



Farmers' Decision-Making on Milk Sales Channels in Indonesian Dairy Cooperatives

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Abstract | This study seeks to identify the prioritized alternatives in the milk market based on the criteria selected by dairy farmers and its role in dairy cooperatives development. The criteria and alternatives in this study were established through literature related to milking activities in Central Java. The research involved seven dairy farmers from four districts in Central Java, chosen for their significant dairy cattle populations and status as dairy centers. Respondents were selected purposively based on specific qualifications, which included being experienced dairy farmers with a minimum of five years in the industry and serving as decision making role models for other farmers. This included village leaders or livestock group administrators. Analytic Hierarchy Process (AHP) was employed to prioritize the alternatives in the milk market. The study utilized seven criteria and five alternatives. The criteria included distance, price, payment period, payment method, accessibility, facilities, and transportation. The alternatives considered in the milk market were consumers, milk collectors (locally known as *loper*), retailers, cooperatives, and home industries. Data were processed using Microsoft Excel. The results indicated that consumers emerged as the primary choice for dairy farmers in the milk market, based on the prioritized criteria of payment period and milk selling price with a vector value of 0.407, followed by cooperatives (0.256), milk collectors (0.160), home industries (0.108), and retailers (0.069). The findings suggest that to enhance their role and competitiveness, dairy cooperatives must improve their services, particularly in terms of pricing and timely payments, to better match farmers' expectations in choosing milk sales channels.

Keywords | Analytical hierarchy process (AHP), Dairy farmers, Milk market

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The dairy farming sector represents a strategic sector for agricultural growth and development in Indonesia, owing to its potential to contribute substantially to national food security and rural economic growth. Among the various regions, Java Island serves as the primary hub for dairy cattle production in the country. Based on statistical data published by the [Ministry of Agriculture \(2022\)](#), the period from 2018 to 2022 saw the highest concentration of the national dairy cattle population in East Java Province, which accounted for approximately 299,330 head, representing 51.79% of the total dairy cattle population in Indonesia. Central Java Province ranked second, with a dairy cattle population of 144,420 head (24.99%), followed by West Java Province with 120,090 head (20.78%). Within Central Java, major dairy production centers include the districts of Boyolali, Semarang, Klaten, and the city of Salatiga, which collectively house the highest concentrations of dairy cattle in the province.

Central Java Province has several dairy cooperatives that are members of the Indonesian Dairy Cooperative Association (GKSI). Cooperatives play an important role in the dairy farming industry in Indonesia, particularly as a place for dairy farmers to sell their milk. In addition to cooperatives, there are other places where dairy farmers in Central Java sell their milk, including milk collectors (locally known as *loper*), retailers, home industries, and direct consumers ([Nugroho et al., 2023](#); [Sari et al., 2017](#); [Anindyasari et al., 2016](#)). Milk collectors often have a wide network and can cover areas not reached by dairy cooperatives. With these various milk selling options, farmers have more choices for marketing their milk products.

The fact that not all farmers sell their milk to cooperatives indicates that there are many alternative places to sell fresh milk. Given the many sales options, farmers have criteria that will be used as references to make decisions about the best place to sell their fresh milk. This study focuses on the priority alternatives for choosing milk sales channels by dairy farmers. The criteria and alternatives in this study are based on literature related to dairy activities in Central Java. Although many milk sales channels are used, there is limited empirical evidence on how dairy farmers determine their preferred marketing options and what criteria they consider most important. Understanding these preferences is essential to improving marketing efficiency and supporting the development of dairy cooperatives, which remain essential for farmer progress.

To systematically analyze how farmers make marketing decisions and prioritize among available sales channels, this study employs the Analytic Hierarchy Process (AHP).

AHP is particularly suitable for this context because it enables structured decision making involving multiple criteria and alternatives. AHP uses a hierarchical approach to break down complex problems into a simpler, more manageable structure. Decision makers begin by conducting pairwise comparisons among criteria and alternatives to determine their relative weights. This method not only helps in identifying priority alternatives but also provides a strong, logical foundation for decision making. Introduced by Thomas L. Saaty in the 1970s and 1980s, AHP has been widely used in business decision making ([Giri and Nejadhashemi, 2014](#); [Govindan et al., 2013](#); [Saaty, 2008](#)), preference analysis ([Reed et al., 2014](#); [Muzayyanah et al., 2012](#)), and forest management planning ([Kurttila et al., 2000](#)). AHP is used for multi criteria decision making by measuring priorities through pairwise comparisons. The assessment in pairwise comparisons involves expert evaluations using a priority scale ([Saaty, 2008](#)). AHP is a mathematical method to analyze complex decision problems using multiple criteria ([Kurttila et al., 2000](#)). This analysis can handle qualitative attributes as well as quantitative ones ([Kurttila et al., 2000](#)).

