Developing Simulation Optimization Model to Minimize Total Inventory Cost under Uncertain Demand

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Abstract

Inventory is one of the essential parts in a shop floor, especially in the chicken slaughter houses industry. The uncertain customer demand affects the uncertain raw materials (live chicken). So, to prevent the opportunity loss in business, the availability of live chicken is unavoidable. It affects the high inventory cost. In addition, the high risk of chicken death makes the problem more complicated. Therefore, this research is proposed to minimize the total inventory cost under demand uncertainty by optimizing the economic order quantity (EOQ). This study develops simulation optimization by integrating the Monte Carlo simulation and the Genetic Algorithm. This model optimizes the value of reorder point and reorder quantity in order to minimize the total inventory cost. Some experiments consider the analytical solutions and heuristic by varying crossover, mutation, and population values to provide a global optimum. The result shows the proposed solution reduces 38.95% from the existing total inventory cost.

Keywords
Inventory, Economic Order Quantity, Monte Carlo Simulation, Genetic Algorithm, Simulation Optimization.

1. Introduction
Inventory is raw materials stored and used to suit future or current needs (Nasution & Widyasari, 2020). Inventory control is an important aspect that arises because of the company's excess or shortage of inventory. The chicken slaughterhouse industry is one of the rapidly growing industries that began to depend on the freshness of raw materials (Sari et al., 2018). Appropriate demand forecasting can reduce excess and inventory shortages and increase profitability (Suman & Kochak, 2015).

This study is based on a case study in one of the chicken slaughterhouses in Yogyakarta, Indonesia. Chicken slaughterhouse is a chicken processing industry ranging from cutting to packaging until distributing to market traders and consumers. Figure 1. presents the production process in a chicken slaughterhouse. It starts from the chicken supplier. Then the chicken is moved to the warehouse. Furthermore, the chicken is taken and then cut. Finally, they are given to the consumer. The problem is about uncertain demands as shown in Figure 2. The chicken slaughterhouse does not have a standard quantity to order and to be stored in the warehouse. This company buys a large live chicken supply to handle uncertain demand. It will affect high total inventory costs consisting of holding costs, ordering costs, and lost sale costs. Inventory overstock and risking damage when stored, so it needed to be reworked (Nafisah et al., 2021).

