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Integrated Production Planning for Shoulder Leader Pin at PT XYZ

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Abstract

Accurate production planning plays a critical role in balancing market demand and a company's production capacity. PT XYZ, a manufacturing company producing industrial spare parts, faces production planning issues for its shoulder leader pin product due to the absence of a structured demand forecasting system. This study aims to develop an integrated production planning framework by applying demand forecasting, Master Production Schedule (MPS), Rough-Cut Capacity Planning (RCCP), and Material Requirement Planning (MRP). One year of historical demand data was analyzed using the Double Moving Average (DMA) and Double Exponential Smoothing (DES) methods of Brown. Forecasting accuracy was evaluated using Mean Absolute Percentage Error (MAPE), with the DMA method achieving a lower MAPE of 3.10%, indicating better accuracy than DES Brown. The selected forecasting results were used as input for the development of the MPS. RCCP analysis demonstrated that the available production capacity at all workstations was sufficient to meet the planned production requirements throughout the planning horizon, without requiring additional capacity. Furthermore, MRP was conducted to determine the quantity and timing of raw material procurement for SUJ2 steel with a one-period lead time. The MRP results indicate that material requirements can be fulfilled precisely in each period without excess inventory. Overall, the implementation of an integrated production planning system enables PT XYZ to improve planning accuracy, align production capacity with demand, and enhance operational efficiency.

1. INTRODUCTION

Production planning and control play an important role in maintaining the balance between customer demand and a company's production capacity. Inaccurate production planning may lead to various operational problems, such as a mismatch between available capacity and production requirements, increased operational costs, and inefficient utilization of company resources. PT XYZ is a manufacturing company engaged in the production of industrial spare parts and is located in the Cikarang industrial area. One product manufactured by the company is the shoulder leader pin, which is the most frequently ordered product compared to other products at PT XYZ. The high demand for this product requires the company to have an effective production planning system to ensure that customer requirements can be fulfilled in a timely and efficient manner.

However, PT XYZ has not yet implemented a systematic demand forecasting process. Production requirements are still determined solely based on actual customer orders without being supported by structured and measurable forecasting methods. This condition causes the company to operate in a reactive manner toward demand fluctuations, resulting in suboptimal production planning. The absence of clear demand forecasting impacts the accuracy of production planning. Consequently, mismatches between available production capacity and customer demand frequently occur. In certain periods, the company experiences excess production capacity, leading to idle capacity conditions characterized by

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underutilized labor. Conversely, during periods of high demand, the company may face capacity shortages that can hinder the timely fulfillment of customer orders.

These issues indicate that PT XYZ requires an integrated and data-driven production planning system. The implementation of demand forecasting methods is necessary to estimate future production requirements for shoulder leader pins more accurately. The forecasting results can be used as the basis for developing the Master Production Schedule (MPS), followed by an evaluation of capacity adequacy using Rough-Cut Capacity Planning (RCCP) to determine whether the available production capacity is sufficient. Furthermore, Material Requirement Planning (MRP) is needed to determine the appropriate quantity and timing of material procurement in accordance with production requirements.

The Double Moving Average (DMA) is one of the moving average methods that applies the single moving average twice, incorporating adjustments between the single moving average and the double moving average as well as trend correction. Since the moving average procedure is performed twice, it is referred to as a double moving average (Sarumaha, 2021). DMA is a forecasting method based on time series data, which is solved by sequentially calculating the average of several time series values (C. V. Hudiyanti, F. A. Bachtiar, and B. D. Setiawan, n.d.). The Double Moving Average is denoted as MA (M×N), where M and N represent the periods of the moving average DMA constructs a new time series by sequentially averaging values from another time series. This method is commonly applied when the data are non-stationary and exhibit a trend pattern, in which case a moving average is applied to the results of the Single Moving Average (SMA) (Yuliana *et al*., 2025). The DMA method generates forecasts that can serve as a reference for faster and more responsive decision-making in addressing operational issues (Putri *et al*., 2024).

Double Exponential Smoothing (DES) is a forecasting method that applies a smoothing process to previous values relative to the actual data, resulting in future demand forecasts (Suprayogi & Umum, 2022). Brown's double exponential smoothing method follows predefined steps and mathematical formulations (Manullang *et al*., 2023). This single-parameter DES method by Brown is derived from the Single Exponential Smoothing equation (Kamal *et al*., 2024). Brown's DES is a linear model that is particularly suitable for forecasting data with an increasing trend. One of its advantages is its ability to model trends using relatively limited data. However, a limitation of this method is the requirement to determine the optimal smoothing parameter (α), which may require a relatively long time to obtain (Medya *et al*., 2022).

The planning stage involves estimating the technical tasks to be performed, identifying potential risks, determining the required resources for system development, defining the expected work products, scheduling activities, and tracking the progress of system implementation (Puspa & Darmiyati, 2023). Rough-Cut Capacity Planning (RCCP) is used to determine whether the planned resources are sufficient to execute the Master Production Schedule (MPS). RCCP is more detailed than Resource Requirements Planning (RRP) because it calculate the workload for all scheduled items within actual time periods (Schedule *et al*., 2024).

