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Investment feasibility and risk management of a small-scale layer business in the Province of North Sulawesi, Indonesia

Erwin Wantasen [1,*], Sintya JK Umboh [1], Jein R Leke [2] and Florencia N. Sompie [3]

[1] *Department of Social-Economics, Faculty of Animal Husbandry, Sam Ratulangi University, Indonesia.*
[2] *Department of Livestock Production, Faculty of Animal Husbandry, Sam Ratulangi University, Indonesia.*
[3] *Department of Nutrition and Cattle Feed, Faculty of Sam Ratulangi University, Indonesia.*

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Abstract

The main expectation of investment in the layers production is to provide benefit for small-scale farmers, who have limited capital and deal with varied business risks. The purpose of this research is to know the feasibility of financial investment and determine an alternative scenario in dealing with risk for farmers in the small-scale egg-layer business with limited capital. The research, then, employed a survey method with a multi-stages sampling technique on 85 farmers of the small-scale layer business located in the District of Tomohon Utara. The City of Tomohon as the center of layers population in the Province of North Sulawesi. Data collection used a list of questions related to the research problem. Further, the use of financial analysis was by criteria of investment feasibility with the measurement of net present value, cost ratio of benefit, internal rate of return, and followed by sensitivity analysis related to business risk. The results of this research demonstrate that the total rate of layer chickens raised by farmers was 2,136 birds and the net present value (NPV) was IDR 36,213,611. Within the five-year investment, the cost ratio of benefit (B/C) was 1.05, and the internal rate of return (IRR) was 22.85 %. Under the current management of a small-scale layer business, performed by farmers, the layers business was feasible to deal with the risk of increasing feed price, increased mortality, and declining egg price, which those factors caused loss for farmers. Therefore, based on the sensitivity analysis, the small-scale farmers had to improve their daily rate of production of eggs by 76%, when the feed price increased by 5%, or the egg price declined by 5%, in minimizing and preventing loss.

Keywords: Investment; Feasibility; Small-scale; Farmers; Layers

1. Introduction

An egg is one of the animal-protein sources, having a significant role for people. In 2020, the egg consumption in Indonesia was 28.16 kg/capita/year, which increased to 38.45% from the egg consumption in 2017 [1]. Also, in 2020, the Indonesian egg consumption was provided from chicken eggs (75.68%), and the rest was eggs from ducks and quails. The population of layers was 151,42 million birds by the amount of eggs production of 1,289,716 tons. Then, egg consumption will increase in line with the increase in population, society's revenue, and the cultural changes in egg consumption patterns. In the same year, according to [2], the Indonesian population was 273 million people. As consequence, Indonesia becomes a potential market for the poultry business. This condition, indeed, indicates that the Indonesian egg poultry business has provided job opportunities for wider society and supported the national economic growth.

* Corresponding author: Erwin Wantasen
Department of Social-Economics, Faculty of Animal Husbandry, Sam Ratulangi University, Indonesia.

Additionally, one of the outstanding agriculture producers in South-East Asia is Thailand. This country has the biggest layers and broilers industry and provides a promising business opportunity for technology providers, investors, and business experts [3]. Meanwhile, in other developing countries, such as Nigeria, poultry has a significant position due to its superiority in resulting a massive economic growth, mainly business opportunities for low-economic groups (4]. In addition, the Government of Pakistan is determined to improve its society's life quality, and prevents hunger and lack of nutrition by designing a productive, efficient, and economically-beneficial agriculture sector [5]. Specifically, small-scale poultry production is a household business, developed in all developing countries as a source of revenue [6, 7,8].

The Indonesian downstream and upstream poultry industry, such as feed industry, day-old chick (DOC), products manufacturing, and medicines, has growingly developed, and 47 poultry industries, including middle and big categories, exist [9]. The sub-system of layer cultivation is performed by varied companies, either small or big scale, but none of the certain records related to business distribution is available. For example, a small company usually deals a fierce market competition with a more-efficient big company. As the result, a small company, having limited capital, will encounter a continuous business risk. [10] argued that the efficiency of eggs production in utilizing production factors, mainly feed, for the big farmers is higher than for smaller farmers.

