



Decision making in determining process priority for dairy milk quality improvement: a study in the application of AHP (Analytical Hierarchy Process)

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Abstract. Dairy milk as a part of the farming sub-sector results has great potentials to support food resilience, one of which is by increasing the quality of dairy milk production. The purpose of this study was to know the most appropriate alternative process to be applied for improving the quality of dairy milk production. This research employed quantitative descriptive method with case study at Galur Murni Dairy Farmers Cooperative in Jember Regency, East Java, Indonesia. The analytical method used in this research was Analytical Hierarchy Process (AHP), which was begun from problem identification, hierarchy arrangement, priority setting for each criterion by implementing pairwise comparison, to consistency analysis which consisted of Consistency Index (CI) and Consistency Ratio (CR) calculation. Revision of opinion was carried out if the value of $CR > 0,100$. It was done by finding the value of RMS (Rood Mean Square) row deviation from and ratio of column weight value. From the findings, the main priority in improving the quality of dairy milk starts from counseling the farmers, that is equal to 0,307 with inconsistency value of 0,10.

1. Introduction

Dairy milk is a result of the livestock sub-sector that has great potentials in Indonesia. Based on Milk Outlook issued by the Ministry of Agriculture, domestic milk production is only able to meet not more than 21% of national milk consumption while 79% of the remaining is obtained from imports. Dairy farmers tend to ignore the quality of dairy milk produced, both during milking and post-harvest processes (Agustina T, 2016). According to Usmiati and Abubakar (2009), the low quality of milk produced by small-scale farming is due to the minimum standard fulfillment on milking management system and milk handling which result on relatively low valued milk by Milk Processing Industry (their milk quality standard setting gets stricter by years). Thus, if the quality of dairy products can satisfy consumers, it automatically promotes their bargaining position.

Quality improvement of dairy milk is the most important thing in marketing. According to Kotler (2009), product quality is a feature, namely the characteristics complementing the functions of a product that can be in the form of a better capital or physical structure compared with other similar products. Even, quality is often considered a parameter of customer satisfaction. Quality referring to customer satisfaction can later be used as an effort for continuous improvement and bargai

position strengthening. When the product has a good bargaining position, the societies' needs are fulfilled and it leads to their food resilience. Food resilience is the ability of a nation to guarantee that all of its citizens get adequate amount of good quality and safe food and things which is based on the optimization of local resource based utilization (Soekartawi; 2008). Based on the description, this study attempted to determine the most appropriate strategy to be applied in improving the quality management of dairy milk production.

2. Methods

This research employed quantitative descriptive approach. According to Silalahi (2010: 28), quantitative descriptive presents further data from observation, such as investigations then measures the size or distribution of the traits among members of a particular group. The research design was case study. According to Silalahi (2010: 186), case studies study one target group member of research subjects intensively or deeply. The research subject of the study was Galur Murni Dairy Farmer Cooperative (KPGM), which is located in Jember Regency, East Java Province, Indonesia.

The analysis used to determine the priority of the strategy was Analytical Hierarchy Process (AHP) method. AHP was analyzed by expert choice. The stages of data processing and dairy milk quality improvement direction determination include:

a. Identifying system

System identification was conducted by discussing with experts and studying some references to get concepts that are relevant to the problem of the study.

b. Arranging hierarchy

The hierarchical arrangement was done by grouping system elements or alternative decisions into an abstraction of decision hierarchy system.

c. Determining priority

Priority determination for each criterion used pairwise comparisons. This technique was done by entering values in numerical form into pairwise comparison matrix. The values inputted were the results of the experts' assessment on the questionnaire that had been made by the researcher. To get a homogeneous assessment, a scale of 1 to 9 was used.

Table 1. Assessment scale of pairwise comparison

Interest Intensity	Information
1	Both elements are equally important.
3	One element is slightly more important than the other.
5	One element is more important than the other element.
7	One element is obviously more important than other element.
9	An absolute element is more important than other element
2,4,6,8	Values between two close-considered values
Opposite	If activity i gets one number compared to activity j, then j has the opposite value compared to i.

