

ADOPTION OF INNOVATIONS IN SMALLHOLDER DAIRY FARMS IN EAST JAVA, INDONESIA

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ABSTRACT

The adoption of innovation is one of the efforts to increase the dairy farming business because it will increase the quality and quantity of the product and also have an effect on income and business progress. This study aims to identify innovations and analyze the adoption rate of innovation in people's dairy farming as the basis for implementing innovation. The research object was 90 smallholder dairy farmers in East Java, Indonesia. The research was conducted using a survey method. The selection of respondents was done by using the multi stage sampling method. Innovation identification and innovation adoption rate were analyzed by descriptive analysis. The results showed that the innovations in people's dairy farms were ammonia straw, fermented straw, concentrate feed, complete feed, animal feed barn, Artificial Insemination, breeds selection, biogas, composting, recording, good housing techniques, dairy machines, chopper machines, and fermented coffee skins. The adoption rate for smallholder dairy farmers in East Java was 0.88.

Keywords: Dairy farming, Innovation, Livestock, Small scale farm, Technology.

1. INTRODUCTION

The progress of the dairy farming business must be supported by the right technology so that it can maximally increase production, however in current practice, dairy farming does not fully understand the use of this technology. The community itself already has indigenous technology (IT) as community property that has been implemented and integrated with local culture. There is only one thing that can help efforts to increase farmers' income, namely by understanding the existing local knowledge system and institutional structure [1]. IT is built based on repeated experiences and experiments according to the ability of society. The community will find it

easier to apply original technology because the input is relatively low, low risk, and quite environmentally friendly, while the introduced technology generally uses high input, has a large risk and is often not environmentally friendly [2].

Smallholder dairy farming has the characteristics of small-scale livestock ownership, which is around 1-4 head, with low milk production, namely 10 liters per day per head. Efforts to increase the dairy cow business are carried out by increasing the business scale from 2 heads to around 7-15 heads / household, and increasing production from around 5 liters / head / day to 10 liters / head / day [3]. The problems on the small-scale livestock businesses were limited forage, decreased the number of farmers, low quality of milk, livestock disease, and limited adoption technology [4]. The scale of the dairy farming business is not directly related to implying the stability of the company. Collaborative efforts between dairy products and horticultural crop cultivation were also found to be beneficial to farmers due to their complementary through the use of manure for horticulture [5].

Innovation is an idea, action or item that is considered new by someone. The novelty of the innovation is measured subjectively, according to the views of the individual who captures it. Adoption of innovation is a mental process or behavior change in the form of knowledge (cognitive), attitudes (affective), and skills (psychomotor) in a person from knowing innovation until deciding to adopt it after receiving innovation [6]. The speed at which innovation spreads throughout the market depends on the amount of communication between marketers and consumers, as well as communication between consumers [7].

The objectives of this study were to 1) identify the existing innovations in people's dairy farming, 2) to analyze the adoption rate of smallholder dairy farmers as the basis for implementing innovation in East Java, and 3) to analyze the factors that support innovation adoption.

2. METHOD

The material used was smallholder dairy farmers. The sample was selected 90 farmers in East Java. The sample was determined by using the multi-stage sampling method, in which 90 smallholder dairy farmers were selected. Analysis of the data used to identify innovation, and innovation adoption rate is descriptive analysis.

3. RESULT AND DISCUSSION

The research was conducted in East Java. East Java was chosen as the research location because East Java is the province with the highest population of dairy cows in Indonesia.

3.1 Respondent Characteristics

The characteristics of smallholder dairy farmers in East Java could be seen in Table 1.

Characteristics	East Java	
	Number	%
Ages Group (year)		
15 – 23	2	2.22
24 – 32	26	28.89
33 – 41	20	22.22
42 – 50	18	20.00
51 – 59	15	16.67
60 – 68	7	7.78
69 – 77	1	1.11
78 – 86	1	1.11
Average	41.83±12.48	
Formal Educationl (year)		
No formal education	9	10.00
Elementary	57	63.33
Junior high	14	15.56
Senior High	8	8.89
College	2	2.22
Nonformal Education (number)		
0	66	73.33
1	15	16.67
2	5	5.56
3	3	3.33
>3	1	1.11
Farming Eksperirience (year)		
1-5	11	12.22
6-10	14	15.56
11-15	17	18.89
16-20	12	13.33
21-25	15	16.67
>25	22	24.44
Average	19.40±11.27	
Family member (number)		
(0-1)	2	2.22
(2-3)	35	38.89
(4-5)	41	46.56
>5	12	13.33

