Profit Optimization Based On Total Production In Textile Home Industry using Evolution Strategies Algorithms

Article · November 2016

DOI: 10.21776/ub.ijleg.2016.002.02.2

PROFIT OPTIMIZATION BASED ON TOTAL PRODUCTION IN TEXTILE HOME INDUSTRY USING EVOLUTION STRATEGIES ALGORITHMS

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Abstract

Profit optimization became one of the main goals of the production process of home industry. A maximum profit can be achieved with proper planning of production. In the process of implementation, production planning has many constraints such as lot sizing, limited stock, overtime work and the many products derived from the same source. To address the problem, we develop computer software using a heuristic method called evolution strategy (ES). ES has capability to solve optimization problems with nearly optimal results. The result of the calculation process of evolution strategy algorithm was compared with data from the source. Computational analysis shows that ES produces a production plan that has profit of Rp 5,324,000. It is bigger than manual production plan that has profit of Rp 2,747,000.

***Keywords**: home industry, profit, optimization, production, evolution strategies*

1. INTRODUCTION

Economic growth is one important indicator in assessing the performance of a country's economy. The economic growth of a country can be seen from some of the economic indicators. One of them is the unemployment rate. Based on the rate of unemployment can be seen the conditions of a country, whether developing or slow its economy and / or even deterioration. According to the Official Statistics (BPS, 2015), the number of unemployed in the State Indonesia in August 2015 to reach 7.6 million people with the Unemployment Rate (TPT) has increased from 5.81% in February 2015 to 6.18% in August 2015. Based on these data, the economic condition in Indonesia has not experienced growth. And so we need a solution in the form of new jobs and fostering entrepreneurship to society in order to minimize the number of unemployed in Indonesia so that the economy can grow.

Home Industry is an industry / small companies that concentrate activities at home. Home industry including one of the government's strategy as an effort to increase household incomes and reducing unemployment. Home industry has recognized really strategic and importance to the improvement of people's income.

In a company engaged in the fields of industry such as Home industry, profit optimization becomes the main goal of each production process. For the achievement itself, required precise calculations and analysis in order to support the achievement of maximum profit. The maximum profit can be achieved with proper production planning.

However, the implementation of production planning has many obstacles such as lot sizing and production scheduling (Roshani et al., 2016, Altay et al., 2016, Mahmudy, 2015, Tempelmeier and Hilger, 2015). Profit calculation, limit stock, overtime work, the diverse product also become obstacles encountered. Obstacles that is diverse enough to make the production planning process difficult to resolve.

Some researchers have tried to solve this problem. Like using statistical models (Carvalho and Nascimento, 2016, Gicquel and Minoux, 2015, Tempelmeier and Hilger, 2015). Different problems in multi-product with restrictions of some needs the same source becomes a major conflict in the study (Gicquel and Minoux, 2015). By using mixed-integer linear programming that has been discussed results show the practical usefulness of the proposed gap besides strengthening MILP formulation and reduce the consumption of computing time. But the issues raised using the restriction is too simple. Additional restrictions need to earn profits necessary to consider overtime.

Production planning has also been solved using Simulated Annealing (SA) (Roshani et al., 2016) and the problems being tested has produced high-quality solutions. But the study explained that they do not include some limits one of which is a dynamic lot sizing.

Through a process of imitation survival of living beings of natural selection makes evolutionary algorithms as a promising alternative (Datta and Regis, 2016). With restrictions that vary and some objective functions in solving optimization problems become the distinct advantage for evolutionary algorithms (Datta and Regis, 2016, Yoosefelahi et al., 2012, Andersen and Santos, 2012). As one of the evolutionary algorithms that implement processes of recombination and mutation, evolution strategies have proven to provide quality solutions to the optimization problem refers to several studies that already exist (Munawaroh and Mahmudy, 2015, Milah and Mahmudy, 2015, Vista and Mahmudy, 2015). Moreover, in some cases, the evolutionary strategy also often experience early convergence. This is why ES is often trapped in local optimum solutions and demonstrate their early convergence.

