



# International Journal of **Dairy Science**

ISSN 1811-9743



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## Research Article

# Total Economic Value of Smallholder Dairy Farm in Java Island Indonesia

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## Abstract

**Background and Objective:** Determining the total economic value in terms of direct value and indirect use value of dairy farming can be used as a consideration for formulating policies and evaluations related to environmental economic assessment and developing business areas based on the potential of local livestock resources. This study aims to estimate the total economic value of dairy cattle in four provinces on Java Island that are centers of dairy cattle production in Indonesia, including West Java, Central Java, East Java and Yogyakarta. **Materials and Methods:** The study uses primary and secondary data. Primary data sourced from the respondents (439 farmers) and secondary data was sourced from the books Livestock and Animal Health Statistics, Livestock in Numbers and Structure of Ruminant Livestock Costs. The analysis was carried out descriptively and quantitatively and the results of the analysis were written in table form. The total economic value was determined using the direct and indirect use value approach. **Results:** The direct use value calculation of the value of live dairy is IDR 11.06100 trillion/year. The added value of dairy is IDR 4.26846 trillion/year; the value of milk production is IDR 3,554,793,911.00 year and the value of manure is IDR 18,097,025,760.00/year. The indirect use value of employment opportunities is IDR 3.06849 trillion/year and the multiplier effect in terms of population is IDR 19,318,876,544.00/year. The province with the highest total economic value is East Java. **Conclusion:** In summary, dairy cattle assets on smallholder farms must be increased, especially milk production and the use of livestock manure.

**Key words:** Dairy cattle, direct use value, local resources, multiplier effect, primary and secondary product, total economic value

**Citation:** Kusumastuti, T.A., M.Z. Abidin and R. Widiati, 2024. Total economic value of smallholder dairy farm in Java Island Indonesia. Int. J. Dairy Sci., 18: 8-17.

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**Competing Interest:** The authors have declared that no competing interest exists.

**Data Availability:** All relevant data are within the paper and its supporting information files.

## INTRODUCTION

Dairy farming relies on increasing livestock productivity, especially milk production as the primary product. Over time, farmers have also implemented strategies to increase the efficiency and sustainability of livestock so that it can be continued between generations<sup>1</sup>. Indonesia has various types of dairy livestock that have the potential to produce milk, including cows, goats, buffalo and sheep. Cow's milk dominates dairy products in Indonesia (60%), goat's milk (24%), sheep's milk (10%) and the lowest is buffalo milk, which contributes (6%) to milk production in Indonesia<sup>2</sup>. Other output comes from waste by-products, which, if not optimized, cause environmental pollution from the methane gas produced.

In Indonesia, the dairy cattle breeds developed are Friesian Holstein (FH) cattle and Grati cattle. Most cow's milk in circulation comes from FH cows because FH cows produce high milk and can adapt to climate types ranging from subtropical to tropical and from highlands to lowlands. Grati cattle, namely a cross between a FH bull and a local female cow of the Javanese and Madurese breed<sup>3</sup>. It was given the name Grati because it was bred and very popular in Grati District, Pasuruan Regency, East Java.

The dairy cattle population in Indonesia, as a developing country, is concentrated in several regions, namely West Java, East Java, Central Java and Yogyakarta. According to Asmarasari *et al.*<sup>4</sup> more than 98% of Indonesia's total dairy cow population lives on the island of Java. There are between 534.22 to 543.55 thousand heads of dairy cattle on Java Island, whereas the dairy population outside Java is only 6.59 thousand heads. In 2022, the number of dairy cows population in West Java, Central Java, East Java and Yogyakarta, respectively, will be 120,792 (20.72%) of the national population), 143,465 (24.61%) of the national population), 314,385 head (53.93%) of the national population) and 3,516 head (0.60%) of the national population). Development conditions of the dairy cattle population and milk production in Indonesia over the last decade show an increase every year. In 2019, there was a decline in population due to the policy to stop beef imports, so beef increased and breeders preferred to sell livestock in the form of meat. In addition, limiting import quotas for feeder cattle and beef will increase domestic beef production and demand for beef, reduce the live cattle population, as well as reduce imports of beef and feeder cattle followed by improvements in production technology<sup>5</sup>. The development of the dairy cattle population is currently concentrated on Java Island, so it is necessary to maintain the existence of dairy farming. It is likely due to several factors, including the level of