AHP can utilize the experience and knowledge of farmers to form priority options, thus overcoming weaknesses commonly found in agriculture in developing countries, such as the lack of reliable quantitative agricultural data and the involvement of complex networks of qualitative factors in agricultural decision-making ([Reed et al., 2014](#)). AHP has been used in livestock research, particularly in dairy farming, to determine the most appropriate processes for improving dairy production quality ([Malika et al., 2018](#)). In that study ([Malika et al., 2018](#)), a decision hierarchy system was constructed based on criteria and alternative levels. One of AHP's key advantages is its ability to incorporate both qualitative and quantitative data, making it particularly relevant in agricultural contexts where farmers' decisions are influenced by a range of tangible and intangible factors. These features make AHP a robust and transparent tool for evaluating complex choices such as selecting milk marketing channels.

While AHP has been widely applied in other agricultural decision making contexts, its application to understanding dairy farmers' preferences in milk channel selection remains limited, particularly in Central Java, Indonesia, a key dairy region with limited empirical evidence on farmers' decision behavior. This study presents a novel application of the Analytic Hierarchy Process (AHP) to systematically explore and rank the criteria and alternative milk channels prioritized by dairy farmers. The findings aim to inform more responsive policies and cooperative development strategies aligned with actual farmer preferences.

RESEARCH LOCATION

This research was conducted in four districts in Central Java, namely Boyolali, Semarang, Klaten, and Salatiga. These districts were selected because they are recognized as central dairy cattle production areas in Central Java, with a high concentration of dairy farmers. The selection of this location was intended to capture a representative cross section of the dairy farming in the Central Java Province, reflecting both geographic diversity and varying scales of production. In addition, these four districts also have several diverse milk channels compared to dairy farm locations in different provinces. This ensures that the findings of the study can be generalized to the broader population of dairy farmers in Central Java.

RESEARCH OBJECT

The study involved a total of seven dairy farmer respondents, selected from the four research location: Boyolali, Semarang, Klaten, and Salatiga (Table 1). The respondents were selected through purposive sampling based on integrated criteria, emphasizing both technical competence and contextual leadership. Specifically, they were dairy farmers with at least five years of farming experience and held influential positions in local decision making structures. These individuals, such as village leaders or heads of livestock farmer groups, were recognized as both policy influencers and role models within their communities. This dual capacity was critical to ensure that the selected individuals possessed not only practical expertise but also the authority and insight needed to represent broader farming perspectives.

Table 1: Decision-making respondent (*keyperson*).

Respondent	Number of Respondents (people)	Location
Village Head	1	Semarang
Hamlet Head	1	Semarang
Livestock Group Leader	2	Boyolali
Livestock Group Leader	1	Klaten
Livestock Group Activist	2	Salatiga
Total	7	

Source: Primary data (2024).

Specifically, the respondent composition included one village head and one hamlet head from Semarang, two livestock group leaders from Boyolali, one livestock group leader from Klaten, and two livestock group activists from Salatiga. In Semarang, both the village head and the hamlet head were considered influential figures and role models in decision making related to dairy farming management, including choices regarding milk channels. This is

attributed to the fact that dairy farming in Semarang is geographically centralized within a specific area, allowing local leaders who are also dairy farmers to exert a significant influence over community decisions. In Boyolali and Klaten, livestock group leaders are regarded as key figures in guiding farmers decisions. Most dairy farmers in Boyolali are organized into livestock group that exist in nearly every village. Consequently, leadership within these livestock groups plays a central role in influencing farm management decisions. Salatiga presents a different dynamic, where decision making authority tends to reside with livestock group activists rather than formally appointed group leaders. Dairy farming in Salatiga is predominantly organized through communal barns managed by each livestock group. This structure fosters a more informal but highly functional leadership dynamic, where farmers naturally follow those who are more active and influential within the group, regardless of their formal titles. Therefore, livestock group activists were considered the most appropriate representatives for this study in the context of Salatiga.