RCCP represents the second level in the priority–capacity planning hierarchy and plays an important role in developing the MPS (Supriyadi & Riskiyadi, 2016). RCCP is a process for analyzing and evaluating the capacity of available production facilities on the shop floor to ensure that they can support the proposed master production schedule (Zainal *et al*., 2024). As a second-level capacity planning hierarchy, the RCCP serves as a validation tool for the

MPS, which also occupies the second level in the production priority planning hierarchy (Septian *et al*., n.d.).

The Master Production Schedule (MPS) is used to determine the schedule of each product to be produced, including when the product is required and how much is needed (Setiabudi *et al*., 2018). The MPS method is essential for deciding when to produce and effectively scheduling production activities. It provides accurate timing and strategic resource allocation, aligning production with customer demand while maintaining operational flexibility (Kapasitas *et al*., 2022). MPS represents a statement of a company's final products in production planning, specifying output quantities and time periods (Liliyen *et al*., n.d.). It defines the final products of an industry within the production planning process, generating outputs in specified quantities and time horizons. The master production schedule decomposes and executes the production plan accordingly (Mutmainah, 2022). In order to effectively apply the MPS method, production planning problems must be formulated so that available capacity (supply) can be expressed in the same units as production requirements (demand) (Komara *et al*., n.d.).

Material Requirements Planning (MRP) is a method used to determine what materials and components are needed, in what quantities, and at what time, to fulfill production planning requirements. Detailed material planning is carried out through MRP by integrating activities that influence coordination within a company (Permadani *et al*., 2020). One approach to ensuring the availability of components required for production planning is the implementation of Material Requirements Planning (MRP). In production scheduling, the MRP also determines ordering schedules, production schedules, expiration dates, and the development of the Bill of Materials (BOM) (Nusantara *et al*., 2023).

By integrating demand forecasting, MPS, RCCP, and MRP, it is expected that PT XYZ will be able to align production requirements with available capacity, reduce idle labor conditions, and improve the overall efficiency and effectiveness of the company's production system.

2. METHODS

This research methodology is designed to develop a systematic and integrated production planning process for shoulder leader pin at PT XYZ. The production planning process is conducted through three main stages: demand forecasting, production planning and capacity evaluation (MPS and RCCP), and material requirement planning (MRP). The research flowcharts are presented in Figures 2 to 4. This study uses primary and secondary data obtained from PT XYZ. Primary data were collected through direct observation of the production process and interviews with production supervisors and operators. Secondary data were obtained from company records related to demand, production, capacity, inventory, and material procurement.

The data required in this study include historical demand data for the shoulder leader pin product, production process sequence, Bill of Materials (BOM), standard processing time at each production process, number of workers, working days, working hours, material lead time, initial inventory, scheduled receipts, and ordering policy. Historical demand data are used as the input for forecasting analysis. Production process sequence, standard time, number of workers, working days, and working hours are used for MPS, RCCP, and CRP calculations. Meanwhile, BOM, lead time, inventory data, and scheduled receipts are used as inputs for MRP calculation.

