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The Toolkit of Success Rate Calculation of Broiler Harvest

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Abstract

Failed in the harvest should be avoided by the owners of broiler farms. Various ways are done to make the harvest successful and make a profit. Preparations made before the period of broiler development can be done optimally, with the hope that the harvest is successful. But the problem, on the field in fact not as smooth as had been planned at the beginning or before the development period. There is always a lack or inappropriate so that the harvest is not optimal or even harvest failure. Based on the background that has been described, we tried to create a toolkit that can be used to calculate success rate of the broiler harvest. With this toolkit, broiler farm owners are expected to have a guide and can make the right move in the period of broiler development. To calculate the success rate of broiler harvest, we used a model based on the performance index calculation. Toolkit that created running on local network environment using an Apache web server. The Toolkit uses JavaScript library to display the calculation results in the form of charts that are easier to understand. Based on the results of testing that has been done, this toolkit can perform calculations in a relatively short time, present the results of calculations with accurate information. The accuracy of success rate calculation toolkit reached 90%. It is obtained by comparing the performance index and the total weight of broiler that obtained when harvested.

Keywords*: toolkit, success rate, broiler harvest*

1. Introduction

Failed in the harvest should be avoided by the owners of broiler farms. Various ways are done to make the harvest successful and earn profits. The way in which livestocks' owner to achieve success can be divided into 2 categories. first, before the broiler development period and second when the period is in progress. The way included in the first category is usually prepared long before the development period is done and is usually dominated by external livestock factors. While the ways included in the second category, more to care, keep the process of developing the broiler in accordance with the desired and much influenced internal farm. External factors of livestock such as temperature or air condition, weather, climate, water supply, and access to farms. Internal factors such as broiler weight, animal feed, and water quality. For the first category, there are several related studies that have been done. Among them is by setting the temperature at the farm [1], or by choosing the best location to be broiler farm [2], and simulating mathematically the environment of broiler farms [3]. For the second category, among others, research related to broiler health level affected by viral infection, causing large-scale harvest failure and reduced stock of broiler meat and influencing the economy of a country [4]. Other studies that also relate to the digestive and feeding processes of broilers have been carried out in recent years [5]. Research when the period of broiler development is also done by some researchers such as the prediction of broiler weight using computer vision device [6]. The goal is to get the ideal broiler weight when harvesting. The research that we do included into this second category, namely when the period of broiler development is underway.

Preparations made before the period of broiler development can be done optimally, with the hope that the harvest is successful. But the problem, on the field in fact not as smooth as had been planned at the beginning or before the development period. There is always a lack or inappropriate so that the harvest is not optimal or even crop failure. This is where the function of the way included into the second category, or anticipation when the development period is in progress absolutely must be done, if not want to harvest failure. When the broiler development

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period is underway, farmers can take care, including monitoring the health and weight of the broiler. Always observe the conditions inside the farm building. There may be things to be added, or reduced according to the conditions and situation at the farm.

Through this research, we try to propose ways that farm owners can use as a guide when the development period is in progress. The way we propose based on the internal factor of the farm. So it can be observed and done directly by the owner of the farm. The way that researchers proposed is making computer-based tools that can be used by the owner of the farm as a guide when the period of development of broiler. The way we propose a device that can calculate the success rate of broiler harvest. So that farm owners can predict the level of success before harvest is done. Can anticipate or concrete steps to optimize the harvest or avoid harvest failure. The calculation of the harvest success rate can also be used to prepare for the next period of broiler development. Calculation model that we use in this research based on the performance index (PI). Calculation model of performance index first introduced by H.R.Bird. After that, the performance index model became very well-known, widely used, and modified as needed.

Then, we put the success rate calculation model into the form of a toolkit that running on the local network. The toolkit of success rate calculation can be used when the broiler development period or after the period ends. The toolkit that we made have similarities with the computer assisted instruction (CAI), when viewed from the function. That is a computer-based tool to solve a problem [7]. However, CAI purpose is like a medium of learning between teachers and students, while the toolkit that we have made to determine decisions or appropriate steps to solve a problem in broiler farms.

Speaking about the decision, we created a toolkit that can be used to determine the appropriate steps based on the results of calculation of index performance. A device can be called a decision support system, when the device is able to provide solutions to the problems and accurately [8]. This is consistent with the definition and objective of a decision support system is to determine the most appropriate steps to solve a problem. Broiler chicken is a hybrid between superior qualities that have high productivity and guaranteed good genetic quality [9]. Good genetic quality will reach to maximum when the chickens are in a good environment, such as high-quality feed, sufficient water needs as well as adequate health care. The history and development of broiler chickens in Indonesia can not be separated from the development of the poultry itself. Indonesia had experienced ups and downs on the development of chicken and poultry.