The selection of these seven individuals was therefore not arbitrary but grounded in their recognized authority, experience, and social capital within their respective communities. Such qualities align with the core principles of the Analytic Hierarchy Process (AHP), which does not require a large sample size but rather emphasizes the use of qualified experts capable of providing consistent, knowledgeable judgments (Saaty, 2008). In AHP, the credibility and contextual relevance of expert input are more critical than statistical representativeness, as the method is designed to capture reasoned judgments rather than general opinions. This approach is consistent with previous applications of AHP in agricultural research, such as in the study by Tošović-Stevanović *et al.* (2020), where the assessment was conducted by a select group of independent experts with substantial experience in agribusiness and agricultural policy, rather than by the broader survey respondents. Thus, the selection of these seven highly experienced and socially influential individuals ensures both the methodological rigor and contextual validity necessary for effective decision modeling using AHP.

ANALYSIS METHOD

Data for the study was collected through in depth interviews using a structured questionnaire. Respondent characteristics were analysed descriptively, while the determination of priority alternatives was analysed using the Analytic Hierarchy Process (AHP). STATA 16 was used for the descriptive analysis of respondent characteristics, and Microsoft Excel was used for the AHP analysis.

AHP is a measurement theory that uses pairwise comparisons and relies on expert judgments using a priority scale.

Comparisons are made using an absolute rating scale representing the relative importance of criteria (Saaty, 2008). The decision making process involves using criteria and sub criteria to determine the priority order of various alternative choices (Saaty, 2008).

The Analytical Hierarchy Process (AHP) consists of four main stages: (1) conducting pairwise comparisons; (2) calculating the priority vector; (3) calculating the consistency ratio; and (4) ranking alternative choices (Giri and Nejadhashemi, 2014).

The assessment was conducted subjectively by the farmers through pairwise comparisons, which were then quantified using a 1–9 scale, as introduced by Saaty (2008) and applied in previous studies (Veisi *et al.*, 2016). The details of the Saaty scale are presented in Table 2. In this study, the Analytical Hierarchy Process (AHP) is employed as a decision-support tool to assist dairy farmers in systematically evaluating and prioritizing alternative milk marketing channels based on multiple criteria.

Table 2: Saaty's scale of relative importance.

Intensity of Importance	Definition
1	Equally importance
3	Weak importance
5	Strong importance
7	Demonstrated importance
9	Absolute importance
2,4,6,8	Intermediate values

Source: Saaty (2008).

The criteria for choosing a place to sell fresh milk include distance, price, payment period, payment method, access, facilities, and transportation. The alternative choices include consumers, milk collectors, retailers, cooperatives, and home industries. The implementation of AHP began with a pairwise comparison questionnaire focused on the selection criteria. This design ensures that farmers concentrate solely on comparing two criteria at a time, reducing cognitive burden and increasing response accuracy. Once the priorities of the criteria were established, a second pairwise comparison questionnaire was administered, this time focusing on the alternative marketing channels. Each set of comparisons in this second stage was organized around a single criterion, such as distance, price, payment period, payment method, access, facilities, and transportation. So that farmers evaluated the alternatives specifically in relation to one criterion at a time. This sequential and structured approach improves the clarity and reliability of the judgment process, allowing farmers to make focused decisions based on individual aspects of each alternative. The AHP framework applied in this study is presented in Figure 1.

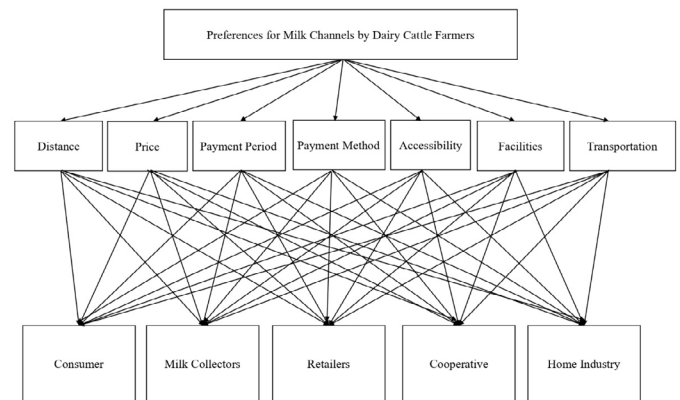


Figure 1: AHP Framework.

