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Research Paper

Farmers' Perceptions of the Role of Agricultural Extension Workers in Strengthening Adaptive Capacity to Hydrometeorological Disasters in Bale Atu Village, Bukit District, Bener Meriah Regency

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Abstract

Farmers in the Gayo Highlands face floods, landslides, heavy rainfall and dry spells, and agricultural extension workers are expected to help them adapt. Evidence on whether farmers' views of extension roles are related to their adaptive capacity is limited and inconsistent. This study described farmers' perceptions of extension workers as facilitators, educators, communicators and motivators and tested the relationship between these perceptions and farmers' adaptive capacity to hydrometeorological disasters in Bale Atu Village, Bukit District, Bener Meriah Regency. A survey was conducted among 40 farmers drawn randomly from 450 farmers active in extension activities. Data were collected with a four-point Likert questionnaire and analysed descriptively and with Spearman rank correlation. Overall, 70% of the farmers agreed and 30% strongly agreed that extension workers performed their roles. The agree category dominated for the facilitator (77.5%), educator (70.0%), communicator (57.5%) and motivator (70.0%) roles, and 87.5% of the farmers rated their own adaptive capacity in the strongly agree category. Correlations between the four roles and adaptive capacity were very weak and not significant (rs = −0.123 to 0.065; p = 0.448–0.774). Positive perceptions of extension workers did not correspond to differences in adaptive capacity, which suggests that extension programmes need to move from information delivery to direct support for disaster-adaptive practices.

Keywords: Adaptive capacity; Agricultural extension; Farmers' perception; Hydrometeorological disaster; Spearman correlation.

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1. Introduction

Climate change has increased the frequency of floods, droughts, heavy rainfall, strong winds and landslides, and agriculture is among the sectors most exposed because every stage of farming depends on weather. Adaptive capacity, the ability of a system or community to adjust to such hazards, moderate damage and cope with the consequences, determines how far these events translate into losses [1]. For farmers, adaptive capacity includes knowledge of climate

risks, technical skills in adaptive practices, access to technology and the economic and social resources needed to recover from disasters.

The Gayo Highlands of Aceh, which include Bener Meriah Regency, are particularly exposed. Climate change is projected to reduce the land suitable for Arabica coffee in Aceh by 90% by 2050, and coffee farmers in Aceh Tengah and Bener Meriah already perceive changes in climate and their own vulnerability [2]. Farmers in the region rated climate-related attributes as the least important characteristics of a coffee variety, and coffee extension activities were negatively associated with the importance they gave to these attributes [3]. A study of Gayo coffee farmers found that adaptation remained low, with a physical adaptation index of 37.81%, and that farmers' perceptions of climate change were not significantly correlated with their adaptation ($r_s = 0.025$; $p = 0.838$) [4].

Agricultural extension is expected to close this gap. A review of 78 studies in Nigeria found that most farmers had no access to climate-related extension services and that extension focused mainly on information transfer [5]. In Ghana, extension services used several strategies to build farmers' adaptive capacity [6], but extension agents relied on radio and television for climate information and faced low agent-to-farmer ratios and inadequate funds [7]. Extension visits had a positive effect on adaptation in northern Ghana, although few farmers received climate information from extension officers [8], and poor extension services constrained most adaptation options in the Central Region of Ghana [9].

Indonesian studies report that extension roles shape farm outcomes, but the roles that matter differ. The role of extension workers as motivator, facilitator, innovator and communicator had a significant effect on rice farmers' adaptation to El Niño in Bone [10]. Among potato farmers, the educator, communicator, innovator and motivator roles were significantly correlated with production, whereas the facilitator role was not [11]. In Kediri, the motivator and consultant roles had positive effects on the adoption of eco-friendly technology, the educator role had a negative effect and the facilitator and communicator roles had no significant effect [12]. Farmers generally perceive extension roles in the high category [13], and partnerships with extension workers form part of farmers' collaborative adaptive capacity [14].

Bale Atu Village in Bukit District is a farming village where heavy rainfall floods some fields, erosion and landslides cut access to hilly plots, and dry seasons limit irrigation water. Extension workers of the Bukit District Agricultural Extension Centre hold farmer group meetings, field mentoring and training on planting times, tolerant varieties, soil and water conservation and disaster risk, but the limited number of extension workers and uneven farmer participation constrain their reach. No study has examined whether farmers' perceptions of these roles are related to their adaptive capacity to hydrometeorological disasters in this area. This study addresses two questions: (1) how do farmers perceive extension workers as facilitators, educators, communicators and motivators in strengthening their adaptive capacity; and (2) is each of these perceived roles related to farmers' adaptive capacity to hydrometeorological disasters?