Broiler chickens are livestock most economical when compared to other livestock. Excess assets are the speed of the meat weight gain in a short period of around 4-5 weeks. Broilers other advantages include the relatively small feed conversion ratio. When the harvest is done, broiler meat can be easily absorbed in the market. Along with the increasing number of consumer needs, the number of broiler into the market is also expected to increase. However, this cannot be achieved in the case of harvest failure. One of the causes of harvest failure is the lack knowledge about the internal factors that influence the broiler harvest. It takes the calculation or formula that can be used as a reference to maximizing the potential of an internal factor on broiler farms.

2. Research Method

For research stage, we use a modification of the waterfall method [10-12] by adding knowledge in the form of a calculation model. Modification and implementation of the waterfall model can be done for a specific purpose, such as knowledge management [13] or an addition as needed. This is done so that the development of toolkit becomes more efficient. Here is a hold stage we did:

2.1. Calculation Model

At this stage, we define the model to be used for the calculation method. Model is selected based on relevance and suitability to the needs. So, the model of calculations are:

$$PI=(((100-PD)xBW)x100)/(FCRx(A/V))$$

Information :
PI : Performance Index
PD : Percentage of depletion (%)
BW : Broiler weight (kg)
FCR : Feed conversion ratio
A/V : Average age of broiler

Performance Index (PI) shows the level of success that broiler farmers can get. The higher the PI value the greater the chances of the breeder to make a profit. In other words, the possibility of farmers to experience harvest failure is getting smaller. The value of PI is determined by several variables: percentage of depletion, broiler weight, feed conversion ratio and the average age of broiler. To measure the weight of broiler (BW), both at weight control and harvesting, we used this formula:

BW=Weight(kg)/The Number of Chickens

The BW value is derived from the total weight of the broiler divided by the total number of broilers. Compare the above calculation results with data from the breeder. Ideally, the average body weight enclosure greater than or equal to the standard. If the average weight is smaller than the standard do some improvements, for example in the management of feeding and cage density settings. The formula to calculate FCR is:

FCR=The Amount of Feed Consumed(kg)/The Weight of Broilers(kg)

In other words, the FCR is defined how many kilograms of feed required to produce one kilogram of body weight. Ideally, one kilogram of feed can produce 1 kg of body weight or even more (FCR ≤ 1). Unfortunately, the condition does not always happen. In broiler usually, target the FCR=1 maximum achievable before 2 weeks old chicks (FCR two weeks ± 1.047 to 1.071. Afterward, FCR will be increased according to the age of chicken. Then, the formula to calculate A/V are:

A/V=∑(VxP)/Total Population

Depletion of the population or shrinking the chickens could come from two things: the death and culled chicken. The formula to calculate the level of depletion (PD) is as follows:

PD=(Number of Dead Chickensx100%)/Initial Population

2.2. Design

At this stage, we draft a toolkit that will be created. The setting for layout and components will be displayed to the user.

2.3. Coding

At this stage, we begin to make the toolkit using a script and make data storage in a database.

2.4. Evaluation

At this stage, an evaluation of the results of the testing that has been done. Reported anomalies and errors occur when testing. For a sample of the data used in testing, we got it from broiler farm in Prabumulih. The sample size is calculated using a formula to determine how big the sample size required of a population to achieve results with acceptable accuracy level [14].

3. Results and Analysis

Input form that we use to derive the parameter value of calculation model is as shown in Figure 1. We create an interface of the success rate calculation toolkit such as computer software in general, it is expected that users, especially owners or farm workers can use it easily. The value of parameter needed for the calculation is as follows: The depletion value is

the percentage of broilers died during development. Broiler weight is the average weight of broilers (kg). Feed conversion ratio is the ratio of feed required by broiler. The average age of the broiler when the harvest is done. Lastly, the total weight is the total weight of broiler overall. Based on the testing that was done, the result as shown in Table 1.

Figure 1. The Interface and the Input Form for Parameters of PI

Table 1. The Last Ten of Broiler Harvest Periods

Periods	PD(%)	BW (kg)	FCR	A/V (days)	PI values
5	0.8	1.84	0.86	34	624.2
6	2.5	1.53	1.11	35	383.9
7	1.6	1.63	0.93	32	538.9
8	8.3	1.39	1.17	32	340.4
9	0.9	1.81	1.00	33	543.5
10	3.3	1.69	1.01	32	505.6
11	2.0	2.04	1.00	33	605.8
12	1.6	1.80	0.89	35	568.6
13	5.0	1.46	1.20	33	350.2
14	0.8	1.79	0.84	34	621.7

Testing of the toolkit starts by calculating the value of PI for ten harvest period. The results of calculation of the value of PI using the toolkit show the value of each parameter that is used greatly affect the final result as shown in Table 2. As far as our personal observations, the toolkit of success rate calculation can receive the value of each parameter and calculate the value of PI without any problems.