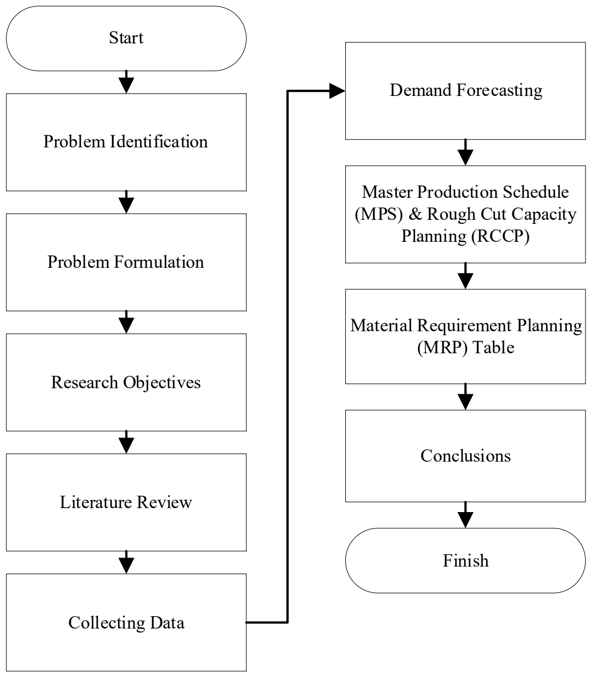

Figure 1.
Research Flowchart

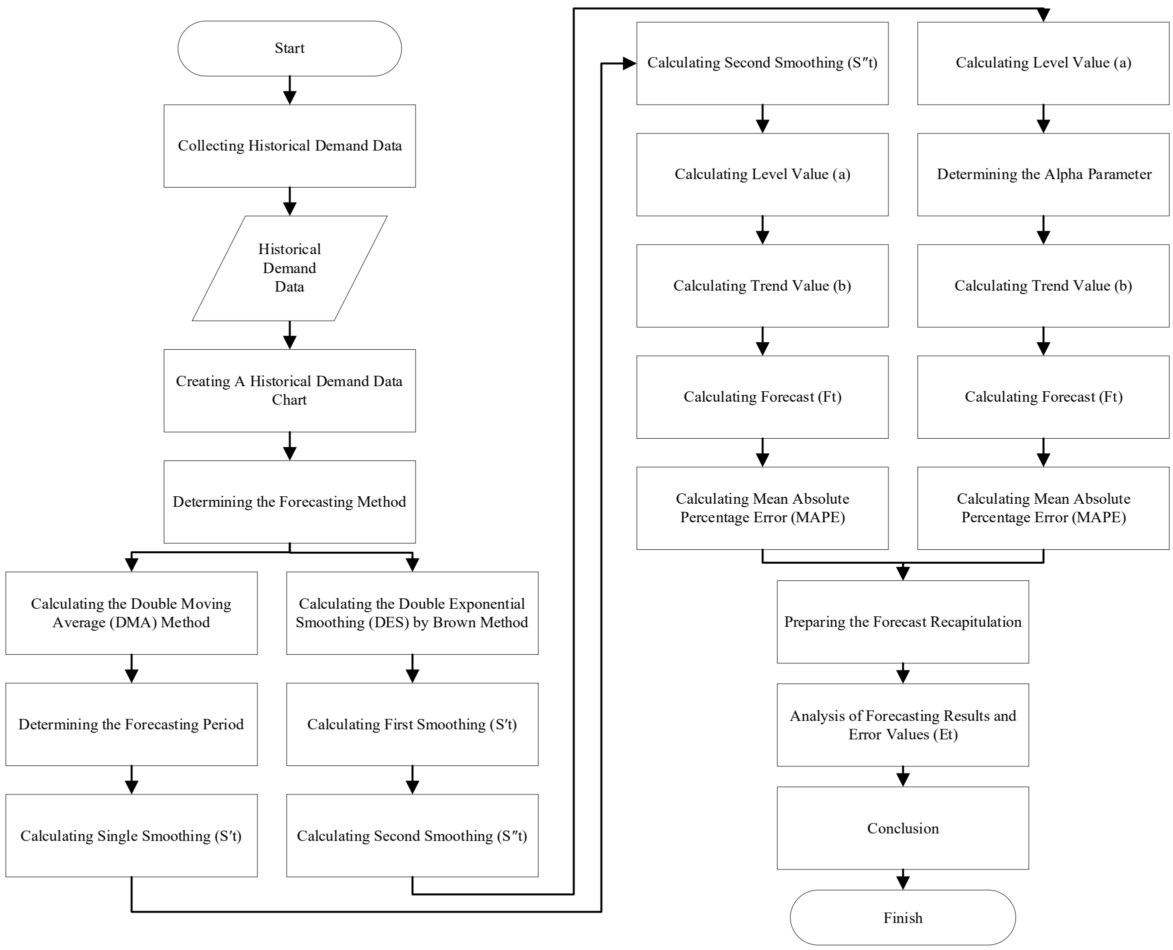

Figure 2.
Flowchart Forecasting

The forecasting methods used in this study are Double Moving Average (DMA) and Double Exponential Smoothing (DES) Brown. These methods were selected because the historical demand data for shoulder leader pins show a fluctuating pattern with no strong seasonal pattern. DMA is suitable for short-term forecasting because it smooths demand fluctuations through repeated moving average calculations. This method is also useful when demand data are relatively stable but still contain minor variations between periods. Meanwhile, DES Brown is selected as a comparison method because it can capture trend components in time-series data using a smoothing parameter. By comparing DMA and DES Brown, the study can determine the most accurate forecasting method based on the lowest Mean Absolute Percentage Error (MAPE).

2.1 Step 1: Demand Forecasting

2.1.1 Double Moving Average

Forecasting using the Double Moving Average (DMA) method is carried out through two stages of moving average calculations or two smoothing processes of data every 3 months. The first smoothing process (S't) is performed starting from the first data point (X1) to the sixth data point (X3) using the following formula: (Sarumaha, 2021), (C. V. Hudiyanti, F. A. Bachtiar, and B. D. Setiawan, n.d.).

1. S'_t (*single smoothing*)

$$S'_t = \frac{X_t + X_{t-1} + X_{t-2} + X_{t-N+1}}{t} \quad (1)$$

2. $S"_t$ (*double smoothing*)

$$S''_t = \frac{S'_t + S'_{t-1} + S'_{t-2} + S'_{t-N+1}}{t} \quad (2)$$

3. a_t = Level value

$$a_t = 2S'_t - S''_t \quad (3)$$

4. b_t = Tren Value

$$b_t = \frac{2}{N-1}\left(S'_t - S''_t\right) \quad (4)$$

5. F_t = Forecast

$$F_t = a_t + (b_t . m) \quad (5)$$

6. *Mean Absolute Percentage Error* (MAPE) = Error Value

$$MAPE = \frac{\Sigma\left|\frac{(X_t - F_t)}{X_t}\right| \times 100}{N} \quad (6)$$

Formulas (5) and (6) are generic and applicable to all forecasting methods.

