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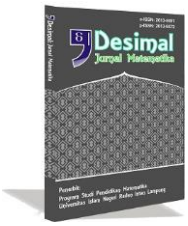

Silver meal heuristic method planning and controlling of cracker production inventory in the assisted business units of the BNN community foundation

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ABSTRACT

Inventory control is a production activity that involves planning the amount, time, or cost that must be controlled to obtain a minimum cost and no loss. At the BNN Community Foundation Building Unit, when producing crackers, the production process was disrupted because the available raw materials did not meet production requirements. This study aims to find out the planning and control of raw materials in producing crackers and compare the company's calculation results with the Silver Meal Heuristic method. In this calculation using the data of 5 raw materials and the main requirements in the production process for three months, the result obtained in the calculation with the heuristic silver meal method obtained a minimum result of IDR 27,488,580. When compared to the calculation from the company for three months of production cost expenses, the calculation using the method silverware heuristic can save costs up to IDR 52,19,420. This proves that the calculation using the silver meal heuristic method is better used because it can control the total cost that the factory has to bear in producing crackers.

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INTRODUCTION

The production process is the act of making something more useful. A process is a set of rules and regulations that govern the actual transformation of human effort, mechanical components, raw materials, and capital into finished products (Ensaftyan, Akmal, & Bahri, 2022). One of the most important processes in the implementation of a company's production is the production process (Amri, Trisna, & Harahap, 2012). This is because increasing profit or generating profit is an activity carried out by using the production process as a method, method, or technique (Herawati & Mulyani, 2014).

The BNN Komuniti Foundation Building Unit is a business unit that produces crackers every day. The crackers produced in this factory are folded

crackers. The large amount of consumer demand sometimes causes the factory to be unable to meet consumer demand. Not only individual requests, but many small shops also request orders from this cracker pub. Therefore, factory owners must evaluate the smoothness of production and sales by maintaining stock of goods or raw materials (Ernawati et al., 2022).

The purpose of this production planning is to create a production schedule that will use the remaining resources or replacements at the lowest cost for the finished product to meet the increasing demand (Baroto, 2002). Businesses that do not use aggregate production planning may face a number of problems, including insufficient use of human resources and strategic plans that conflict with sales and production plans (Kusuma, 2009).

According to research, in order to anticipate the possibility of a lack of capacity in production, production planning must be done as best as possible at the lowest cost (Ariani, 2018). So that there is no shortage in the production process, the company gets optimal profit in each production (Sukendar & Kristomi, 2008). According to the study by Zakaria, Meutia, & Melinda Pane (2020), inventory control has a very important role in estimating the products produced at this time to meet market demand and affect the smoothness of the production process in the company.

This research takes the case of a business unit fostered by Yayasan Komuniti BNN that experienced interruptions in the production process because the available raw materials did not follow production requirements. The increase in production costs is due to the relatively fluctuating prices of raw materials that require the supply of raw materials so that the factory can minimize the cost of producing crackers (Herjanto, 2008). As a result, we can organize and plan the production of raw materials using the Heuristic Silver Meal approach.

The purpose of this research is to examine how the production of crackers involves the management of raw resources. Overstocking of raw materials can lead to high storage costs as well as the risk of damage and shrinkage due to long storage and when raw materials are in limited supply (out of stock).

At the BNN Community Foundation Construction Unit, the use of raw materials to produce quality crackers in order to obtain a good product requires the supply of raw materials and good raw materials. It requires costs in the provision of raw materials to produce them because the price of raw materials is relatively up and down, so it is necessary for the factories to make an inventory of their raw materials so that there is no high tariff in the cost of producing crackers. So, a method that can be used to control the supply is needed, which is the Silver Meal Heuristic method.

In addition, the heuristic silver meal method has been used in a study entitled Calculation of Tofu Production Cost Efficiency with the Heuristic Silver Meal Method. This research shows good results compared to using other methods, such as research by Taufan, Eddy, & Hasibuan (2021), who used the Perak method. The Food Heuristic method is based on future demand so that the purchase of raw materials can be determined accurately and the minimum inventory cost can be determined using the heuristic food cell method. Furthermore, the silverware heuristic method has been used in the silverware application. The Heuristic method is used to minimize the raw materials needed to make tofu (Yetrina, Rifki Muhida, & Abu Bakri, 2023). Based on previous studies, this study tries to apply the Silver Meal Heuristic for calculating production costs to obtain minimal results. In particular, to plan the production of raw materials to be produced as well as inventory and make

reorder estimates when supplies start to run out using the ROP method so that production activities are not interrupted due to running out of raw materials (Berliana & Rochmoeljati, 2022; Koesdijati & Adi Waluyo, 2022).