Dairy cow ownership (Unit)		
0,01-4	19	21.11
4,01-8	36	40.00
8,01-12	20	22.22
12,01-16	5	5.56
16,01-20	3	3.33
>20	6	6.67
Average	8.71±6.89	

Low knowledge is a characteristic inherent in small-scale dairy farmers [8]. More than 60% of farmers in Central Java have only attended primary school level and around 14% of them have not graduated from primary school [9]. Smallholder dairy farming is a family-based livestock business. Smallholder dairy farms are faced with limited factors of production, management, and simple maintenance technology. From the farmer's point of view, the objective of a dairy cattle business is to get profit from milk, calves and its waste. The implementation of the production process on dairy farming requires production factors in the form of capital, land and labor, whereas in people's farms the ownership of these production factors is very limited, so to maximize profits it is necessary to allocate production factors efficiently and optimally.

3.2 Innovation

An innovation will be adopted by the user community if the innovation provides higher benefits or relative added value obtained when a technology is adopted [10]. The percentage of farmers who adopt innovations in East Java could be seen in Table 2.

Table 2: Types of innovations in smallholder dairy farming in East Java

Kinds of innovation	Percentage of respondents (%)
Ammonia straw	1.11
Fermented straw	3.33
Concentrated feed	93.33
Complete feed	1.11
Feed barn	10
Selection of superior grass	15.56
AI	83.33
Selection of superior livestock breeds	13.33
Biogas	28.89
Composting	7.78
Recording	8.89
Good housing technique	11.11

Milking machine	7.78
Chopper	7.78

Smallholder dairy farmers in East Java had started to recognize several innovations that supported the improvement of product quality and quantity. The known innovations in the three provinces were ammonia straw, fermented straw, concentrate feed, complete feed, animal feed barn, selection of superior grass seeds, IB, selection of superior livestock seeds, biogas, composting, recording, good housing techniques, milking machine, and chopper machines.

Table 2 showed that East Java was more concentrated on innovations regarding feed and waste handling. Based on the data in Table 2, it was known that IB was the innovation most widely adopted by farmers. The innovation that was least adopted by farmers was feed processing, namely complete feed.

1. Ammonia and Fermented Straw

Based on the data in Table 2, it was known that most of the dairy farmers in East Java have not adopted ammonia and fermented straw. Most farmers had not adopted the straw feed innovation because some farmers feel that processing fermented and ammonia straw requires a lot of energy, time, and space, meanwhile livestock were willing to eat only with straw without processing.

2. Concentrate Feed

Giving animal feed in the form of forage alone will not meet the nutritional needs of livestock, therefore additional feed in the form of concentrate was required. Concentrate feed was feed with high energy and protein content and low crude fiber [11].

Almost all dairyfarmers in East Java had adopted concentrate feed. Concentrated feed was one of the innovations most widely used by farmers. The high rate of concentrate feed adoption was because already know the benefits of using concentrate and its effect on the quality and quantity of the product. So even though the concentrate price was fluctuating, farmers will try to fulfill it.

3. Complete Feed

Complete feed is a combination of concentrate and fiber in one diet [12]. There were few farmers that processed feed into complete feed. Dairy Farmers generally looking the feed for one or two days, so they were not interested in doing feed processing. In addition, the provision of feed such as complete feed to livestock required adaptation and farmers thought that livestock did not like preserved feed.

4. Animal Feed Barn

Only a few dairy farmers in East Java adopted the barn. This was because the application of the barn for animal feed required a large area. In addition, farmers were accustomed to finding or buying animal feed for a day, so that no feed was stored.

5. Selection of superior grass

The selection of superior grass seeds in East Java was still small due to the lack of information obtained. In addition, the reason for the low adoption rate of innovation was that farmers in some areas did not grow their own grass for animal feed. Many of them search the grass in the forest and the field, or buy it.

6. Artificial Insemination

This indicated that almost all dairy farmers in East Java had adopted Artificial Insemination (AI). There were 83.33% of farmers in East Java who adopted AI. There were some farmers who prefer natural conception because in East Java there were still quite a few dairy bull. Moreover, the cost of natural conception was cheaper.