Hence, in this research, the prevention of earlier convergence by applying the random injection (Horng et al., 2012, Lee et al., 2015, Tsang and Situ, 2011). Random injection process proved to prevent early convergence. Because the process is carried out on a random set of solutions making it more diverse and more varied process of finding solutions. So with the random injection in ES, production planning problems can be resolved and provide a solution that is able to achieve maximum profit.

2. PROBLEM DESCRIPTION

The location of data collection is in Jalan Yos Sudarso RT 9 RW 3 No. 80, Medaeng, Waru, Sidoarjo, East Java, Indonesia. The data used for this study is data obtained directly from survey respondents through the interview process. The data used are kinds of manufactured products (20 kinds), the raw materials used in each product, stocks of raw materials every month, and the gain on sale of every product.

From these data then needs to be developed a mathematical model in order to do the calculation to find the value of maximum profit by using Evolution Strategies Algorithms. Data of raw materials available for one month are presented in Table 1.

Table 1. Raw of Materials Every Month

raw materials	stock
fabric (m^2)	2000
long yarn (m)	9282
rubber (cm)	8000
zipper (cm)	9000
rope (cm)	6500
silicon (kg)	200

The profits obtained from the sale of a textile product is presented in Table 2.

Table 2. Profit Per Product

raw of materials	stock
pillowcases normal	7000
pillowcases seat	15000
pillowcases love	8000
pillowcases relaxing	8000
pillowcases baby	10000
bolsters baby	10000
bolsters adult	7000
bed linen 180	25000
bed linen 160	20000
bed linen 150	15000
bed linen 120	10000
bed linen 100	7000
bed linen 90	5000
pillow normal	21000
pillow seat	14000
pillow love	24000
pillow relaxing	24000
Pillow baby	11000
bolster baby	8000
bolster adult	26000

The raw of materials required to manufacture textile products are presented in Table 3.

From the data in Table 3, it can be structured a mathematical model that is composed of a number of objective function and a number of constraints. The objective function represents the objectives to be optimized (maximize or minimize).

On this issue, if the amount of production does not exceed 600 for all product then the objective function is obtained by multiplying the amount of profit to the quantity of the product. However, if total production exceeds 600 then the objective function is obtained by multiplying the amount of profit to the quantity of the product is reduced overtime. If the quantity of each type of product is denoted by X_i, where i is a product with the total of n then the objective function is expressed in equation (1).

Table 3. Raw Material of Each Product

product	fabric (m2)	yarn (m)	rubber (cm)	zipper (cm)	rope (cm)	silicon (kg)
pillowcases normal	0.629	3.867	0	50	0	0
pillowcases seat	0.441	3.437	0	50	0	0
pillowcases love	0.911	4.297	0	50	0	0
pillowcases relaxing	0.897	4.297	0	70	0	0
pillowcases baby	0.629	3.291	0	40	0	0
bolsters baby	0.288	3.916	0	0	96	0
bolsters adult	0.75	4.990	0	0	150	0
bed linen 180	3.96	8	200	0	0	0
bed linen 160	3.52	7.6	180	0	0	0
bed linen 150	3.3	7.4	160	0	0	0
bed linen 120	2.64	6.8	140	0	0	0
bed linen 100	2.2	6.4	120	0	0	0
bed linen 90	1.98	6.2	120	0	0	0
pillow normal	0.48	3.683	0	20	0	1
pillow seat	0.32	3.291	0	25	0	0.65
pillow love	0.72	4.071	0	30	0	1.5
pillow relaxing	0.72	4.071	0	25	0	1.5
Pillow baby	0.24	3.157	0	15	0	0.25
bolster baby	0.24	3.727	0	10	0	0.6
bolster adult	0.665	4.687	0	15	0	1.5

Maximize :

$$f(x_1,..,x_n) = \begin{cases} \sum_{i=1}^{n} \text{profit}x_i \times x_i \,, if\ production \leq 600 \\ \sum_{i=1}^{n} \text{profit}x_i \times x_i - 500 \times \left(\left(\sum_{i=1}^{n} x_i\right) - 600\right), \\ \qquad if\ production > 600 \end{cases} \quad (1)$$

In the production process, the amount of material used to manufacture the entire product must not exceed the amount of raw material available. If a number of raw materials used over there is an obstacle. These obstacles are adapted to all kinds of raw materials available. So that there are constraints on raw materials, as already described in Table 1.

$$\sum_{i=1}^{n} P_{i,j} \leq (St_j),\ j = 1,2,..k \quad (2)$$

Where j is raw material number k, with $P_{i,j}$ is part of the raw material required to make the i product The total number of parts i to n from raw material j have limitation may not exceed the stock of raw material j symbolized by St_j.

