Vulnerability Assessment Framework**

A conceptual framework of integration of three important components (exposure, sensitivity, and adaptive capacity) is used to determine the vulnerability of a community to climate change. Simply put, vulnerability may be defined as exposures and sensitivity divided by adaptive capacity. Exposure can be defined as the level to which a community is exposed to climate related risks that can be flood, drought, heatwave, or cyclone. Regions are highly exposed to communities situated in coastal areas, flood plains or areas prone to droughts. Sensitivity on the contrary is a term used to discuss the extent to which a community is impacted by these climatic stresses. It relies on such aspects as reliance on climate-dependent livelihoods (ex: agriculture or fishing), health, population level, and infrastructure quality. As an example of this, societies that highly depend on rain-fed farming are more susceptible to alterations in rain patterns. Adaptive capacity is the capacity that a community has to respond to, manage, and recuperate the climate effects. It encompasses availability of financial resources, technology, education, institutional support and social networks. An increased adaptation capacity makes the communities more resilient to disasters by facilitating effective coping and adaptation mechanisms. Thus, when the exposure and sensitivity are high, high adaptive capacity can have a considerable negative effect on vulnerability. This framework offers an orderly approach to assessing and comparing the resilience of other communities, the most vulnerable populations, and interventions that focus on specific areas. With this knowledge of the interactions between these three elements, policymakers, and researchers can develop more effective, comprehensive, and sustainable climate adaptation plans that would attend to the immediate threats and long-term resiliency requirements.

3.4. Proposed Framework Flowchart

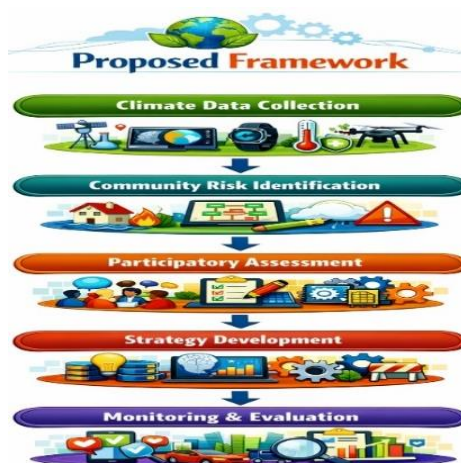


Fig 3 - Proposed Framework Flowchart

3.4.1. Climate Data Collection

The initial process in the suggested model is the systematic gathering of climate related information of various sources such as the meteorological departments, satellite readings and the local environmental records. Some of the parameters contained in this data are variations in temperature, precipitation, frequency of high weather, and changes in seasons. Precise and up-to-date climate information is what is needed in studying the historical trends and forecasting future climatic conditions. Also, the combination of scientific data and local observations would also promote the effectiveness of the analysis and the analysis would be based on the fact that the information obtained is representative of macro and micro climatic conditions.

3.4.2. Community Risk Identification

The step after the data collection entails determining the nature of the danger to the community. This will entail the interaction of the climate hazards with the local socio-economic as well as environmental factors to develop vulnerabilities. These factors include geographic position, livelihood dependence, quality of infrastructure, population aspects among others to determine the level of risks. Identification of the risks will assist in distinguishing the most vulnerable populations and locations in the community, thus allowing purposes to plan the interventions.

3.4.3. Participatory Assessment

Participatory assessment is a very important phase when the community members get actively involved in realizing their vulnerabilities, resources, and adapting requirements. Local knowledge and experiences are injected by the local stakeholders through community mapping, focus groups and participatory rural appraisal methods. It is an inclusive method that helps to make the assessment process responsive to local realities and priorities and, as well, allows making the members of the community feel a sense of ownership and empowerment. It interprets the discrepancy between the outside research and local views.

3.4.4. Strategy Development

Depending on knowledge that has been acquired at the earlier phases, suitable adaptation mechanisms are designed with the stakeholders. Such strategies can be livelihoods diversification, ecosystems restoration, better water management approach, and disaster preparedness. It concentrates

on developing context-based, sustainable and economical solutions that will see to it that both short-term risks of the business are handled as well as long-term resiliency. The participation of the stakeholders makes the strategies acceptable culturally and practically.

3.4.5. Implementation

Implementation stage entails the actualizing of the developed strategies into action with the help of synchronized actions amid members of the community, local authorities as well as supporting organizations. This is a phase that needs to be properly planned, resource allocation, capacity-building, and support in order to be carried out well. The proposed adaptation measures, such as training programs, awareness campaigns, and technical assistance, are important to empower communities to implement and maintain proposed adaptation measures.

3.4.6. Monitoring & Evaluation

The last step of the framework is the process of tracking the progress and assessing the efficiency of the introduced strategies. This will entail monitoring critical performance indicators, evaluation, and finding areas of improvement. Feedback on the community and the stakeholders is provided regularly to improve and make the needed adjustments to the strategies. Monitoring and evaluation make the community processes accountable, help to enhance the learning process, and sustain the community-driven adaptation programs in the long-term.