2. Method

Research Design, Location and Sample

This study used a quantitative survey design in Bale Atu Village, Bukit District, Bener Meriah Regency. The population comprised 450 farmers in farmer groups who took part in extension activities. The sample size was determined with the Slovin formula at a 15% margin of error:

$$n = N / (1 + N e^2) = 450 / (1 + 450 \times 0.15^2) = 40.4 \approx 40 \quad (1)$$

where n is the sample size, N is the population and e is the margin of error. Respondents were drawn randomly from farmers who were actively farming, had attended extension activities and had experienced hydrometeorological disasters. The Slovin formula coincides with Cochran's formula only under specific conditions and does not take population variability into account [15].

Data and Variables

Primary data were collected through a structured questionnaire, interviews and field observation, and secondary data were obtained from the Agricultural Extension Centre, the village office and related agencies. The questionnaire contained 25 statements on a four-point Likert scale: strongly agree (4), agree (3), disagree (2) and strongly disagree (1). Perceptions of extension workers covered four roles. The facilitator role referred to bridging access to inputs and infrastructure assistance, technical field assistance and solutions during disaster-related crises. The educator role referred to materials, technical training and education on disaster adaptation strategies. The communicator role referred to conveying weather forecasts and early warnings in a clear and understandable way. The motivator role referred to moral support, rebuilding the spirit of farming after disasters and encouraging adaptive planting patterns. Adaptive capacity referred to farmers' knowledge, technical skills and economic and social capacity to reduce disaster risks and sustain farming.

Data Analysis

Likert scores were converted to percentages of the maximum score and classified into four categories with an interval of (100% − 25%)/4 = 18.75%, as shown in Table 1. Farmer perception indices of this kind have been used to classify perceptions of agricultural technology in Aceh [16].

Table 1. Classification of Likert scores

Score (% of maximum)	Category	Likert score
25.00–43.75	Strongly disagree	1
43.76–62.50	Disagree	2
62.51–81.25	Agree	3
81.26–100.00	Strongly agree	4

Source: Calculated from the four-point Likert scale used in this study.

The relationship between each perceived role and adaptive capacity was tested with Spearman rank correlation, a non-parametric test suited to ordinal data that does not require normally distributed variables:

$$r_s = 1 - 6\,\Sigma d_i^2 / [n(n^2 - 1)] \quad (2)$$

where r_s is the Spearman coefficient, d_i is the difference between the ranks of the two variables for respondent i and n is the number of respondents. The null hypothesis of no relationship was rejected when the two-tailed significance value was below 0.05.

3. Results and Discussion

Characteristics of the Respondents

Table 2 summarises the characteristics of the 40 respondents.

Table 2. Average characteristics of the respondents

No.	Characteristic	Unit	Average
1	Age	Years	42.9
2	Formal education	Years	11.9
3	Family dependants	Persons	3.3
4	Farming experience	Years	16.2

Source: Primary data, processed (2026).

The average farmer was 42.9 years old, had 11.9 years of formal education, close to completion of senior secondary school, supported 3.3 dependants and had 16.2 years of farming experience. The respondents were therefore of working age, literate enough to follow written extension material and experienced with local weather risks. Farmer characteristics such as these have been analysed as factors shaping farmers' perceptions in Aceh [17], and age, education and extension contact were among the determinants of adaptation practices in India [18].

Farmers' Perceptions of Extension Roles and Adaptive Capacity

Overall, 28 farmers (70%) were in the agree category and 12 (30%) in the strongly agree category regarding the performance of extension roles. Table 3 shows the dominant category for each indicator.

Table 3. Dominant perception category by indicator (n = 40)

No.	Indicator	Dominant category	Farmers	Percentage
1	Extension worker as facilitator	Agree	31	77.5%
2	Extension worker as educator	Agree	28	70.0%
3	Extension worker as communicator	Agree	23	57.5%
4	Extension worker as motivator	Agree	28	70.0%
5	Farmers' adaptive capacity	Strongly agree	35	87.5%

Source: Primary data, processed (2026).

Most farmers agreed that extension workers help them obtain adaptation information, technology and program support (facilitator), provide knowledge on disaster adaptation and suitable cultivation techniques (educator), and encourage preparedness and the adoption of innovations (motivator). The communicator role had the smallest majority (57.5%), which indicates that weather forecasts and early warnings reach farmers less consistently than other forms of support. Positive ratings of extension roles are consistent with the high category reported for rice farming in Sangkub 4 Village [13] and with the strong agreement on extension roles among rice farmers facing El Niño in Bone [10]. In Kediri, by contrast, most farmers rated the facilitator role only in the medium category [12].