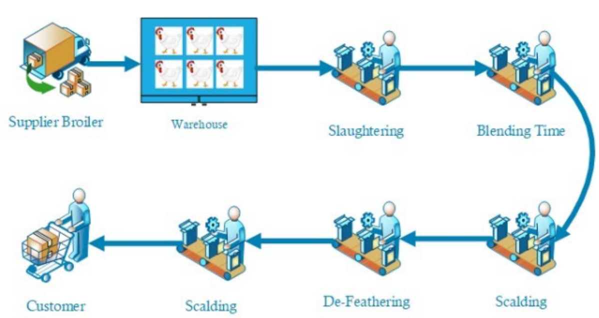

Figure 1. Production Process of Chicken Slaughterhouse

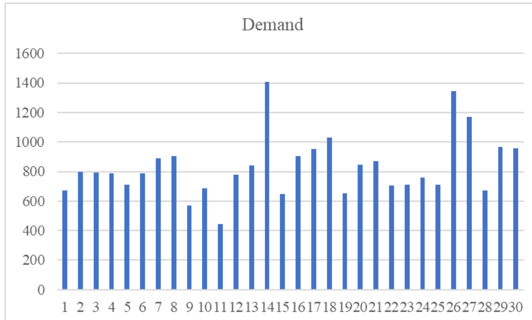

Figure 2. Demand Chart September 2020

Uncertainty demand can lead to the increased costs and impact on the provision of raw materials. One of the methods used to manage raw material inventory is the Economic Order Quantity (EOQ) and Simulation Methods as proposed by (Leepaitoon & Bunterngchit, 2019). The EOQ inventory model with Monte Carlo Model by Maddah & Noueihed (2017) was chosen by determining the Reorder Point (R*) where the chicken slaughterhouse knows a point to add inventory before running out of supplies or can be called safety stock. In addition, Reorder Quantity (Q*) is calculated to know how many live chickens to be reordered. This study develops the Monte Carlo simulation model combined with genetic algorithms by considering several scenarios. Monte Carlo simulation is a probabilistic simulation that solves problems based on random number (Ramadan et al., 2020). Algorithm genetics is one of the metaheuristic algorithms which is famous for its stochastic optimization methods, as stated by Noh et al. (2020). Genehunter software is one of the genetic algorithm applications that will be used for this study.

1.1 Objectives

Carson & Anu Maria (1997) states that simulation optimization can be defined as finding the best input variable value from all possibilities. This research aims to minimize the total inventory cost, including the holding cost, set up cost, and lost sale cost, by optimizing the value of reorder point (R*) and reorder quantity (Q*). The GeneHunter® Genetic Algorithm software and Microsoft Excel software are employed to solve this inventory optimization problem under uncertain demand.

2. Literature Review

This section discusses the related previous researches about EOQ, Monte Carlo Simulation, and Genetic Algorithm. Xu et al. (2019) proposed a multi-echelon inventory system simulation-based optimization model for fresh agricultural products. It makes decisions and technical for inventory control policies and shows the results of the modeling system simulation. It is an effective method for solving complex system problems. Pamungkas et al. (2019) studied at one of the power plant industries that often impaired or performance failure. The goal of his study was to determine the reliability level and time of preventive maintenance based on Monte Carlo simulations. Widyadana et al. (2017) Previous research has also combined Monte Carlo simulations, evolutionary algorithms, and EOQ on a bicycle shop's sales demand. The objective is to solve the inventory problem with the customer demand for stochastic at bicycle stores in Indonesia. Simulations conducted for five bike items and simulation models are optimized with evolutionary algorithms that the model R,Q the best for all products.

In addition, Leepaitoon & Bunterngchit (2019) developed a study to find economic order quantity and reorder point from the inventory in the retail store below lead time and uncertainty demand. After data is simulated for all selected items and get the optimal order quantity by using the Monte Carlo simulation method, generate new values economic order quantity and reorder point that can save inventory costs currently issued. Cahyani & Slamet (2019) purposed of this study is to examine more deeply the use of the method Quantity Economic Order (EOQ) under the control of the raw material company Brownies Burn Lyn's. The results show the optimal supply of flour raw materials using the EOQ method more effectively and efficiently. Mulya et al. (2020) developed simulation-optimization models that generate lower total inventory cost for uncertain demand and lead time to get a better result of optimal order quantity. And then, using a simulation approach to consider uncertain demand and lead time to get better results from optimal order quantity inventory costs.

Genetic algorithm is not only used for inventory, Akbar & Aurachmana (2020) proposed combined two algorithms to optimize the rute. A genetic algorithm is used to generate distribution routes that exist as individuals first and reordered next individuals. The total route distance can be reduced after performing calculations to determine the optimum route using the Genetic Algorithm, Tabu Search, and Hybrid Genetic Algorithm. Genetic algorithm also can be used for lot size integration and scheduling model, Badri et al. (2020) developed Genetic Algorithm, and Taguchi approach are used to optimize the models by finding the optimal model solution for each objective. The researcher used GeneHunter® software is used to represent the optimization process using GA. The purpose of the model can be achieved by determining the optimal production results quantity and job sequences to simultaneously address the problem of lot allocation and scheduling.

From the previous researches that had been reviewed, there are few researches related to simulation optimization, especially in a chicken slaughterhouse. Chicken slaughterhouse with uncertain demand and a long distance from the chicken supplier makes the company have the stock of live chickens. These live chickens must be fed and have the potential to die. Considering that complexity of the system in the chicken slaughterhouse makes the total inventory cost higher, this research proposes developing a simulation optimization model to minimize the total inventory cost by optimizing the value of reorder point (R*) and reorder quantity (Q*).

