Planning For Procurement of Raw Materials and Supplies for Small and Medium Enterprise

Christian, Lina Gozali and Lamto Widodo
Industrial Engineering Department
Faculty of Engineering
Tarumanagara University
Jakarta, Indonesia
christian.545200040@stu.untar.ac.id, Linag@ft.untar.ac.id,
lamtow@ft.untar.ac.id

Abstract

The company where the research is carried out is a small and medium enterprise engaged in fashion with a make-to-stock system. The problem in these small and medium enterprises is the accumulation of inventory in raw material warehouses. In this study, the author carried out forecasting calculations using data from the past and using the SES, DES, SMA, and DMA methods. By looking at the error rate in each forecast, the smallest error is the SES method $\alpha=0.1$ with MAPE of 6.4%, MSE of 2338352.9, and MAD of 392.5. Then the calculation of MPS for raw materials is carried out. RCCP calculation using 3 methods, namely CPOF, BOLA, and RPA. After that, a safety stock calculation is carried out for each raw material.

Keywords
Forecasting, SES Method, SMA Method, Safety Stock Determination

1. Introduction
In the current industrial era, there are various types of industrial fields; one of the important industries is the manufacturing industry. The manufacturing industry can be in the form of a company or the form of a small and medium enterprise. The manufacturing industry has many sectors, so it can make this industry quite promising. These sectors include manufacturing in the fields of food, textiles, fashion (clothing), wood products, and many more.
Small and medium enterprise is a business that has an important role in the economy of Indonesia. Micro, small, and medium enterprises themselves are regulated in Law, namely, Law No. 20 of 2008 concerning Micro, Small, and Medium Enterprises passed by President Dr. H. Susilo Bambang Yudhoyono on July 4, 2008. Small and medium enterprises in Indonesia itself from time to time have experienced rapid development. Small and medium enterprises can play an important role because they can provide access to job opportunities from various sectors. Sectors in small and medium enterprise businesses are very varied, both from industry, services, informal sector, and other sectors.
The small and medium enterprise that I took is a small and medium enterprise engaged in fashion. A small and medium enterprise was founded in 2012. This small and medium enterprise produces fashion products such as blouses, games, t-shirts, and many more tailored to existing orders.

As we know inventory control must be done so that inventory is not too large so that costs do not become greater, but inventory also should not be too little because it can make production which makes goods experience delays in reaching consumers, this can make consumers switch to competitors so that it will make losses. The small and medium enterprise itself uses the Make to Stock (MTS) system, although this small and medium enterprise has received many orders, often because it receives too many orders inventory accumulates and makes production hampered. So, you must incur additional costs to store excess inventory. The objective of this paper from small and medium enterprises uses a manual method in controlling stock. They do this by using books to write inventory stock in warehouses. This small and medium enterprise updates the condition of this stock every day by writing which stocks are increasing and decreasing. With this method, often the stock in the warehouse experiences a buildup of goods, so it is necessary to plan and forecast and to overcome errors in forecasting, a minimum inventory (safety stock) is made.This research will end with a simulation by creating a computer-based program where this program aims to help small and medium enterprises facilitate decision-making in the future.

2. Literature Review
The following is a literature review which is a reference and thesis research guideline, the literature review can be seen in Table 1.