In the context of Indonesia, the issue of the fluctuating price of eggs and feed is the most frequent risk dealt with layer producers [11,12]. Further, the fluctuating price of eggs is due to fluctuating demand on religious holidays. In detail, the market structure is an oligopoly, where its main characteristic is price leader enacted by the biggest company or producer. Thus, the fluctuating price of feed commonly occurs, impacting on the declining profit of farmers, particularly small farmers. Also, the layers cultivation with various commercial strains has utilized the designed technology, which requires a big investment [13]. The investment perspective in a small business is necessarily important to consider profitability, other than job procurement to a low-economy group. However, the investment usage contains risk, so a projection of a risk event must be balanced with its result [14,15,16,17]. Subsequently, investment analysis is defined as the evaluation process of investment regarding both profitability and risk. Based on this view, both investment analysis and risk management are necessarily performed, mainly in a small businesses with limited capital. The underlying issue is that none of the sufficient information related to such issues is available in previous research.

Therefore, the research is conducted to evaluate financial investment feasibility and determine an alternative solution dealing with the risk of a small-scale layer business in the Province of North Sulawesi. Moreover, this investment analysis is beneficial to overcoming risk, determining the expansion possibility of small businesses that can provide job opportunities, and improving welfare for low-economy groups.

2. Material and methods

2.1. Research site and sampling method of breeders

The research site was determined by a multistage sampling method. Firstly, the City of Tomohon was selected as the largest layer population in the Province of North Sulawesi. Second, the District of Tomohon Utara was selected as the largest layer population in the City of Tomohon. The next stage selected the Village of Kakaskasen Satu purposively as it was the largest total of layers. In the Village of Kakaskasen Satu, there are 97 layer breeders, then 85 farmers were selected purposively who have a business scale smaller than 3,500 birds. Additionally, it was in accordance with Laws of the government of Republic of Indonesia number nine of 1995, stating that the total of assets that are smaller than 3,500 birds is categorized into small-scale business.

2.2. Data colection

Primary data was collected by survey method, using directly in-depth interviews, with respondents with a questionnaire. The research was conducted from April to July 2021. The primary data, then, was focused on farmers' socio-economics, production management, and production and economic parameters. Further, the egg production was calculated by the following equation, as follows:

$$\text{Daily layers production (\%)} = \frac{Total\ of\ egg\ productions}{Total\ of\ living\ layers}\ x\ 100$$

Based on the formulation above, the rate of daily eggs production was measured in percentage (%) (18]. Data of economic parameters was the cost of production factors and price of manufactured products, such as cost of pullets (hens), feed, vaccine and medicines, labor's wages, egg price, and price of culled layers. In addition, the secondary data

was derived from institutions related to this research, such as the Statistic Center Agency (BPS), Service of Agriculture and Husbandry, and online sources on the internet.

2.3. Data analysis

The stages of the investment analysis were to determine 1) production and economic parameters based on raising management performed by respondents, 2) analysis of cash flow, 3) analysis of investment feasibility, 4) scenario in using the sensitivity analysis in dealing with business risk. Both production and economic parameters were employed to estimate cash flow within 5-years investments, based on the technical duration of cage investment. Particularly, cash flow is one of the methods of investment completion. Component of a company's revenue and expenses can be used to make a projection of cash flow for producers from a certain range of time during ongoing investment [19,20,]. Further, it is said that cash flow was used as the base of investment analysis during the investment period using discount factor value and inflation level in line with the economic condition as the research was conducted. An investment analysis means the assessment process of investment for profit, risk, and investment return value [21]. The criteria of investment assessment comprised net present value (NPV), benefit-cost ratio (B/C), and internal rate of return (IRR),, which were used to determine the investment feasibility of layers production. Then, Microsoft Excel 2010 was utilized for overall calculation related to the current project/business by discontinuing future cash flow during the project period with capital opportunity cost.