This study uses the EOQ model to calculate R* and Q* values and then performs optimization simulations by integrating monte carlo simulation and genetic algorithms. First, calculate the R* and Q* values generated from calculations with the model and then simulate them with a Monte Carlo simulation so that the total inventory cost results with the EOQ model are known. Then, optimize the EOQ model results with a genetic algorithm that uses five scenarios by varying the population, crossover, and mutation to get optimal global results.

3. Methods

In this study, the methodology will be used to solve uncertain inventory in a chicken slaughterhouse and find the right policy for this problem. Determining the value of the reorder quantity (Q*) of an item is ordered when the stock reaches the reorder point value (R*). In this policy, the quantity (Q*) is ordered when the inventory reaches the total value (R*), the value (Q*) and (R*) are obtained from equations (1) and (2).

$$Q^* = \sqrt{\frac{2KD}{h}} \tag{1}$$

$$R^* = LT \times D + SS = LT \times D + z.\sigma \tag{2}$$

Where:

Q = Order quantity
K = Ordering Cost
D = Demand per Period
h = Holding Cost per unit Per Period
LT = Lead Time
z = Service Level
σ = Standard Deviation

Simulation optimization methods have been applied to applications with a single objective, applications requiring multiple criteria optimization, and non-parametric objectives. Monte Carlo simulation is a method to simulate the probabilistic system. Monte Carlo simulation is a computerized mathematical technique that makes it possible to simulate and describe complex system behavior for risk analysis and decision making (Tomis et al., 2016). Monte Carlo simulation generates a value to form a model of its variables (Utama & Siswanto, 2017). The number of the simulation experiments as follows: Simulation experiment – simulation run of the simulation model (Raska & Ulrych, 2019); Optimization experiment – performed with a specific optimization method setting to find the optimum of the objective function; Series – replication of optimization experiments with a particular method of optimization setting. This replication ensures the reduction of the influence of random implementation in the optimization algorithm. From the historical data collected, the data is the triangular distribution. After that, the random number generation of this distribution is obtained on equations (3) and (4).

$U \sim U[0,1]$, if $U \leq c$, back $X = \sqrt{cU}$ or $X = 1 - \sqrt{(1-c)(1-U)}$ (3)

Microsoft Excel with syntax =Rand() (4)

Genetic Algorithm (GA) begins with a set of populations, which is the initial set of random solutions. Then Genetic Algorithm selects chromosomes to get good fitness scores. For this process, Genetic Algorithm consists of three operators: selection, crossover, and mutation (Noh et al., 2020). Different Genetic Algorithm parameters impact quality solution quality and maintain a balanced parameter value (Hassanat et al., 2019). Genetic algorithm could be used to find optimal solution for the model (Gao et al., 2020). Simple the GA concept is as follows (Makasarwala & Hazari, 2017).

1. Population
   Determine the initial population that has a different population value, this research employs a population value between 500-1500.
2. Gene
   An individual is characterized by a set of parameters (variables), a variable in a chromosome. And then, this research uses value Reorder Point (R*) and Reorder Quantity (Q*).
3. Chromosome
   The individuals in the population, Genes join into strings to form Chromosomes (solution). In this research, chromosome value of Reorder Point (R*) + Reorder Quantity (Q*).
4. Fitness Function
   The objective function is used to find out how the solutions are to achieve the goals that have been set. To approach the optimal value, total Inventory Cost is selected.
5. The GA works through three operators
   a. Selection
      The selection process ensures the chromosomes are selected to mate and reproduce. The number of offspring each chooses chromosomes production. The main objective of the selection process is to choose the best fitness value.
   b. Crossover Rate
      The number of times a cross occurs for a chromosome in a generation, i.e., the chance of two chromosomes exchanging several parts, a 100% cross rate means that all descendants are made through crosses. If 0%, then the completely new generation individuals should be copied exactly from the older population, except those resulting from the mutation process.
   c. Mutation Rate
      Determining how many chromosomes should be mutated in a generation, the mutation rate is in the range of [0,1]. The mutation aims to prevent GA convergence to local optimal, but GA is converted into a random search if it happens very often.