In addition to constraints in terms of the materials is another constraint on the minimum number for a product to be manufactured. Because in addition to products sold there are made possible orders or for personal use so that there are constraints outlined in equation 3.

$$x_i \geq \text{minimal}(x_i) \quad (3)$$

In this constraint, the amount of production of a product shall not be less than the minimum amount. A minimal amount obtained when there is an order for a particular product.

3. OPTIMIZED PROFIT OF PRODUCTION USING ES

Unlike the GAs that uses crossover as the main reproduction and mutation operator as operator support, ES more reliant upon mutation carriers. ES also use self-adaptation mechanism that is used to control changes in the value of search parameters. The advantage of using evolution strategies it is possible to simultaneously handle multiple objectives and constraints to achieve the optimum approach.

In this study discusses the optimization of production using ES profit. How to get the maximum profit, in addition, based on the amount of production can also be done by combining estimates of market interest. In estimating / forecasting market interest can use several methods such as *time series* forecasting. However, the unavailability of data from sources that are needed for forecasting the market interest, in this study, it is assumed that the maximum profit earned from the sale of products based on the amount of production that can generate maximum profit.

In evolution strategies algorithm used in this study, the first step is to generate the initial population randomly according to the population size that has been entered. Further reproduction. ES mode used is (μ/r+λ), then at the stage of reproduction is done through two processes, namely recombination and mutation. Then make the selection using the method of elitism selection. At this stage of selection, selected the best individual of 75% of the μ (miu). Then at the stage of the new population carried out random injection amount of 25% of μ (miu). Thus obtained *n* new individual number μ of selection results and random injection. New individual that has been formed is used as a parent for the next generation. Iteration is done to achieve maximum generation. Selection results obtained in the last generation is the individual with the best chromosome/solution.

The parameters used in the example are λ (lambda) is 6, μ (popSize) is 4, The minimal amount is 5 for love pillowcase and 0 for others, and also the range between 0-50 chromosomes.

3.1. Chromosome Representation

In representing the chromosome, according to the number of products produced so the decision variables (X_1-X_{20}) directly became a string chromosome genes. In addition to the genes that express the decision variables, additional parameters attached to each chromosome is σ (sigma). This value is expressed mutations to the chromosome level. This value also changes adaptively throughout the generations. Chromosomes will be encoded in real numbers. The length of the chromosome is forty-some twenty-first gene are X_1-X_{20} and the next twenty genes are σ1−σ20. Figure 1 is the structure of chromosomes in each individual.

In the twenty-first gene, the real value shown is the amount of product to be manufactured. The real value is then converted into integers to fit the solution to the problems. Then in the next twenty genes is the value of each σ (sigma) which has range [0,1].

1	2		20	1	2		20
39.95	30.11		37.36	0.33	0.51		0.01

x σ

Figure 1. The Chromosome Representation

Suppose there are twenty kinds of products with a production of 364 and the number of each of each product has a profit. In addition, each product is done by multiplying the number of products with the profits obtained so that the total for the entire product multiplication of 5155000. Because of the amount of production is 364 (<600) so that the objective function value is equal to the total profit of all products because it does not need to be reduced overtime costs. Based on the examples of such cases it can be determined the calculation formula *fitness*.

$$fitness(x_1,\dots,x_{20}) = f(x_1,\dots,x_{20}) - 2000\ (c_1 + c_2 + c_3 + c_4 + c_5 + c_6 + c_7)$$

Where $c_1 - c_6$ are constraints referring to equation 2 and c_7 is a constraint in accordance with equation (3).

