Divergent Perspectives on Ecosystem-Based Adaptation: A Comparative Analysis of Governmental Officials and Farmers in Mountainous Communes of Thua Thien Hue Province, Vietnam

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Article

Divergent Perspectives on Ecosystem-Based Adaptation: A Comparative Analysis of Governmental Officials and Farmers in Mountainous Communes of Thua Thien Hue Province, Vietnam

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Abstract: Ecosystem-based Adaptation (EbA) has been recognized as the key practice to support farmers in adapting to climate change. The success of EbA requires a cohesive alignment from the national level to community implementation. However, harmonized efforts from central governments to local farmers remain underexplored in literature of climate change and adaptation, especially in the context of mountainous areas of Vietnam. This study applied multiple qualitative research tools including 12 key informant interviews, 6 focus group discussions, and 18 in-depth interviews to explore the varying perspectives of EbA between government officials and farmers, which then affect their involvements in governmental initiatives. Using matrix coding visualization in NVIVO, the study showed the differences between government officials and farmers in EbA perceptions affecting the EbA practice at communes. The study also found the factors affecting the EbA practices including knowledge, economic priorities, and institutional support, labor shortages, limited market access, and funding inadequacies. The policy implication drawn from this study is necessary for bridging top-down policy with local realities to ensure the sustainability and effectiveness of EbA. The paper then contributes to EbA literature by encouraging for context-specific adaptation strategies to enhance the effectiveness and inclusivity of EbA practice in vulnerable communities.

Keywords: ecosystem-based adaptation; sustainability; smallholder farmers

1. Introduction

Climate change and environmental degradation heavily affect the agriculture, forestry, and fishing sectors, causing the cumulative losses of 3.8 trillion USD between 1991 and 2021, with 123 billion USD in annual average. The Asian countries, who contributing up to 65% of global value-added in agriculture, forestry, and fishing have faced the highest absolute losses [1,2] caused by the heightened exposure to climatic and environmental perturbations and low capacity for adaptation [3]. Meanwhile Asian farmers encounter significant difficulties to adapt the climate change and environmental degradation because of the limited accessibility cultivated land, lack of technical and financial support, and limited education. Moreover, farmers often cultivate in marginal lands which highly vulnerable to risk such as landslides, floods, and droughts. Accordingly, farmers are unable to adapt the escalating frequency and intensity of extreme weather events and gradual environmental degradation.

Different efforts have been made by governments, research institutions, and non-governmental organizations (NGOs) to increase the capacity for farmers to adapt the climate change and environmental degradation such as diversifying and modernizing the agricultural techniques [4],

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providing the governmental subsidies and assistance [5], developing the credit schemes[6], and improving of good farm management practices[7]. Despite the effectiveness of these measures recognized, the practices require high level of investments and supports which surpass the farmers' capacities. Therefore, agroecological and ecosystem services-based agriculture management have been considered as the cost-effective and alternative practices for farmers to adapt the climate change and environmental degradation.

Ecosystem-based Adaptation (EbA) includes measures that protect and enhance biodiversity and ecosystem services. These are used in farming to keep and increase production while making farmers more resistant to extreme weather [8]. Various EbA has been commonly practiced, especially in mountainous area such as agroforestry to reduce the negative impacts of rainfall and high temperatures on crops and livestock [9,10]; the establishment of windbreaks to reduce damage from strong winds [11]; application of cover crops and terracing to protect soil fertility and erosion [12]; design of live fences to prevent soil erosion and provide fodder for livestock; and diversifying of agricultural productions to mitigate the risk of productivity losses caused by extreme weather events, pests, and diseases [13]. In forestry sector, different EbA such as forest restoration and rehabilitation have been applied to reduce the risk of landslide and erosion [14], conserving riparian forests to regulate streamflow under varying rainfall conditions [15] and protecting upland forests to prevent erosion and landslides triggered by extreme weather events [16].

Although the consistency of government and local communities in perception and implementation of EbA has been considered as the critical factor for successful practice of this measure, the issue remains underexplored in the literature. Amend [17] stated that successful climate change adaptation relies not only on governmental actions but also on collaboration with various stakeholders, including local communities. Similarly, Reid [18] emphasized that a consistent alignment between national and community-level policies ensures the contextual relevance and effective implementation of EbA initiatives.