METHOD

This research was conducted at Gg. Paria Dusun 1, Sei Rotan Village, Percut Sei Tuan District. The study was conducted for three months (January–March 2024). This type of research is done using a qualitative approach. The data study was conducted on the cracker factory of the BNN Community Foundation Building Unit. Data collection methods are conducted through direct observation and interviews with companies related to production costs in factories. The data in this study is production data for raw material requirements within a period of three months.

The data required in this study is primary, including the number of costs in supply, order costs, purchase costs, and storage costs. All information used in this study comes directly from the BNN Community Foundation Building Effort Unit factory, in particular, original data on demand volume, capacity, and production costs (Sutoni & Juandi, 2017).

Planning and controlling the materials that enter the production system (raw materials and additives), flow into the production system (as components or sub-assemblies), and exit the production system (as finished products or spare parts) can generally be understood as planning and controlling production inventory. This is done to ensure that demand is met effectively and efficiently (correct quantity, accurate delivery time, and minimal production costs) (Eunike et al., 2021).

Production planning is a statement of production plans in aggregate form (Ginting, 2007). Production planning serves as a channel of communication between the production department and top management. In addition, production planning can be seen as a tactical plan designed to provide the best option for the organization to meet the demand for the final product, taking into account its resources. Personnel, machine capacity, owned technology, and other resources are considered resources (Fadillah, 2022).

The heuristic approach incorporates the Silver-Meal strategy. A heuristic approach is a strategy for solving problems that does not consider whether the solution is proven but often provides excellent answers or solves simpler problems that include or intersect with more difficult problems to solve. The goal of heuristic approaches is to improve conceptual simplicity or computational efficiency, often at the expense of accuracy or precision. When calculating inventory (warehouse planning) with fluctuating demand, a heuristic approach can also be used (Munawir, 2011).

Problems through the Silver Meal Heuristic method can be solved through the following stages:

a. Calculate the average allocation cost per period (Kartika, Puspita, & Yuliza, 2019)

$$K(m) = \frac{1}{m}(A + hD_2 + 2hD_3 + \ldots + (m-1)hD_m) \quad (1.1)$$

$$TC = A + hD_2 + 2hD_3 + \ldots + (m-1)hD_m \quad (1.2)$$

So that the equation can be rewritten with the formula:

$$K(m) = \frac{1}{m}(TC)$$

Calculate with $K(m) = 1, 2, 3, 4, \ldots, n$ and stop when $K_{(m)}, K_{(m+1)} > K_{(m)}$
Where,

$K_{(m)}$ = Average inventory cost per period

D_m = Demand in the m-th period $(D_1, D_2, D_3, \ldots, D_m)$
A = Booking Fee
h = Storage Fee per Unit per Period
m = Period
TC = Total Cost

b. Calculate the Total Relevant Cost (TRC) through the Formula:

$$\frac{TRC}{t} = \frac{C + ph\sum_{K=1}^{T}(k-1)R_k}{k}$$

$$= \frac{C + holding\ cost\ at\ the\ end\ of\ period\ T}{t} \quad (1.3)$$

- Creating a control table is the purpose of this method to determine the value of T, which, under the following conditions, can be used to minimize the relevant total cost for each period (Ristono, 2009):

$$\frac{TRC(t+1)}{t+1} > \frac{TRC(T)}{t} \quad (1.4)$$

- Create an order table
  The calculation of raw material orders in a certain period so that the lowest price and the amount of raw materials ordered for use in that period are formulated as follows:

$$\frac{TRC(T)}{t}\frac{TRC(T)}{t}$$

$$Q_t = D_1 + D_2 + D_3 + \ldots + D_t \quad (1.5)$$

A certain amount (Safety Stock, or SS) is prepared in advance to account for these uncertainties, especially those related to demand and lead time, and to reduce the possibility of stockouts. The total food supply can be calculated as follows:

$$Z = \frac{x - \mu}{\sigma} \quad (1.6)$$

Because food supply is the difference between x and μ (Herjanto, 2008) then:

$$Z = \frac{SS}{\sigma} \text{ or } SS = \sigma Z \quad (1.7)$$

Where:
SS = Safety Stock
Z = Service Level (Safety Factor)
σ = Standard Deviation from the request level
μ = average number of requests over three months (items)