After the pairwise comparisons are made, the next step is to test consistency by calculating the consistency index (CI). CI is calculated using the formula:

$$CI = \frac{\lambda_{max} - n}{n - 1}$$

Next, the consistency ratio (CR) is determined using the formula:

$$CR = \frac{CI}{RI}$$

Where; RI is the Random Index derived from average consistency indices of randomly generated pairwise comparison matrices, based on the number of criteria being compared. The Consistency Ratio (CR) measures the degree of consistency in the judgments provided by the respondents, and its value should not exceed 0.1. The CR is a crucial component in the Analytical Hierarchy Process (AHP), as it assesses the logical coherence of the pairwise comparisons. A CR value of less than 0.1 (10%) indicates that the judgments are acceptably consistent, and the data can be considered valid for decision-making. Conversely, if the CR exceeds 0.1, it implies an unacceptable level of inconsistency, requiring the judgments to be reviewed and revised. This 0.1 threshold is based on the assumption that a deviation of 10 percent or less from perfect consistency is tolerable. The RI values used to compute CR, which vary depending on the number of elements compared, are presented in Table 3 and were originally proposed by Saaty (2008).

RESULTS AND DISCUSSION

CHARACTERISTICS OF RESPONDENT

The characteristics of the farmers who participated in this study are presented in Table 4. The results show that the average age of the respondents is 49.14 ± 11.33 years, and the average education level is 11.86 ± 2.19 years. This in-

dicates that, on average, the farmers have not completed high school. The average farming experience is 19.57 ± 9.29 years, and the average dairy cattle ownership is 3.89 ± 1.90 Tropical Livestock Units (TLU). Farming experience enables farmers to become more independent and skilled in managing their farming operations, which helps them make better decisions (Purnomo *et al.*, 2017).

Table 3: Values of the random index RI.

n	1	2	3	4	5	6	7	8	9	10
RI	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49

Source: Saaty (2008).

Table 4: Descriptive statistics of respondents.

Variables	Mean
Age (years)	$49,14 \pm 11,33$
Formal Education (years)	$11,86 \pm 2,19$
Farming Experience (years)	$19,57 \pm 9,29$
Herd Size (TLU)	$3,89 \pm 1,90$

Source: Primary data (2024).

THE IDENTIFICATION OF PRIORITIZED ALTERNATIVES IN THE MILK CHANNELS USING THE ANALYTIC HIERARCHY PROCESS (AHP)

PRIORITY CRITERIA: The pairwise comparison matrices for both criteria and alternatives yield the weighted vectors presented in Table 5 and Table 6. These weighted vectors are then ranked from the highest to the lowest value. The highest-ranked weighted vector indicates that the corresponding criterion or alternative is a priority for the dairy farmers. The results of the AHP calculation demonstrate consistency, with a consistency ratio value of less than 0.1.

Table 5: Vector weights and the ranking of criteria in determining the location for selling milk by dairy farmers.

Criteria	Weight	Con- sumer	Coop- erative	Milk Col- lectors	Home Industry	Re- tailers
Payment Period	0,300	0.626	0.101	0.097	0.115	0.061
Price	0,299	0.479	0.219	0.117	0.120	0.064
Distance	0,108	0.215	0.380	0.245	0.074	0.086
Accessi- bility	0,087	0.355	0.269	0.200	0.110	0.067
Transpor- tation	0,074	0.045	0.472	0.342	0.107	0.083
Facilities	0,071	0.033	0.560	0.240	0.058	0.060
Payment Method	0,060	0.267	0.347	0.153	0.127	0.106

Source: Primary data (2024).