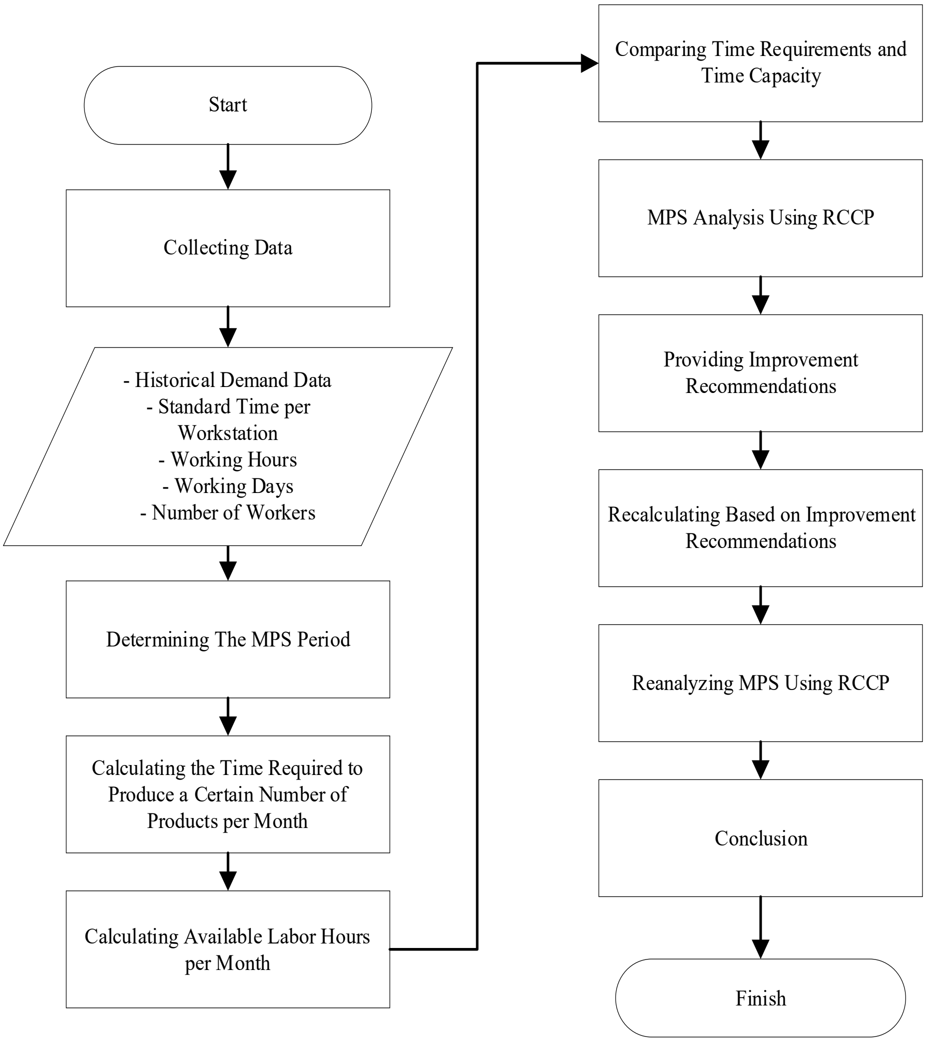

Figure 2.
Flowchart MPS & RCCP

Table 1.
Production Process Sequence

No.	Process	Description
1	Cutting Process	Cutting the SUJ2 steel material according to the required size
2	Turning Process	Shaping the material using a lathe machine
3	Grinding Process	Improving the dimensional accuracy and surface finish
4	Finishing and Inspection Process	Final checking and quality inspection

2.2. Step 2: Master Production Schedule (MPS) & Rough Cut Capacity Planning (RCCP)

$$Forecast\ at\ periode\ t \times Standard\ Time \quad (7)$$

Available production capacity

$$Number\ of\ workers \times Working\ Days \times Working\ Hour \quad (8)$$

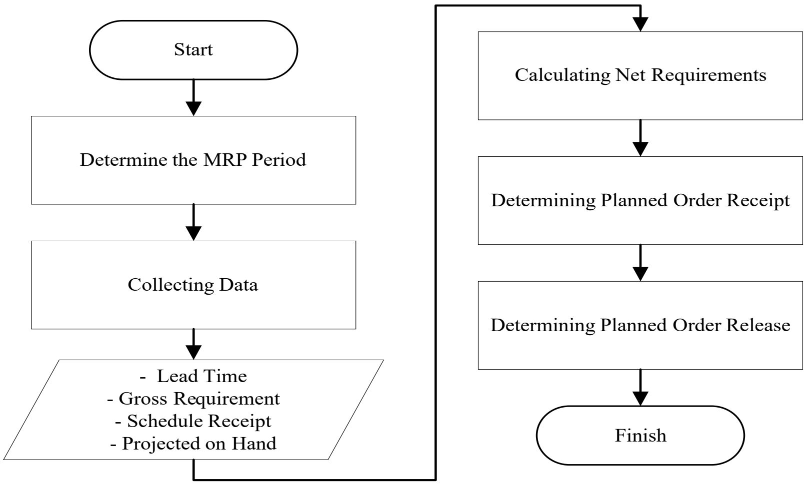

Figure 3.
Flowchart Material Requirement Planning (MRP)

2.3 Material Requirement Planning (MRP)

Projected on Hand = (Projected on Hand for The Previous Period + Scheduled Receipts + Planned Order Receipts) – (Gross Requirements) .... (9)

Net Requirement = (Gross Requirement + Safety Stock)-(Scheduled Receipts + Projected on Hand for The Previous Period) .... (10) (Permadani *et al*., 2020) (Nusantara *et al*., 2023).