Through the case study in mountainous communes of Thua Thien Hue province, Central Vietnam, this study examines the contrasting perspectives of governmental officials and farmers on EbA practices. Particularly, the paper aims to understand EbA practice by smallholder farmers across three studied communes; (2) identify the divergence of perception on EbA between governmental officials and farmers; and (3) explore the factors influencing farmers' adoption of EbA practices.

2. Literature Review

2.1. Ecosystem Based Adaptation for Smallholder Farmers in Mountainous Area

Ecosystem based adaptation (EbA) is a holistic approach that integrates the ecosystem restoration with human livelihoods by leveraging the biodiversity and ecosystem services to strengthen human resilience to the impact of climate change [8]. In mountainous area, EbA has been highlighted as the effective initiative to address the vulnerabilities of smallholder farmers – who depend on fragile ecosystems for their livelihoods - amid extreme weather conditions and the environmental degradation [14]. Mountainous areas face a unique set of geographical, ecological, and socio-economic challenges, which make them susceptible to hazard conditions and highly expose to extreme weather conditions such as soil erosion, landslides, flooding, and droughts [19].

The EbA practice of farmers in mountainous is challenged by the topography of the region such as steep slopes and fragile soils and risks associated with environmental degradation [20]. Moreover, the previous studies highlighted barriers for farmers to practice EbA including lack the financial resources, low technological capacity, and shortage of infrastructure to effectively cope with these challenges. These issues consequently make smallholder farmers especially vulnerable to climate-induced shocks [14]. Furthermore, the limitation of accessing external support such as limited access to credit, low markets and information accessibility further inhibits their ability to adopt more resilient agricultural practices [12].

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Since smallholder farmers' livelihood are intricately linked to natural resources, they are often at the forerunner of climate adaptation. Various practices of EbA conducted by smallholder farmers has been significantly reviewed, with studies highlighting the potential to improve productivity, mitigate the vulnerability, and maintain ecosystem functions [14]. For instance, the practice of agroforestry systems in mountainous area have been contributing to stabilize soils and improving the water retention. Moreover, this practice provides additional income for households [9]. Similarly, the initiatives of soil conservation including terracing and/ or cover cropping are effective in reducing the erosion and improving the soil fertility [12]. However, the practice of EbA by smallholder farmers in the context of mountainous areas is hindered by various challenges. The previous studies stated that farmers often face the shortage of financial accessibility, limited know-how on agriculture production, and inadequate institutional support, which constrain the effective implementation of EbA [21]. Besides, other relevant studies mentioned the socio-economic challenges of smallholder farming, including labor shortages and market uncertainties, exacerbate these challenges [8]

2.2. The Unalignment of EbA Practice Between Government and Local Farmers

Various studies explored the alignment of government and local farmers, examining how effective this cooperation contributes to the success of EbA. Most these studies confirmed that there is lack of the cooperation between these two stakeholders in implementing and enforcement of EbA due to the policy misalignment [22,23], challenges of integrating local knowledge into national strategies [24], lack of institutional support [25], insufficient communication between stakeholders [26]. These barriers cause a disconnect between government and local communities in design, implementation, and reinforcement of adaptation strategies. Moreover, the top-down approach in government initiatives may not coherent between localized needs and priorities for EbA practice [27] While Tran and Nichols [28] stated that the coordination among stakeholders is crucial for implementing and maintaining the effectiveness and sustainability of EbA through the knowledge integration into adaptation strategies. Similarly, Kissi et al [29] confirmed that the coordination between government and farmers is significant to improve the resilience against the extreme weather conditions and enhance the local people livelihoods

The government refers systemic approach to improve the resilience of ecosystem and human livelihood in long term, therefore the policy framework on EbA targets to ecological priorities and address macro-scale environmental challenges [30,31], whereas local communities and farmers also emphasize the short term benefits of EbA practice to address the issues emerged from agriculture and livelihoods [32]. To achieve the outcomes of EbA, the government launched the relevant programs on forest restoration, biodiversity conservation, and agroforestry to obtain the broader development goals [33]. Different governmental supports to practice EbA initiatives includes capacity-building programs, financial incentives, and regulatory frameworks aimed at promoting sustainable land management. Therefore, many studies underscore the importance of integrating approach to EbA, in which institutional priorities are aligned with localized needs of farmers. Participatory planning and co-design of adaptation strategies has been considered as the measure to address this gap. Through the involvement of farmers in decision making processes, the government can issue the relevant policies on EbA with the suitable for context-specific, inclusive and match the local needs [34].