PAYMENT PERIOD: The research findings indicate that the top priority criterion for dairy farmers in selecting

a fresh milk selling outlet is the payment period (vector value 0.300). The payment period refers to the length of time required for payment after each milk sale. Farmers prioritize channels that provide prompt payments to meet immediate financial obligations, such as purchasing inputs or covering household expenses (Jitmun and Kuwornu, 2019). Shorter payment periods reduce financial risk, allowing farmers to manage uncertainties in production and market fluctuations more effectively (Rasyidin *et al.*, 2024). Small scale farmers often cash flow constraints, and therefore, prefer receiving early payments, which can alleviate the financial burden (Ishaq *et al.*, 2017). Based on the AHP results as presented in Table 5, consumers are the most favored actors regarding payment period, with a score of 0.626. This indicates that direct to consumer sales are perceived to offer the fastest or most reliable payments. They are followed by home industries (0.115), cooperatives (0.101), milk collectors (0.097), and retailers (0.061). This preference is consistent with field observations, where dairy farmers who sell milk directly to consumers receive immediate payment at the time of sale. As there is no delay or extended waiting period, this direct transaction model eliminates the financial gap between selling and receiving income.

Table 6: Weighted vectors and ranking of alternatives in determining the location for selling milk by dairy farmers.

Alternatives	Alternative Weights
Consumer	0,407 (1)
Cooperative	0,256 (2)
Milk Collectors (<i>Loper</i>)	0,160 (3)
Home Industry	0,108 (4)
Retailers	0,069 (5)

Source: Primary data (2024).

PRICE: While price also holds a substantial level of importance in farmers decision making, with a vector value of 0.299, nearly identical to payment period, the slight numerical difference should not overshadow its practical relevance. The closeness of these values suggests that both factors are nearly equally influential in farmers channel preferences. However, the greater emphasis placed on payment period in the discussion reflects the urgency of liquidity needs, especially for smallholders who face more immediate financial constraints. In contrast, price though essential for long term profitability may be perceived as a slightly more flexible criterion compared to the pressing need for prompt cash flow.

Fresh milk pricing varies considerably depending on the sales channel. Farmers selling directly to consumers receive the highest prices, ranging from IDR 6,800 to IDR 10,000 per liter, with an average of IDR 9,014. Consumers do not provide any additional services to dairy farmers; their

only involvement is collecting the milk directly from the farm. This arrangement eliminates the need for delivery or logistical support from the farmers side, thereby reducing operational burdens while maximizing income. Conversely, farmers who sell through cooperatives obtain considerably lower returns, with prices ranging from IDR 4,000 to IDR 7,150, and an average of IDR 6,504. Similarly, those who utilize intermediary channels such as milk collectors receive prices between IDR 4,000 and IDR 8,500, averaging at IDR 6,456. Despite the lower prices, cooperatives and milk collectors provide a range of valuable services.

In Boyolali, Klaten, Semarang, and Salatiga, both cooperatives and milk collectors often offer milk collection services from designated pickup points near the farmers residences, making the sale process more convenient. They also provide access to dairy feed in the form of concentrates, with flexible payment terms allowing farmers to accumulate costs and settle payments periodically. A key distinction is that cooperatives typically invest more in infrastructure, such as establishing milk cooling stations across villages, allowing farmers greater flexibility in milk delivery times while maintaining milk quality.

Home industries offer varied services depending on their production focus. Generally, dairy farmers who supply to home industries sell their milk for small scale processing into ready to drink beverages, often sold in local street stalls. A notable advantage of selling to home industries is the immediacy of payment, similar to direct consumer sales as payment is typically made at the point of milk handover. Retailers, on the other hand, operate similarly to milk collectors but on a much smaller scale. They provide little to no support services to dairy farmers and are often avoided due to consistently low prices and lack of added value. These figures show that prices offered by cooperatives or other channels are significantly lower compared to direct sales to consumers (Kumar *et al.*, 2011). Thus, while price is a critical determinant, farmers overall preferences reflect a careful balance between monetary returns and liquidity, with payment period marginally outweighing price due to its immediacy and impact on financial resilience.

DISTANCE: Distance is the third priority criterion for farmers in selecting a milk selling channels (vector values 0.108). Farmers tend to avoid channels that incur higher transport costs, making distance an influential factor in their decision (Kurgat *et al.*, 2023). The proximity of the sales point affects the overall cost. Transport and marketing expenses are reduced when the distance from the farm is minimised (Ishaq *et al.*, 2017). Shorter distances not only lessen costs but also help maintain milk quality, which tends to deteriorate during transportation from the farm to the processing site (Kumar *et al.*, 2011).