7. The Selection of Good Dairy Cattle Breed

The data in Table 2 showed that the selection of good livestock breeds had not been widely adopted by dairy farmers. Farmers had not adopted livestock breeds due to the lack of information obtained about the use of good livestock breeds. Information and adoption decisions of the breed selection were obtained from the veterinarians and the inseminators during health checks and AI. Farmers who used the AI method were more likely to get good livestock breeds because the veterinarians or inseminators can provide suggestions for choosing the right livestock breeds. Meanwhile, dairy farmers who prefer natural conception were not due to the limited number and quality of bulls. However, most farmers who used AI did not know for sure the type of cement used. The farmer obeyed the inseminators and veterinarians who performed AI.

8. Biogas

Some farmers had knowledge of biogas, but they admitted that it was difficult to adopt it. This was because the average livestock ownership was small, while filling the biogas tank required a lot of manure. Manure continuity must be maintained in order to activate the biogas process properly. In addition, cost was the main obstacles in biogas adoption. Biogas installation required a large amount of money. Farmers who had biogas installations generally receive government

support. The farmer got the whole support or pays half of it. The biogas plant can be used by several farmers, so it can meet the needs of biogas raw materials [13].

9. Composting

There were not many farmers in East Java who adopted compost. Farmers knew the method of making commercial compost using compost or effective microorganisms such as EM4, but not many had adopted it. This was because farmers were more interested in using manure to become biogas if they had an installation. Meanwhile, farmers who did not have an installation accumulated the manure behind the cage. Then, when it dried, they will immediately use as plant fertilizer.

10. Recording

Accurate recording is needed to provide complete information of each animal for use as material for evaluation and future planning [14]. There were very few farmers in East Java who did the recording because they did not get enough information about the benefits of recording. Farmers felt that recording was not important to do, they only recorded the date of birth, and AI date on the wall or cage post.

11. Good Housing Technique

Farmers in East Java had not adopted many good housing techniques. The reason for the low implementation of good housing was because most of the smallholder dairy farmers only have limited capital. In addition, information regarding good housing techniques had not been widely received by farmers.

12. Milk Machine

The adoption of milk machines was not high because the milk machines were expensive, so they relied on assistance from the government. In addition, farmers considered that the use of dairy machines made livestock afraid and stressed. Milking machines caused oxytocin release and milk ejection via neuroendocrine reflexes, but milking machines sometimes caused stress and led to reduce milk production [15].

13. Chopper

The chopper machine is a tool used to chop animal feed into small pieces with a uniform shape, so that it is easy for livestock to eat and is easy to store. Farmers already knew the benefits of using a chopper machine. The low adoption of chopper machines was due to the high price of

chopper machines for farmers. In addition, the chopper machine required additional costs for electricity costs.

3.3 Adoption Innovation Rate

The rate of adoption of innovation is a dynamic process that is determined by many factors such as socio-demographic characteristics, types of innovation, situations and conditions of users (farmers) [16]. The innovation adoption rate is the number of innovations that have been adopted by farmers compared to the number of innovations that have been introduced to farmers [17]. The innovation rate is measured by the continuum line, where the low innovation rate describes the individual or unit in the organization that is weak in adopting innovation, on the other hand, the high innovation rate reflects the strong adoption position of individuals or units in the organization [18]. Adoption is a process that consists of learning, deciding and acting over a certain period of time [19]. The high adoption rate is influenced by the nature of innovation that is simple in adoption, relatively profitable, involves minimal skills and can be applied to local conditions easily adopted and disseminated into the social system [20].

The adoption rate is classified into three, namely high, medium and low with the criteria of low (0.0 - 33.3%), medium (33.4 - 66.7%) and high (66.8 - 100%) [21]. The innovation adoption rate could be seen in Table 5. Based on Table 5, it was known that the innovation adoption rate in East Java was high. In the research entitled Factors Influencing the Planned Adoption of Continuous Monitoring Technology states that social influences, business expectations, performance expectations, and facility conditions affect the plan for sustainable technology adoption [22]. There are four factors that influence the innovation decision process in relation to social systems, namely social structure, system norms, the role of leaders and agents of change [23].

Farmers are interested in technologies related to feeding, breeding and disease management. However, farmers only apply technology that does not require large capital and complicated methods. Lack of farmers' technical knowledge is another obstacle forcing farmers to adopt traditional practices [24]. In innovation adoption, farmers should be motivated through organizing trainings and demonstrations at field levels [25].

4. CONCLUSION

The innovations in people's dairy farms in East Java were dominated by innovations in the field of feed. The adoption rate of the people's dairy farmers in East Java was high, with a value of 0.88.

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