Genetic algorithm (GA) is a stochastic population-based global search procedure in which an initial set of seed candidates, often unequally selected, is developed over several generations using the main operations of crossover, reproduction, and mutation (Okorocha et al., 2020). GeneHunter® includes an Excel Add-In that allows the user to run an optimization problem from Microsoft Excel and a Dynamic Link Library of genetic algorithm functions that may be called from programming languages such as Microsoft® Visual Basic or C.

The flowchart of this research is shown in Figure 3. First of all, understanding the process flow is the first and one of the most important step in this research. After a deeper understanding of the process, the main problem and the effects of that problem were identified. The observations and discussion with the supervisor and manager were conducted to get appropriate solutions to solve that problem. Then, the objective of this study was proposed in order to be able to develop an appropriate methodology to solve the problem already formulated. After that, the model conceptualization was developed to select and modify the basic assumptions of current system characteristics and data collected. Next, collecting the data is conducted to analyze the input and to validate it. Then, model translation is proposed to translate the model conceptualization and data collection into a computer simulation. This research uses Microsoft Excel software. After the model is translated, the validation and verification were conducted to ensure the base model is correct. Then, the simulation optimization model was developed. This model integrates Monte Carlo simulation and Genetic Algorithm. The objective is to optimize the value of R* and Q* (refer to Equation (1) and (2)) in order to total inventory cost can be minimized. Then, the production runs and analysis was conducted to measure the performance of the proposed model. Finally, the documentation and reporting were completed.