As the number of items in stock continues to decrease, the ROP model comes into play. In order to ensure a sufficient and safe supply of raw materials to meet customer demand, Reorder Points need to be maintained (Sugeng, 2017).

$$ROP = \mu \times LT + SS \quad (1.8)$$

This research started by collecting data by interviewing factory owners and by direct observation in the field. The data taken from this research is primary data from three-month raw material order data for the diving factory (January–March 2024). By using a qualitative analysis of the method of calculating the average cost of raw materials produced for three months, solve the problem using the silver meal heuristic method to calculate production costs to a minimum, as well as calculate safety supplies and reorganize raw materials that will run out of stock.

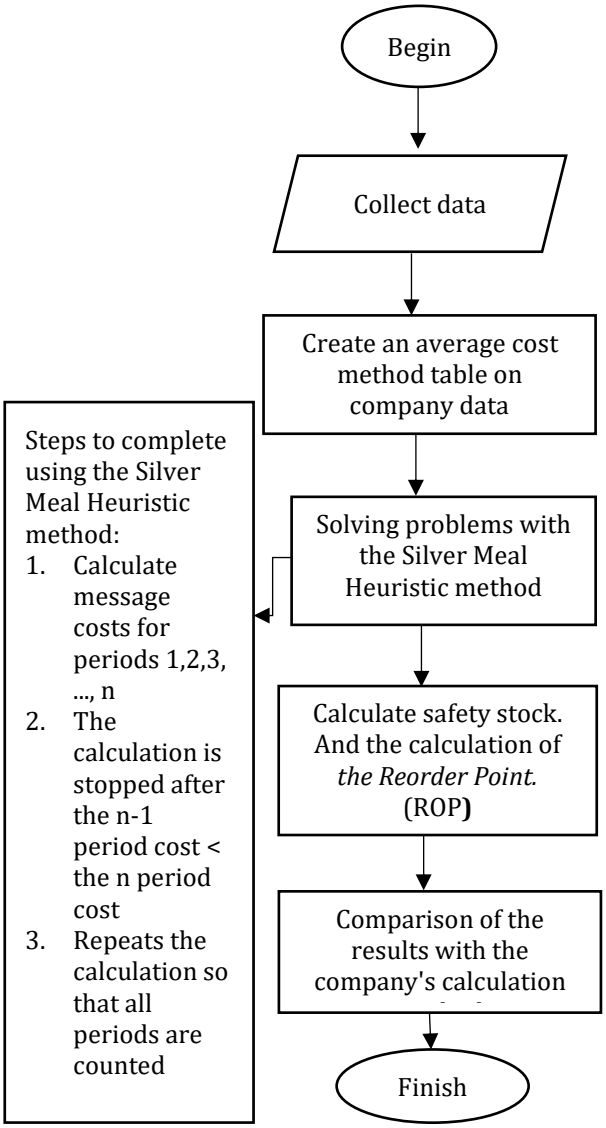

Figure 1. Flowchart

RESULTS AND DISCUSSION

In this research, production inventory control will be carried out for five main raw materials, namely cassava flour, wheat flour, salt, garlic, and cooking oil, to produce crackers at the Business Unit fostered by the BNN Community Foundation. Raw material price data, lead time data, raw material ordering cost data, raw material storage cost data, and demand data for January to March 2024 are required for calculation. Lear time is the amount of time that elapses between ordering raw materials and when the raw materials arrive at the warehouse.

In Table 1, based on the results of the interview with the owner of the cracker factory, it is assumed that for three months producing crackers, the factory spends IDR 79,685,000. In January, the factory needs 1,720 kg of main raw materials out of a total of 5 main raw materials. In February, the factory needs 1,890 kg of main raw materials, and in March, the factory needs 1,700 kg of main raw materials so that, on average, in three months, the factory produces 1,770 kg of raw materials of the total raw materials for three months of production. The factory has not implemented planning and

production control of the supply of raw materials to be produced. In this study, we will calculate the data obtained from the factory using heuristic calculations of silver dishes as a production planning method to minimize production costs.