Each type of milk purchasing actor such as consumers, milk collectors, cooperatives, retailers, and home industries, has varying and often uncertain proximities to dairy farmers. This is largely because the majority of the population in Boyolali, Klaten, Semarang, and Salatiga are dairy farmers, and milk purchasing actors are generally integrated within these farming communities. However, among the different actors, cooperatives, milk collectors, and consumers are typically the closest to the dairy farmers. These actors often operate within the same village or neighborhood, reducing the need for long distance milk transport. In contrast, home industries and retailers are more likely to be located which tend to be farther from the farms.

ACCESSIBILITY: The fourth criterion identified is accessibility, which holds a vector value of 0.087. Although its weight is relatively lower compared to other factors, accessibility remains a critical determinant in evaluating the option of a milk selling channels. Improved access to marketing locations can significantly enhance operational efficiency by minimizing transportation time and reducing logistical costs associated with the distribution of fresh milk. As noted by Mengistu and Meressa (2023), Easier access can reduce delivery time and costs associated with milk transport. Dairy farmers perceive consumers as the most accessible milk channel actors, followed in order by cooperatives, milk collectors, and home industries, while retailers are considered the least accessible among all options.

TRANSPORTATION: Transportation ranks as the fifth priority, with a vector value of 0.074. Although it may initially seem similar to the distance factor, farmers tend to interpret these two aspects in distinct ways. While distance is primarily concerned with the physical proximity between farms and milk channel actors, transportation refers to a broader set of considerations, including the availability of transport infrastructure, associated costs, time investment, and physical effort involved in the delivery process.

For many smallholder dairy farmers, transportation is not merely about moving milk from one point to another, it also represents a significant opportunity cost, particularly when labor resources are limited and transport options are constrained. Fuel expenses, vehicle maintenance, and time away from other farm duties all contribute to the perceived burden of transportation. Interestingly, despite its close relationship with distance, transportation ranks lower in priority. This may be attributed to the fact that in many rural areas across Central Java, milk channels actors whether they are consumers, cooperatives, or collectors are often located relatively close to the producers. As a result, the actual burden of transport becomes less critical than the mere proximity to actors. Rather than focusing exclusively on maximizing profit margins, farmers often prioritize

minimizing transportation burdens and optimizing resource allocation (Kuma *et al.*, 2013). Efficient transportation systems, therefore, play a pivotal role in supporting sustainable and economically viable dairy supply chains.

FACILITIES: Facilities are ranked sixth in terms of priority, with a vector value of 0.071. Although positioned lower than other criteria, the availability of adequate facilities plays an important role in shaping farmers preferences for milk channels. These facilities may include access to capital through loan schemes, provision of quality feed, availability of key production inputs, and daily milk collection services. Such support mechanisms are crucial in reducing farmers operational burdens, improving productivity, and enhancing long term economic resilience. As highlighted by Kadigi (2013), access to credit enables farmers to adopt improved dairy practices, thereby increasing their overall milk output.

Among the various milk marketing actors, cooperatives are considered the most reliable providers of comprehensive facilities. They typically offer bundled services such as animal health care, credit systems, and input distribution, while also maintaining milk cooling stations to ensure quality control. Milk collectors, although less formal, often support farmers by offering milk pick-up services and flexible payment arrangements, including feed procurement on credit. Home industries may occasionally assist farmers with immediate payments or small scale input supply, though their support remains limited and highly dependent on individual arrangements. In contrast, retailers provide minimal to no facilities, and consumers offer none at all, aside from purchasing the milk directly.

PAYMENT METHOD: The last priority criterion is the payment method (vector value 0.060). Payment methods differ depending on the chosen outlet (Kuma, 2012), and they may influence the decision-making process regarding milk sales location (Jaiswal *et al.*, 2016). Farmers preferred marketing channels that offered immediate cash payments (Innocent *et al.*, 2018). However, most dairy farmers in Central Java conduct transactions using cash, regardless of whether they sell to cooperatives, milk collectors, or other outlets. Hence, the payment method is not perceived as a differentiating factor across these alternatives.