Can be seen in some periods PI values match to the percentage of depletion. This can be seen in the harvest period 9th, 11th, and 14th. It was concluded temporary, the lower the rate of depletion, the higher the value PI obtained and vice versa. It can be seen in the harvesting period 8th and 13th.

However, the success rate of broiler harvest depends not only on the high or low percentage of depletion, so as to prove whether toolkit that created running well, need to see and compare the results of calculation with harvest result overall. In other words, a whole of result can be seen from the total weight of broiler obtained when harvested.

Table 2. The Comparison Between Total Weight and PI Value

PI values	Harvest Periods	weight (kg)	Success rate
624.2	5	33.000	high
383.9	6	27.000	low
538.9	7	29.000	medium
340.4	8	23.000	low
543.5	9	27.000	medium
505.6	10	29.500	medium
605.8	11	30.000	high
568.6	12	32.000	high
350.2	13	25.000	low
621.7	14	32.000	high

It turned out that after the comparison between PI values obtained from the calculation using the toolkit to the total weight of broiler, the result was quite good. Can be seen in the first period PI value reached 624, while the total weight is 33 tons of broiler. This means the results of the calculation of the toolkit is proportional to the total weight of broiler. So for the 1st period, the accuracy of toolkit achieve 100%.

Then, for the period 6th, we performed the same comparison. Where toolkit that tested can also be proved by the low value of PI (382) according to the harvest of broilers in the period 6th (only 27 tons). It also occurred in the period 7th and 8th. The anomalies occur in the calculation 9th, the results of calculation of the value of PI 543 (height), but the overall weight of broiler only 27 tons (lower). This is contrary to the desired outcome, in other words, the accuracy of toolkit only 0% or calculation result of PI value is inversely related to the result of harvest.

The analysis can be given is the percentage of depletion on this period only 1% (low) while the value of FCR is ideal, 1. This means that at this period the mortality of broiler is very little, as well as the conversion ratio of the food needs of the broiler on a scale of 1:1. The value of PI in this period is fall into the medium category. Another factor that can affect the weight of broiler can come from the environmental conditions of the farm. We observed the development of broilers during the rainy season, feed conversion ratio (FCR) in the range of 1:1-1:1,2 scale. In the rainy season, the average air temperature is below 30^{o} Celsius. In the 9th period with high rainfall, the air temperature was very low and the humidity was very high. This causes the broiler to adapt to cold temperatures in the farm environment. As we know, the poultry adapts to cold temperatures by reinforcing the feathers on their bodies. In other words, the feed that enters the body is not fully absorbed into the meat but is mostly used to thicken the feathers. This applies to all broilers on the farm, which will affect the overall value of the FCR. While the value of FCR the multiplier factor used in the formula to find the value of PI. So the calculation of the value of PI using the toolkit becomes ineffective for a case like this. From the cases of period 9th that the input value for each parameter of toolkit greatly influences for the final calculations.

From the case of this 9th period, livestock owners can anticipate or provide solutions to low air temperatures in the rainy season by adding heating equipment contained within the cattle ranch. So the temperature inside the farm can stay warm. The calculation is performed for the next harvest period. In the 10th until 14th periods, the toolkit can do its job properly. In the 11th and 12th periods beginning to enter the dry season with very little rainfall, the weight of broiler (kg) to the average FCR value is in the range of 0.9:1-1:1 scale. With the air temperature is quite hot during the day and at night, feeds that enter the body of the broiler will be more converted into meat. It also tells us to always pay attention to factors around the farm, such as the temperature and humidity of the environment, or the pungent odors that can disturb the livestock.