Table 1. Literature Review

Title, Source and Author Name	Findings	Linkage to Research
Production Planning and Inventory Control on Manufacturing Companies (Journal of Accounting and Taxation Research Vol. 8, No.01, 14-27, Myra Beatrice Soeltanong, Catur Sasongko)	PT X faced inventory problems due to improper production planning, causing excess and shortage of inventory. Their solution was to hire additional manpower, but this resulted in a buildup of inventory and high costs. The recommended solution is to form a comprehensive production plan based on forecasting customer demand. Inventory control systems such as EOQ, Safety Inventory, and Reorder Points are also required. This is expected to reduce overtime labor costs, shorten lead times, and make companies no longer dependent on specific individuals in determining production. [1]	In this study, forecasting demand and this research uses the EOQ method which is useful for controlling inventory to reduce costs.
Production Planning and Control on the Combination of MRP and MILP Methods (Journal of EurekaMatika Vol 8, No.01, Arwan Zhagi, Fitriani Agustina and Bambang Avip Priatna)	Research is carried out with the aim of achieving production and inventory systems and schedules on time, quantity, and price. To save time, the construction of forecasting application programs as well as production planning and inventory control was carried out using a combination of Material Requirement Planning and Mixed Integer Linear Programing methods for materials produced. [2]	This research uses the method of production planning and inventory control with the MRP method as a system specifically designed for situations of bumpy demand where demand is typically dependent, which aims to ensure the availability of materials
Application of Forecasting Method (Forecasting) On Demand Roof At PT. X (Journal of Industrial Engineering ITN Malang, Anna Lusiana, Popy Yuliarty)	This research was conducted at PT. X is engaged as a distributor of building material products produced by the parent company such as H roofing products. The purpose of this study is to determine three forecasting methods that can be used based on historical data forecasting chart patterns by looking at the smallest error rate. [3]	This study uses exponential methods in forecasting and compares the method with several alphas and looks at the smallest errors to see the best forecasting.
Analysis of Raw Material Inventory Control to Streamline the Production Process in	The purpose of this research on UD Aura Kompas is to find out how much raw material is used efficiently using the EOQ	This research uses the EOQ method and performs safety stock calculations that are useful for controlling stock in

Title, Source and Author Name	Findings	Linkage to Research
Meeting Consumer Demand at UD Aura Kompos (Journal of Applied Management Research Vol.4 No.2, Putri Wijayanti and Siti Sunrowiyati)	method, and safety stock. So that it can help purchasing raw material stocks, determine the amount of safety inventory capacity to maintain obstacles in the production process and when the raw materials are needed. [4]	inventory so that there is no excess or lack of stock that can increase costs.
System Forecasting Planning Production by Method Single Exponential Smoothing at Cassava Chips Srikandi Di City Langsa (Journal of Accounting Economic Research Vol.2, No.1, Dewi Rosa Indah and Evi Rahmadani)	The purpose of this study is to forecast the sales of cassava chips in order to increase profits and avoid the advantages and disadvantages of producing cassava chips using the SES method with the parameters used using several types of alpha so that the comparison of errors and the smallest forecasting errors are taken. [5]	This study uses the Single Exponential Smoothing (SES) forecasting method and looks at errors in forecasting using Mean Absolute Deviation (MAD), Mean Squared Error (MSE), and Mean Absolute Percent Error (MAPE)
Raw Material Inventory Control by Method Material Requirements Planning (MRP) at PT. Semen Indonesia (Persero), Tbk. (Journal Knowledge Industrial Engineering, Putut Ade Irawan, Achmad Syaichu)	PT. Semen Indonesia often experiences problems in terms of determining raw materials that are not right so that MRP systems are designed. to create production and purchase orders to manage the flow of raw materials and inventory in progress until according to the production schedule for the final product. By determining the production master schedule first, then analyzed using the MRP method to determine production planning and raw needs in each component and determine the lead time. [6]	This research uses production planning and inventory control methods with MRP methods to determine the best method for raw materials
Planning and Control of Yarn Raw Material Inventory with Lot Sizing Economic Order Quantity (Journal of Industrial Engineering and Management Systems Vol. 10, No. 2, Christian Lois, Janny Rowena, Hendy Tannady)	This research was conducted at a sock product company with the aim of knowing the picture of planning and controlling the inventory of yarn raw materials and knowing how much raw materials need to be prepared and the total production costs generated by applying the Material Requirement Planning method of the production process [7]	In this study, forecasting demand and this research uses the EOQ method which is useful for controlling inventory to reduce costs so as to provide an overview of raw material inventory scheduling starting from data processing with forecasting, making scheduling plans per month, to knowing the total costs that can help smooth the production process so that the production process runs efficiently.
PRODUCTION PLANNING OF SOY SAUCE AND SAUCE PRODUCTS ON CV. FANI JAYA (Journal of EMBA Vol. 2,	The purpose of the study is to find out the production planning inside determine the quantity of products that should be produced in the company CV. Fani	This study uses a time series forecasting method that is in accordance with production patterns that are calculated from the past. By knowing this