$$c_1 = \begin{cases} 0\ ,\ \text{if } 0.629x_1 + \cdots + 0.665x_{20} \le 2000 \\ (0.629x_1 + \cdots + 0.665x_{20}) - 2000,\ \text{others} \end{cases}$$

$$c_2 = \begin{cases} 0\ ,\ \text{if } 3.867x_1 + \cdots + 4.687x_{20} \le 9282 \\ (3.867x_1 + \cdots + 4.687x_{20}) - 9282,\ \text{others} \end{cases}$$

$$c_3 = \begin{cases} 0\ ,\ \text{if } 200x_8 + \cdots + 120x_{13} \le 8000 \\ (200x_8 + \cdots + 120x_{13}) - 8000,\ \text{others} \end{cases}$$

$$c_4 = \begin{cases} 0\ ,\ \text{if } 250x_1 + \cdots + 15x_{20} \le 9000 \\ (250x_1 + \cdots + 15x_{20}) - 6000,\ \text{others} \end{cases}$$

$$c_5 = \begin{cases} 0\ ,\ \text{if } 96x_6 + 150x_7 \le 6500 \\ (96x_6 + 150x_7) - 6500,\ \text{others} \end{cases}$$

$$c_6 = \begin{cases} 0\ ,\ \text{if } x_{14} + \cdots + 1.5x_{20} \le 200 \\ (x_{14} + \cdots + 1.5x_{20}) - 50,\ \text{others} \end{cases}$$

$$c_7 = 100 * \left(\sum_{i=0}^{20} x_i \ |x_i \begin{cases} 0,\ \text{if } x_i \ge \text{minimize}(x_i) \\ x_i - \text{minimize}(x_i), \text{others} \end{cases} \right)$$

The formula for calculating *fitness*, $f(x_1,\dots,x_{20})$ is the objective function derived from the sum of the multiplication of profit and the amount of each textile products. While $c_1 + c_2 + c_3 + c_4 + c_5 + c_6 + c_7$ are penalty which is the sum of each constraint. Then the penalty will be multiplied by the number of 2000. The 2000 figure is a random number having a value large enough to be able to minimize the constraints. Fitness produced is 1795000

3.2. Population Initialization

Based on the determination of the parameters that have been described previously, the population number is 4. So on one population contains 4 individuals/ chromosomes.

Table 4. A Population of 4 Chromosomes

$P_{(t)}$	chromosome						*fitness*
P1	39.95	…	37.36	0.33	…	0.01	4337000
P2	31.41		38.95	0.41		0.02	1151000
P3	31.41		38.95	0.37		0.02	841000
P4	47.21		6.18	0.79		0.36	-37401000

3.3. Recombination

In the process of recombination, each new individuals (offspring) generated by some individuals in the population (two or more) randomly. Recombination method used in this research is to calculate the average value of the individuals elected

Suppose that two individuals selected from the population (parent) randomly namely P2 and P3. Once on average it will produce offspring 1 (C1)

Table 5. Recombination Process

$P_{(t)}$	chromosome						*fitness*
P2	39.95	…	37.36	0.33	…	0.01	4337000
P3	31.41		38.95	0.37		0.02	841000
C1	35.68		38.15	0.35		0.01	3387000

Recombination results in Table 5 show that X_1 of chromosome C1 with value 35.68 is the result of the average between the value of X_1 on chromosome P2 (39.95) and P3 (31.41). The average calculation performed until the last gene.

3.4. Mutation

In the type of ES (μ/r + λ), σ for offspring value obtained through comparison fitness of parent and offspring. The formula determines σ' for offspring can be seen in equation 4.

$$\sigma' = \begin{cases} \sigma \times 1.1, \text{if } fitness(\text{Offspring}) > fitness(\text{Parent}) \\ \sigma \times 0.9, \text{if } fitness(\text{Offspring}) \leq fitness(\text{Parent}) \end{cases} \quad (4)$$

The resulting number of individuals in the process of mutation is the same as the number of individuals contained in recombination. Offspring mutated is calculated from the offspring result of recombination sequences. Suppose C1 produce individual C5. In the early stages of mutation will raise the value of N(0,1) randomly for each chromosome genes.