3. RESULTS AND DISCUSSION

3.1 Step 1: Demand Forecasting

Demand forecasting at PT MTI was conducted using one year of historical demand data for the research object, namely, the shoulder leader pin product. The demand for this product ranges from 25 to 28 units. Based on the data mapping results, it can be observed that the product demand exhibits a fluctuating pattern and does not show a strong trend, as illustrated in Figure 8. Table 1 presents the historical demand data for shoulder leader pin products from October 2024 to October 2025. These data are used as the basis for identifying demand patterns and conducting forecasting analysis using the DMA and DES Brown methods.

Table 2.
Historical Demand Data

Periode	Demand (pcs)
October ‘24	26
November	27
December	26
January ‘25	27
February	28
March	28
April	27
May	28
June	27
July	26
August	27
September	26
October	25

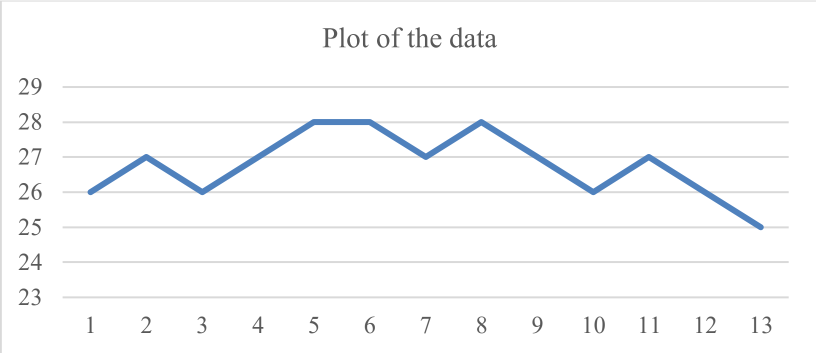

Figure 4.
Plot of the Historical Demand Data

The results of the forecasting accuracy evaluation using the Mean Absolute Percentage Error (MAPE), as presented in Table 2, show that the Double Moving Average (DMA) method produces a MAPE value of 3.10%, whereas the double exponential smoothing (DES) Brown method results in a MAPE value of 3.29%. A smaller MAPE value indicates a lower forecasting error; therefore, the DMA method demonstrates better accuracy than the DES Brown method. Consequently, the DMA method was selected as the best forecasting method in this study. The selection of the DMA method is based on its ability to produce the lowest forecasting error and its suitability for handling fluctuating data without a strong trend, resulting in forecasting outcomes that are closer to the actual data.

Based on Figure 5, the historical demand pattern for shoulder leader pins shows relatively stable fluctuations within the range of 25–28 units per period. The demand does not show an extreme increase or decrease and does not indicate a strong seasonal pattern. This condition shows that the demand pattern is relatively stable with minor fluctuations. Therefore, the DMA and DES Brown methods are considered appropriate for forecasting because both methods can be applied to time-series data with fluctuating patterns and moderate trends.

Table 3.
Summary of MAPE values from the forecasting results

Forecast	DMA	DES by Brown
November'25	25,40	26,32
December	25,13	26,32
January '26	24,87	26,33
February	24,60	26,33
March	24,33	26,33
MAPE	3,10	3,29

3.2. Step 2: Master Production Schedule (MPS) & Rough Cut Capacity Planning (RCCP)

The selected forecasting results are used as the main input in the development of the Master Production Schedule (MPS), which functions to determine the quantity and timing of final product production in detail according to market requirements. After the MPS is established, an evaluation of production capacity capability is required. At this stage, Rough-Cut Capacity Planning (RCCP) is applied to examine the consistency between the production plan and available resource capacity. RCCP is conducted by comparing the capacity requirements derived from the MPS with the actual capacity owned by the company.

In the implementation of MPS and RCCP, several key data inputs are required, including demand forecasting results, standard processing times expressed in seconds, the number of workers, the number of working days, and the available working hours, as presented in Tables 2 (DMA) and 3. These data are used to calculate the required and available production capacity, thereby determining whether the production plan can be fulfilled or whether adjustments are necessary.