2.4. Net Present Value/NPV

It was based on the estimation of cash flow from a relevant and consistent project with inflation. The project would be profitable if NPV was positive, but, contrastingly, if NPV was negative, the investment would be non-profitable. The equation of NPV can be shown in the following, as follows:

$$NPV = \sum_{t=1}^{n} \frac{Bt-Ct}{(1+i)^t}$$

Where:
Bt : Business gross revenue in year-t
Ct : Business gross expenses in year-t
t : Investment period (1,2…5 years)
i : Discount rate

2.5. Benefit-cost ratio

The benefit-cost ratio was a total of the benefits series divided by costs, having been multiplied by the discount factor. The project would be beneficial if B/C was greater than 1, by the following equation as follows:

$$B/C = \frac{\sum_{t=1}^{n} \frac{Bt}{(1+i)^t}}{\sum_{t=1}^{n} \frac{Ct}{(1+i)^t}}$$

Where:

- Ct: cost in year-t, n = 1, 2, …5
- Bt: benefit or revenue in year-t, n = 1, 2, …5
- t: investment period of poultry eggs production (5-years investment project)
- i: the interest rate of discount factor that could be determined by using opportunity cost from the capital, where 10%, the stipulated interest rate for small-business, was used in this research.

Whereas;

- B/C > 1: beneficial and performable investment of layer business.
- B/C < 1: non-profitable and unfeasible investment of layer business.
- B/C = 1: investment of layer business was neither profit nor loss (break-even point), and investment decision depended on the owners of layer business

2.6. Internal rate of return (IRR)

It was a discount rate, resulting NPV equal to zero, where a decision to accept investment in a project as if the discount factor was less than the internal rate of return [22]

2.7. Sensitivity analysis

This type of analysis was employed to know the risk of changes in production parameters towards performance changes of the production system in resulting profit. Based on the sensitivity analysis, possible risks occurring from such changes could be previously known and anticipated. Specifically, in this research, the sensitivity analysis was performed to obtain an alternative to dealing with the risk of loss due to changes in feed price, eggs price, eggs production, and mortality. [23] argued that one of the issues, causing risk in a small-scale business of layer production is instability market price, production factor (feed), and products (eggs). Further, production parameters, such as the total of egg productions (hen day average) and layer mortality, become the necessarily anticipated risk. According to the details above, the scenario of the sensitivity analysis was designed to anticipate the worsening risk of the company's expenses and cash flow projection. [24] followed by [25], stated that business continuity of a business, mainly small-medium scale business (UKM), requires monitoring and controlling of cash flow.

3. Results and discussion

3.1. Characteristics of research site

According to data from [1], the research site was located on a highland in a tropical climate. Geographically, its altitude was 300 m up to 700 m from the sea level, and its temperature was between 24^{o}C – 30^{o}C. In the research site, the total population of three villages was 8,975 people, comprising 2,175 families, with a density of 315 people/km. 71.84% of residents domiciled in the research site worked in agriculture, estate, and husbandry. Additionally, the main living produced rice, corn, cloves, and coconut. However, in the last years, the production of cloves and coconut had decreased, and rice and corn were unstable. Thus, society tried to seek business opportunities outside of agriculture and estate, such as layer business.

3.2. Characteristics of respondents' socio economics

As shown in the following Table 1, the data depicts that the respondents, farmers, had productive age, such as 46.63 years old. According to [2], residents, including productive age, 15-64 years old. Then, the respondents, layer farmers, were included in the productive age, so it hoped that they could be able to adopt new technology in developing their business. The production improvement and agricultural productivity were highly supported by technology adoption, where such technology adoption was extremely influenced by a demographic factor, such as the farmer's age [26]. On average, the farmers' education was 10 years, or equal to junior high school, and farmers' average experience was 15 years. It means that farmers had more than 10 years of experience, but they were still classified as small employers. Particularly, their total of layer ownerships was less than 3,500, such as 2,136 birds on average, and they only employed household labor, such as 3 people without hiring contracted labor.

