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Analysis of Farmers' Knowledge on Animal Feed Processing and Its Adoption Constraints: A Case Study

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Abstract. An effective animal feed extension program is expected to support the development of the livestock sector and improve farmers' welfare. This study aims to analyze farmers' knowledge of animal feed processing as an outcome of an extension program and to identify the constraints faced in adopting feed processing technologies. The research was conducted at the Putrayasa Livestock Farmer Group in Tenganan Village, Karangasem Regency, Bali, Indonesia. A census method was applied, involving all 54 group members as respondents. Data were collected through observation, interviews, and documentation, and analyzed using quantitative and qualitative descriptive approaches. The results show that farmers' knowledge of animal feed processing is in the high category, with an average score of 4.06. This indicates that the extension program has been effective in improving farmers' understanding of feed processing technologies. However, the adoption of these technologies remains limited. The main constraints identified include the inconsistent implementation of processed feed and financial limitations among farmers. These findings suggest that although extension programs are successful in increasing knowledge, additional efforts are required to enhance practical skills and address economic barriers to improve the adoption of feed processing technologies.

Keywords: animal feed processing, extension program, farmers' knowledge, technology adoption

Abstrak. Program penyuluhan pakan ternak yang efektif diharapkan dapat mendukung pengembangan sektor peternakan serta meningkatkan kesejahteraan peternak. Penelitian ini bertujuan untuk menganalisis tingkat pengetahuan peternak mengenai pengolahan pakan ternak sebagai hasil dari program penyuluhan serta mengidentifikasi kendala yang dihadapi dalam penerapan teknologi pengolahan pakan. Penelitian dilaksanakan pada Kelompok Ternak Putrayasa di Desa Tenganan, Kabupaten Karangasem, Bali, Indonesia. Metode sensus digunakan dengan melibatkan seluruh anggota kelompok sebanyak 54 orang sebagai responden. Data dikumpulkan melalui observasi, wawancara, dan dokumentasi, kemudian dianalisis menggunakan pendekatan deskriptif kuantitatif dan kualitatif. Hasil penelitian menunjukkan bahwa tingkat pengetahuan peternak mengenai pengolahan pakan ternak berada pada kategori tinggi dengan nilai rata-rata 4,06. Hal ini mengindikasikan bahwa program penyuluhan telah efektif dalam meningkatkan pemahaman peternak terhadap teknologi pengolahan pakan. Namun demikian, penerapan teknologi tersebut masih terbatas. Kendala utama yang ditemukan meliputi belum konsistennya penggunaan pakan olahan serta keterbatasan finansial yang dimiliki peternak. Temuan ini menunjukkan bahwa meskipun program penyuluhan berhasil meningkatkan pengetahuan peternak, diperlukan upaya lanjutan untuk meningkatkan keterampilan praktis serta mengatasi hambatan ekonomi guna mendorong adopsi teknologi pengolahan pakan yang lebih luas.

Kata kunci: pengolahan pakan ternak, program penyuluhan, pengetahuan peternak, adopsi teknologi

Introduction

Livestock development plays a very important role in economic development at the village, district/city, and even national levels (Baltenweck et al., 2020; Suresti et al., 2021; Yang et al., 2022). The livestock sector requires more serious attention to be developed by the government and various stakeholders. Currently, the condition of the livestock sector has not reached maximum results, especially in farmers' performance and their family welfare (Suresti et al., 2021), and the limited development of animal feed. This condition is particularly observed among smallholder farmers in Tenganan Village, Karangasem Regency, where livestock are predominantly fed with natural forage. This practice occurs due to several factors, including the limited knowledge of alternative feed processing techniques, the availability of forage resources in the

surrounding environment, and the perception that forage feeding is more practical and cost-efficient compared to processed feed. However, during prolonged dry seasons, the availability of forage becomes limited, resulting in feed shortages and reduced livestock productivity. On the other hand, during long droughts, animal feed is very difficult to obtain. Related to this problem, it is necessary to have an extension program in the field of animal husbandry.

Extension is a vital activity in agricultural development, especially at the level of changes in farmer behavior (knowledge, attitudes, and skills) in order to realize better farming, better business, and better living. Extension is part of the communication process in agricultural development, namely the diffusion of agricultural innovations. Diffusion of innovations as a dissemination of innovations into a social system that aims to create the adoption of innovations by members of the social system or farming community as the target of extension (Sedana, 2020).