need for or consumption of meat on Java Island, which is relatively greater when compared to the need for meat outside Java Island. Another factor is the infrastructure, technology and livestock industry, which is more advanced on Java Island compared to other regions, especially the animal feed supply industry so that the livestock subsector can develop better.

Dairy farming businesses in Indonesia range from individual small-scale farming businesses to privately managed farms with large-scale businesses. People's dairy farming is the most dominant type of dairy farming in Indonesia<sup>6</sup>. Natural resources accounting or environmental economic balance through assessing dairy cattle resources is needed. This study analyzes the environmental and economic value of smallholder dairy farming to support Indonesia's environmental and economic balance which was prepared based on the SEEA (System of Environmental-Economic Accounting) 2012 Central Framework methodology<sup>7,8</sup>. Physical asset balances for livestock resources and energy resources from waste utilization can explain the number of resource stocks and their changes over time. The monetary asset balance sheet presents the monetary value of the valuation results of the physical asset balance sheet so that it can be calculated whether there will be a depletion of Indonesia's environmental assets in 2023 compared to the previous year.

Estimation of the biomass and value of key livestock types by province in Indonesia, with the estimation of value being based on the concept of total economic value<sup>9,10</sup>. Livestock value consists of two major parts: The use value and the non-use value. Non-use value includes the value of livestock as an asset to be passed on to future generations (bequest value), the value to others of having livestock (altruistic value) and the value that occurs due to the continued existence of livestock (existence value). The use value of livestock includes: (1) The value of direct use of livestock; this includes the value of the population, the value of primary outputs (e.g., meat, eggs and milk), secondary outputs (e.g., manure) and the value of draft power and other services, (2) The value of indirect use (e.g., cultural uses) and (3) The value of the option of future use (e.g., the value of genetics). In this paper, the value of livestock based on the direct and indirect use value portions of the total economic value was estimated. Limitations in data availability mean that the scope of the estimation is limited to the population value of livestock and the value of major primary and secondary outputs of those dairy cattle over a year. These are estimated for a range of livestock in each of the four provinces of Indonesia.

## MATERIALS AND METHODS

**Location:** This study was conducted in the four provinces of Indonesia, namely East Java, Central Java, West Java and Yogyakarta. The study was carried out from June, 2023 to September, 2023. Milk production centers in East Java Province are centered in Pasuruan Regency and Malang Regency. Sleman Regency is the only milk production center in Yogyakarta. Central Java is mainly in Boyolali Regency and West Java is in West Bandung Regency.

**Data collection:** The primary data were collected using two techniques, namely: (1) Observation, data collection by directly observing the study object and (2) Interviews, namely the collection of data by requesting information from respondents. The respondents used in this study were 439 farmers from four provinces in Java Island. Data collected include farmer's demography characteristics, dairy cattle management based on business scale, cattle characteristics (animal status), cattle ownership, milking management, milk production, cattle feeding management and waste disposal management. Furthermore, livestock population data by province for dairy cattle is based primarily on secondary data available from the Indonesian Bureau of Statistics (BPS-Statistics Indonesia and BPS-Statistics Province) and the Directorate General of Livestock and Animal Health (Ditjen PKH)<sup>11-13</sup>. This is supplemented with data from publications based on recent dairy cattle study publications in Indonesia. The data obtained were summarized in tabular form.

These data will be used to determine the economic value of dairy cattle. The economic value of dairy cattle is the sum of their direct use value and indirect use value. Direct use value includes population, primary product (production) and secondary product. The value of live livestock is the product of the total population (head) and the price of livestock (IDR/head). The primary product of dairy cattle per head per year in Indonesia consists of weight gain (38.59%), milk production (58.65%) and sales of elderly livestock (1.17%), which is slaughtered<sup>14</sup>.