Title, Source and Author Name	Findings	Linkage to Research
No.3, Tria S. Lengkey, Lotje Kawet, Indrie D. Palandeng)	Jaya. Forecasting is carried out to determine soy sauce production in the next few years by looking at production and sales in the previous 1 year by looking at constant data plots. So, CV. Fani Jaya can estimate how much soy sauce production can be made for next year's production. [8]	forecasting is done so that it can help the company in knowing the level of production so that it can increase profits and growth of the company itself.
DESIGNING A BREAD PRODUCTION QUANTITY PLANNING SYSTEM USING THE FUZZY MAMDANI METHOD (Journal of Mantik Penusa Vol. 20, No. 1, Murni Marbun, Hengki Tamando Sihotang, Normi Verawati Marbun)	This research is the design of a bread production amount planning system using the fuzzy Mamdani method at Judens Bakery. This bakery often experiences instability in market demand for bread production which is sometimes high and low. So, it often produces excess bread and cakes. As a result, it makes a loss. This problem needs to be solved by planning the amount of bread production based on the amount of inventory and the amount of demand using the fuzzy Mamdani method. [9]	This research is the author's reference in making software to plan the amount of bread production based on inventory data and the amount of demand, making it easier for companies to
ANALYSIS OF BUSBAR INVENTORY PLANNING AND CONTROL BASED ON MRP (MATERIAL REQUIREMENT PLANNING) SYSTEM AT PT. TIS (Jurnal PASTI, Vol. IX, No. 3, Katarina Zita Anggriana)	Planning the right inventory of Cu Busbar raw materials for blinding electrical panels is a strong reason for PT TIS to meet current market needs. In planning this raw material, 4 forecasting methods are used, namely Simple Moving Average (SMA), Weight Moving Average (WMA), Exponential Smoothing, and Linear Regreasion. So that the best forecasting method can be seen by looking at the smallest error value. The results of the comparison of the three methods resulted that the MRP Period Order Quantity method requires the most efficient cost [10]	This study uses SMA, DMA, Linear Regreasion, SES methods in forecasting and compares these methods with several alphas and looks at the smallest error to see the best forecasting and inventory control with the MRP method with the POQ approach is carried out by determining the material order period by considering the cost of ordering and material storage costs.

3. Methods
This research was conducted on small and medium enterprises in the field of fashion, research was conducted by making direct observations asking the owners of small and medium enterprises, and conducting literature studies from various sources. After that, identify and formulate problems, and determine the objectives, benefits, and limits of research. After carrying out the previous activity, it was continued by collecting data in the form of demand data and product sales data from small and medium enterprises for the last 1 year. The data was then analyzed by forecasting calculations and then continued with MPS calculations, RCCP calculations using the BOLA, CPOF, and RPA