Table 6. Mutation Process

	X_1	X_2		X_{40}	*Fitness*
N(0,1)	0.561	0.388	…	0.256	-
C1	35.68	29.9		0.01	3387000
C5	35.87	30.09		0.01	3228000

On the C5 gene to chromosome 1 is worth 35.87. This value is obtained from the calculation following.

$x_1' = x_1 + \sigma_1 N_1(0,1)$
$= 35.68 + 0.35*0.561$
$= 35.87628$

35.68 is the value of the first gene in C1, 0.35 is a value of the first sigma in C1, and 0.561 is a value of N(0,1) in C5. After obtained all the genes of C5 then calculated the fitness. On the result of the mutation indicates that *fitness* of offspring (C5) is smaller than the parent (C1), then sigma obtained using σ'= σ × 0.9. So on the first sigma obtained in the following ways :

$\sigma_1' = \sigma_1 * 0.9$
$= 0.35 * 0.9$
$= 0.315$

0.35 is the first sigma value in C1, then after multiplied by 0.9 the result of the first sigma in C5 is 0.315.

3.5. Selection

The selection method used is elitism selection. Selection involves individual parent (Parent) and child (Offspring). First, the individual parent who has been raised in the initialization phase and the individual child that has been generated in the process of recombination and mutation process are sorted in descending order based on the value of fitness (Mahmudy et al., 2013, Mahmudy, 2014).

Table 7. Elitism Selection

P(t)	*fitness*
P1	4772000
C2	3479000
C3	3387000
C4	3387000
C6	3299000
C7	3228000
C8	3109000

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P2	1151000
P3	841000
C5	-17943000
C1	-18554000
P4	-37401000

Then the individual with the best fitness value of 75% * miu selected (75%*4=3). Then do a random injection to 25% * miu individual (25%*4=1 in order to fulfill the individual number which will be used for the next generation. Random injection method is used to enable the diversity of the population, thereby reducing the risk of early convergence.

Table 8. The Result of Elitism Selection and Random Injection

$P_{(t+1)}$	$P_{(t)}$	chromosome				*fitness*
P1	P1	39.95	30.11	…	0.01	4337000
P2	C2	35.68	29.77		0.01	841000
P3	C3	35.68	29.90		0.01	3387000
P4	RI	31.51	33.20		0.07	-52287000

* RI = Random Injection

In the fourth individual Tables 8 (line 4) is the result of a random injection. It can be observed that of these individuals have different fitness values far enough. So with the individual results of random injection is able to increase the diversity of the population.

4. EXPERIMENTAL RESULT

The first test is the range of maximum production. The second test is the test value λ (lambda) which aims to determine the effect λ (lambda) against the resulting fitness. The third testing is testing population size which aims to get the right size of the population in producing the best fitness value. The fourth Testing is testing the amount of generation that aims to determine the amount of generation of effective and efficient in generating optimum fitness values. The tests are carried out, assuming no minimal amount of production.

4.1. The Maximum Range Value of Production

In this test, the value λ (lambda) used is 4, the number of next-generation 100 and the value of the size of the population (miu) used vary namely 15, 20, 25, 30, 35, 40, 45, and 50. The test value ranges maximum production used is the range of 10 to 100 with a value multiple of 10. Having obtained the fitness value for each value range maximum production with the parameters that have been entered, it will be calculated the average value of fitness. Then we will get the average value of the best fitness. So do an analysis of the range of maximum production value is used. The test results maximum production range is presented in Figure 2.

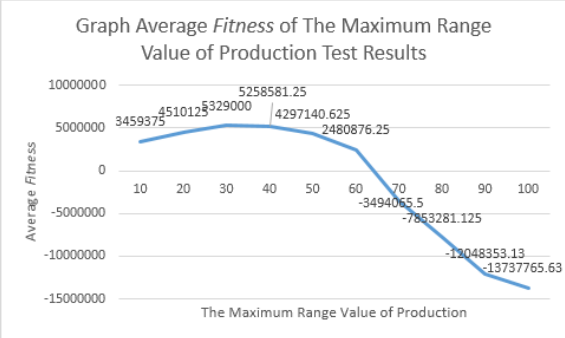

Figure 2. Average Fitness of The Maximum Range Value of Production Testing

In Figure 2 it can be seen that the average fitness increased when the value of the range of maximum production number 10 to number 30. Then, the average value of fitness has decreased continuously until the value of the production range of the maximum number of 100. Based on these test results can be seen that the value range the maximum production which produces an average of the best fitness is 30. Fitness obtained is highly influenced by the availability of raw material amount. Thus, if the availability of a number of raw materials is increasing, then the value of the range of maximum production that is able to produce the best fitness value is also increased.