Milk output is the product of milk production and milk price, while cull livestock is the product of the number of livestock slaughtered and the livestock slaughter weight. Direct use value, that is the secondary product (dairy cow manure) which is the product of the weight of manure per head of dairy cow (kg), the population of dairy cows (heads) and the price of dairy cow manure. The by-product consists of dung, biogas and liquid fertilizer (1.57%).

The indirect use value of employment opportunities is the multiplication of the percentage of labour costs for maintenance per dairy cow, labour wages and dairy cow population with the assumption that wages are (23.62%) of total production costs, consisting of paid workers (0.84%) and not-paid or family workers (22.78%). Whereas, indirect use value multiplier effect from the population approach (live dairy cows) is used for simple linear regression analysis with the formula<sup>15</sup>:

$$Y = a + bX$$

Where, Y is GDP data for the livestock subsector for the last 5 years, a is constant, b is regression coefficient and X is dairy cow population (head).

The effect multiplier value is formulated as follows:

$$\Delta \text{GRDP} = k \times \Delta I$$

Where,  $\Delta I$  is dairy cow population  $\times$  price of dairy cows/head and k is b (regression coefficient).

**Data analysis:** The descriptive method was used to analyze the demographic characteristics of respondent dairy farmers, cattle ownership, milk production and the direct use value of dairy cattle, including the primary product, namely population, livestock production from weight gain, milk and culled livestock, as well as secondary products, namely manure waste, which has a sales value. Indirect use value is the potential of dairy cattle as a provider of employment opportunities and the multiplier effect of the potential of dairy cattle to increase economic growth on Java Island. The calculation of dairy cattle in Indonesia in 2022 was completed using a custom-developed spreadsheet-based model in Microsoft Excel. This set of population, output values and multiplier effects is then combined to give an estimate of total economic value.

**Ethical consideration:** The study procedure was approved by the standard of the ethical procedure from the Research Ethics Commission of the Directorate of Research, Universitas Gadjah Mada, Indonesia.

## RESULTS AND DISCUSSION

**Demographic characteristics of respondent dairy farmers, cattle ownership and milk production:** Demographic characteristics of respondent dairy farmers included gender,

Table 1: Demographic characteristics of respondent dairy farmers

Characteristics	West Java	Central Java	East Java	Yogyakarta	Unit
<b>Gender</b>					
Male	89.3	77.9	78.0	87.0	%
Female	10.7	22.1	22.0	13.0	%
<b>Age</b>					
Productive	97.1	87.5	86.0	88.0	%
Non-productive	2.9	12.5	14.0	12.0	%
Average age of farmers	44.4±9.8	49.6±12.9	48.7±11.7	49.8±11.3	Years
<b>Formal education</b>					
No schooling	2.0	4.4	17.0	11.0	%
Elementary school	55.0	34.6	27.0	61.0	%
Junior high school	24.0	30.9	35.0	10.0	%
Senior high school	17.0	27.9	18.0	17.0	%
College/University	2.0	2.2	3.0	1.0	%
<b>Farming experience (years)</b>					
≤10	20.4	30.0	24.0	28.0	%
11-25	63.1	39.2	47.0	41.0	%
≥26	16.5	30.8	29.0	31.0	%
Average	18.1±8.5	10.1±9.5	21.3±13.6	19.5±10.9	Years
<b>Number of family members (years)</b>					
≤2	6.0	5.9	7.0	15.0	%
3-4	77.6	66.9	60.0	66.0	%
5-6	11.9	22.8	31.0	15.0	%
≥7	4.5	4.4	2.0	4.0	%
Average	4.0±2.0	4.0±1.2	4.0±1.1	3.7±1.3	Person
<b>Main occupation</b>					
On-farm	100.0	86.0	55.0	83.0	%
Off-farm	0.0	8.8	41.0	11.0	%
Non-farm	0.0	5.2	4.0	6.0	%

age, education, farming experience, the number of family members and the main occupation affecting the dairy cattle production system were shown in Table 1.