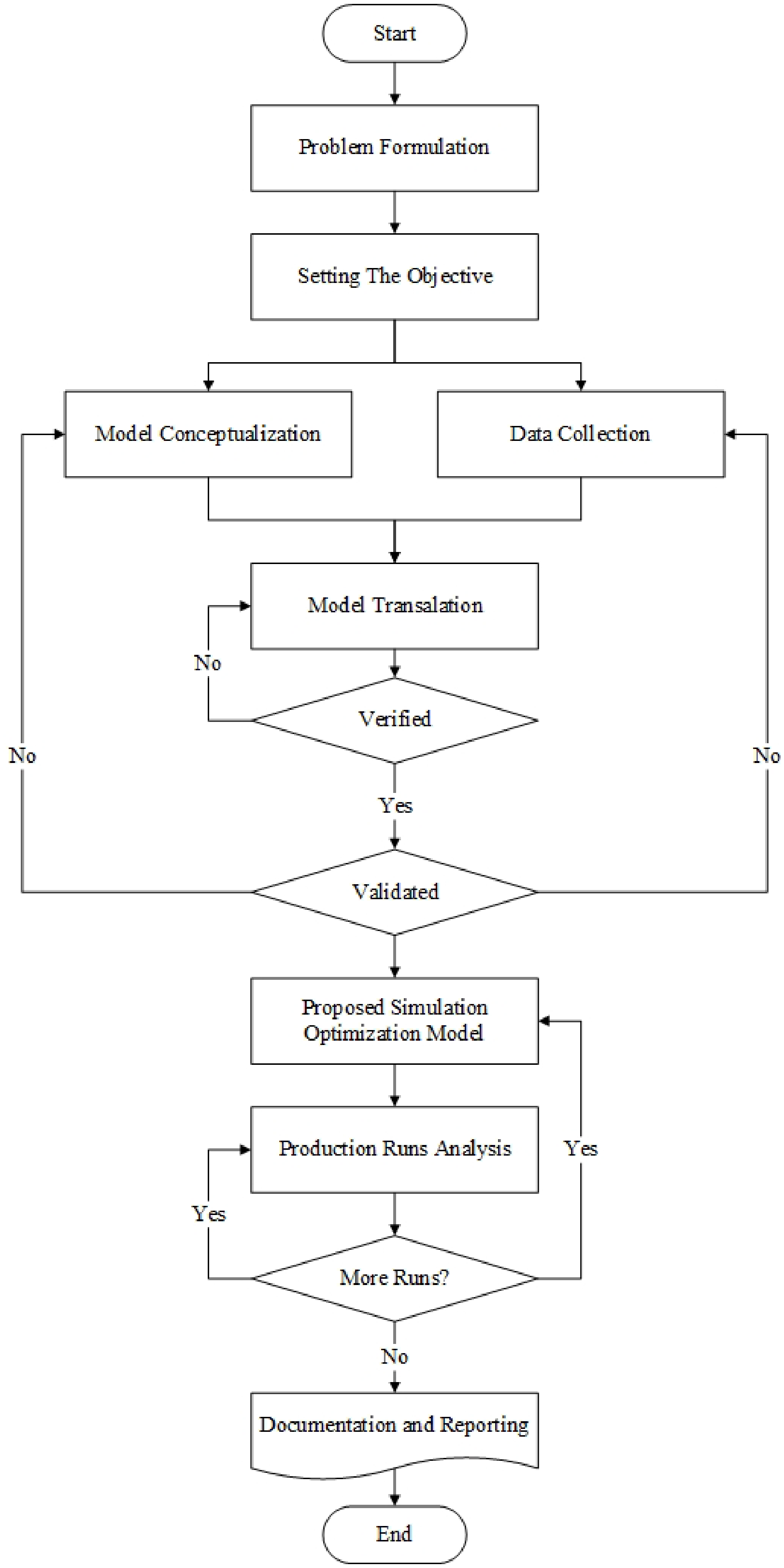

Figure 3. Research Flowchart

4. Data Collection

The data was collected in one of the chicken slaughterhouses in Yogyakarta, Indonesia. The product produced by this chicken slaughterhouse is fresh chicken which is directly sold to consumers for daily needs. Figure 4. presents the current inventory simulation from demand data used in September 2020.

Current Inventory System										
Period	Initial Inv	Order Quantity	Inv Quantity	Demand	On Hand Inv	Holding Cost	Ordering Cost	Lost sale		
1	835	900	1735	671	1064	Rp 401.128	Rp 330.000	Rp -	Holding Cost	Rp 377
2	1057	1011	2068	796	1272	Rp 479.544	Rp 330.000	Rp -	Ordering Cost	Rp 330000
3	1259	567	1826	795	1031	Rp 388.687	Rp 330.000	Rp -	Lotsale	Rp 4000
4	1020	817	1837	788	1049	Rp 395.473	Rp 330.000	Rp -		
5	1044	530	1574	712	862	Rp 324.974	Rp 330.000	Rp -		
6	861	895	1756	788	968	Rp 364.936	Rp 330.000	Rp -		
7	962	995	1957	891	1066	Rp 401.882	Rp 330.000	Rp -		
8	1063	770	1833	902	931	Rp 350.987	Rp 330.000	Rp -		
9	925	425	1350	572	778	Rp 293.306	Rp 330.000	Rp -		
10	772	855	1627	686	941	Rp 354.757	Rp 330.000	Rp -		
11	941	340	1281	444	837	Rp 315.549	Rp 330.000	Rp -		
12	834	890	1724	776	948	Rp 357.396	Rp 330.000	Rp -		
13	939	645	1584	840	744	Rp 280.488	Rp 330.000	Rp -		
14	741	1540	2281	1408	873	Rp 329.121	Rp 330.000	Rp -		
15	873	610	1483	647	836	Rp 315.172	Rp 330.000	Rp -		
16	831	1160	1991	902	1089	Rp 410.553	Rp 330.000	Rp -		
17	1086	837	1923	951	972	Rp 366.444	Rp 330.000	Rp -		
18	963	1070	2033	1030	1003	Rp 378.131	Rp 330.000	Rp -		
19	1000	855	1855	654	1201	Rp 452.777	Rp 330.000	Rp -		
20	1191	550	1741	845	896	Rp 337.792	Rp 330.000	Rp -		
21	891	1000	1891	868	1023	Rp 385.671	Rp 330.000	Rp -		
22	1016	545	1561	708	853	Rp 321.581	Rp 330.000	Rp -		
23	847	830	1677	711	966	Rp 364.182	Rp 330.000	Rp -		
24	958	590	1548	757	791	Rp 298.207	Rp 330.000	Rp -		
25	780	920	1700	710	990	Rp 373.230	Rp 330.000	Rp -		
26	985	1480	2465	1343	1122	Rp 422.994	Rp 330.000	Rp -		
27	1120	830	1950	1172	778	Rp 293.306	Rp 330.000	Rp -		
28	774	835	1609	672	937	Rp 353.249	Rp 330.000	Rp -		
29	933	986	1919	967	952	Rp 358.904	Rp 330.000	Rp -		
30	947	815	1762	956	806	Rp 303.862	Rp 330.000	Rp -		
TOTAL	28448	25093	53541	24962	28579	Rp 10.774.283	Rp 9.900.000	Rp -		
Average				832	953					
Variance					16172,45					
Std. Deviation					127,1709366					
TIC								Rp 20.674.283		