methods, and safety stock calculations (Gozali et al. 2021; Christifan et. al. 2021; Lefta et al. 2020; Gunawan et al. 2021) . The stages of research methodology can be seen in Figure 1.
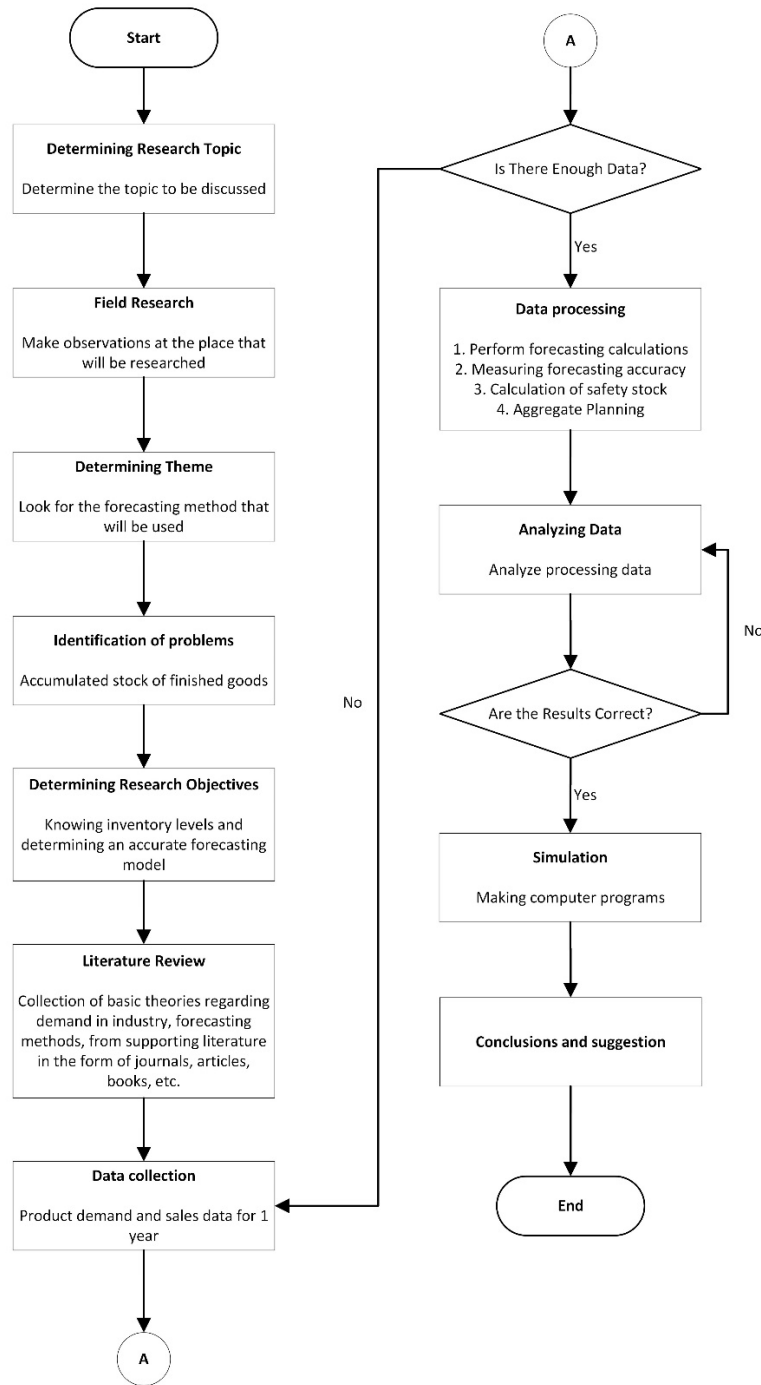

Figure 1. Research Methodology Flowchart

4. Data Collection

Based on demand and sales data that has been asked when collecting data by conducting questions or interviews with small and medium enterprise owners, a data plot is made, and it is found that the data plot contributes constantly. The data plot can be seen in Figure 2.
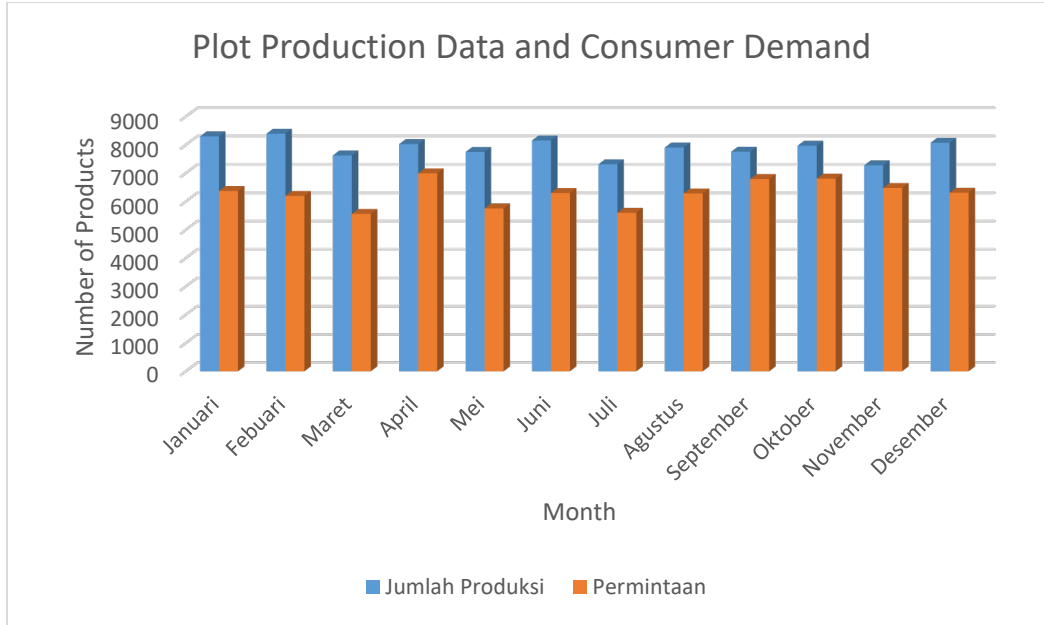
Figure 2. Plot Production and Consumer Demand Data