Based on Table 1, the respondents were dominated by men, above 70% and the productive age of farmers was less than 60 years. West Java has an average age of farmers who are younger than those three other provinces, with an average of  $44.40 \pm 9.80$  years (range 15 to 64 years old). The average age of farmers in Central Java, East Java and Yogyakarta was  $50.97 \pm 10.31$ ,  $41.83 \pm 12.48$  and  $49.49 \pm 11.31$  years, respectively<sup>16</sup>. More than 50% of farmers in West Java and Yogyakarta and 40% of farmers in Central Java and East Java with low education and no schooling, study by Guntoro *et al.*<sup>16</sup> and Widyobroto *et al.*<sup>17</sup>. In general, the formal education of farmers is still low at elementary school level. Farmers' knowledge and skills are supported by non-formal education, namely training and counseling in terms of livestock maintenance and health, technology for processing milk, feed and manure by Department of Agriculture as Government, Non-Government Organization (NGO) and Academician from college or university.

Working as dairy farmers is the mainstay for farmers. Livestock is a hereditary business according to socio-cultural conditions, besides livestock is a source of investment and

functions as cash of money. Livestock rearing is dominated by the head of the family and is assisted by family members with an average number of members of 3 to 4 people Guntoro *et al.*<sup>16</sup> and Widyobroto *et al.*<sup>17</sup>. The wife also helps the head of the family and plays a role in managing and processing milk. The main occupations of the majority are farmers and non-farm farmers such as sand miners, traders, construction workers, teachers and government employees.

The ownership and milk production of dairy cows were shown in Table 2. The ownership of dairy cows varies greatly between the four provinces. In terms of ownership of cattle, farmers in West Java have cattle more ( $9.51 \pm 5.80$  head) than those farmers in three other provinces (East Java  $8.45 \pm 8.69$  head, Central Java  $6.56 \pm 5.08$  head and Yogyakarta  $4.25 \pm 2.66$  head). The heterogeneity of livestock on the island of Java shows that the proportion of lactating heifer is lower than non-lactating, so they have not achieved efficient livestock productivity. However, this study is still higher than previous studies where the average lactation was more than 50%, male calves were sold at the age of 6 to 12 months and female calves were kept as replacement heifer<sup>16-18</sup>.

Table 2 shows that on average farmers have 4 to 9 heads below the standard of ownership of 10 to 12 heads/farmers<sup>18</sup>. People's dairy farming is not yet

Table 2: Cattle ownership and milk production on dairy farmers

Parameter	West Java	Central Java	East Java	Yogyakarta	Unit
<b>Animal status</b>					
Cow lactation	5.33±2.40	3.60±3.53	4.48±3.99	2.03±1.52	Head
Cow non-lactation (dry)	2.00±1.49	1.94±1.58	2.46±2.55	1.45±0.96	Head
Heifer	1.94±1.32	1.28±0.46	2.57±2.23	1.42±0.62	Head
Bullocks	2.67±2.69	1.56±0.73	2.75±2.06	1.50±0.58	Head
Bull	3.33±3.39	2.08±1.47	1.00±0.00	1.00±0.00	Head
Calf-male	1.61±1.42	1.42±0.84	1.84±1.46	1.27±0.59	Head
Calf-female	1.67±1.34	1.82±1.35	1.97±1.56	1.69±0.93	Head
Average cattle ownership	9.51±5.80	6.56±5.08	8.45±8.69	4.25±2.66	Head
Milk production	15.81±3.63	9.41±3.35	9.43±2.49	11.05±4.14	L/head/day