Agribusiness system extension plays a crucial role in improving farmers' capacity by facilitating changes in knowledge, attitudes, and skills related to livestock management (Anwarudin and Dayat, 2019; Wardani and Anwarudin, 2018). Behavioral change is necessary because many smallholder farmers still rely on traditional practices, such as feeding livestock solely with natural forage, which limits productivity and resilience, particularly during periods of feed scarcity. Therefore, extension programs aim to transform specific behaviors, including the adoption of improved feed processing techniques, efficient utilization of agricultural waste, and better livestock management practices. Extension activities can be carried out flexibly by extension workers depending on farmers' needs. An extension program is considered successful when it leads to measurable changes in these behaviors, which ultimately contribute to increased productivity and improved farmer welfare (Suparta, Sutrisna, and Nuraini, 2009; Suparta, Sutrisna, Nuraini, et al., 2009).

One of the farmer groups that received animal feed extension services is the Putrayasa Livestock Farmer Group located in Tenganan Village, Manggis Sub-district, Karangasem Regency, Bali Province, Indonesia. Tenganan Village was selected as the research site purposively because it represents a rural livestock community where extension programs on animal feed processing have been implemented, particularly focusing on fermented feed technology. Although similar extension programs may also be conducted in other areas, this location was chosen due to the active participation of farmers and the relevance of feed-related challenges, especially during the dry season when forage availability decreases. The extension program aims to enable group members to process animal feed into preserved forms with longer storage capacity, such as fermented feed. Based on this context, this study analyzes the level of farmers' knowledge regarding the extension program and examines the constraints faced in adopting feed processing technologies, in order to evaluate the extent to which farmers implement the knowledge gained from the program.

Materials and Methods

This research was conducted at the Putrayasa Livestock Farmer Group located in Tenganan Dauh Tukad Hamlet, Tenganan Village, Manggis District, Karangasem Regency, Bali Province, Indonesia. Karangasem Regency is situated in the eastern part of Bali and is characterized by a predominantly rural economy where livestock farming plays an important role in household livelihoods.

The research location was selected using a purposive sampling method based on several considerations. First, the Putrayasa Livestock Farmer Group is an active farmer group that has participated in animal feed extension programs, particularly in fermented feed processing.

Second, the group represents smallholder livestock farmers who still rely largely on traditional feeding practices, making it relevant for assessing knowledge improvement and technology adoption. Third, the area experiences seasonal feed shortages, especially during the dry season, which highlights the importance of feed processing innovations. These characteristics make the location appropriate for examining farmers' knowledge and constraints related to animal feed extension programs. The population in this study consisted of all 54 members of the Putrayasa Livestock Farmer Group. A census method was applied, in which all members of the population were included as respondents.

The data used in this study include primary and secondary data, both qualitative and quantitative in nature, related to the level of farmers' knowledge and the constraints in adopting animal feed processing results. Data collection techniques were carried out through observation, interviews, literature study, and documentation.

To measure the level of farmers' knowledge, this study used several indicators, namely: (1) general knowledge of animal feed, (2) knowledge of types of animal feed ingredients and forages, (3) knowledge of agricultural waste as processed animal feed, (4) knowledge of fermented/silage feed, and (5) skills in making fermented feed. Each indicator was assessed using a Likert scale to obtain quantitative data, which were then categorized into knowledge levels. Qualitative analysis was used to describe the constraints faced by farmers in adopting animal feed processing, while quantitative descriptive analysis was applied to measure and categorize the level of farmers' knowledge based on the scores obtained.

Results and Discussion

Overview of the Research Site

Tenganan Village, also known as Tenganan Pegeringsingan, is one of the ancient villages in Bali. The pattern of community life reflects the culture and customs of the Bali Aga (pre-Hindu) village unique from other villages in Bali. Therefore, Tenganan Village was developed as one of the objects and attractions of cultural tourism.

Tenganan Pegeringsingan Village is located in Manggis Sub-district, about 65 km from Denpasar City, 17 km away from Amlapura City (the regency capital), and 5 km from Candidasa tourism area. This village is geographically bordered by Ngis Village to the west; Macang and Bebandem Villages to the north; Bungaya, Asak, and Timrah Villages to the east; and Pasedahan Village to the south. The land area of Tenganan village is 1,034 hectares, consisting of 499.74 hectares of moorland, 243.315 hectares of agricultural land, 95.825 hectares of temple profit land, 80,000 hectares of village land, 40,000 hectares of cemetery land, 0.030 hectares of pond land, and 75,090 hectares for other purposes (Kantor Desa Tenganan, 2020).

Respondent Characteristics

This research involved 54 respondents who are members of the Putrayasa Livestock Farmer Group. The demographics of respondents are as follows:

Age

The age groups of respondents are presented in Table 1. Almost 95% of the respondents were of productive age (17–64 years), while only a small proportion were above 64 years (5.56%). This indicates most farmers are individuals in their economically active years, who generally have a higher capacity for adopting agricultural innovations.