Table 4.
Primary Data for the RCCP

Production Flow	Production Time		Labor	Working Days	Working Hours
Cutting Process	0,007	Hour	2	22	8
Turning Process	0,004	Hour	1	22	8
Grinding Process	0,007	Hour	2	22	8
Finishing and Inspection Process	0,005	Hour	2	22	8

The Rough-Cut Capacity Planning (RCCP) calculation is presented in Table 4, which illustrates the comparison between the required production capacity to meet the forecasted demand shown in Table 2 (DMA) and the currently available production capacity. Based on the calculation results, the existing capacity is sufficient to meet the production requirements. Therefore, the capacity is categorized as sufficient, and no adjustments or additional production capacity are required.

Table 5.
Rough Cut Capacity Planning (RCCP) November 2025-March 2026

RCCP-Capacity Requirements vs. Available Capacity (November)				
Process	Time/Unit (hours)	Total time required (hours)	Available Labor Hours (hours)	Description
Cutting Process	0,007	0,18	352	Sufficient
Turning Process	0,004	0,09	176	Sufficient
Grinding Process	0,007	0,17	352	Sufficient
Finishing and Inspection Process	0,005	0,13	352	Sufficient
RCCP-Capacity Requirements vs. Available Capacity (December)				
Process	Time/Unit (hours)	Total time required (hours)	Available Labor Hours (hours)	Description
Cutting Process	0,007	0,17	352	Sufficient
Turning Process	0,004	0,09	176	Sufficient
Grinding Process	0,007	0,17	352	Sufficient
Finishing and Inspection Process	0,005	0,13	352	Sufficient
RCCP-Capacity Requirements vs. Available Capacity (January 26)				
Process	Time/Unit (hours)	Total time required (hours)	Available Labor Hours (hours)	Description
Cutting Process	0,007	0,17	352	Sufficient
Turning Process	0,004	0,09	176	Sufficient
Grinding Process	0,007	0,17	352	Sufficient
Finishing and Inspection Process	0,005	0,13	352	Sufficient

Tabel 5 . (Lanjutan)
Rough Cut Capacity Planning (RCCP) November 2025-March 2026

RCCP-Capacity Requirements vs. Available Capacity (February 26)				
Process	Time/Unit (hours)	Total time required (hours)	Available Labor Hours (hours)	Descriptio n
Cutting Process	0,007	0,17	352	Sufficient
Turning Process	0,004	0,09	176	Sufficient
Grinding Process	0,007	0,16	352	Sufficient
Finishing and Inspection Process	0,005	0,13	352	Sufficient
RCCP-Capacity Requirements vs. Available Capacity (March)				
Process	Time/Unit (hours)	Total time required (hours)	Available Labor Hours (hours)	Descriptio n
Cutting Process	0,007	0,17	352	Sufficient
Turning Process	0,004	0,09	176	Sufficient
Grinding Process	0,007	0,16	352	Sufficient
Finishing and Inspection Process	0,005	0,13	352	Sufficient

3.3 Step 3: Material Requirement Planning

After demand forecasting is conducted and the production plan is developed through the Master Production Schedule (MPS) and validated using Rough-Cut Capacity Planning (RCCP), the next stage in production planning is the development of Material Requirement Planning (MRP). MRP functions as a material planning system aimed at ensuring the availability of raw materials and production components in the appropriate quantities and at the right time.

3.4 Bill of Materials

The Bill of Materials (BOM) is used as the main input for Material Requirement Planning (MRP). In this study, the shoulder leader pin product consists of one main raw material, namely, SUJ2 steel. The BOM structure is shown in the following table.

Table 6.
Bill of Materials (BOM)

Level	Parent Item	Component	Quantity
0	Shoulder Leader Pin	Finished Product	1 unit
1	Shoulder Leader Pin	SUJ2 Steel	1 unit

Based on the BOM structure, each unit of shoulder leader pin requires one unit of SUJ2 steel as the main raw material. Therefore, the raw material requirement is directly proportional to the planned production quantity generated from the Master Production Schedule (MPS).

MRP is developed based on the MPS that has been confirmed to be feasible in terms of capacity through RCCP. Therefore, the MRP calculation is more realistic, as the production plan has already considered resource capacity constraints. MRP uses information on product structure, lead time, and available inventory to determine material requirements and ordering schedules for each production period. The supplementary data needed for preparing the MRP table are listed in Table 5.

Table 7.
Supporting Data for the MRP

Data	Description
Material	Baja SUJ2
Lead time	1 Month
Projected on hand	None
Production System	Job order
Ordering Method	Materials are ordered according to the needs of each period.

Table 6 presents the results of the Material Requirement Planning calculation with a lead time of one period. The planning is conducted for the next five periods based on the established production requirements. The Gross Requirement indicates the quantity of material required in each period, which is 25 units in periods 1 and 2, and 24 units in periods 3 through 5. The scheduled receipt has no value because there are no material orders currently in process or scheduled to be received during the planning horizon. In the Projected On-Hand row, the initial inventory is set to zero, and no remaining inventory is observed in any period, indicating that all available materials are directly used to meet production requirements.

Since there is no initial inventory and no scheduled receipts, the Net Requirement in each period is equal to the Gross Requirement. The Gross Requirement and Net Requirement are calculated using Equations (9) and (10), respectively. Based on these net requirements, the Planned Order Receipt is determined, representing the quantity of material planned to be received in each period to satisfy production needs. Given that the material lead time is one period, the Planned Order Release is scheduled one period earlier than the planned order receipt. Therefore, material orders are placed in the preceding period, including a past-due order to meet the requirements of the first period.