3. Methodology

3.1. Research Design

Different from other previous quantitative based studies using questionnaires [14,35], this study applied qualitative method design to explore the perceptions of governmental staff and farmers about ecosystem-based adaptations. This approach provides the opportunity to get insight into the practice of EbA, the factors affecting EbA practices, and the consequences of it.

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3.2. Study Area

The study was conducted in three communes: Phong My in Phong Dien district, Hong Thuong in A Luoi district, and Thuong Lo in Nam Dong district located in the mountainous region of Thua Thien Hue Province, central Vietnam. These three communes have a different natural and socio-economic condition, climate vulnerabilities, and as well as EbA approach. Phong My commune has a natural area of 40,000 hectares, with 75% covered by natural forest. Since the commune has hilly terrain and moderate slopes, it has potential to diverse the agriculture production and other critical ecosystem services. Due to the extreme weather events such as storm, floods, and irregular landslides, which disrupt agriculture production and local livelihoods, various EbA have been applied by local smallholder farmers such as community forest management, promotion of indigenous tree species, medicinal plants, and conversion low productivity land into orchard.

In contrast to Phong My commune, Hong Thuong commune faces the significant challenges in agriculture production and local farmers' livelihood due to its geography on the upstream of A Sap River and at the edge watershed. The commune is highly vulnerable to climate change when it has faced the increasing of rainfall intensity, landslides, soil erosion which reduce the agriculture production. Since the poor land condition, there are a few EbA practices with the primarily focusing on sustainable forest management and cultivation the medicinal plants under the canopy. A Lack of market accessibility for agriculture product remains challenges for farmers, especially the ethnic minority who replying on traditional agriculture production for their main livelihood sources.

Thuong Lo commune has the favorable condition to develop agriculture production and forestry activities, with the highest percentage of forest cover at 87% and the location on the fertile valleys. However, the commune also faces the erratic weather patterns including storms, heavy rains which pose risk to the disruption of agriculture production and local people livelihood. Various EbA has been adopted by the smallholder farmers such as developing the resilient crops like pineapple and cinnamon, community forest management, and diversifying orchard in garden such as green pomelo, and orange, and other animal husbandry models. Forestry remains a keystone of local people livelihoods, in which restoring the indigenous species being actively promoted in this commune.

3.3. Data Collection Methods

The deliberate contacts with stakeholders were initially set up to give the introduction of research objectives. In this process, the study applied a nonprobability purposive method to select stakeholders from different groups such as government staff and farmers for interviewing. The selection of stakeholders from governmental organizations was based on their functions related to climate change adaptation in agriculture and forestry. As result, there were 12 stakeholders involving in this study, who are from Department of Agriculture and Rural Development, department for Forestry management, Department of Rural Development, Forest Development and Protection fund, Division of Agriculture and Rural Development at District level, Center for Agriculture Technique, and Commune Authorities. There were 18 farmers involved in this study who have typically agriculture production at communes. The study conducted in-depth interviews with 18 smallholder farmers (6 from each commune). The interviews explored the types of EbA practices adopted, the perceived impacts of climate change, and the factors influencing the adoption of EbA strategies. Moreover, 6 focus group discussions were held, with 4–6 participants in each group, consisting of farmers, local agricultural extension officers, and community leaders. The discussions provided additional insights into the collective experiences and community-level factors that influence EbA adoption.

3.4. Data Analysis

This paper applied theme content analysis as this method is suitable and relevant for providing the policy implications [36,37]. Based on a priori themes, the themes identified in this study were: climate change adaptation, EbA practices, economic considerations, livelihood strategies,

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infrastructure issues, and local initiatives. Following this, the collected data and information were imported into Nvivo for coding analysis. The coding process was created by reading carefully the data and identifying suitable information linked to a specific theme. However, during the analysis, new information and insights emerged, leading to the creation of emerging themes to incorporate these new ideas.