efficient due to a lack of production inputs such as livestock, capital, technology and limited land for animal feed. Meanwhile, in terms of average milk production, milk production in West Java ( $15.81 \pm 3.63$  L/head/day) and Yogyakarta ( $11.05 \pm 4.14$  L/head/day) was better than those in East Java ( $9.43 \pm 2.49$  L/head/day) and Central Java ( $9.41 \pm 3.35$  L/head/day). Daily milk production should reach at least about 10 L/head/day, to have an impact on farmer income<sup>18</sup>. The problems almost in all dairy smallholders were that the farms were less efficient, dairy cattle cultivation that is not yet optimal is coupled with low-performing lactating cows that produced about 8 to 12 L/head/day, utilization of feed processing technology, waste and livestock by-products that is not yet optimal, which resulted in low farm income<sup>19,20</sup>.

**Total economic value of dairy farming:** Value estimates based on the total economic value concept can be used to estimate the biomass and value of key livestock (dairy cattle) by province in Indonesia, according to the explanation from Nyariki and Amwata<sup>9</sup> and Hansson *et al.*<sup>10</sup>. The total economic value of dairy farming is determined using the direct and indirect use value approach. Determining the total economic value of dairy farming can be used as a consideration for formulating policies and evaluations related to environmental economic assessment and developing business areas based on the potential of local livestock resources.

**Direct use value dairy cattle:** Average dairy cattle ownership in Indonesia, especially Java, is still low. Livestock ownership is dominated by lactating cows ( $\geq 50\%$ ), with average cattle ownership of 4 to 6 head/farmer and lactating cows of 2 head/farmer<sup>17</sup>. Ownership of dairy cows is also influenced by the area of forage land for livestock. Availability of land indirectly influences the relationship with the production performance of dairy cattle through the forage produced or feed availability<sup>13</sup>.

The main products at the farmer level are milk and the sale of calves, as well as the slaughter of cull livestock. Culling

is important in the management of dairy herds, as less-productive, old, infertile, or unhealthy cows need to be regularly replaced with younger and genetically superior heifers to maximize profitability. The main causes of culling due to death and slaughter were reported as feet and claw disorders (26.4%) of culled cows, udder disorders (22.6%), metabolic and digestive disorders (18.1%) and fertility problems (12.5%)<sup>21</sup>.

The total direct use value of population, primary and secondary products is IDR 15.53800 trillion (Table 3). The direct use value of dairy cattle in 2022 by four provinces on Java Island varies between IDR 94,069,198,605.00 in Yogyakarta and IDR 8.37554 trillion in East Java. The concentration of livestock in Java is clearly shown, with East Java accounting for 53.90% of the total direct use value on Java Island. East Java has the largest population of dairy cattle. Dairy cattle production centers are mainly in Pasuruan Regency and Malang Regency (Fig. 1).

Since the endemic outbreak of Foot and Mouth Disease (FMD) in 2022, many cattle have died, causing high economic losses to farmers. The reappearance of FMD as a re-emerging disease in animals in Indonesia on June 25, 2022, is based on the Decree of the Minister of Agriculture of the Republic of Indonesia No. 500.1/KPTS/PK/300/M/06/2022<sup>22</sup>. It was recorded that until the end of June 2022, 19 provinces and 221 districts and cities were infected with foot and mouth disease, for a total of 291,538 cases. The World Organization for Animal Health (WOAH) reported that decreased appetite, excessive salivation, lameness, fever and blisters were the clinical signs first observed by field officers<sup>23</sup>, as well as a decrease in milk production and body weight of dairy cows.