Table 1 Characteristics of socio-economics of layer farmers

Number	Characteristics	Average
1	Age (years old)	46.63 ± 8.45
2	Total of layer ownerships (birds)	2,136 ± 954
3	Farmers' education (year)	10.03 ± 3.14
4	Experience (year)	15.11 ± 4.37
5	Household labor (people)	3.08 ± 1.03

Table 2 Farmers' layer production management

Items	Types	Famers' management
Type of layers	Brown layers	Initial laying-age: 21.33 ± 1.52 weeks Culled age: 92.94 ± 6.78 weeks
Feed	Corn, concentrate, bran	The ratio of feed composition: 50%:32%:18%
Vaccine	New castle disease (ND) Gumboro Avian influenza	Every 2 months Once every laying period Once every laying period
Vitamin	Egg stimulus Aminovit	Given every 2-3 days Given every 2 days
Cages	Battery-cage system	Made from bamboo by the size of 45 cm x 45cm x40 cm and distance from the ground was around 1,5 m
Disinfectant	Limestone	Free chemical substances

3.3. Layers' production management and produstivity

The significant focus in the layer production management was the management of feed, vaccine, vitamins, cages, and disinfectants, as presented in Table 2. In this research, the type of layer was a brown-pullet layer with varied strains selected by the respondents, farmers. From the results of the interview related to the respondents' experience, strains of such brown layers were adaptable to the environment and had high production efficiency, and had mostly preferred eggs by consumers. Farmers conducted their business management to obtain low costs in order to provide profit [27]. Also, they dealt with capital issues, so they had to minimize costs. [28] postulated that the main issue experienced by small-scale layer farmers, sequentially, is insufficient finances, expensive feed prices, low eggs prices, high costs of medicines and vaccines, and investments in poultry cages. Based on the results of the survey, it is found that farmers using a dosage of feed, vaccine, vitamin, cages, and disinfectant were based on a series of instructions (leaflet) by the supplier, their experience, and education from other farmers in such group. For example, cages were only made from bamboo with the soil-based ground, so it saved costs. A stage-shaped cage enabled farmers to clean the cage from manure. They only used limestone as a disinfectant by spreading it around the cage. Additionally, the layer productivity could be described as a production parameter, as shown in Table 3, and used as the base of further analysis.

The production parameter of the Brown Lohmann-strained layers, raised in the Research Laboratory in West Java, demonstrates that feed consumption was 120±10 g/day/bird and the production average was 88.30±11.38 percent [29]. [24] recommended that the consumption of alternative consumption for Brown Lohmann is 110- 125 g, and the peak production at 24 weeks with the average egg production is 92-96%. Further, the weight reaches 1.9-2.1 kg/bird, and the mortality standard of layers from starter up to grower is 2.5 percent; while, the weight during the production period is 5%. Also, research performed in such research laboratory showed that the eggs production of the White Leghorn under different lightning produces 88.50 percent of average eggs production, where the daily consumed feed is 96 g, on average [30]. Other research reported that the eggs production derived from brown strain, aged 24 up to 78 weeks, and the production of hen day average is 78,10% [13]. Descriptively, in this research, the results of the production parameters were still in line with the results of previous research.

Subsequently, the production parameter along with the economic parameter, or price of production and product factors would determine the expenses of the layer company as the base of further investment analysis (Table 4). The investment analysis for the profitability of layer business consisted of 3 stages, such as (1) cash flow analysis, (2) analysis of investment profitability, and (3) sensitivity analysis.

Table 3 Layer production of 2,136 birds-scaled business

Number	Production parameters	Average
1	Initial laying age (week)	21.33± 1.52
2	Averagely daily eggs production (%)	75.27± 13.77
3	Pullet mortality (%)	6.10 ± 5.06
4	Age of culled layer (week)	84.05 ± 6.27
5	Average layer feed (g/bird/day)	108.08 ±10.13

The cash flow projection of a 5-years investment was estimated based on the results of production management (Table 2), production parameter (Table 3), and economic parameter (Table 4), as presented in the following Table 5.