5. Results and Discussion

5.1 Numerical Results

This forecasting serves to plan the amount of production in the future so that there is no overproduction or underproduction. The selection of forecasting methods for product demand can be done by using calculations and observations of the behaviors of forecasting data series. Forecasting is carried out using several time series methods, namely Single Exponential Smoothing (SES), Double Exponential Smoothing (DES), and Single Moving Averages (SMA). Double Moving Averages (DMA) using POM-QM software. The use of these forecasting methods serves to find the best forecasting method by looking at and analyzing the error value of each forecasting method. The forecasting results with the smallest error are the SES method α=0.1 with MAD of 392.5, MSE of 238352.9 and MAPE of 6.4%. The results of forecasting and SES methods with α=0.1 can be seen in Table 2 and Table 3.

Table 2. SES Method Forecasting Results α=0.1

Forecast Period	SES α=0,1
1	6368
2	6351
3	6271
4	6343
5	6284
6	6285
7	6217
8	6223
9	6280
10	6332
11	6347

Forecast	SES
Period	**α=0,1**
12	6343

Table 3. SES Method forecasting error α=0.1

Error	**α=0,1**
MAD	392,5
MSE	238352,9
MAPE (%)	6,4%

After knowing the best forecasting, MPS (Master Production Schedule) calculations are carried out to determine the number of raw materials needed for 1 year. MPS raw materials for t-shirt products can be seen in Table 4.

Table 4. MPS Raw Material T-shirt Products

Month	Forecast (Pcs)	Raw Materials			
		Fabric 0.18 kg	Brand 1 Pcs	Hangtag 1 Pcs	Side Brand 1 Pcs
January	6368	1146	6368	6368	6368
February	6351	1143	6351	6351	6351
March	6271	1129	6271	6271	6271
April	6343	1142	6343	6343	6343
May	6284	1131	6284	6284	6284
June	6285	1131	6285	6285	6285
July	6217	1119	6217	6217	6217
August	6223	1120	6223	6223	6223
September	6280	1130	6280	6280	6280
October	6332	1140	6332	6332	6332
November	6347	1142	6347	6347	6347
December	6343	1142	6343	6343	6343
Total		13616	75644	75644	75644

Rought Capacity planning is carried out to determine whether the production capacity can meet the production plan that has been obtained from previous calculations. The calculation is carried out by 3 methods, namely CPOF, BOLA and RPA. The calculation of these three methods can be seen in Table 5, Table 6 and Table 7.

Table 5. RCCP CPOF method

Month	Forecast	Working Hours (Minutes)	Fabric Marking (Minutes)	Fabric Cutting (Minutes)	Clothes Tailoring (Minutes)	Brand Tailoring (Minutes)	Thread Cutting (Minutes)	Iron (Minutes)	Tag Installs (Minutes)	Finishing (Minutes)
January	6368	272550	19104	29930	130544	6368	45850	9552	15920	15283
February	6351	271823	19053	29850	130196	6351	45727	9527	15878	15242
March	6271	268399	18813	29474	128556	6271	45151	9407	15678	15050
April	6343	271480	19029	29812	130032	6343	45670	9515	15858	15223
May	6284	268955	18852	29535	128822	6284	45245	9426	15710	15082
June	6285	268998	18855	29540	128843	6285	45252	9428	15713	15084
July	6217	266088	18651	29220	127449	6217	44762	9326	15543	14921
August	6223	266344	18669	29248	127572	6223	44806	9335	15558	14935
September	6280	268784	18840	29516	128740	6280	45216	9420	15700	15072
October	6332	271010	18996	29760	129806	6332	45590	9498	15830	15197
November	6347	271652	19041	29831	130114	6347	45698	9521	15868	15233
December	6343	271480	19029	29812	130032	6343	45670	9515	15858	15223
Historical Proportion			0,0700935	0,10981308	0,47897196	0,023364486	0,168224299	0,03504673	0,05841121	0,056075
Total Hours (Minutes)		3237563	226932	355527	1550702	75644	544637	113466	189110	181546