Milk production is still low, ranging from 0.01% to 0.04% of total output. The difficulty of domestic dairy farms producing milk is caused by several complex factors. Dairy cattle ownership in Indonesia is still dominated by small-scale (low scale), with cattle ownership of 1 to 2 head<sup>6</sup>. Another opinion states that livestock raising in Indonesia is still traditional. This condition causes low

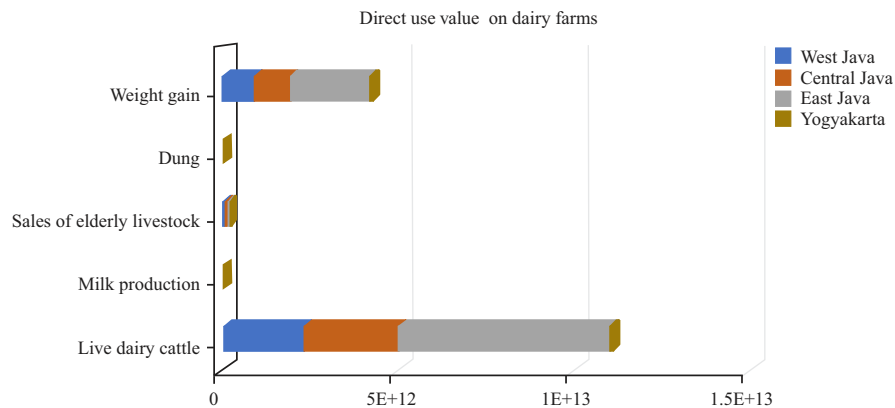


Fig. 1: Direct use value on dairy farms on Java Island

Table 3: Direct use value on dairy farms on Java Island (IDR per year) in trillions

Output value	West Java	Central Java	East Java	Yogyakarta	Total
Live dairy cattle	2.29509	2.72584	5.97332	0.06680	11.06100
Milk production	0.00123	0.00039	0.00191	0.00001	0.00356
Sales of elderly livestock	0.04715	0.05288	0.08543	0.00136	0.18682
Dung	0.00376	0.00446	0.00977	0.00011	0.01810
Weight gain	0.88567	1.05190	2.30510	0.02578	4.26846
Total	3.23290	3.83546	8.37554	0.09407	15.53800

productivity in dairy cows<sup>24</sup>. The major constraints to milk production were feed shortages, disease prevalence and low milk yields. Disease is one of the major problems associated with dairy production or the milk production system that causes mortality and reduced milk production<sup>25</sup>. Production recording also needs to be disseminated to breeders to obtain optimal livestock productivity and improve quantitative characteristics in cattle<sup>13,17</sup>. On the other hand, efforts can be made to increase milk production and quality by increasing the human resource capacity of farmers and providing assistance in implementing good dairy farming practices. Farmers need to improve maintenance management, especially in the aspects of selection methods, business recording, cage layout and waste handling<sup>26</sup>. The dairy cattle industry can become a driving force for rural industrialization by being developed into a commercial business that empowers farmers in terms of strengthening capital, guaranteeing milk prices and maintaining livestock health<sup>27</sup>. Livestock death insurance also needs to be developed through livestock insurance. The Ministry of Agriculture, together with Bank Indonesia, launched a cattle insurance product in the second quarter of 2013 as a strategy to protect farmers by collaborating with the state-owned insurance company, namely PT Asuransi Jasa Indonesia (JASINDO). In this regard, the high risk of livestock death due to accidents, natural disasters, epidemics of infectious animal diseases,

climate change and/or other types of risks, according to Law No. 19 of 2013 on the protection and empowerment of farmers and Regulation of the Ministry of Agriculture No. 40/Permentan/SR.230/7/2015 concerning agricultural insurance facilitation, so agricultural insurance is necessary<sup>28</sup>.

The use of dairy cow manure is also not optimal. If farmers get used to processing livestock waste into biogas and fertilizer, they can save on household expenses and increase farmers' income. So far, waste management has generally only been piled up, left in the yard, or placed in a dug hole. This is a problem because it causes the cow pen to look dirty and causes an unpleasant odor. The price of LPG for producing dairy products is quite high, so biogas production technology is needed as a substitute for alternative energy and organic fertilizer<sup>29,30</sup>. Processing livestock manure through the use of biodigesters for anaerobic digestion, biofiltration and composting can reduce methane emissions<sup>31</sup>.