Table 1. Frequency distribution of respondents' age

No.	Age (years)	Frequency	Percentage (%)
1	< 17	0	0.00
2	17-64	51	94.44
3	> 64	3	5.56
Total		54	100

Source: Data processed from survey results

Table 2. Frequency Distribution of Respondents' Education Level

No.	Educational Background	Frequency	Percentage (%)
1	Not in school	0	0
2	Elementary school	7	12.96
3	Junior high school	16	29.63
4	Senior high school	29	53.70
5	Scholar	2	3.70
	Total	54	100

Source: Data processed from survey results

Table 3. Occupational Distribution of Respondents

No.	Occupation	Frequency	Percentage (%)
1	Not working	3	5.56
2	Farmer/rancher	32	59.26
3	Labor	15	27.78
4	Private employee	4	7.41
	Total	54	100

Source: Data processed from survey results

Younger farmers, particularly those aged 17–30 years, tend to engage in livestock farming due to either limited alternative employment opportunities in rural areas or the strong influence of family-based farming traditions. In many cases, farming is not only an economic activity but also a continuation of household livelihoods passed from generations before them. Meanwhile, farmers in the age group of 31–50 years generally have more experience, stronger decision-making capacity, and greater responsibility in managing livestock production.

This age distribution suggests that the Putrayasa Livestock Farmer Group has both the physical capacity and adaptive potential to adopt agricultural innovations, including animal feed processing technologies. Previous studies reported that farmers within these age groups tend to have better access to information, higher labor efficiency, and a greater willingness to adopt modern agricultural practices (Seyoum et al., 2020; Amondo et al., 2022). Furthermore, their active participation in extension activities enhances their ability to improve livestock productivity and sustainability (Okello et al., 2021).

Education

The educational background of the respondents is illustrated in Table 2. Based on the data tabulation above, most farmers (53.70%) graduated from high school, and 29.63% finished junior high school. A small percentage of them were elementary school or university graduates. This distribution shows that the majority of members of the Putrayasa Livestock Farmer Group have completed secondary education, which is an important foundation for receiving, understanding, and applying new information in livestock practices. According to Suarta et al. (2020), individuals in a younger age group with at least a secondary education tend to have better communication abilities and a stronger willingness to innovate to improve performance. Furthermore, international studies support the notion that education significantly enhances a farmer's ability to adopt and implement agricultural innovations, including feed processing, due to improved cognitive skills, access to extension services, and better decision-making capacity (Wossen et al., 2019; Ogada et al., 2020). Education also positively influences attitudes toward change, openness to technology, and participation in group learning processes, which are critical for sustainable livestock development (Asfaw et al., 2021).

Occupation

The characteristics of respondents based on their work are illustrated in Table 3. Based on the results of the study, 15 people (27.78%) of the respondents were laborers, 4 people (7.41%) were private employees, and 3 people (5.56%)

were unemployed. The majority, more than 50%, worked as farmers and livestock breeders. This figure indicates that most members of the Putrayasa Livestock Farmer Group are engaged in the agriculture and livestock sectors. As such, they are more likely to participate in agricultural extension activities and have greater capacity to process animal feed effectively. Individuals who are directly involved in farming are more motivated to improve production practices and are more responsive to innovations introduced through extension services. Recent studies confirm that occupational engagement in farming increases both exposure to and application of agricultural technologies, including feed processing and livestock management systems (Manda et al., 2020; Ghimire et al., 2021). In particular, those who depend on agriculture for their primary livelihood are more likely to invest time and resources into sustainable innovations, especially when they perceive tangible benefits. Accordingly, their occupational background contributes not only to knowledge accumulation but also to technical skills and motivation for producing high-quality animal feed.

Farmers' Knowledge Level

The level of farmers' knowledge is an important determining factor to agricultural innovation adoption, including animal feed processing technologies. In this study, farmers' knowledge reflects the outcomes of the animal feed extension program that has been implemented in the Putrayasa Livestock Farmer Group. Therefore, the indicators of farmers' knowledge were (1) general knowledge of animal feed, (2) knowledge of types of animal feed ingredients and forages, (3) knowledge of agricultural waste as processed animal feed, (4) knowledge of fermented/silage feed, and (5) skills in making fermented feed. Based on these indicators, the level of farmers' knowledge can be assessed and categorized, then presented in Table 4.

Based on Table 4, the overall farmers' knowledge falls into the high category, with an average score of 4.06. This indicates that farmers have a good understanding of animal feed and feed processing practices as outcomes of the extension program. Among the indicators, knowledge of agricultural waste as processed animal feed achieved the highest score (4.23), suggesting that farmers are highly aware of alternative feed resources derived from agricultural by-products.