PRIORITY ALTERNATIVES

The consistency ratio in the pairwise comparison of criteria is $0.077 \leq 0.1$, indicating a consistent judgement in the selection process. Following the pairwise comparison of all criteria, the next step is the pairwise comparison of alternatives against each criterion. The alternatives compared in this study include consumers, milk collectors, retailers, cooperatives, and home industries. These pairwise comparisons based on alternatives are presented in Table 6.

CONSUMER: The choice of fresh milk channels holds significant importance for the livelihoods of smallholder dairy farmers in Central Java. The selection of sales channels by farmers can create distinct milk marketing channels, each with varying degrees of efficiency in terms of distance, time, and cost (Sari *et al.*, 2017). The research findings reveal that direct consumers are the top priority for dairy farmers when selecting a milk selling channel for fresh milk (vector value 0.407). Payment period and selling price are key considerations in any business activity, and direct sales to consumers offer clear advantages in both aspects. Therefore, it is understandable that consumers are the main alternative priority, according to dairy farmers assessments in Central Java. Farmers selling milk directly to consumers tend to receive higher prices compared to selling to other outlets (Kumar *et al.*, 2011). A study conducted in Bihar, India, another Asian country, emphasized that small scale farmers frequently favor direct sales to consumers, as this channel typically offers more favorable prices (Singh, 2018).

However, despite these advantages, selling directly to consumers also presents notable limitations and risks. One significant constraint is the relatively small volume of milk that can be sold through this channel. Consumer demand is typically restricted to household scale quantities, limiting farmers ability to distribute large volumes consistently. Additionally, this marketing channel is highly vulnerable to demand volatility, as it depends on the purchasing behavior of individual buyers, which can fluctuate due to changing preferences, income levels, seasonal variations, or shifting household needs. This instability introduces uncertainty into farmers income streams and may complicate long-term planning. Consequently, while the consumer channel may provide higher immediate financial returns and faster payment, it often lacks the consistency, scalability, and risk mitigation features necessary to support sustainable income generation for farmers with higher milk production volumes.

COOPERATIVE: Cooperative are the second priority alternative considered by farmers for marketing fresh milk with a vector value of 0.256, especially when taking into account criteria such as facilities and transportation. Dairy cooperatives in Central Java offer facilities and transportation that make it easier for farmers to sell their milk. Some of these facilities include animal health services, provision and distribution of production inputs, savings and loan services, and credit facilities (Isna *et al.*, 2020; Affah *et al.*, 2016).

Although cooperatives often offer lower monetary returns compared to other milk channels, they provide substantial non monetary benefits that remain highly valued by dairy farmers. Several cooperatives offer daily milk collection

services, relieving farmers from transportation burdens and ensuring timely delivery. In addition, cooperatives frequently provide access to essential inputs such as dairy feed, veterinary services, and milk cooling infrastructure, all of which support the long term sustainability of dairy farming operations. These facilities and services, however, involve operational costs that are typically subsidized internally by the cooperative. As a result, the price offered to farmers is generally lower than that of direct to consumer sales, where minimal services are provided. Farmers are, in effect, trading off a portion of their potential income in exchange for convenience, access to resources, and greater long term stability. These non monetary advantages, particularly market stability, service access, and collective support are especially valuable for small scale farmers who may prioritize security and continuity over short-term financial gain. Consequently, many farmers continue to favor cooperatives despite the lower prices, illustrating that marketing decisions are shaped by a combination of economic and non economic factors.

MILK COLLECTOR: Milk collector rank as the third priority alternative for dairy farmers (vector value 0.160). When farmers prioritise criteria such as facilities and transportation, it is reasonable for milk collectors to be considered a preferred outlet. Milk collectors offer daily milk collection services, similar to cooperatives, which facilitate farmers in terms of logistics and access. Farmers who prioritise shorter distances also tend to choose milk collectors as their marketing channel. This finding aligns with the study by [Anindyasari et al. \(2016\)](#), which found that many dairy farmers prefer to sell fresh milk to collectors due to proximity. While these services help reduce the farmers logistical burden, they also influence the purchase price of milk. The convenience offered by milk collectors, particularly in collecting milk from or near the farmer's location, typically comes at a cost, which is reflected in the lower price paid to farmers. Compared to direct to consumer sales, the milk price offered by collectors tends to be lower because part of the value is offset by the collection service provided. Thus, similar to cooperatives, farmers accepting lower milk prices are essentially compensating for the ease and regularity of milk pickup and access to informal support services.