From a managerial perspective, the implementation of integrated production planning provides several benefits for PT XYZ. Forecasting results help the company estimate future demand more accurately, allowing management to prepare production schedules before actual orders occur. This can reduce reactive decision-making and minimize sudden changes in production activities.

The MPS provides a clear production schedule regarding how many shoulder leader pin products should be produced in each planning period. RCCP helps management evaluate whether the available production capacity is sufficient to meet the planned production schedule. If capacity shortages occur, management can consider alternatives, such as overtime, additional labor, subcontracting, or rescheduling production. However, the results show that the available capacity is sufficient, so additional capacity is not required.

MRP supports the purchasing department in determining the quantity and timing of SUJ2 steel procurement. This helps prevent material shortages and excessive inventory. Furthermore, CRP validates whether the planned production orders from MRP can be supported by the available detailed capacity. Therefore, the integration of forecasting, MPS, RCCP, MRP, and CRP can improve coordination between production planning, purchasing, and production departments.

Table 8.
Material Requirement Planning (MRP)

Lead time = 1	Period					
-	*Past Due*	1	2	3	4	5
Gross Requirement	-	25	25	24	24	24
Schedule Receipt	-	-	-	-	-	-
Projected on the Hand	0	0	0	0	0	0
Net requirement	-	25	25	24	24	24
Planned order receipts	-	25	25	24	24	24
Planned Order Release	25	25	24	24	24	-

Based on the BOM structure, one unit of shoulder leader pin requires one unit of SUJ2 steel. Therefore, the gross requirement for SUJ2 steel is directly derived from the MPS quantity of shoulder leader pin. Since there is no initial inventory and no scheduled receipt, the net requirement is equal to the gross requirement in each period.

Table 9.
MRP Detail

Component	**Period 1**	**Period 2**	**Period 3**	**Period 4**	**Period 5**
Shoulder Leader Pin demand	25	25	24	24	24
SUJ2 Steel requirement	25	25	24	24	24
Initial inventory	0	0	0	0	0
Scheduled receipt	0	0	0	0	0
Net requirement	25	25	24	24	24
Planned order receipt	25	25	24	24	24
Planned order release	25	25	24	24	24

The planned order release is scheduled one period earlier than the planned order receipt because the lead time of SUJ2 steel is one period. This means that material orders must be released before the period in which the material is required.

Table 10.
CRP

Process	**Standard time (hours/unit)**	**Maximum planned order**	**Required capacity (hours)**	**Available capacity (hours)**	**Description**
Cutting Process	0.007	25	0.175	352	Sufficient
Turning Process	0.004	25	0.100	176	Sufficient
Grinding Process	0.007	25	0.175	352	Sufficient
Finishing and Inspection Process	0.005	25	0.125	352	Sufficient

The CRP results show that all production processes have sufficient available capacity. The highest required capacity occurs in the cutting and grinding processes, with 0.175 hours, while the available capacity reaches 352 hours. This indicates that the planned production orders can be completed using the existing production resources. Therefore, the MRP plan is feasible from a capacity perspective.

3.5 Capacity Requirement Planning (CRP)

Capacity Requirement Planning (CRP) is conducted to validate whether the planned production orders generated from the MRP system can be supported by the available production capacity. CRP uses planned order release data, standard processing time, number of workers, working days, and working hours as input.

The CRP calculation compares the required capacity for each production process with the available capacity. The required capacity is obtained by multiplying the planned order quantity by the standard processing time for each process. Meanwhile, the available capacity is calculated based on the number of workers, working days, and working hours.

Based on the CRP analysis, the required capacity for each process is lower than the available production capacity. This indicates that the production plan generated from the MRP system is feasible to be implemented. Therefore, PT XYZ does not need additional workers, overtime, or machine capacity during the planning horizon.

4. CONCLUSION

Based on the results of this study, it can be concluded that the Double Moving Average (DMA) method provides the best forecasting performance for the shoulder leader pin product at PT XYZ, with a Mean Absolute Percentage Error (MAPE) of 3.10%, which is lower than the 3.29% obtained using the Double Exponential Smoothing (DES) Brown method. The selected forecasting results indicate an average production requirement of approximately 24–25 units per period for the planning horizon from November 2025 to March 2026.

The forecasting results were used as the basis for developing the Master Production Schedule (MPS) and were subsequently evaluated using Rough-Cut Capacity Planning (RCCP). The RCCP analysis shows that the available production capacity in each production process, namely, cutting, turning, grinding, and finishing & inspection, is sufficient to meet the required production capacity. Therefore, no additional production capacity is required.