Figure 4. Current Inventory System

5. Results and Discussion

The data used in this study is sales data in September 2020, where the demand varies widely every day. Here will be done optimization of reorder quantity and reorder point that have been calculated previously using five scenarios created with genetic algorithms in GeneHunter ® software**.**

5.1 Fitting Data

The fitting data is employed to determine the type of distribution demand data. From the data fitting process will get the results of the parameters that can be used to generate data. The result of distribution that has been done with Arena software is Triangular Distribution with expression TRIA (444, 733, 1.41e+003). Furthermore, the calculation of the number of replications that will be done in this study as much as 4 replication.

5.2 Replication

After fitting data, it is then generating random variables from current demand data that has been obtained from the random numbers. Show in Table 1. demand simulation for four replications.

Table 1. Demand Replication

Periode	R1	R2	R3	R4	Periode	R1	R2	R3	R4	Periode	R1	R2	R3	R4
1	759	760	726	580	11	609	616	1055	932	21	474	1136	933	466
2	1078	858	900	887	12	834	1105	804	872	22	1033	680	1142	1116
3	915	1024	700	993	13	895	1022	540	907	23	764	790	544	584
4	534	769	821	1108	14	904	561	901	594	24	895	942	1151	506
5	673	800	922	532	15	743	595	720	808	25	539	652	1234	627
6	595	616	513	959	21	1262	1169	745	792	26	1074	497	916	504
7	993	515	921	662	22	793	611	1233	808	27	998	921	536	889
8	977	1060	824	1234	23	978	639	1255	528	28	724	639	580	1012
9	655	1022	687	886	24	979	1099	799	1095	29	921	970	835	1095
10	610	645	1302	868	25	1074	945	812	1086	30	1343	677	651	972

5.3 Verification and Validation

After the replication process, verification and validation are conducted. Validation to test the model that has been made is an accurate representation of the actual system. Validation by comparing the simulation output with the real system outputis using SPSS software. The comparison of two means output test shown in Figure 5. The result indicates that the data is valid because Asymp. sig. (2 tailed) > 0.05.

Ranks

Output		N	Mean Rank	Sum of Ranks
On_Hand_Inv	Output Real	30	31,23	937,00
	Output Simulation	30	29,77	893,00
	Total	60		

Test Statistics[a]

	On_Hand_Inv
Mann-Whitney U	428,000
Wilcoxon W	893,000
Z	-,325
Asymp. Sig. (2-tailed)	,745

a. Grouping Variable: Output

Figure 5. Comparison Of Two Means Output Test

After that, the verification process is conducted. It is to ensure the developed model is correct. It includes the data, the conceptual model, and the computer program.