Based on the results of cash flow analysis, it shows that none of the profit was obtained up to the first year of layer business, or nest cash flow was negative due to obligation to return the investment cost paid in the first year, yet net cash flow was positive in the second up to the fifth year of layer business.

Table 4 Economic parameter of layer business

Number	Economic parameters	Average
1	Price of pullet (IDR/bird)	59,765
2	Feed price of layer (IDR/kg)	5,135
3	Price of bamboo-made cages, drinking and feeding container (IDR/bird)	65,000
4	Average egg price (IDR/kg)	37,750
5	Average culled layer price (IDR/bird)	45,000
6	Labor's wage (IDR/day)	100,000
7	Loan interest for small-scale business (%)	10
8	The 2020 inflation average (%)	5.73
9	Exchange currency of Rupiah (IDR) to 1$	14,385

Table 5 Cash flow projection of 2,136 birds-scaled layer business

Year-	**0**	**1**	**2, 3, 4**	**5**
		IDR	…….	IDR
Revenue				
Eggs selling		569,729,082		569,729,082
Manure and feed sacks		1,631,705		1,631,705
Culled layer				137,691,718
Residual value				34,312,000
Inflation compensation				26,334,477
Total of Revenue (IDR)	0	**571,360,787**		**769,698,982**

Operating Costs				
Feed		405,989,520		405,989,520
Medicines, vaccines, & vitamin		8,170,200		8,170,200
Disinfectant		192,240		192,240
Electricity		801,000		801,000
Transportation and marketing		2,883,600		2,883,600
Labor		21,030,000		21,030,000
Inflation compensation				14,741,599
Miscellaneous		827,700		827,700
Total of Operating Costs (IDR)		**439,894,260**		**454,635,859**
Investment of Capital				
2,136 pullets	0	127,658,040		127,658,040
Cages, drinking and feeding container	168,560,000			
Eggs' tray	0	2,007,840		
Motorcycle	7,500,000			
Land leasing	3,990,000			
Other costs (shovel, wheel-barrow)		667,500		
10% of investment capital interest	13,420,600	11,440,500		11,120,000
Inflation compensation of 5.73%				4,851,287
Total of Investment Costs (IDR)	**193,470,600**	**141,773,880**		**143,629,327**
Total of Costs (B + C)	**193,470,600**	**581,668,140**		**598,265,186**
Net Revenue (IDR) (A-D)	**-193,470,600**	**- 10,307,353**		**+ 171,433,796**

3.4. Analysis of investment feasibility

The analysis results of investment feasibility with a 10 % of discount factor (in line with the average loan interest from some respondents taking credit) find that NPV was positive; B/C ratio was greater than one; and, IRR was higher than (df), as presented in Table 6. In detail, the investment profitability was shown from NPV of IDR 36,213,611/5-years, or IDR 603,560.183/month. Such profit was considered small rather than the Minimal Regional Wage (UMR) of the City of Tomohon in 2020, IDR 1,350,700/month for 7-8 work hours per day. However, farmers still obtained revenue other than net revenue from the wage of household labor of IDR 1,500,000 /month (inserted in cash flow). [31] stated that the pullet production derived from DOC, conducted in Nigeria, is profitable due to absorbing labor for an agricultural society. It means that the development of poultry production can provide job opportunities for wider society. Therefore, it can be said that a small-scale layer business could provide job opportunities and social welfare for low-class society, but small businesses dealt with business risks related to limited production and market factors [17, 32, 33, 34]. Thus, the sensitivity analysis, such as scenarios, was highly important in determining business/project risk, an alternative solution, and business continuity.