Since this study is to explore the different perspectives of governmental officials and farmers on Ecosystem-based Adaptation (EbA) that affect the practices at three communes in the mountainous districts of Thua Thien Hue Province, Vietnam, the coding was grouped into two different groups, being governmental officials and farmers. To analyze the data, word frequency analysis, coding comparison, and matrix coding queries were applied to examine how frequently government officials and farmers mentioned EbA-related topics. Additionally, a cross-tabulation of EbA-related strategies was conducted to identify the differences in perspectives between the two groups.

4. Findings

4.1. Climate Change Impacts and EbA Practices at Study Sites

Smallholder farmers, especially the forest-dependent households are highly vulnerable to climate change. The group discussion across three communes indicated that extreme weather events such as storms, floods, and droughts have negatively impacted on local people livelihoods as well as destroying the infrastructure (see table 1). The specific negative impacts of climate change on agriculture and livelihoods be discussed by the groups at three communes include land degradation, erosion exacerbate soil infertility, pest outbreaks, and temperature extremes, jeopardizes food security, and the decreased water availability. The discussion also highlighted that since most population are ethnic minority and poor households, they face the significant challenges in investing in climate resilience models and establishing the adaptative strategies for their households, leading to the intensifying their exposure to risks.

Table 1. The EbA practice of households and its impacts on livelihood.

Climate Change Impacts	EbA practice	Livelihood benefits from EbA
Extreme weather events (e.g., storms, floods, droughts)	Adopting climate-resilient crops and cropping patterns	Improved crop yields and income
Land degradation and erosion	Planting indigenous and drought-resistant tree species, medicinal plants cultivation	Enhanced ecosystem services (e.g., carbon sequestration)
Loss of crops and livestock	Promoting agroforestry and sustainable farming practices	Reduced vulnerability to climate impacts
Decreased water availability	Enhancing community forest management	Sustainable forest and resource management

Source: in-depth interview and group discussion.

EbA practices at across the three communes are the promising solution to reduce the negative impacts of climate change through integrating ecosystem services. The data from in-depth interview with smallholder farmers indicated various EbA adopted to ensure agriculture and forestry activities can withstand climate variability. For crop production, climate-resilient crops and cropping patterns have been adopted to cope with abiotic stresses including drought and flooding. Moreover, indigenous and drought-resistant tree species have been piloted and scaled up to maintain the ecosystem and mitigate exposure to diseases and extreme weather. Different techniques in agroforestry and sustainable farming such as soil erosion prevention, suitable fertilizing have been applied to enhance the biodiversity, stabilize the household income, and improve the resilience of

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farming system. In forestry activities, the community forest management plays an important role to ensure the sustainability of forest resources while improving the households' income sources, such as ecotourism and medicinal plant cultivation. These practices are countered by developing alternative livelihoods that reduce dependence on climate-sensitive agricultural systems.

The benefits of these EbA practice are recognized by both the local authorities and smallholder farmers. The group discussion and in-depth interview highlighted the improvement of crop yields and diversified income streams ensure stability for farmers even during adverse conditions. Moreover, enhancing ecosystem services such as carbon sequestration and water regulation, benefit both local smallholder in particularly and the district. Vulnerability to climate risks is reduced as diversified livelihoods and improved natural resources provide a buffer against shocks. Moreover, the governmental officials recognized that sustainable forest and resource management secures long-term ecological system, which then provide the critical services for local people. The study found varying levels among three communes in practicing the ecosystem-based adaptation, of which Thuong Lo commune has demonstrated the most advantages to practice EbA, while Phong My has shown the moderate EbA implementation. By contrast, Hong Thuong has lagged behind this adaptation (see table 2).

The focus group discussion and in-depth interviews in Thuong Lo indicated that local farmers have strong awareness about EbA and view the EbA practices as the transformation of production to achieve both economic and environment benefits. Accordingly, the local people have partly transformed their production from acacia and rubber to different kinds of crops such as cinnamon and pineapple, applying FSC for forest plantation, and developing medicinal plants under the forest canopy.

The local people in Phong My commune have moderate understanding of EbA and different types of EbA practices have been implemented such as land conversion into fruit trees and medicinal plants and developing community forest management. Different from the other two communes, the local people in Hong Thuong commune exhibited low awareness of EbA. The term itself was not mentioned by residents during interviews. Moreover, there has not been agriculture transformation at the commune during the last 10 years, due to the low conditions of land fertility and lack of effective water supply. Therefore, the local people are still keen on acacia for their economic development.