Farmers rated their own adaptive capacity higher than any extension role, with 87.5% in the strongly agree category. They reported adjusting planting times to weather conditions, applying suitable cultivation techniques, using weather information and early warnings, and taking measures to reduce disaster losses. This self-assessment contrasts with the low adaptation indices reported for coffee farmers elsewhere in the Gayo Highlands [4].

Relationship between Perceived Extension Roles and Adaptive Capacity

Table 4 presents the Spearman correlations between each perceived role and adaptive capacity.

Table 4. Spearman correlation between perceived extension roles and adaptive capacity (n = 40)

No.	Extension role	Correlation coefficient	Sig. (2-tailed)	Decision
1	Facilitator	−0.123	0.448	Not significant
2	Educator	−0.047	0.774	Not significant
3	Communicator	0.065	0.690	Not significant
4	Motivator	0.062	0.704	Not significant

Source: Primary data, processed with SPSS (2026).

All coefficients were very weak, ranging from −0.123 for the facilitator role to 0.065 for the communicator role, and all significance values exceeded 0.05. The null hypothesis was not

rejected for any role, so farmers who rated extension roles more favourably did not have measurably higher adaptive capacity. The negative signs for the facilitator and educator roles are too small to indicate an inverse relationship.

This result differs from studies in which extension roles were related to farm outcomes. The educator, communicator and motivator roles were significantly correlated with potato production [11], extension roles had a significant effect on adaptation to El Niño [10], and extension contact had positive effects on adaptation in India [18] and northern Ghana [8]. The result is consistent with the non-significant correlation between perception and adaptation among Gayo coffee farmers [4] and with the negative association between coffee extension and the perceived importance of climate attributes in the same region [3].

Three factors can explain the absence of a relationship. First, adaptive capacity was rated very high by most farmers, which leaves little variation to be associated with differences in perception. Second, farmers' 16.2 years of experience suggest that their adaptive practices draw mainly on their own experience and other farmers; in northern Ghana, most farmers relied on personal experience and only a small share obtained climate information from extension officers [8]. Third, extension activities that concentrate on information transfer [5] and face shortages of staff, funds and logistics [7], [19] may raise farmers' awareness without changing their adaptive actions. Experts in Albania observed that awareness of climate change exceeded awareness of adaptation actions and called for adaptation to be prioritised in extension programmes [20].

These findings imply that extension in Bale Atu Village should move from general information delivery to direct support for disaster-adaptive practices, such as timely early warnings, demonstration plots for tolerant varieties and soil and water conservation, and links to input and recovery assistance. Strengthening extension workers' technical and communication capacity [7] and building partnerships between farmers, extension workers and other institutions [6], [14] would support this shift.

Limitations

The sample of 40 farmers was determined with a 15% margin of error, which limits the precision of the estimates [15]. Adaptive capacity was self-assessed and concentrated in the highest category, which reduces the power of the correlation test. The cross-sectional design identifies associations rather than causal effects, and only the dominant category of each indicator was reported. Further studies should use a larger sample, objective indicators of adaptive practices and measures of the frequency and content of extension contact.

4. Conclusion

Farmers in Bale Atu Village perceive agricultural extension workers positively: 70% agreed and 30% strongly agreed that extension workers performed their roles, and the agree category dominated for the facilitator, educator, communicator and motivator roles, with the communicator role receiving the smallest majority. The perceived roles were not significantly related to farmers' adaptive capacity to hydrometeorological disasters ($r_s = -0.123$ to 0.065; $p > 0.05$), which most farmers rated in the strongly agree category. The Bukit District Agricultural Extension Centre and the local government should strengthen the delivery of early warnings, provide field demonstrations of adaptive practices and support farmers' access to inputs and recovery assistance, so that positive perceptions of extension workers are translated into adaptive action.

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Authors' contributions and responsibilities

Nadira collected the field data, performed the analysis and wrote the first draft. Teuku Fadhla and Ainal Mardhiah supervised the study, refined the research design and revised the manuscript. All authors agreed to the published version.

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Availability of data and materials

Questionnaire responses and correlation outputs are available from the corresponding author upon reasonable request.

Competing interests

The authors report no competing interests.

Ethical approval

Formal ethical approval was not sought because this was a minimal-risk, non-interventional survey of adult farmers that collected no sensitive personal data. Before data collection, respondents were informed of the purpose of the study and of their right to decline or withdraw at any time, and they gave verbal informed consent. Participation was voluntary, responses were kept confidential, and results are reported only in aggregate form without personal identifiers.

Declaration of generative AI use

The authors employed a generative AI tool for English-language editing and reference formatting. After using this tool, the authors checked all data, statements and citations and remain fully responsible for the content of this article.

Additional information

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