Table 1. Purchase of Raw Materials

Purchases/month	Types of Raw Materials	Quantity/kg	Price (Rp)	Total Cost
January	Tapioca Flour	300	6,000/kg	1,800,000
	Flour	150	10,000/kg	1,500,000
	Salt	40	9,000/kg	360,000
	Garlic	150	20,000/kg	3,000,000
	Cooking Oil	1,080	18,000/kg	19,440,000
February	Tapioca Flour	350	6,000/kg	2,100,000
	Flour	200	10,000/kg	2,000,000
	Salt	50	9,000/kg	450,000
	Garlic	200	20,000/kg	4,000,000
	Cooking Oil	1,090	18,000/kg	19,620,000
March	Tapioca Flour	310	6,000/kg	1,860,000
	Flour	175	10,000/kg	1,750,000
	Salt	45	9,000/kg	405,000
	Garlic	170	20,000/kg	3,400,000
	Cooking Oil	1,000	18,000/kg	18,000,000
Total		5,310		79,685,000

In inventory control, space is needed for the storage of raw materials, which requires storage costs. The storage cost of raw materials is the amount of money spent on managing the storage of raw materials, known as the storage cost (Siswanto, 2007). Table 2 shows the storage costs in this study.

Table 2. Raw Material Storage Costs

Cost	Cost
Cost of Production Equipment	1,500,000
Labor Costs	10,000,000
Warehouse Maintenance Costs	500,000
Entire	12,000,000

The total storage cost per month obtained is IDR 12,500,000. The average amount of raw materials for three months is 1,770 materials from the main raw materials, so the storage cost of raw materials per month is IDR 12,500,000: IDR 1,770 = IDR 7,062.

Table 3. Raw Material Ordering Costs

Information	Fee (Rp)
Telephone Charges (Credit/Internet)	20,000
Transportation Costs	200,000
Total in 1 Message	220,000

Ordering fees are all costs that occur from ordering the goods to the availability of the goods in the warehouse. The data is processed based on the total fees incurred by the company. The average cost of raw material availability is obtained on the condition that, if $\frac{TRC(t+1)}{t+1} > \frac{TRC(T)}{t}$, then the calculation is stopped. At T+1 time, another order for raw materials must be carried out. The order time (T) starts from period 1, which makes the storage cost (h) occur again to be 0.

Table 4 Results of the Calculation Process of Tapioca Flour Raw Materials using the Silver Meal Heuristic Method

Tapioca Flour		A	H
Time	**Total Demand**	**220,000 TRC(Rp)**	**7,062 TRC/t(Rp)**
Period 1*	300	220,000	220,000
Period 1,2	650	2,691,700	1,345,850
Period 2*	350	220,000	220,000
Period 2,3	660	2,409,220	1,204,610
Period 3	310	220,000	220,000

Description*= order has been created

Booking 1
Booking fee/month = IDR 220,000
Storage fee/month = IDR 7,062
For m = 1
A (message fee) = IDR 220,000
h (storage fee) = 0
Average cost/month = $\frac{1}{m}(A)$
$= \frac{1}{1}(220{,}000)$
Average cost/month = IDR 220,000
So, the average cost/month for period -1 on tapioca flour raw materials is IDR 220,000.
$TC_1 = A$
$TC_1 = 220{,}000$

For m = 2
A (message fee) = IDR 220,000
h (storage fee) = IDR 7,062
$D_2(\text{demand period} - 2) = 350$
Average cost/month = $\frac{1}{m}(A + hD_2)$
$= \frac{1}{m}(220{,}000 + (7{,}062)(350))$
Average cost/month = IDR 1.345.850
So, the average cost/month for *period-2* on tapioca raw materials is IDR 1,345,850.
$TC_2 = A + hD_2$
$TC_2 = 220{,}000 + (7{,}062)(350)$
$TC_2 = 2{,}691{,}700$
The cost for m = 1 is smaller than the cost for m = 2, or 220,000 < 1,345,850. So, the number of orders is stopped, and the order for raw materials is restarted. And the ordering time (T) starts from period 1, which makes the storage cost (h) occur again at 0.