Table 2. The varying levels of EbA at three studied communes.

	Thuong Lo	Phong My	Hong Thuong
Awareness and Understanding of EbA	Strong awareness; active in community-based forest management; sees EbA as economic and environmental opportunity.	Moderate awareness; some discussions but not a major focus.	Low awareness; no direct mention of EbA initiatives.
Agricultural Adaptation Strategies	Shifting from acacia/rubber to cinnamon and pineapple; hesitant about FSC due to storm risks.	Major land use shifts (rubber to acacia, fruit trees, and medicinal plants) driven by economic opportunities.	No significant adaptation strategies focused on EbA.
Forest and Community-Based Approaches	Active community forest management: households receive carbon credits; focus on non-timber forest products.	Community forest groups manage large areas; interest in medicinal plants but lack market support.	Forest protection group contracted and paid by the commune.
Challenges in Implementing EbA	Market instability for alternative crops; economic priorities over environmental concerns.	Lack of financial incentives; weak market for medicinal plants and agroforestry products.	Likely limited support from governance; low engagement in ecosystem-based solutions.

Source: Data analysis from group discussions and in-depth interview commune authorities.

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4.2. Disaggregation Between Institutional Strategies and Local Realities Related to Climate Change and EbA Practice

Governmental officials at all levels and smallholder farmers have different understanding of climate change and its impacts, which may lead to varying perceptions of EbA (see table 3). Governmental officials referred to issues such as flood, drought and deforestation which are seen as province-wide challenges related to extreme weather conditions and natural resources degradation. As mentioned by the deputy director of Thua Thien Hue provincial Department of Agriculture and Rural Development, the provincial government has been struggling to the fragmented land and infrastructure inadequacies, which exacerbate climate vulnerabilities. Similarly, the officials from Department of Forest management focused on the degradation of natural forest, low investment for forest restoration, and the ecosystem services provision at provincial levels as the issues of climate change. Conversely, smallholder farmers recognize climate change and the disruption on daily livelihoods based on their perspectives and experiences. Mrs. X, a farmer in Hong Thuong commune showed the extreme weather event by the increasing severity of rainfall causing landslides, while other households pointed to the storm and how it does repeatedly damage the crops and livestock. These personal accounts highlight the immediate, evident consequences of climate change at the household level.

Table 3. The differences among interviewees regarding climate change impacts, ecosystem-based adaptation (EbA) measures, barriers, benefits, and awareness.

	Government officials	**Smallholder farmers**
Perceptions of climate change impacts	Discuss macro-level impacts such as drought, deforestation, floods, and infrastructure challenges	Focus on localized impacts like rainfall intensity, landslides, and crop damage
Proposed EbA practice	Advocate systemic, long-term strategies: agroforestry, indigenous species, and community forest management	Prioritize immediate, practical measures: crop shifts, resilient species, and FSC acacia planting.
Barriers to implementation	Highlight structural issues: funding shortages, limited infrastructure, and technical expertise	Cite practical challenges: labor shortages, immediate financial needs, and market access.
Emphasis on benefits	Focus on long-term ecological and socioeconomic benefits: resilience, carbon sequestration, and soil health.	Prioritize short-term economic returns: quick income through crops like acacia and cassava.
Awareness and training	Emphasize training programs for forest management and ecological farming.	Mixed awareness: some actively participate in training, while others lack exposure

Source: Synthesizing from group discussion and in-depth interview.

The divergence in EbA perception between government officials and smallholder farmers has led to the differences in proposing and prioritizing the EbA measures. There broad and systemic strategies related to EbA proposed and prioritized by government officials are promoting agroforestry, planting indigenous tree species, and improving community forest management. According to Forestry Management Department and department of Rural Development, the provincial government are now focusing on the long-term strategy for EbA solutions including rehabilitating the medicinal plants under the canopy and strengthening sustainable forest management. These EbA in the future will ensure the biodiversity conservation, better ecosystem service provision, and accessibility to carbon credit.