HOME INDUSTRY: Home industry are the fourth alternative for dairy farmers when selling fresh milk (vector value 0.108). This option is especially considered by farmers who view payment period as an important criterion. Farmers believe that selling to home industries results in quicker payments compared to cooperatives, milk collectors, or retailers. Nevertheless, the advantage of faster payment is not accompanied by other essential support services, most notably pickup services. The absence of such logistical

support poses a significant challenge, particularly for small scale farmers who often face transportation constraints. Consequently, despite the benefit of quicker financial transactions, the lack of comprehensive service provision means that home industries are not automatically selected as the preferred channels by all dairy producers.

RETAILER: Retailer are the least prioritised alternative for dairy farmers in marketing fresh milk (vector value 0.069). Retailers are generally not preferred due to lower selling prices and the lack of supporting facilities and transportation compared to other alternatives. Although retailers have purchasing systems similar to those of milk collectors, they differ in terms of payment period and pricing. The lower prices offered by retailers lead farmers to prefer other marketing channels, as the primary objective of their business is to generate profit ([Hailu, 2017](#)).

THE ROLE OF THE AHP RESULTS IN SUPPORTING DAIRY COOPERATIVE DEVELOPMENT

The application of the Analytic Hierarchy Process (AHP) in this study provides a robust, evidence based framework for cooperatives to realign their operations with farmers preferences. The AHP methodology not only identifies farmer priorities, such as faster payment periods and higher prices, but also quantifies their relative importance through vector values. This offers precise guidance on areas where cooperatives need to improve. Similar AHP based approaches have been applied in other dairy contexts. For example, a study by [Malika et al. \(2018\)](#) utilized AHP to systematically prioritize milk-quality improvement programs in farmer cooperatives.

Additionally, literature emphasizes the effectiveness of AHP in aligning cooperative strategies with farmer expectations. [Mor et al. \(2019\)](#) demonstrated that a SWOT AHP hybrid approach could optimize key decision criteria in the dairy supply chain, especially when addressing payment systems and market access. These findings support the results of our study, which show that direct to consumer sales rank highest due to timely payments and better prices. Therefore, cooperatives must reform their payment mechanisms and offer more competitive pricing to increase their attractiveness as milk marketing channels.

By leveraging the decision priorities identified through AHP, cooperatives can make informed changes that improve their responsiveness to farmer needs. Implementing prompt and transparent payment systems and adjusting price structures to remain competitive can help rebuild farmer trust and preference. In doing so, cooperatives can enhance their strategic position in the milk market and evolve into leading marketing institutions that better support smallholder dairy farmers.

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Dairy farmers prioritize selling milk directly to consumers, followed by cooperatives, milk collectors, home industries, and retailers. This preference is primarily influenced by shorter payment periods and higher selling prices. The current position of cooperatives as a secondary option underscores the need for targeted improvements in service delivery, particularly in terms of pricing structures and payment timeliness, to better align with farmers expectations. To enhance their competitiveness, cooperatives should consider adopting more frequent payment schedules, such as daily disbursements. In parallel, improving internal financial management and enhancing transparency in milk volume tracking may also support faster, more reliable payments. Strengthening these operational aspects can increase farmer loyalty and promote cooperative-based milk marketing as a more attractive and sustainable option.

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NOVELTY STATEMENTS

The novelty of this research lies in applying expert-based decision-making using the Analytic Hierarchy Process (AHP) at the level of dairy farmers. While AHP is commonly used in agricultural research, its application to milk marketing decisions by dairy farmers in Central Java has not been previously examined.

AUTHOR'S CONTRIBUTIONS

The authors confirm their contribution to the paper as follows: study conception and design: A. T. Alya, A. R. S. Putra, M. A. U. Muzayyanah; data collection: A. T. Alya, A. R. S. Putra, M. A. U. Muzayyanah, M. Y. Syihabuddin; analysis and interpretation of results: A. T. Alya, A. R. S. Putra, M. A. U. Muzayyanah; draft manuscript preparation: A. T. Alya, A. R. S. Putra, M. A. U. Muzayyanah, M. Y. Syihabuddin.

CONFLICT OF INTEREST

We declare no conflicts of interest related to the content of

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