Booking 2
Booking fee/month = IDR 220,000
Storage fee/month = IDR 7,062
For m = 1
A (message fee) = IDR 220,000
h (storage fee) = 0
Average cost/month = $\frac{1}{m}(A)$
$= \frac{1}{1}(220{,}000)$
Average cost/month = IDR 220,000
So, the average cost/month for period -1 on tapioca flour raw materials is IDR 220,000.
$TC_1 = A$
$TC_1 = 220{,}000$
For m = 2
A (message fee) = IDR 220,000
h (storage fee) = IDR 7,062
$D_2(\text{demand period} - 2) = 310$
Average cost/month = $\frac{1}{m}(A + hD_2)$
$= \frac{1}{2}(220{,}000 + (7{,}062)(310)$
Average cost/month = IDR 1,204,610
So, the average cost/month for period-2 on tapioca raw materials is IDR 1,204.610
$TC_2 = A + hD_2$
$TC_2 = 220{,}000 + (7{,}062)(310)$
$TC_2 = 2{,}409{,}220$
The cost for m = 1 is less than the cost for m = 2, or 220,000 < 1,204,610. So, the number of orders has stopped. In the calculation with the Silver Meal Heuristic method for the raw material order of cassava flour, two orders are made.

Table 5. Results of the Calculation Process of Wheat Flour Raw Materials using the Silver Meal Heuristic Method

Flour		A	H
Time	**Total Demand**	**220,000 TRC(Rp)**	**7,062 TRC/t(Rp)**
Period 1*	150	220,000	220,000
Period 1,2	350	1,632,400	816,200
Period 2*	200	220,000	220,000
Period 2,3	375	1,455,850	727,925
Period 3	175	220,000	220,000

Description*= order has been created

In Table 5, the results of the wheat flour raw material calculation process using the heuristic silver meal method for the cassava flour raw material order were made twice. The first order was 150 kg, and the second order was 375 kg of wheat flour.

Table 6. Results of the Calculation Process of Salt Raw Materials using the Silver Meal Heuristic Method

Salt		A	H
Time	**Total Demand**	**220,000 TRC(Rp)**	**7,062 TRC/t(Rp)**
Period 1*	40	220,000	220,000
Period 1,2	90	473,100	286,500
Period 2*	50	220,000	220,000
Period 2,3	95	573,790	268,000
Period 3	45	220,000	220,000

Description*= order has been created

In Table 6, the results of the salt raw material calculation process using the heuristic silver dish method for ordering salt raw materials are carried out twice. The first order was 40 kg, and the second order was 50 kg of salt.

Table 7. Results of the Calculation Process of Garlic Raw Materials using the Silver Meal Heuristic Method

Garlic		A	H
Time	**Total Demand**	**220,000 TRC(Rp)**	**7,062 TRC/t(Rp)**
Period 1*	150	220,000	220,000
Period 1,2	350	1,632,400	816,200
Period 2*	200	220,000	220,000
Period 2,3	370	1,420,540	710,270
Period 3	170	220,000	220,000

Description*= order has been created

In Table 7, the results of the process of calculating the raw materials of garlic using the heuristic silver meal method for ordering raw materials of garlic were made twice. The first order was 150 kg, and the second order was 170 kg of garlic.

Table 8. Results of the Calculation Process of Cooking Oil Raw Materials using the Silver Meal Heuristic Method

Cooking Oil		A	H
Time	**Total Demand**	**220,000 TRC(Rp)**	**7,062 TRC/t(Rp)**
Period 1*	1,080	220,000	220,000
Period 1,2	2,170	7,917,580	3,958,790
Period 2*	1,090	220,000	220,000
Period 2,3	2,090	7,282,000	3,641,000
Period 3	1,000	220,000	220,000

Description*= order has been created

In Table 8, the results of the wheat flour raw material calculation process using the silver meal heuristic method for cooking oil raw material orders were made twice. The first order was 1,080 kg, and the second order was 1,090 kg of cooking oil.