4.2. The Lambda (λ) Testing

In this test, the value of the range of maximum production that is used is the best value in testing the range of the maximum production that is 30. The number of generations is 100. The population size (miu) used vary namely 15, 20, 25, 30, 35, 40, 45, and 50. λ (lambda) used is 2 to 10. Having obtained the fitness value of each λ (lambda) based on the parameters so compute the average value of fitness. Then obtained the average value of the best fitness so do an analysis of λ (lambda) were tested. The test results λ (lambda) is presented in Figure 3.

From Figure 3 it can be seen that the average value of fitness has increased the price fluctuates. However, in general, if the λ (lambda) is increasing, the average fitness value tends to increase. Based on these results, we conclude that the difference in fitness values obtained in each test λ (lambda) had a modest increase significantly.

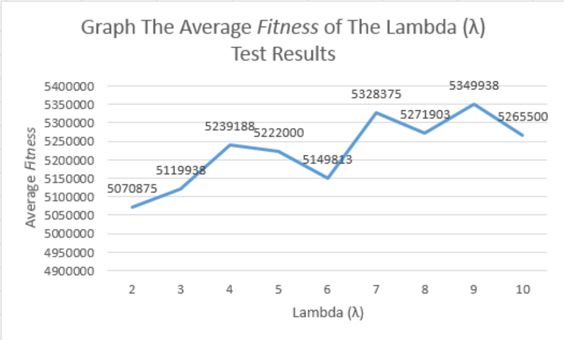

Figure 3. Average Fitness of The Lambda (λ) Testing

4.3. Population Testing

In this test, the value of the range of maximum production that is used is the best value in testing the range of the maximum production is 30. λ (lambda) is 9 which is the best λ (lambda) obtained in earlier tests. Total generation 100. Values population size (miu) is the range of 10 to 100 in increments of 10. The experiment was performed eight times for each size of the population tested. Then from the fitness of each population size was calculated the average value in order to do an analysis of the size of the population being tested. Results of testing the population size (miu) are presented in Figure 4.

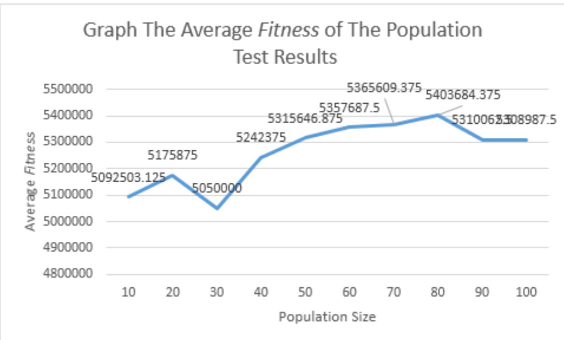

Figure 4. Average Fitness of Population Testing

From Figure 4 it can be seen that the population size affects the outcome of Evolution Strategies algorithm shown in the average fitness generated. The larger the population, the average fitness yield earned is also likely to increase. If the population size is too small, the algorithm simply evaluates the possible solutions are limited and difficult to obtain near the optimum solution. Although the size of the larger populations tends to give better results but to some extent, the increase in fitness gained less significant.

4.4. Generation Testing

In this test, the value of the range of maximum production, the value of λ (lambda), and the size of the population used is the best value in earlier tests is 30, 9 and 80. The number of generations that were tested is the range of 100 to 1000 in increments of 100. The value of a number of experiments carried out eight times for any number of generations that were tested. Then it will be calculated the average value of fitness results obtained on any number of generations to be analyzed. Results of testing the number of generations are presented in Figure 5.