Table 6. RCCP BOLA method

Month	Forecast	Working Hours (Minutes)	Fabric Marking (Minutes)	Fabric Cutting (Minutes)	Clothes Tailoring (Minutes)	Brand Tailoring (Minutes)	Thread Cutting (Minutes)	Iron (Minutes)	Tag Installs (Minutes)	Finishing (Minutes)
January	6368	272550,4	19104	29929,6	130544	6368	45849,6	9552	15920	15283,2
February	6351	271822,8	19053	29849,7	130195,5	6351	45727,2	9526,5	15877,5	15242,4
March	6271	268398,8	18813	29473,7	128555,5	6271	45151,2	9406,5	15677,5	15050,4
April	6343	271480,4	19029	29812,1	130031,5	6343	45669,6	9514,5	15857,5	15223,2
May	6284	268955,2	18852	29534,8	128822	6284	45244,8	9426	15710	15081,6

Month	Forecast	Working Hours (Minutes)	Fabric Marking (Minutes)	Fabric Cutting (Minutes)	Clothes Tailoring (Minutes)	Brand Tailoring (Minutes)	Thread Cutting (Minutes)	Iron (Minutes)	Tag Installs (Minutes)	Finishing (Minutes)
June	6285	268998	18855	29539,5	128842,5	6285	45252	9427,5	15712,5	15084
July	6217	266087,6	18651	29219,9	127448,5	6217	44762,4	9325,5	15542,5	14920,8
August	6223	266344,4	18669	29248,1	127571,5	6223	44805,6	9334,5	15557,5	14935,2
September	6280	268784	18840	29516	128740	6280	45216	9420	15700	15072
October	6332	271009,6	18996	29760,4	129806	6332	45590,4	9498	15830	15196,8
November	6347	271651,6	19041	29830,9	130113,5	6347	45698,4	9520,5	15867,5	15232,8
December	6343	271480,4	19029	29812,1	130031,5	6343	45669,6	9514,5	15857,5	15223,2
Total Hours (Minutes)		3237563	226932	355526,8	1550702	75644	544636,8	113466	189110	181545,6

Table 7. RCCP RPA Method

Month	Forecast	Working Hours (Minutes)	Fabric Marking (Minutes)	Fabric Cutting (Minutes)	Clothes Tailoring (Minutes)	Brand Tailoring (Minutes)	Thread Cutting (Minutes)	Iron (Minutes)	Tag Installs (Minutes)	Finishing (Minutes)
January	6368	272550,4	19104	29929,6	130544	6368	45849,6	9552	15920	15283,2
February	6351	271822,8	19053	29849,7	130195,5	6351	45727,2	9526,5	15877,5	15242,4
March	6271	268398,8	18813	29473,7	128555,5	6271	45151,2	9406,5	15677,5	15050,4
April	6343	271480,4	19029	29812,1	130031,5	6343	45669,6	9514,5	15857,5	15223,2
May	6284	268955,2	18852	29534,8	128822	6284	45244,8	9426	15710	15081,6
June	6285	268998	18855	29539,5	128842,5	6285	45252	9427,5	15712,5	15084
July	6217	266087,6	18651	29219,9	127448,5	6217	44762,4	9325,5	15542,5	14920,8
August	6223	266344,4	18669	29248,1	127571,5	6223	44805,6	9334,5	15557,5	14935,2
September	6280	268784	18840	29516	128740	6280	45216	9420	15700	15072
October	6332	271009,6	18996	29760,4	129806	6332	45590,4	9498	15830	15196,8
November	6347	271651,6	19041	29830,9	130113,5	6347	45698,4	9520,5	15867,5	15232,8

Month	Forecast	Working Hours (Minutes)	Fabric Marking (Minutes)	Fabric Cutting (Minutes)	Clothes Tailoring (Minutes)	Brand Tailoring (Minutes)	Thread Cutting (Minutes)	Iron (Minutes)	Tag Installs (Minutes)	Finishing (Minutes)
December	6343	271480,4	19029	29812,1	130031,5	6343	45669,6	9514,5	15857,5	15223,2
Total Hours (Minutes)		3237563	226932	355526,8	1550702	75644	544636,8	113466	189110	181545,6

Safety Stock is a safe supply that needs to be provided by the company determined by MRP planning to cope with fluctuations in demand. This calculation is done to avoid stock out or excess stock. The calculation of the Standard deviation can be seen in Table 8.