5.4 Simulation Optimization

By using the Equation (1), the value of R* 1173 and Q* 1205 was calculated. Then, these values are used as input on EOQ simulation model as shown in Figure 6.

Simulation R,Q

Periode	Order Quantity	Initial Inv	Demand	On Hand Inv	Is The Total Broiler Less?	Total Less Broiler	Add Order	Q*	Waiting LT	Holding Cost	Set Up Cost	Lotsale
1	-	835	759	76	No	0	Yes	1205	1	Rp 28.652	Rp 330.000	Rp -
2	1205	1281	1078	203	No	0	Yes	1205	1	Rp 76.531	Rp 330.000	Rp -
3	1205	1408	915	493	No	0	Yes	1205	1	Rp 185.861	Rp 330.000	Rp -
4	1205	1698	534	1164	No	0	Yes	1205	1	Rp 438.828	Rp 330.000	Rp -
5	1205	2369	673	1696	No	0	No	0	0	Rp 639.392	Rp -	Rp -
6	0	1696	595	1101	No	0	Yes	1205	1	Rp 415.077	Rp 330.000	Rp -
7	1205	2306	993	1313	No	0	No	0	0	Rp 495.001	Rp -	Rp -
8	0	1313	977	336	No	0	Yes	1205	1	Rp 126.672	Rp 330.000	Rp -
9	1205	1541	655	886	No	0	Yes	1205	1	Rp 334.022	Rp 330.000	Rp -
10	1205	2091	610	1481	No	0	No	0	0	Rp 558.337	Rp -	Rp -
11	0	1481	609	872	No	0	Yes	1205	1	Rp 328.744	Rp 330.000	Rp -
12	1205	2077	834	1243	No	0	No	0	0	Rp 468.611	Rp -	Rp -
13	0	1243	895	348	No	0	Yes	1205	1	Rp 131.196	Rp 330.000	Rp -
14	1205	1553	904	649	No	0	Yes	1205	1	Rp 244.673	Rp 330.000	Rp -
15	1205	1854	743	1111	No	0	Yes	1205	1	Rp 418.847	Rp 330.000	Rp -
16	1205	2316	1262	1054	No	0	Yes	1205	1	Rp 397.358	Rp 330.000	Rp -
17	1205	2259	793	1466	No	0	No	0	0	Rp 552.682	Rp -	Rp -
18	0	1466	978	488	No	0	Yes	1205	1	Rp 183.976	Rp 330.000	Rp -
19	1205	1693	979	714	No	0	Yes	1205	1	Rp 269.178	Rp 330.000	Rp -
20	1205	1919	1074	845	No	0	Yes	1205	1	Rp 318.565	Rp 330.000	Rp -
21	1205	2050	474	1576	No	0	No	0	0	Rp 594.152	Rp -	Rp -
22	0	1576	1033	543	No	0	Yes	1205	1	Rp 204.711	Rp 330.000	Rp -
23	1205	1748	764	984	No	0	Yes	1205	1	Rp 370.968	Rp 330.000	Rp -
24	1205	2189	895	1294	No	0	No	0	0	Rp 487.838	Rp -	Rp -
25	0	1294	539	755	No	0	Yes	1205	1	Rp 284.635	Rp 330.000	Rp -
26	1205	1960	1074	886	No	0	Yes	1205	1	Rp 334.022	Rp 330.000	Rp -
27	1205	2091	998	1093	No	0	Yes	1205	1	Rp 412.061	Rp 330.000	Rp -
28	1205	2298	724	1574	No	0	No	0	0	Rp 593.398	Rp -	Rp -
29	0	1574	921	653	No	0	Yes	1205	1	Rp 246.181	Rp 330.000	Rp -
30	1205	1858	1343	515	No	0	Yes	1205	1	Rp 194.155	Rp 330.000	Rp -
Total		53037	25625	27412				26510	22	Rp 10.334.324	Rp 7.260.000	Rp -
Rata-Rata			854	914								
TIC												Rp 17.594.324