Table 6 Investment Analysis of 2,136 Birds-Scaled Layer Business in the Current Condition

Year	Revenue (IDR)	Cost (IDR)	Discount Factor 10% (DF)	PV Revenue (IDR)	PV Cost (IDR)	Net Present Value (IDR)
0	0	195,550,002	1	0	195,550,002	-195,550,002
1	571,360,787	583,647,280	0.9091	519,424,091	530,593,742	-11,169,651
2	632,485,787	596,921,395	0.8264	522,686,254	493,295,840	29,390,414
3	632,485,787	483,056,284	0.7513	475,186,571	362.920.186	112,266,385
4	591,537,771	599,968,676	0.683	404,020,297	409,778,605	-5,758,308
5	772,355,167	599,968,676	0.6209	479,555,323	372,520,550	107.034,773
			Total	2,400,872,536	2,364,658.,925	36, 213,611

NPV = IDR 36,213,611; B/C = 1,05; IRR = 22,85

3.5. Sensitivity analysis

The cash flow estimation depended on production parameters and production and market factors. Then, if those parameters changed, NPV, B/C, and IRR would differ and had not resulted in profit yet. Since eggs became the main production of layer business, the fluctuating market price of eggs was risk necessarily considered by farmers. Also, the risk was feed price and mortality. Feed was the biggest cost, expending up to 65 – 70% of operating production cost [35,36] Hence, in this research, a scenario of the sensitivity analysis was focused on changes in feed price, eggs price, eggs production (EP), and mortality, as presented in the following Table 7. Based on the results of the sensitivity analysis, such as scenarios, it demonstrates that without productivity improvement of layer, such as eggs production (EP), there were increasing in feed price and declining of egg price of 5 up to 10% from this current condition, and mortality rose from 6,10% to 10%, where these situations would cause loss for farmers. The occurrence of such changes could be anticipated by improving eggs production (EP), minimally up to 76% due to 5% of egg and feed price changes. Specifically, the declining egg price was more sensitive to a loss than the increasing feed price, as seen in the 8th and 11th scenarios (Table 7). 76% of eggs production would cause 5% of egg price declining, where profit (NPV) would decrease up to 51%; while, 5% of the increasing feed price would result in greater profit (123%) than the current condition, where eggs production (EP) was 76%.

Table 7 Sensitivity analysis of risk in small-scale layer business

Scenario	Event	NPV (IDR)	NPV percentage compared with the current condition
1	Current condition	36, 213,611	100
2	5% increasing of feed price	-19, 872,674	-53.21
3	10% increasing of feed price	-76,812,325	-207.25
4	5% declining of egg price	-42,416,210	-113.32
5	10% declining of egg price	-123,447,723	-327.17
6	10% of Mortality	-28,317,219	-74.35
7	80% of EP and 10% declining of egg price	-25,131,216	-64,17
8	76% of EP and 5% declining of egg price	19,517,237	51.38
9	80% of EP and 10% increasing of feed price	-94,169,386	-253.88
10	76% of EP and 10% increasing of feed price	-138,791,136	-365.28
11	76% of EP and 5% increasing of feed price	45,321,209	123.53

According to the results of this research, small-scale layer farmers were highly at risk of changes in eggs production, egg and feed price, and mortality. In the small-scale layer business, farmers were necessarily assisted with the structure of

economic unit that could stabilize procurement of factors of production and their price, and structure of supporting service, such as agriculture counselor, so that the layer productivity could improve [7,36].

In short, the results of this analysis were significant for farmers as the base for improving their production management, which, in turn, it could increase eggs production (EP) and minimize mortality. Also, the analysis results provided beneficial information for the government in designing a fair policy in controlling the supply and demand of factors of production and products of poultry business, so, consequently, the fluctuating price could be diminished.

4. Conclusion

The current small-scale layer business based on farmers' management can provide profitability, and it is feasible to be performed. A small-scale layer business can provide job opportunities and welfare for low-class society, but it deals with business risk. To anticipate the risk of the increasing feed price, the declining egg price, and increased mortality, farmers must improve raising management, so the minimal egg production (EP) is 76%. Further, to support the business continuity of such small-scale industries, this study recommends to the Government in managing the productivity of small-scale businesses and policy of price stability related to feeding and eggs.

Compliance with ethical standards

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Disclosure of conflict of interest

None of the conflicts of interest among the research teams exists.

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