The Bill of Materials shows that one shoulder leader pin unit requires one unit of SUJ2 steel. Based on the MRP calculation, the raw material requirements are 25 units for periods 1–2 and 24 units for periods 3–5. Since there is no initial inventory or scheduled receipt, all material requirements are fulfilled through planned order releases. Furthermore, the CRP analysis confirms that the planned production orders generated from the MRP system are feasible because the available production capacity is higher than the required capacity. Overall, the integrated production planning approach can improve planning accuracy, support material availability, align production capacity with demand, and enhance operational efficiency at PT XYZ.

5. REFERENCE

1. Hudiyanti, C.V., Bachtiar, F.A & Setiawan, B.D. 2019. Perbandingan double moving average dan double exponential smoothing untuk peramalan jumlah kedatangan wisatawan mancanegara di bandara Ngurah Rai. *Jurnal Pengembangan Teknologi Informasi dan Ilmu Komputer*, 3(3), 2667–2672.

2. Kamal, M.A., Shihab, M.U., Hidayat, A., Effendi, U. 2024. Rough cut capacity planning produk refined carrageenan. *Journal of Industrial View*, 6(2), 1–16.
3. Komara, M.A., Yusuf, R.A., Salim, A.Y., Wahyuni, R.S & Heryana, G. 2023. Rancang bangun sistem PPIC (Production Planning and Inventory Control) CV. Dea Ayu Lestari. *Journal of Applied Mechanical Technology*. 2 (1),42–50.
4. Liliyen, D., Hernawati, T., Harahap, B. 2020. perencanaan kapasitas produksi teh hitam menggunakan metode Rough Cut Capacity Planning di PT. Perkebunan Nusantara IV Unit Kebun Tobasari. *Buletin Utama Teknik*, 15(3), 249–254.
5. Manullang, S., Mansyur, A. 2023. Peramalan penjualan beras di perum bulog sub divre medan menggunakan metode double Exponential Smoothing. *Jurnal Riset Rumpun Matematika dan Ilmu Pengetahuan Alam*. 2(1), 26–36.
6. Medya, N., Kamila, I. 2022. Metode double Exponential Smoothing dalam peramalan. *Jurnal Statistika dan Komputasi*. 2(1), 23–31.
7. Mutmainah, N.H. 2022. Perencanaan kapasitas percetakan Ethica Group menggunakan metode Rough Cut Capacity Planning. *Jurnal Rekavasi*. 10(1), 1–8.
8. Nusantara, P.D., Zuli, F., Kurniawan, T.A., Kusumawati, K., Nauli, S.B. 2023. Implementasi material requirements planning pada perencanaan persediaan kebutuhan bahan baku roti. *Jurnal Ilmiah FIFO*. 15 (1),10–18.
9. Permadani, S.B., Widajanti, E., Sunarso, S. 2020. Analisis pengendalian persediaan bahan baku dengan menggunakan metode Material Requirement Planning pada PT. Dan Liris di Sukoharjo. *Jurnal Ekonomi dan Kewirausahaan*. 19(1) , 103–113.
10. Puspa, M.D., Darmiyati, I. 2023. Peramalan kebutuhan material filter 5M menggunakan metode Moving Average di Perusahaan XYZ. *Jurnal Teknologi dan Manajemen Industri*, 2(6) , 798–806.
11. Putri, D.M., Hasibuan, L.H., Rahmah, F., Hasanah, U., Jannah, M. 2024. Comparison of double exponential smoothing and fuzzy time series markov chain in forecasting. *Jurnal Matematika dan Terapan*, 18(3), 1817–1828.
12. Sarumaha, D. 2021. Penerapan metode Double Moving Average untuk memprediksi penjualan tiket Kereta Api. *Journal of Computer Science and Information Technology*, 1(1),10–13.
13. Septian, L.A., Juniani, A.I., Purnomo, D.A. 2018. Perhitungan kapasitas produksi dalam penyusunan master production schedule pada divisi manufacturing mould shop. *Proceedings Conference Series*. (pp. 263–268). Surabaya: Politeknik Perkapalan Negeri Surabaya.
14. Setiabudi, Y., Afma, V.M., Irwan, H. 2018. Perencanaan kapasitas produksi ATV12 dengan menggunakan metode Rough Cut Capacity Planning (RCCP) untuk mengetahui titik optimasi produksi. *Jurnal Profisiensi*, 6 (2), 80–87.
15. Suprayogi, M.A. 2022. Model Double Exponential Smoothing dalam peramalan penerimaan pajak pemerintah pusat Indonesia. *Jurnal Statistika dan Komputasi*, 1(2),83–92.
16. Supriyadi, S., Riskiyadi, R. 2016. Penjadwalan produksi IKS-Filler pada proses Ground Calcium Carbonate menggunakan metode MPS di perusahaan kertas. *Sinergi*, 20(2),157–164.
17. Yuliana, N.L., Santi, N.C., Mahmudah, N. 2025. Peramalan penjualan semen menggunakan metode Single Moving Average dan Double Moving Average. *Jurnal Riset Komputer*, 12(3),185–192.
18. Zainal Nur Hafid, M., Septiari, R., Galuh, J.H. 2024. Penjadwalan produksi pada pengolahan limbah plastik dengan metode Master Production Schedule. *Jurnal Valtech*, 7 (1), 215–224.