Table 9. Recapulation of Raw Material Calculation using the Heuristic Silver Meal Method for Three Months

Types of Raw Materials	Demand (kg)	Total Cost (Rp)
Tapioca Flour	1,310	5,100,920
Flour	725	3,088,250
Salt	185	1,046,890
Garlic	720	3,052,940
Cooking Oil	4,260	15,199,580
Entire		27,488,580

Table 9 is the result of the recalculation of the raw material calculation using the heuristic silver meal method on the raw material of cassava flour, resulting in a total cost of IDR 5,100,920 with a demand of 1,310 kg, wheat flour resulting in a total cost of IDR 3,088,250 with a demand of 725 kg, salt producing a cost of IDR 1,046,890 with a demand of 185 kg, garlic producing a cost of IDR 3.053,940 with a demand of 720 kg, and cooking oil produces a cost of 15,199,580 with a demand of 4,260 kg, so the total cost of production is obtained by using the silver meal heuristic method, which is IDR 27,488,580.

Based on the results of interviews with factory owners, the lead time (LT) value for the raw materials of cassava flour and wheat flour is 2 days, while the order time for salt, garlic, and cooking oil is 1 day. From the interview with the factory owner's assumption that the depletion of all raw materials does not exceed 5%, it is known that the value of Service Level (Z) is 95%. With a Z value of 1.64, it is obtained with the help of Microsoft Excel using the function (NORM. S.INV (95%). This is also proven by looking at the Z distribution table. While the value of σ (Standard Deviation) is obtained with the help of Microsoft Excel using the function (STDEV.P), it can be calculated with the formula:

Calculation of tapioca flour raw materials

$SS = \sigma Z$

$SS = (22)(1.64)$

$SS = 36.08$

Table 10. Safety Stock Value

Types of Raw Materials	Safety Stock Value (kg)
Tapioca Flour	36.08
Flour	32.8
Salt	6.56
Garlic	34.44
Cooking Oil	65.6

In Table 10, which is the safety stock sheet, the factory needs to prepare a safety stock of 36.08 kg of cassava flour, 32.8 kg of wheat flour, 6.56 kg of salt, 34.44 kg of

garlic, and 65.6 kg of cooking oil for the supply of raw materials.

The calculation of Rearrangement Points (ROP) can be calculated using the following formula:

$ROP = \mu \times LT + SS$
$ROP = 320/1\ month \times 2\ days + 36.08$
$ROP = 320/30\ days \times 2\ days + 36.08$
$ROP = 10.77 \times 2 + 36.08$
$ROP = 47.57$

Table 11. Results of Reordering Point Calculation (ROP)

Types of Raw Materials	Rearrange Point Values (ROP) *(kg)*
Tapioca flour	57.62
Flour	38.6
Salt	8.06
Garlic	40.21
Cooking Oil	100.8

Table 11 is the result of the ROP calculation where the factory reorders when the remaining inventory is 57.62 kg of cassava flour, 38.6 kg of wheat flour, 8.06 kg of salt, 40.21 kg of garlic, and 100.8 kg of cooking oil.

Table 12. Results Comparison

Calculation Method	Result
Heuristic Silver Meal	27,488,580
Company Policy	79,685,000

In Table 12, the comparison of results can be seen by using the silver meal heuristic method to obtain minimum results compared to the calculation of factory production costs before implementing production planning and inventory control over cracker raw materials.

CONCLUSIONS AND SUGGESTIONS

The production costs incurred by the factory initially cost IDR 79,685,000 for three months of production. Based on the results of the study obtained on the inventory control system using the Silver Meal Heuristic method, this method obtains optimal booking results for three months; the result is IDR 27,488,580. The factory can save production costs of IDR 52,19,420.

To anticipate inventory costs, the factory must prepare a safety stock, which includes 36.08 kg of cassava flour, 32.8 kg of wheat flour, 6.56 kg of salt, 34.44 kg of garlic, and 65.6 kg of cooking oil. The factory reordered when the remaining inventory was 57.62 kg of cassava flour, 38.6 kg of wheat flour, 8.06 kg of salt, 40.21 kg of garlic, and 100.8 kg of cooking oil.

REFERENCES

Amri, Trisna, & Harahap, E. N. (2012). Perencanaan pengendalian produksi air minum dalam kemasan menggunakan metode aggregate planning. *Malikussaleh Industrial Engineering Journal*, *1*(1).

Ariani, A. M. (2018). *Penerapan pengendalian persediaan dengan menggunakan metode economic order quantity (eoq) guna meminimumkan persediaan bahan baku kain fleece pada cv. maxtorz bandung*. Universitas Pasundan, Bandung.