Table 2. The matrix formulations of priority determination

	j	A ₁	A ₂	...	A _n
i					
A ₁		W ₁ /W ₁	W ₁ /W ₂	...	W ₁ /W _n
A ₂		W ₂ /W ₁	W ₂ /W ₂	...	W ₂ /W _n
...	
A _n		W _n /W ₁	W _n /W ₂	...	W _n /W _n

W_i / W_j values, with i, j = 1,2, ... n, obtained from the experts' assessment in the quality management of dairy milk.

d. Conducting consistency analysis

The level of consistency indicates a value of an opinion that matches the element grouping in the hierarchy and shows the level of accuracy of an opinion on elements at a hierarchical level. The indicator in AHP is the values of the CR (Consistency Ratio).

(1) Consistency Index (CI) Calculation

The level of consistency indicates a value of an opinion that matches the element grouping in the hierarchy. The Consistency Index (CI) used the following formulation.

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

Information:

maks : Eigen Value = (number of columns X priority)

n : The number/amount compared

(2) Consistency Ratio (CR) Calculation

The overall consistency of various considerations can be measured from the value of the Consistency Ratio (CR). To find out the Consistency Ratio (CR), value the following formulation is used.

$$CR = CI/RI$$

Information:

CR : Consistency Ratio

CI : Consistency Index

RI : reference table value that matches the matrix size

e. Revising opinion

Revision of opinion was done if the CR value was more than 0.1. The revision was conducted by finding the RMS (Rood Mean square) deviation value from the rows (a_{ij}) and the comparison of the column weight value (w_i / w_j) and revising the opinion on the row with the greatest value. The use of this revision was very limited due to the deviation from the actual answer.

3. Results and Discussion

Galur Murni Dairy Farmer Cooperative (*Koperasi Peternak Galur Murni/KPGM*) is one of the cooperatives located in Jember Regency. It is located in Rowotengah Village, Sumberbaru District, Jember Regency, East Java Province (as shown in figure 5.1). The focus area of this cooperative is animal farming, especially dairy cows. It was established in 1999 and focused on dairy farming from 2010 to presents with SIUP Number 503/513/436.314/2006 and Sign of Company Register (*Tanda Daftar Perusahaan*) 13.07.2.52.00522. Beside savings and loan activities, It manages several units of business activities. The business activity units produces products, such as dairy milk, pasteurized milk, and yogurt. This cooperative accommodates its members in distributing dairy milk produced by their dairy cows. The dairy milk is usually collected and then stored to the Milk Processing Industry. To ease the dairy milk collection process, the collecting sites are divided in three areas, Ajung, Balung, and Sumberbaru Districts.

Based on the in-depth interview results with several respondents (the chairman of Galur Murni Dairy Farmer Cooperative, members of the cooperative, and a staff of *Dinas Ketahanan Pangan dan Peternakan Kabupaten Jember*), hierarchies arranged through grouping system elements or alternative decisions were established. The Hierarchy can be seen in **Figure 1**.