Holding Cost	Rp 377,00
Set Up Cost	Rp 330.000,00
Lotsale	Rp 4.000,00
Lead Time	1

Perhitungan	
ROQ (Q*)	1205
ROP (R*)	1173

Figure 6. EOQ Simulation Model

After that, the GA model is combined with EOQ simulation model in order to optimize the value of R* and Q* by using GeneHunter® GA software. The objective is to minimize the total inventory cost. This model employs five scenarios that varying the value of population, mutation rate, and crossover rate. It is needed to be conducted as population affects the performance and effectiveness of genetic algorithms (Roeva et al., 2015). Then, the crossover rate is used to control crossover operators. The greater the probability value of crossovers, the faster new structures are introduced in the population. Next, the mutation rate is employed to increase population variation. The low probability of mutation will causes a gene that potentially untried, on the contrary, a high mutation rate will causes offspring to be more similar with the parent (Hassanat et al., 2019). The scenarios of this developed model are GA1, GA2, GA3, GA4, and GA5, as shown in Table 2.

Table 2. Proposed Scenarios By Varying Population, Mutation And Crossover

VALUE	GA1	GA2	GA3	GA4	GA5
Population	500	750	1000	1250	1500
Crossover	0,82	0,86	0,9	0,94	0,98
Mutation	0,01	0,02	0,03	0,04	0,05

After the calculation can be compared from the existing calculation results, ranging from the current system to the proposed scenario that has been created. The total inventory cost (TIC) in chicken slaughterhouses has been compared that is shown in Table 3. The minimum total inventory results are done using simulation optimization compared to both current and EOQ models.

Table 3. Total Inventory Cost

REPLICATION	VALUE	CURRENT	EOQ	SO
REPLICATION 1	(Q*) Items	-	1205	945
	(R*) Items	-	1173	662
	TIC (Rupiah)	20,674,283	17,594,324	12,709,111
REPLICATION 2	(Q*) Items	-	1205	1129
	(R*) Items	-	1173	451
	TIC (Rupiah)	20,674,283	17,181,761	11,276,527
REPLICATION 3	(Q*) Items	-	1205	980
	(R*) Items	-	1173	685
	TIC (Rupiah)	20,674,283	17,641,826	13,317,033
REPLICATION 4	(Q*) Items	-	1205	1006
	(R*) Items	-	1173	636
	TIC (Rupiah)	20,674,283	17,706,168	13,182,674

Widyadana et al. (2017) research supports that continuous review policy uses EOQ, Simulation Monte Carlo, and Evolutionary Algorithm to reduce inventory costs. Mulya et al. (2020) developed that combine two models of optimization in inventory management, the result show simulation optimization much lower inventory cost. In this case study, the research result shows that the simulation optimization model can lower inventory cost than the EOQ model.

6. Conclusion

Chicken slaughterhouses do not have standards in making purchases from suppliers. So that the chicken slaughterhouse buys a large number of chickens every day for supply because the number of chicken demands is uncertain. This causes problems, namely high inventory costs, because chicken slaughterhouses have to pay holding costs so that the chickens do not die.

In this study, we develop an simulation optimization model simulation using Monte Carlo simulation and genetic algorithm to determine the amount of R* and Q* for the proposed standard in order to minimize the total inventory cost. After the calculation can be determined, reorder quantity and reorder point optimally. If the Chicken Slaughterhouse uses the EOQ model, then it can save 15,20% of total inventory cost. But most studies focus only on lowering inventory costs and not focus on stochastic demand issues. This genetic algorithms are used to solve complex problems solved with analytical solutions. It can be seen that solving with simulation optimization can further optimize the value Reorder Quantity (Q*), Reorder point (R*) in order to minimize total inventory cost. Based on the results of the calculations in Table 3. then the results of these calculations are averaged to get the results of Q* 1015 and R* 609 so that the TIC value is Rp. 12,621,336. If the Chicken Slaughterhouse will improve, it can use the value of the results of the calculation of simulation optimization because it can lower the cost by 38.95%.

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