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On the contrary, the in-depth interview with smallholder farmers at communes showed the challenges to implement these EbA proposed by government officials at communes. Indeed, these EbA requires the high investment which may surpass the farmers capacity. Moreover, other relevant issues related to the seedlings of medicinal plants, the market for product consumption, the willingness of local households involving in sustainable forest management barrier the practice of these EbA. The stakeholder farmers prefer the immediate and practical adaptation to mitigate their daily production and livelihood. Accordingly, shifting cropping patterns, adopting resilient crops, and choosing economically viable options like acacia are the most favorable EbA practiced by smallholder farmers. The in-depth interview smallholder farmers also indicated the farmers' hesitancy to adopt new crops, such as cinnamon or medicinal plants due to their concerns over economic viability and market uncertainties, highlighting a gap between long-term EbA goals and immediate livelihood needs.

The barriers of EbA practice have been differently recognized between government officials and smallholder farmers. From government officials' perspective, structural challenges embedded in inadequate funding, lack of technical support, and low infrastructure conditions. The head of Division of Agriculture and Rural Development in Phong Dien noted the limited resources in both finance and human and fragmented markets for product consumption limited the capacity to practice EbA at commune. By contrast, farmers cite more localized and practical constraints. The group discussion found that labor shortages, immediate financial needs, and limited market access inhibitor the possibility of EbA practices. Mr. H, a farmer in Phong My commune, hesitated to apply FSC acacia production due to the extended growth cycles required, which conflicts with their need for quick returns. These contrasting perspectives highlight the disparity in addressing systemic versus day-to-day challenges. Data from in-depth interviews with government officials and smallholder farmers revealed the notable differences between these two groups in prioritizing the EbA practices at communes. Government officials preferred the long-term benefits such as soil health, carbon sequestration, and resilience capacity to climate change, viewing these as important ecological and socio-economic outcomes from EbA practices. For this reason, the government officials encouraged farmers to transform the short-term survival strategic in agriculture production and forest management to toward sustainable practices. Smallholder farmers, by contrast, focused on short business circle of crop for faster economic returns. This discrepancy between government officials and farmers underscores the challenges of long-term strategy for adaptation to climate change and the urgent economic realities of farmers.

The strategies to build capacity for EbA practice also differ between government officials and farmers. Of which government officials expected to design a training curriculum to increase the awareness of local people about sustainable practices. To this end, various training on sustainable forest management and ecological farming haven been conducted for farmers. However, the effectiveness of these training has been limited, which in turn affect the awareness of smallholder farmers about EbA and its benefits. The smallholder farmers, indeed, are keen on the technical training in agriculture production and market training so that they have more productivity and better product consumption. Moreover, the level of absorption about the training varied among the farmers. For instance, Mr. Y, a farmer in Thuong Lo commune, actively engage in forest management since he has better understanding about the importance of EbA and the benefits. By contrast, Mrs. Z, lack exposure to key concepts like organic farming or sustainable forestry. This variation in awareness among smallholder farmers reflects gaps in communication and resource distribution, which inhibit the adoption of EbA practices.

4.3. Factors Affecting EbA

The study found the multifaceted factors including awareness, social, cultural, economic, institutional, and technique on the EbA practice in mountainous communes. Moreover, these factors shape the engagement of government officials and smallholder farmers in EbA initiatives.

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The analysis of data from in-depth interview and group discussion showed that government officials have a comprehensive understanding of EbA as well as the long-term benefits. Strategic measures, including promoting agroforestry, planting indigenous trees, and advocating policies to support sustainable forestry management, have been prioritized by the government. As stated by the vice chairman of Forest Management Department, forestry restoration and sustainable forestry management is the prerequisite for ecosystem resilience, biodiversity conservation, adaptation to climate change, and achieve the sustainable economic outcomes. In contrast, the awareness of smallholder farmers on EbA is more localized and practical. While some smallholder farmers are familiar with EbA practices that directly impacts to their livelihood such as diversifying crops or involving in forest monitoring, many lack broader knowledge of EbA concept. Ms T, a women farmer mentioned that she involved in community forest management group as she can get payment for the forestry patrolling, meanwhile she was unaware that the forestry conservation and restoration would support to community to adapt the climate change, reducing landslide, and environment degradation.