**Indirect use value dairy cattle:** Data on indirect use value providing employment opportunities were shown in Table 4. The total provision of employment opportunities for dairy farming businesses on Java Island is IDR 3.06849 trillion. If the calculation includes labour from dairy farming companies, the total increases by IDR 59,134 million. Based on dairy company statistics for 2022, the total employment opportunities for dairy farming businesses on Java Island come from 22

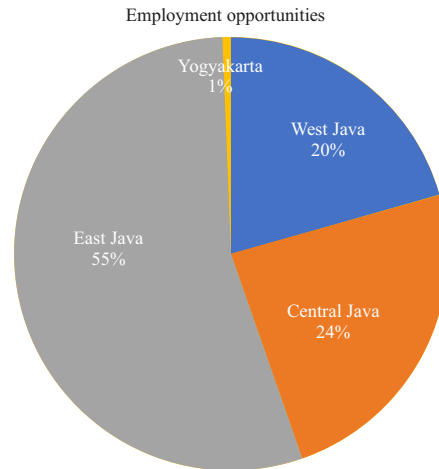


Fig. 2: Percentage of employment opportunities from dairy farming businesses

Table 4: Indirect use value providing employment opportunities

Province	Wages/month (IDR)	Population (Head)	Total (IDR per year) in trillion
West Java	1,840,000	120,794	0.629976
Central java	1,810,000	143,465	0.736013
East Java	1,890,000	314,385	1.684170
Yogyakarta	1,840,000	3,516	0.018337
Total			3.068490

companies that are active in carrying out breeding, cultivating dairy cows and collecting cow's milk with a workforce of 785 labour. The percentage of employment opportunities from dairy farming businesses were shown in Fig. 2.

The number of working hours for men is 2.33 hrs/day, while for women it is 1.95 hrs/day. The average time allocated for the dairy business is for male workers (849.64 hrs, or 106.20 person working days) and female workers (738.11 hrs, or 81.57 person working days)<sup>32</sup>. Labour wages are calculated based on the provincial minimum wage. The low contribution of providing employment opportunities for raising dairy cattle on a community scale means it is necessary to increase off-farm activities, namely through the development of the agro-industry, which directly involves farmers and rural communities. Cow's milk production is used by large and medium-sized industries as raw material and by households directly, while the rest is used by food and beverage processing companies<sup>33</sup>. It is hoped that many dairy processing industries can collaborate with smallholder farmers as raw material suppliers. Farmers not only sell fresh milk but also carry out product differentiation so that they can increase sales value and provide employment opportunities for the surrounding community<sup>34</sup>.

Data on indirect use value providing employment and multiplier effects were shown in Table 5. The total indirect use value is IDR 3.08781 trillion. The contribution from the multiplier effect of the dairy cow population is IDR

0.02000 trillion. The study shows that the multiplier for the dairy cow population was 0.02, meaning that gross regional domestic income from the livestock subsector on Java Island increased by 0.02 times due to investment in dairy cattle resource assets. The low value of the multiplier effect is due to low expenditure on milk consumption and population. The low population has an impact on the low milk production produced. The government's role in terms of investment is needed to increase the population, especially lactating heifer. On the other hand, the milk drinking campaign through distributor agents in rural areas has had an impact on increasing people's spending on consuming milk.

Data total economic value of dairy farming on Java Island were shown in Table 6. East Java Province is the center population of dairy cattle and the largest milk production in Indonesia<sup>35</sup>, especially in Pasuruan Regency, Malang Regency and Tulungagung Regency. Sutawi *et al.*<sup>35</sup> explained that in 2018, East Java contributed 252,680 heads (49.66%) to 544,791 dairy cattle populations and 461.73 thousand tons (54.25%) to 920,093 tons of Indonesian milk production and for the last five-year period (2018 to 2022), East Java Province provided the first largest contribution, namely 51.79% or 299,331 heads. Table 6 shows that the output of milk production (IDR 0.00355 trillion) and livestock manure (IDR 0.01810 trillion) in terms of total economic value is still low. The sale of milk may not be the