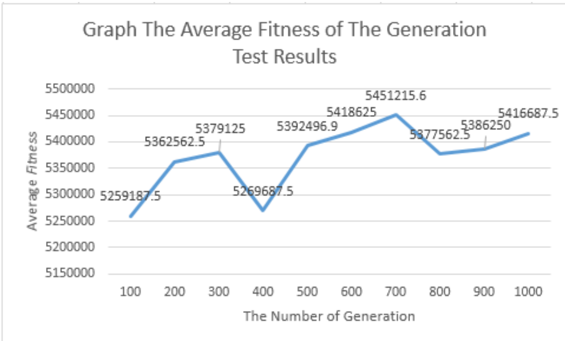

Figure 5. Average Fitness of Generation Testing

In Figure 5 it can be seen if the number of generations increases the average fitness generated is also likely to increase. However, on the results of the degradation that occurs twice in the test generation number 400 and 800. At each increase in the number of generations of testing changes in the average fitness value which is less significant. It can be concluded that when the number of generations used more, then obtained fitness value is better but not significant.

4.5. Result Analysis

The best results based on testing that has been done before will be used as the input value of each parameter to obtain the optimum solution. The results of the best parameters based on the previous testing are presented in Table 9.

Results of one experiment using the best parameters obtained fitness value of 5554000. The objective function of the same value in the amount of Rp. 5,554,000 due to the constraints of the materials used for the production does not exceed the stock of available materials. In this testing, the residual rubber material is used up, the remaining 15 cm zippers, straps remaining 254 cm, silicone 23.75 kg, 1663.3124 m2 fabric, and yarn 7639,243 m2. Differences in the remaining amount of each raw material are significant. In fact, the amount of raw material available is very influential on the resulting fitness as an obstacle in the production process. Thus, in order to fitness which is produced can provide a more optimal in addition to the best parameters that have been obtained, then the amount of material available, especially in rubber, zippers, straps, and silicon needs to be added to the fabric and thread is left can still be used and the amount of production become increased.

Table 9. The Best Parameter of ES

Parameter	Number
Maximum Range of Production	30
λ (lambda)	9
Population size (miu)	80
Generation	700

The resulting solution by using Evolution Strategies compared with real solutions based on production data from interviewees in June. Best parameters shown in Table 9 is used to experiment to get the fitness value ten times with the assumption that there is minimal production on pillowcases normal number of 20 (according to the data from the interviewees) for each experiment. From these experiments obtained the value of the average fitness of 5316000 and an average profit of 5324000 which is used as a comparison against the fitness value and profit real derived from production data in June 2016 through the interviewees, assuming without including the rest of the raw material in the previous month to June 2016.

In Table 10 fitness and the profits obtained from the quantity of production through Evolution Strategies in comparison with the fitness and the profits obtained by the data quantity of production of interviewees, it can be seen that fitness is generated using Evolution Strategies larger, ie 5.316.000 compared to 2.747.000 with the difference 2569000. Profits produced using Evolution Strategies also produced the greater value of Rp 5,324,000 to Rp 2,747,000 compared with a difference of Rp 2,577,000. From these results, the Evolution Strategies produce a better solution.

Table 10. Comparing Result

	fitness	**profit**
ES	5316000	5324000
Real Production of Interviewees in 2016	2747000	2747000

5. CONCLUSION

Based on test results and analysis, Evolution Strategies can be applied to optimize the profit based on the amount of production in the home textile industry and produce a better solution than the estimated quantity production process manually. Best results are obtained using the best parameters ES, namely the production range to a maximum of 30, lambda at 9, Miu is 80, and the number of generations 700.

The parameter values of the range of maximum production are highly dependent on the amount of raw material available. If the amount of raw material available the more the value of the parameter number of the production range which produces optimum fitness also increased. Vice versa.

In order to obtain the maximum profit, then not only use data sales profits but can be combined with data from forecasting the market interest (interest of consumers). It is possible that a certain product that is mathematically able to generate the maximum profit is not necessarily the most demanded product market. Data forecasting the market interest can be data time series. In addition, there is another way to increase profits is by modifying the algorithm Evolution Strategies or merging (hybridization) with the other algorithms.

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