3.5. Resilience Index Calculation

Compositiveness of Resilience index is used to measure the resilience of a community in reference to three vital dimensions that include adaptive capacity, livelihood stability and governance effectiveness. The Resilience Index is expressed simply as the average of these three elements that are the adaptive capacity/livelihood stability and governance effectiveness, i.e. the total is divided by three. Adaptive capacity is the theory of how a group of people can predict, react and recuperate to climate-based shocks, and it is based on educational levels, availability of technology, finances, and social connections. Livelihood stability is associated with uniformity and sustainability of sources of income in the community especially during environmental changes. The distribution of income in communities that are diversified, e.g., a mixture of agriculture and small-scale enterprises or other types of employment, is generally more stable in livelihood and not affected by climate change as much. The third component is the governance effectiveness which captures the quality of institutional assistance, policy execution, transparency as well as participation of community in the processes of decision making. Good governance makes the adaptation plans well coordinated, inclusive and effectively implemented. These three factors are integrated into one index through the framework, and this is what gives a comprehensive view of the resilience as a measure of socio-economic and institutional aspects. An increased Resilience Index represents a greater capacity to resist and adapt to the effects of climate of the community, whereas a lower index reflects those places where specific measures have to be taken. The technique helps policy makers and researchers to also compare their levels of resilience within any community and come up with design solutions that would build the weak components which can result in sustainable and inclusive climate change adaptation.

4. RESULTS AND DISCUSSION

4.1. Key Findings

The review demonstrates that community-based adaptation (CBA) is an important tool towards resilience and vulnerability to the effects of climate change. CBA guarantees the context-specificity of interventions, their cultural appropriateness and their attentiveness to the real needs through engaging

the local communities in planning and implementing the adaptation strategies. The results show that the more communities have well-built social networks, i.e. trust, cooperation and mutual support, the more resources are shared, information disseminated and the collective response to the challenges associated with climatic changes. These social systems make it easier to recover faster in case of environmental shocks as well as make it easier to adopt new practices of adapting. Moreover, availability of efficient institutional support, such as local governmental institutions, nongovernmental organizations and policy framework, plays a major role in enhancing adaptive capacity. Through such institutions provision of financial resources, technical knowledge and training programs is facilitated and thus enabling communities to undertake sustainable adaptation practices. Another crucial observation of the research is that societies who combine both traditional knowledge and use of modern science are the ones that will induce more benefits of resilience. Moreover, it determines diversified livelihoods, increased access to infrastructure and the involvement of the community in decision-making as major aspects of enhancing adaptive capacity. Conversely, those societies that are not supported by institutions or have low social cohesion adapt more slowly, and have greater amounts of vulnerability. In general, the results highlight that environmental exposure alone does not make individuals resilient but social and institutional processes also have the strong impact. Thus, inclusion of everyone, empowerment of local institutions, and creation of networks through building communities are fundamental principles towards improving the effectiveness and sustainability of climate adaptation.

4.2. Percentage-Based Results Table – Explanation

Table 1: Percentage-Based Results Table – Explanation

Parameter	Improvement (%)
Adaptive Capacity	68%
Livelihood Stability	62%
Resource Management	71%
Community Participation	75%
Disaster Preparedness	66%

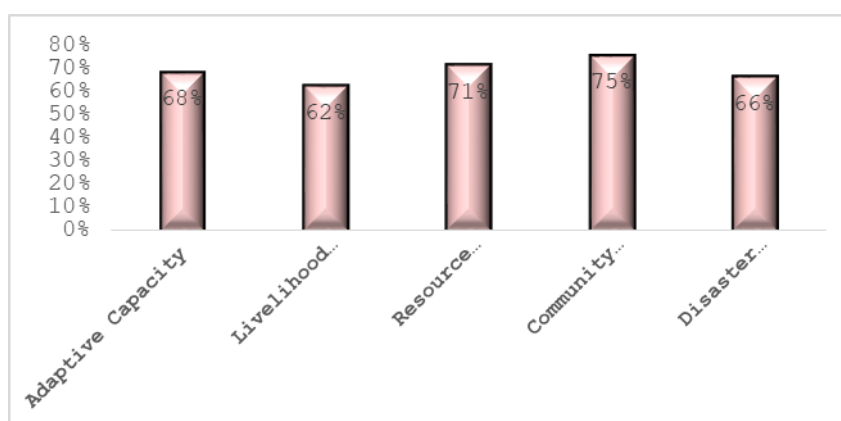


Fig 4 - Percentage-Based Results Table – Explanation

4.2.1. Adaptive Capacity (68%)

According to the results an increase in the adaptive capacity was made by 68 percent, which implies a great deal of improvement in ability of the community to react and recuperate in regards to issues on climate. This can be credited to heightened awareness, availability of climate resistant technologies, and an improvement in the education and training programs. The communities have

enhanced their coping capacities and they now have better farming methods, use of early warnings, and have enhanced social support systems. Such improvement indicates a healthy change which is toward proactive adaptation instead of being reactive.