Table 8. Standard Deviation Calculation

Forecast	The Need for a BOM		
	0,25	1	2
6368	1592	6368	12736
6351	1587,75	6351	12702
6271	1567,75	6271	12542
6343	1585,75	6343	12686
6284	1571	6284	12568
6285	1571,25	6285	12570
6217	1554,25	6217	12434
6223	1555,75	6223	12446
6280	1570	6280	12560
6332	1583	6332	12664
6347	1586,75	6347	12694
6343	1585,75	6343	12686
St.Dev	13	51	102

After obtaining the standard deviation calculation, the safety stock calculation is carried out. The calculation of the safety stock itself can be seen in Table 9

Table 9. Safety Stock Calculation

Raw Materials	Lead Time/Day	Lead Time/Month	Service Factor 90%	Average Demand	Safety Stock
Fabric (kg)	5	0,17	1,28	1135	7
Brand (Pcs)	4	0,13	1,28	6304	24
Hangtag (Pcs)	4	0,13	1,28	6304	24
Side Brand (Pcs)	4	0,13	1,28	6304	24

5.2 Proposed Improvements

MRP is a technique used to plan and control production. In this MRP, three methods are used, namely EOQ (Economic Order Quantity), POQ (Periodic Order Quantity), and LFL (Lot for Lot). Based on the calculation results of the three methods, the best method is the POQ method because it has the smallest total cost. The results of MRP calculation using the POQ method can be seen in Table 10.

Table 10. Calculation of Total MRP Cost with POQ

Raw Materials	Cost of Raw Materials with POQ
Cotton Fabric	IDR 5,495,125
Brand	IDR 746,135
Hangtag	IDR 799,495
Side Brands	IDR 745,100
Total Cost	IDR 7,785,855
Efficiency	43%

6. Conclusion

This research focuses on T-shirt production companies. From the results of the analysis conducted, the best forecasting was the SES (Single Exponential Smoothing) method with α=0.1 with MAPE of 6.4%, MSE of 2338352.9, MAD of 392.5. Then to avoid stock out or excess stock obtained for safety stock for cotton fabric of 7 kg, brand of 24 pcs, hangtag of 24 pcs and side brand of 24 pcs. Based on the results of the analysis of MRP scheduling calculations with the three methods, the selected and most appropriate method is the POQ method with a total cost of Rp. 7,785,855.

References

Myra, B. S. and Catur S., Perencanaan Produksi dan Pengendalian Persediaan pada Perusahaan Manufaktur, Jurnal Riset Akuntansi dan Perpajakan, vol. 8, no. 01, pp. 14-27, 2021.

Zhagi, A., Agustina, F. and Priatna, B. A., Perencanaan Produksi dan Pengendalian pada Kombinasi Metode MRP dan MILP, *Jurnal EurekaMatika,* vol. 8, no. 01, pp. 56-69, 2020.

Lusiana, A. and Yuliarty, P., PENERAPAN METODE PERAMALAN (FORECASTING) PADA PERMINTAAN ATAP di PT X, *Jurnal Teknik Industri Malang,* pp. 11-20, 2020.

Wijayanti, P. and Sunrowiyati, S., Analisis Pengendalian Persediaan Bahan Baku guna Memperlancar Proses Produksi dalam Memenuhi Permintaan Konsumen pada UD Aura Kompos, *Jurnal Penelitian Manajemen Terapan,* vol. 4, pp. 179-190, 2019.

Indah, D. R. and Rahmadani, E., Sistem Forecasting Perencanaan Produksi dengan Metode Single Eksponensial Smoothing pada Keripik Singkong Srikandi Di Kota Langsa, *JURNAL PENELITIAN EKONOMI AKUNTANSI,* vol. 2, pp. 10-18, 2018.

Irawan, P. A. and Syaichu, A., PENGENDALIAN PERSEDIAAN BAHAN BAKU DENGAN METODEMATERIAL REQUIREMENT PLANNING (MRP) PADA PT. SEMEN INDONESIA (PERSERO),Tbk, *Journal Knowledge Industrial Engineering,* pp. 15-22, 2016.

Lois, C., Rowena, J. and Tannady, H., Perencanaan dan Pengendalian Persediaan Bahan Baku Benang dengan Lot Sizing Economic Order Quantity, *Journal of Industrial Engineering and Management Systems,* vol. 10, pp. 111-118, 2017.