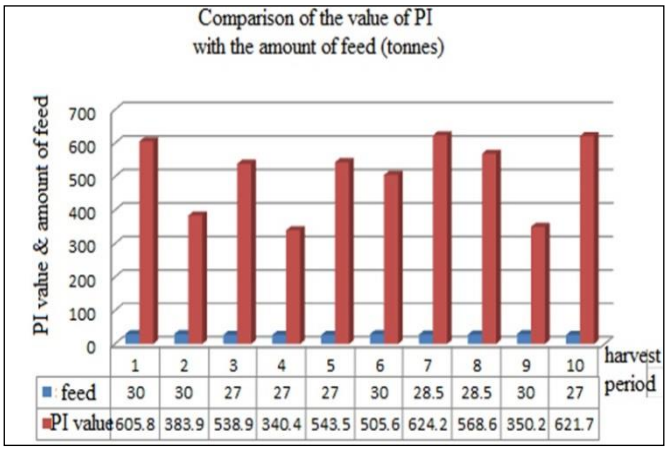

Figure 9. Comparison of the value of PI with the amount of feed (tons)

The amount of feed (tons) will be inversely proportional to the value of PI, this is in accordance with the results of calculations that have been done for each period. The lower the amount of feed required for each period, the higher PI values obtained, and vice versa. An example can be seen in the period 10, with the amount of feed 27 tons, the value of PI obtained reached 621.7. Of course, by looking at the value of PI in prior periods are expected for broiler breeders to prepare a strategic move or a solid plan for the next period.

As a comparison of the performance of our proposed toolkit, we show the comparison of the success rate of broiler harvest using PI value and traditional approach or without using PI value which is well known among breeders. In the calculation of this method only involves the number of broilers in the early development period, the number of broilers at harvest and total weight of broiler.

Table 3. Success Rate Calculation between IP Value and Traditional Approach

Total Weight (kg)	IP Values	Traditional Approach	Success Rate	
			PI values	Traditional Approach
33.000	624.2	10.85	high	medium
27.000	383.9	17.56	low	high
29.000	538.9	4.25	medium	low
23.000	340.4	16.12	low	high
27.000	543.5	17.82	medium	high
29.500	505.6	5.15	medium	low
30.000	605.8	14.26	high	high
32.000	568.6	9.67	high	medium
25.000	350.2	2.13	low	low
32.000	621.7	5.44	high	low

The success rate is obtained by comparing the results of the calculation of the yield obtained at the end of the period. The success of the harvest can be seen from the total weight of broiler (BW) as a whole and the value of feed conversion ratio. Based on the results of the comparison that has been done, can be seen the traditional approach or without using the value of PI tend to experience errors and not appropriate. Based on the comparison, the accuracy rate calculation using PI value reaches 90%, while the traditional approach is only 20%. The traditional approach succeeded in determining the success rate of harvest only during the period of the 11th and 14th. As for other periods, the traditional approach fails in determining whether the harvest is successful or not. In contrast, calculations using PI scores succeeded in determining the success of the harvest for almost all periods, except for the 9th period, as discussed earlier. This is because the traditional calculation process involves only the number of broilers in the early development period, the number of broilers at harvest and total weight of

broiler. Without entering the value of feed conversion ratio and the average age of broiler as used in the calculation of PI value.

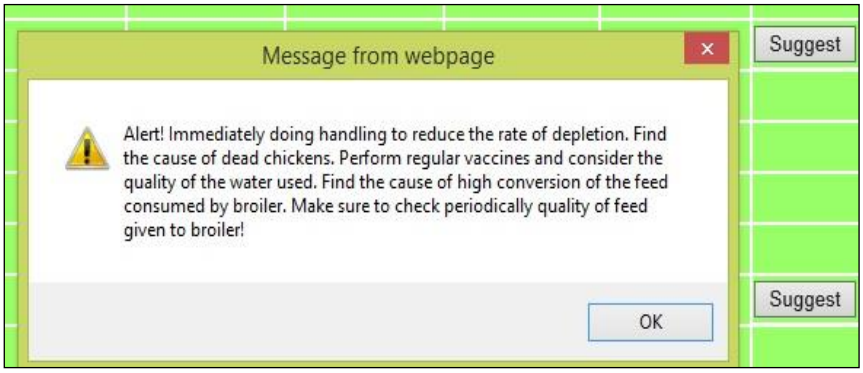

Figure 11. Suggestion dialog box

The toolkit can also provide suggestion to livestock owners, about actions that can be taken to address common problems that often arise in the management of broiler farms.

4. Conclusion

Based on testing and discussion that has been carried out, the toolkit that we created proven can perform calculations of PI values to assess the success rate of the harvest. The accuracy of the toolkit in determining the success rate of broiler harvest reached 90%. This is evident from tests on 10 broiler harvest period. The accuracy obtained from the ratio between the value of PI to the total weight of broiler obtained when the harvest is done. Further research is needed to improve the accuracy and speed up the process of calculation. The implementation of the toolkit that we created on society must through testing that involves all interested parties.

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