Table 5: Indirect use from providing employment and multiplier effects in trillions

Value	West Java	Central Java	East Java	Yogyakarta	Total
Employment opportunities	0.62998	0.73601	1.68417	0.01834	3.06849
Multiplier effect	0.01607	0.00139	0.00107	0.00079	0.01932
Total	0.64604	0.73740	1.68524	0.01913	3.08781

Table 6: Total economic value in trillions

Output value	West Java	Central Java	East Java	Yogyakarta	Total
Live dairy cattle	2.29509	2.72584	5.97332	0.06680	11.0610
Milk production	0.00123	0.00039	0.00191	0.00001	0.00355
Sales of elderly livestock	0.04715	0.05288	0.08543	0.00136	0.18682
Dung	0.00376	0.00446	0.00977	0.00011	0.01810
Weight gain	0.88567	1.05190	2.30510	0.02578	4.26846
Employment opportunities	0.62998	0.73601	1.68417	0.01834	3.06849
Multiplier effect	0.01607	0.00139	0.00107	0.00079	0.01932
Total economic value	3.87894	4.57287	10.06080	0.11302	18.6258

primary objective and in many cases, no milk is sold. Milk production is just one of many activities of the household and may be integrated with crop production<sup>36</sup>. The policy to increase milk production as a main product is improving feed technology and dairy cow maintenance management which has a direct impact on increasing the income of small-scale dairy farmers in Indonesia<sup>37</sup>. The development of biogas technology on dairy farms has the potential to overcome the negative impacts of livestock waste while alleviating poverty and providing clean energy and improving human health<sup>38</sup>.

This study is limited to smallholder dairy farms which dominate dairy farming in Indonesia. Therefore, further study is needed on commercial or industrial scale dairy farming so that livestock resource assets can be identified as a whole to support the total economic value of dairy farming on the island of Java. Production input on smallholder livestock is still low, especially capital and technology. So far, programs and assistance from the Animal Husbandry Department, educational institutions and the private sector have existed but have not been carried out periodically. Apart from that, the financial budget is still limited due to the increase in population. Therefore, the policy implications and recommendations that can be made are increasing farmers' agribusiness knowledge, especially the use of technology that is economically profitable so that it can increase farmers' income.

## CONCLUSION

The estimated total economic value of dairy cattle in 2022 was 18.62000 trillion, or around 1.70% of the overall livestock GDP of Java Island. Calculating the TEV of dairy cattle by province shows the dominance of provinces in East Java in livestock production. The output of milk production (IDR 0.00355 trillion) and livestock manure (IDR 0.01810 trillion) in

terms of total economic value is still low. In general, dairy cattle assets on smallholder farms must be increased, especially milk production and the use of livestock manure. The novelty of the study is measuring the total economic value of dairy cattle on smallholder farms to estimate the investment value and utilization of livestock resource assets in Java Island. The benefit of the study is can be useful for policymakers in terms of lobbying for dairy cattle resources for the livestock subsector.

## SIGNIFICANCE STATEMENT

Research on the environmental economic value of dairy farming to support Indonesia's Environmental and Economic Accounts prepared based on the SEEA (System of Environmental-Economic Accounting) methodology. The development of the dairy cattle population in Indonesia is currently only concentrated in 4 provinces on the island of Java so it is necessary to maintain the existence of dairy farming. This study is useful for directing the sustainability of livestock resources through calculating total economic value by including the internalization of direct and indirect use value. The results of the study are used as information on the asset value of dairy cattle input resources to realize sustainable and environmentally friendly economic growth in the livestock subsector.

## ACKNOWLEDGMENTS

We acknowledge financial support from Universitas Gadjah Mada with 2023 Academic Excellence Improvement Program Number 7725/UN1.P.II/Dit-Lit/PT.01.03/2023. Gratitude is also extended to the assistants of the Department of Livestock Social Economics, Faculty of Animal Science, Universitas Gadjah Mada for their technical assistance.

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