Lengkey, T. and Palandeng, I., PERENCANAAN PRODUKSI PRODUK KECAP DAN SAOS PADA CV. FANI JAYA, *Jurnal EMBA,* vol. 2, pp. 1614-1621, 2014.

Marbun, M., Sihotang, H. T. and Marbun, V. N., PERANCANGAN SISTEM PERENCANAAN JUMLAH PRODUKSI ROTI, *Jurnal Mantik Penusa,* vol. 20, pp. 48-54, 2016.

Anggriana, K. Z., ANALISIS PERENCANAAN DAN PENGENDALIAN PERSEDIAAN BUSBAR BERDASARKAN SISTEM MRP (MATERIAL REQUIREMENT PLANNING) DI PT. TIS, *Jurnal PASTI,* vol. 9, pp. 320-337, 2015.

Gozali, L., Daywin, F. J., and Wijaya, A. T., Production Planning and Control in Furniture Company at PT. Lion Metal Works. In *IOP Conference Series: Materials Science and Engineering IOP Publishing*, 2021

Christifan, A. J., Gozali, L., Widodo, L., Daywin, F. J., and Doaly, C. O., Production Planning and Inventory Control Using Artificial Neural Network Forecasting for Furniture Industry 4.0 Custom Production. In *Proceedings of the 11th Annual International Conference on Industrial Engineering and Operations Management*, pp. 2636-2649, 2021

Lefta, F., Gozali, L., and Marie, I. A., Comparison Study Among Production Planning Research in Some Papers and Industries in Indonesia. In *IOP Conference Series: Materials Science and Engineering*, Vol. 852, No. 1, p. 012096. IOP Publishing. July, 2020

Gunawan, P. A., Gozali, L., Widodo, L., Daywin, F. J., and Doaly, C. O., Production planning and capacity control with demand forecasting using artificial neural network (Case study PT. Dynaplast) for industry 4.0.

In *Proceedings of the 11th Annual International Conference on Industrial Engineering and Operations Management*, pp. 2722-2732, 2021.

Biographies

Christian is a final year student in Industrial Engineering, Faculty of Engineering at Tarumanagara University, Jakarta, Indonesia. He is a student who is active in several campus activities such as being a coordinator in several events. Now he is doing his thesis which takes the theme of production planning and inventory.

Lina Gozali is a lecturer in the Industrial Engineering Department at Universitas Tarumangara since 2006 and a freelance lecturer at Universitas Trisakti since 1995. She got her Bachelor's degree at Trisakti University, Jakarta - Indonesia, then she graduated Master's Degree at STIE IBII, Jakarta – Indonesia, and graduated with her Ph.D. at Universiti Teknologi Malaysia, Kuala Lumpur – Malaysia in 2018. Her apprentice college experience was in paper at Kertas Bekasi Teguh, shoe at PT Jaya Harapan Barutama, automotive chain drive industry at Federal Superior Chain Manufacturing. She teaches Production System and Supply Chain Management Subjects and her Ph.D. research about Indonesian Business Incubator. She actively writes for almost 40 publications since 2008 in the Industrial Engineering research sector, such as Production Scheduling, Plant Lay Out, Maintenance, Line Balancing, Supply Chain Management, Production Planning, and Inventory Control. She had been worked at PT. Astra Otoparts Tbk as International.

Lamto Widodo is a lecturer at Tarumanagara University Jakarta since 1994, joining the Mechanical Engineering Department.; he is involved as a team for the Industrial Engineering Department opening in 2004-2005. He was starting in 2005 as a lecturer in the Industrial Engineering Department. Obtained a Bachelor's degree at the Sepuluh Nopember Institute of Technology Surabaya (ITS), then completed a Master's degree at the University of Indonesia (UI) and graduated with the title Dr. at the Bogor Agricultural Institute (IPB). He is engaged in research and publication in Product Design and Ergonomics, Production Systems, and Engineering Economics and teaches at many universities in Jakarta. He has published nearly 30 publications in the field of Industrial Engineering research both nationally and internationally. Active in various professional organizations, especially in the field of Ergonomics (IEA), and active in the organization of the Indonesian Industrial Engineering Higher Education Cooperation Agency (BKSTI).