4.2.2. *Livelihood Stability (62%)*

The livelihood stability has improved by 62 percent, indicating that communities have gone a long way in developing their income sources in an effort to make them more stable. This involves adopting alternative livelihoods, e.g., small scale business, skill based jobs and agriculture methods that are resistant to climate change. Communities are more resistant to environmental surprises by diversifying through the elimination of a single source of income, which is climate dependent. In as much as the improvement is significant, it similarly suggests that additional efforts to attain more consistent and sustainable economic resilience are necessary.

4.2.3. *Resource Management (71%)*

There have been a high improvement of 71 in resource management, which means that natural resources are utilized and conserved proficiently through water, soil and forest resources. This has been through community-based measures such as rain water harvesting, sustainable agriculture and rehabilitation of the ecosystem. It has also been contributed by the convergence between the traditional knowledge and the contemporary resource management methods. This percentage is high to prove that societies are increasingly more efficient in using scarce resources in a sustainable way, which is the key to a long-run resilience.

4.2.4. *Community Participation (75%)*

Community involvement with an improvement of 75 percent becomes one of the greatest successes of the adaptation framework. More participation of local stakeholders in decision making process, planning and implementation has increased ownership and accountability. Participatory methods such as group discussion, local committees and local initiatives have empowered people and made adaptation measures to be inclusive and context-based. This sustained interaction is essential toward effectiveness and viability of community-level adjustment.

4.2.5. *Disaster Preparedness (66%)*

The 66 percent increase in disaster preparedness implies the improved level of disaster preparedness among communities to foresee and react to climate-related risks like floods, droughts, and storms. This involves early warning systems, evacuation, emergency response training as well as awareness programs. The communities can now reduce the damage and are likely to recover faster on disasters. Although the development is rather positive, modernization of infrastructures, training, and communication mechanisms is a future task which needs to be systematically invested to increase resilience and preparedness even more.

4.3. Discussion

The study findings strongly highlight the importance of participatory strategies in improving effectiveness of the climate adaptation strategies. Participatory approaches as they engage the community members in the decision-making process, in planning as well as implementation processes make sure that the adaptation responses are based on local realities and adjusted to the local environmental and socio-economic circumstances. This involvement creates a sense of ownership in the community members, which goes a long way in enhancing the acceptability, adoption and sustainability of adaptation measures. Moreover, participatory approaches contribute towards the

alignment of indigenous knowledge and scientific knowledge resulting to more creative and context sensitive solutions. Also highlighted in the study results are the fact that communities that are engaged more have better social cohesion, have better management of resources as well as are more resilient to shocks created by climate factors. Nevertheless, as much as community participation is a major factor of success, it cannot exist on its own basis. It has been shown in the discussion that external support is critical to overcome limitations that exist and expand adaptation activities. The adaptation projects should be executed and maintained with the provisions of the financial assistance especially in the communities which are resource-starved. Also, there is need to establish a sound policy integration to coordinate local programs with regional and national clusters climate orientation initiatives to achieve coherence and institutional support. Government, research and non-governmental agencies can also be useful in technical training, implementation of new technologies and general arming of communities. As such, the moderate methodology that integrates high levels of community involvement and sufficient external assistance is essential in realising sustainable and scalable climate adaptation results.

5. CONCLUSION

This paper has shown that community-based solutions to climate change adaptation offer an inclusive and viable solution to help in dealing with the challenging increasing problems related to climate variability and extreme weather events. With communities being central to the process of developing adaptation plans and implementation, such strategies aim to make sure that strategies rest on the realities of a place, respond to a culture, and react to the particular environmental and socio-economic circumstances. It has been demonstrated that indigenous and local knowledge combined with scientific practices would considerably add value to the applicability and usefulness of adaptation practices. Further, the energy of involvement in the activities concerning community members enhances social cohesion, fosters social responsibility, and improves the chances of sustainability and effectiveness of interventions in the long term. It is also important to note that in the study the significance of the building of institutional capacity at local levels is discussed because successful adaptation of communities is made possible through effective structures of governance and accessibility of resources and supportive policies. The results also indicate that community-based approaches can not only help in minimizing vulnerability, but also establish long-term resilience through the process of tackling the socio-economic and environmental factors. Yet, to achieve their maximum potential, there is the necessity to have a further integration between local programs and global policy frameworks. The initiators of the policymaking process should focus on creating and passing innovative policies that allow communities to participate, get necessary funding, and access technical knowledge. Multi-level governance systems should be reinforced with a higher capacity to coordinate local and regional stakeholders, and national stakeholders to scale up and make adaptation efforts more influential. Moreover, education, capacity building and infrastructure investments are key to empower communities and maintain the adaptation efforts in the long-term. To move forward, future studies should aim at finding ways of measuring up effective models of community-based adaptation integrated models in various geographic and socio-economic settings. The search into the combination of the new knowledge systems with the existing climate information systems, remote sensing, and digital platforms in an effort to build upon adaptive capacity is also increasing. Full integration of participatory strategies with technology and good institutional backing can enable the climatic adaptation processes to be more effective, technologically efficient and equitable. Finally, this paper supports the argument that sustainable climate resilience could only be attained by joint, community-based, and multi-layered measures.

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