In-depth interview governmental officials showed that they have faced the shortage of financial incentives, subsidies, and program to support the EbA implementation. Structural barriers to implement the EbA are limited fundings from government, the fragmented market for product consumption, and high costs of implementing the EbA such as FSC certification. The discission with governmental officials also explore economic opportunities at macro level to support the EbA practice at local communities such as the carbon credit system or the ecotourism, which are seen as the market-based mechanism to address the shortage of national budget allocated to forestry sector. The smallholder farmers, on the contrary, focused on immediate financial needs and practical constraints. They prioritized the changes of crops to receive the quick economic returns, event if these crops are less sustainable or more vulnerable to climate impacts. Mr P, a farmer at Thuong Lo commune, expressed hesitancy to apply FSC certification for their acacia production due to the uncertainty of market price and the high cost of this application. As a result, he remains the traditional current system of acacia for short business circle with quick turnover.

Since the study was conducted in mountainous communes that are home to high percentage of indigenous people, the social and cultural factors are significant to the implementation of EbA. In-depth interview with governmental officials revealed the importance of community engagement and social cohesion as the key factor affecting the EbA implementation at communes. Therefore, the government officials advocate the collective actions in all EbA initiatives at commune such as community-based forestry management and indigenous tree species development. Moreover, the relevant policies on EbA emphasized the involvement of marginalized groups, such as ethnic minorities and stress the inclusion of gender perspectives and equitable participation. By contrast, the involvement of smallholder farmers in EbA initiatives at communes varies. While some farmers actively engage in community forest management and receive the benefits from the collective efforts. Whereas other farmers faced the challenges of weak cohesion or low levels of trust hindering their participations in collective EbA initiatives such as community forest restoration through medicinal plants development and forestry patrolling.

The government officials have targeted the objectives of large-scale environment for every EbA initiatives such as forest restoration, soil conservation, and biodiversity protection. Therefore, the EbA initiatives aims to restoring the indigenous species and improving ecosystem health to enhance the resilience capacity to climate change. By contrast, farmers emphasized the localized environmental issues, including poor soil fertility and lack of water availability, which directly affect the crop productivity. The group discussion with farmers indicated that cite steep terrain and soil erosion are the barriers them to practice the EbA on crop production.

Institutional factors, including relevant policies and the coordination among stakeholders, affect the implementation and enforcement EbA. Policy gaps such as the inconsistencies between national or provincial planning on climate change adaptation and the local realities hindered the better practice of EbA. To address this issue, training initiatives and financial support mechanisms have

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been considered as important measures to building capacity for local people to better practice of EbA. Furthermore, the study found that in spite of the role of coordination among stakeholders in providing technical assistance and information for smallholder farmers to practice EbA, the result has not met the expectation due to the inconsistency in planning and monitoring the practice of EbA by smallholder farmers. From a bottom-up perspective, the smallholder farmers showed that they concerned about the accessibility of government support such as subsidies or training sessions. Mr. H, a farmers, stated that although the local people recognizes the benefits of FSC for forest plantation for both economically and environmentally, the smallholder farmers have faced the constraints of prolonging production cost and time-consuming, meanwhile the market for better consuming FSC timber is not clear.

During the interview, government officials have prioritized advanced tools and technologies such as satellite monitoring for forests and improved irrigation systems to support smallholder farmers to implement the EbA initiatives. Moreover, the issue related to technical capacity-building and infrastructure development have been discussed by the government officials for successful EbA implementation. Farmers, on the other hand, preferred the tools and techniques that they can apply to improve their agriculture production. The group discussion with smallholder farmers revealed that limited technical knowledge and access to technology constraint to practice EbA at communes. Some of farmers have inaccessibility to technical training on using technology in better production management and sustainable forestry management. Moreover, some farmers still reply on traditional agriculture practice without any alternative method applied. These issues limit the smallholder farmers' ability to implement EbA measures effectively.

5. Discussion and Conclusion

The study revealed distinct perspectives of government officials and smallholder farmers on EbA, exposing significant contrasts shaped by their roles, priorities, and experiences. Long-term strategies of adaptation including forest restoration, biodiversity conservation, and carbon credit systems have been prioritized by the government officials, which is aligned with relevant policies on environment and ecosystem services. Smallholder farmers, by contrast, emphasized the short-term adaptation to meet the immediate livelihood needs and quick economic returns. This divergent perspective creates a gaps leading to the differences in understanding EbA implementation, which consistent with other previous studies but also contributing new insights.