Baroto, T. (2002). Perencanaan dan pengendalian produksi. In *Universitas Pancasakti Tegal* (Vol. 1). Jakarta: Ghalia Indonesia.

Berliana, S., & Rochmoeljati, Rr. (2022). Optimasi persediaan bahan baku utama cat dinding menggunakan metode silver meal heuristic. *Prosiding SENIATI*, *6*(2), 363–371. https://doi.org/10.36040/seniati.v6i2.4843

Ensaftyan, M. B., Akmal, S., & Bahri, S. (2022). Perencanaan dan pengendalian produksi roti menggunakan metode aggregate planning heuristik di cv. family bakery. *Jurnal ARTI (Aplikasi Rancangan Teknik Industri)*, *17*(2), 136–144.

Ernawati, Lestari, S. P., Fauzan, R., Haribowo, R., Tannady, H., Yunus, A. I., … Susanti, I. (2022). *Manajemen*

operasional (3rd ed.). Jakarta: PT. Global Eksekutif Teknologi.

Eunike, A., Setyanto, N. W., Yuniarti, R., Hamdala, I., Lukodono, R. P., & Fanani, A. A. (2021). *Perencanaan produksi dan pengendalian persediaan*. Malang: UB Press.

Fadillah, F. (2022). Analisis perencanaan pengendalian persediaan dengan menggunakan metode heuristic silver meal dan least unit cost. *SIJIE: Scientific Journal of Industrial Engineering*, *3*(2), 24–29.

Ginting, R. (2007). *Sistem produksi*. Yogyakarta: PT. Graha Ilmu.

Herawati, H., & Mulyani, D. (2014). Pengaruh kualitas bahan baku dan proses produksi terhadap kualitas produk pada ud. tahu rosydi puspan maron probolinggo. *Universitas Panca Marga Probolinggo*.

Herjanto, E. (2008). *Manajemen produksi dan operasi* (3rd ed.). Jakarta: PT Gramedia Widiasarana Indonesai.

Kartika, Y., Puspita, F. M., & Yuliza, E. (2019). Pengendalian persediaan obat di pt. pratapa nirmala palembang dengan metode heuristik silver meal (hsm). *Jurnal Penelitian Sains*, *21*(2), 98–105.

Koesdijati, T., & Adi Waluyo, D. (2022). Glucose supply control using silver meal heuristic method at pt. xm sidoarjo. *Tibuana*, *5*(2), 135–140. https://doi.org/10.36456/tibuana.5.2.5940.135-140

Kusuma, H. (2009). *Manajemen produksi: Perencanaan dan pengendalian produksi*. Yogyakarta: Andi.

Munawir. (2011). *Analisis laporan keuangan* (5th ed.). Yogyakarta: Liberty.

Ristono, A. (2009). *Manajemen persediaan* (1st ed.). Yogyakarta: Graha Ilmu.

Siswanto. (2007). *Operation research*. Jakarta: Erlangga.

Sugeng, B. (2017). *Manajemen keuangan fundamental*. Yogyakarta: Deepublish.

Sukendar, I., & Kristomi, R. (2008). Metoda agregat planning heuristik sebagai perencanaan dan pengendalian jumlah produksi untuk minimasi biaya. *Prosiding Seminar Nasional Teknoin*, 107–112.

Sutoni, A., & Juandi, E. D. (2017). Perencanaan persediaan bahan baku berdasarkan permintaan probabilistik. *JISS: Journal Industrial Servicess*, *3*(1).

Taufan, M. B., Eddy, E., & Hasibuan, Y. M. (2021). Perhitungan efisiensi biaya produksi tahu dengan metode heuristic silver meal. *JiTEKH*, *9*(1). https://doi.org/10.35447/jitekh.v9i1.328

Yetrina, M., Rifki Muhida, & Abu Bakri. (2023). Penerapan metode silver meal heuristic untuk minimasi biaya persediaan bahan baku tahu. *Jurnal Teknologi*, *13*(1). https://doi.org/10.35134/jitekin.v13i1.89

Zakaria, M., Meutia, S., & Melinda Pane, A. (2020). Perencanaan produksi dan pengendalian persediaan bahan baku di pt. jakarana Tama Medan. *Industrial Engineering Journal*, *9*(2). https://doi.org/10.53912/iejm.v9i2.574