Meanwhile, the relatively lower score was in skills for making fermented feed (3.86), indicating that although farmers possess sufficient knowledge, the practical application of feed processing technologies has not yet been fully optimized. This condition reflects a gap between knowledge acquisition and practical implementation, which is a common challenge in the adoption of agricultural innovations.

The relatively high level of farmers' knowledge in this study may suggest that the extension program has been effective in improving farmers' understanding of feed processing technologies.

Table 4. Farmers' Knowledge Level on Animal Feed Processing as an Outcome of the Extension Program at Putrayasa Livestock Farmer Group

No.	Variable Indicator	Score Mean	Category
1	General Knowledge of Animal Feed	4.08	High
2	Knowledge about types of animal feedstuffs and forages	4.17	High
3	Knowledge of Farm Waste Processed Animal Feed	4.23	Very high
4	Knowledge of Fermented/Silage Feed	3.97	High
5	Skills for Making Fermented Feed	3.86	High
	Knowledge Level	4.06	High

Source: Primary Data

Knowledge plays a crucial role in influencing farmers' ability to adopt innovations as it involves not only recalling information but also understanding and applying it in practice (Bolisani and Bratianu, 2018). Farmers with higher levels of knowledge tend to be more capable of adopting improved livestock management practices, including the utilization of agricultural waste and fermented feed (Nelson et al., 2023; Nurliza et al., 2018; Widhiningsih, 2019).

However, knowledge alone is not sufficient to ensure full adoption of feed processing technologies. The gap identified between knowledge and practical skills demonstrates the need for more intensive training and continuous assistance. Previous studies have shown that effective extension programs should emphasize participatory approaches, hands-on training, and ongoing support to enhance farmers' capacity in applying new technologies (Maredia et al., 2020; Tesfaye et al., 2022). Therefore, strengthening practical components in extension activities is essential to ensure that knowledge can be translated into sustainable livestock production practices.

Constraints Faced by Farmers in Adopting the Results of Animal Feed Processing

The constraints faced by farmers in adopting animal feed processing technologies were identified based on qualitative data obtained from interviews and field observations involving members of the Putrayasa Livestock Farmer Group. The findings indicate that there are two main constraints, namely the limited practical implementation of processed feed and financial limitations among farmers.

The first constraint is related to the consistent implementation of processed feed. Based on the interview results, some farmers reported that they rely primarily on natural forage as the main feed source, indicating traditional feeding practices. This is due to farmers' perception that forage is easier to obtain, does not require additional processing, and is considered sufficient for daily livestock needs. As a result, although farmers have received knowledge about feed processing through extension programs, the application of this knowledge remains limited and not yet oriented toward improving production outcomes. This condition indicates a gap between knowledge and practice in the adoption of feed processing technologies.

The second constraint is related to financial limitations. Farmers reported that feed processing activities require additional costs for equipment, raw materials, and labor, which are perceived as burdensome for smallholder farmers. In contrast, forage feed is readily available in the surrounding environment and does not require direct financial expenditure. This economic consideration influences farmers' decisions to continue using traditional feeding practices rather than adopting processed feed technologies.

These findings are consistent with previous studies indicating that the adoption of agricultural technologies is often constrained by limited financial capacity, perceived risks, and the availability of traditional alternatives (Teklewold et al., 2013; Abdulai and Huffman, 2014). Therefore, to improve the adoption of feed processing technologies, extension programs should not only focus on increasing farmers' knowledge but also address practical and economic barriers through continuous assistance, access to affordable inputs, and the development of supportive institutional mechanisms.

Conclusions

Farmers in the Putrayasa Livestock Farmer Group have a high level of knowledge regarding animal feed processing as an outcome of the extension program, with an average score of 4.06. This indicates that the extension program has been effective in improving farmers' understanding of feed processing technologies.

Despite this, the adoption of feed processing practices remains limited, thus revealing a gap between knowledge and practical implementation. The main constraints include inconsistent application of processed feed and limited financial resources. These results suggest that knowledge alone is not sufficient to ensure the adoption of innovations, and that practical and economic factors play a crucial role in influencing farmers' decisions.

Some recommendations are proposed for the current practice of the Putrayasa Livestock Farmer Group. First, extension programs should be strengthened through practical training and hands-on demonstrations to improve farmers' skills in feed processing. Second, continuous assistance and mentoring are needed to ensure that farmers are able to consistently apply feed processing technologies in their daily practices. In addition, support from local government is necessary to address financial constraints, such as providing access to affordable inputs, equipment, or credit schemes to facilitate the adoption of feed processing innovations. Strengthening collaboration between extension agents and farmer groups is also important to enhance the sustainability of livestock development in the study area.

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