EbA has been viewed as the transformative approach to achieving the sustainability and the resilience of ecosystem. Consequently, the government officials have set the plan to implement EbA through developing indigenous tree species, promoting agroforestry, and enhancing sustainable forest management. These priorities consistent with other previous studies by Adhikari, Baral [38] and Sapkota, Keenan [39], who found that policymakers play the essential role of setting the long term strategies to achieve the environmental benefits. By contrast, this study is in line with Colls, Ash [40] to confirm that smallholder farmers often resist adopting the long term adaptation strategies due to the economic pressure. Therefore, they emphasize the short-term adaptation to achieve the immediate financial needs and securing livelihoods. The study also contributes to relevant research by addressing the localized challenges to implement the EbA including fragmented markets and labor shortages constraining farmers' ability to adopt EbA measures.

Risk perception regarding the negative impacts of climate change and environmental degradation differed between governmental officials and smallholder farmers, leading to the divergence of priorities. Deforestation and biodiversity loss are the systemic risk which emphasized by government officials, as a result they considered EbA as the long term solution to mitigate these large scale of risk as noted by [27]. Smallholder farmers, conversely, emphasized the visible and short-term risk such as loss of crop and low soil fertility, which reflects their immediate livelihood concerns. The study also addressed the economic uncertainties as barriers to practice the EbA including market access and resource constraints, exacerbate this focus [21]. Different from other previous studies, this

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research highlighted the role of social cohesion and labor dynamics in shaping farmers' decision-making, offering a more nuanced understanding of these barriers.

The gaps in awareness and understanding EbA between government officials and smallholder farmers limited the capacity to adopt this solution. The government officials present a comprehensive understanding of EbA and its relationship with ecological, economic, and social dimensions. Whereas many farmers remain unfamiliar with this concept of EbA. This gap reflects the necessary to conduct the capacity-building initiatives to bridge knowledge disparities [41]. The paper also addressed the variability among smallholder farmers in which some smallholder farmers actively engaging in sustainable practices like forest monitoring and agroforestry. This suggests that designed community-specific approaches could enhance awareness and participation in EbA programs.

The valuations of ecosystem services differed between government officials and farmers. Of which government officials prioritized the economic value from ecosystem services such as carbon sequestration, biodiversity, and water regulation, which confirmed the underscoring the role of ecosystem services in climate adaptation [42]. Farmers, conversely, valued ecosystem services for their visible outputs improved soil fertility and access to non-timber forest products, which is line with Locatelli and Pramova [43] who noted that farmers often prioritize ecosystem services with tangible benefits. Then, the integration of smallholder farmers into policy frameworks is the condition to better design for EbA strategies, ecological and socioeconomic objectives.

Smallholders engagement emerged as a basis of the success of EbA, as this collective action contributing to sustainable adaptation, as noted by [34]. However, the study explored challenges including weak social cohesion and competing priorities limiting participation in some communities. Unlike earlier studies, financial incentives are a critical driven for these solutions. It found that smallholders who received the payments for ecosystem services and other financial supported are more likely to engage in EbA initiatives, highlighting the importance of linking economic incentives to collective actions.

A better integrated approach that bridges the gaps between institutional strategies and grassroots realities is necessary to design the relevant program on EbA and adaptation to climate change. Co-designing policy should be conducted between policy makers and smallholder farmers is crucial to ensure the alignment of immediate needs such as financial security and market access and long-term ecological goals. Moreover, capacity-building programs adapted to local contexts, linked with improved market access and financial incentives, can enhance EbA implementation. Additionally, encouraging the social cohesion and community participation is significant for the success of collective initiatives like forest management.

This paper contributes to the growing literature on EbA by addressing the problematic interplay between government officials and smallholder farmers. Of which long term adaptation and resilience have been concerned by institutional priorities, whereas the immediate practicalities were emphasized by smallholder farmers, causing the gaps that affects the implementation of EbA strategies. The solutions to address this gap include participatory planning, tailored support, and enhanced communication to effectively implement the EbA. Future research should explore how these approaches can be scaled to diverse contexts, ensuring that EbA strategies are both impactful and equitable.

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