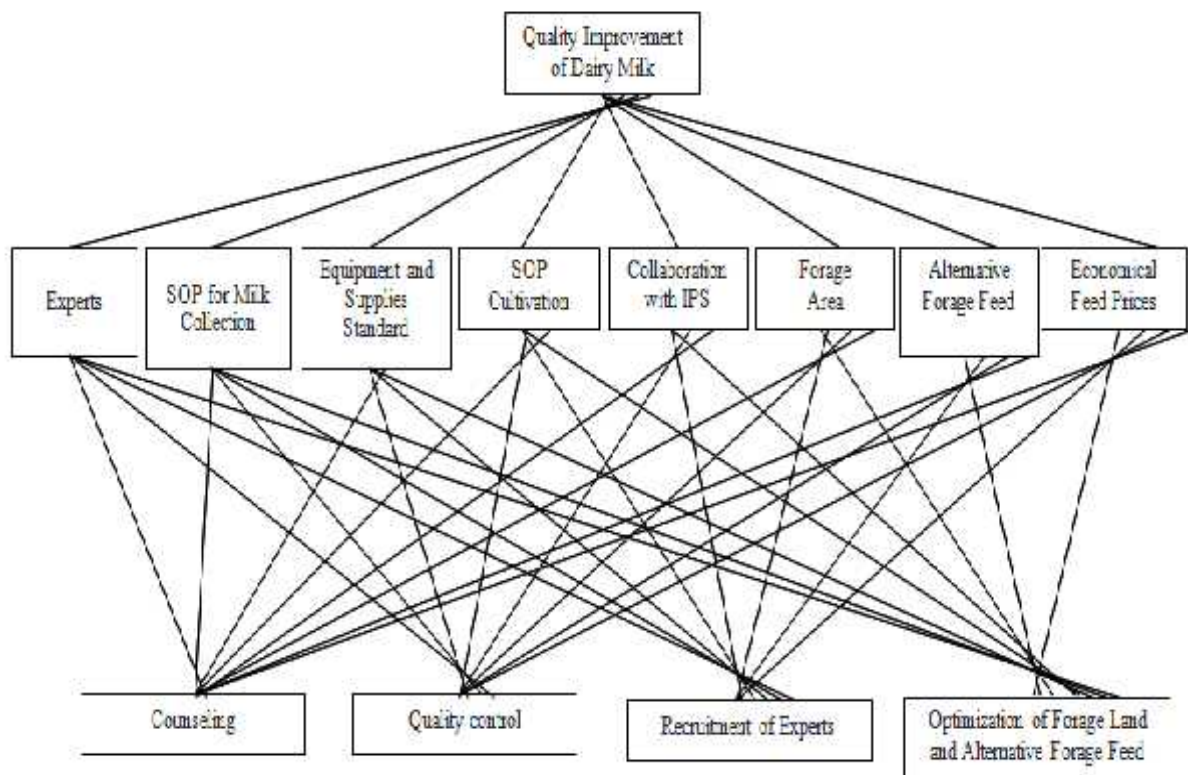


Figure 1. Hierarchy of Dairy Milk Quality Improvement

The first level of the hierarchy is quality improvement of dairy milk. In determining the quality improvement, there are several criteria to be considered, such as experts, Standard Operating Procedure (SOP) for collecting the dairy milk, equipment and standard supplies, cultivation SOP, collaboration with Milk Processing Industry, forage area, alternative feed, and economical feed prices, which are at Level 2 of the hierarchy. Level 3 of the hierarchy consists of alternative strategy which were used on quality improvement, such as counseling, quality control, recruitment of experts, and optimization of forage land and alternative forage feed. Based on the Analytical Hierarchy Process

using expert choice software, the mainly prioritized strategy was intensive counseling to dairy farmers. The second priority was the quality control strategy. Then, the third was the recruitment of experts and the last was the optimization of forage and forage feed.

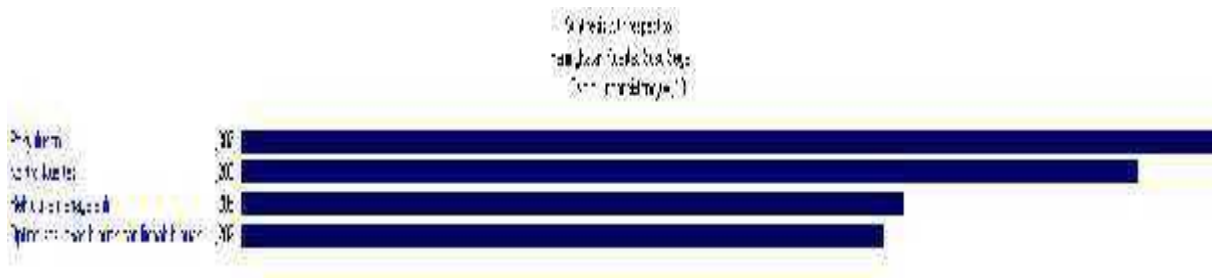


Figure 2. Analytical Hierarchy Process (AHP) Results

Based on the AHP results shown in Figure 1, the main priority for improving the quality of dairy milk is intensive counseling to dairy farmers. Counseling factor had the highest value among the other factors, which was equal to 0,307 with inconsistency values of 0,10. The second priority was quality control (0,283), the third was recruitment of experts (0,209), and the fourth was optimization of forage land and alternative forage feed (0,202). Without prior counseling, farmers in the cooperative would not know the criteria requirements of the dairy milk quality. After the carrying out of the intensive counseling, the farmers understood the criteria of dairy milk quality. Then, the quality control can be carried out on the activities of the farmer.

4. Conclusion

Based on the results and discussions, it can be concluded that the priority in improving the quality of dairy milk is counseling to farmers. Without prior counseling, farmers (especially in KPGM) would not know the criteria required in the dairy milk quality. After counseling, the farmers understood the criteria for the quality of fresh milk. Later, quality control could be carried out in the farmers' activities. This can be applied to dairy farming activities as an effort to improve the quality of produced dairy milk. Thus, it can meet the needs of consumers (milk management industries), reduce the amount of milk imports, support food resilience in Indonesia

5. References

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