Production and Supply Optimization in PT. Goodyear Indonesia Tbk.

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Abstract. The Production and Supply Optimization in PT. Goodyear Indonesia Tbk and its study in this paper provide the purposes to create a model of the Master Production Schedule (MPS). The mentioned MPS complies with company policy, production capacity and supply received. From view point of Industrial Engineering, there are needs for forecasting method effectiveness toward the company production capacity. Furthermore, from view point of Information Systems, there are needs to provide the MPS as compare to prior systems that was done manually resulting in the frequent error at the time of making MPS deductible. Several Methods are used and considered, such as: The method of time series, Mean Square Error (MSE), Mean Absolute Percentage Error (MAPE), the calculation of production capacity, MPS, and designing information systems. By having the combination of views from Industrial Engineering and Information Systems perspective the improvement can be conducted from both theoretical development and its managerial implications.

Keywords: Master Production Schedule (MPS), Industrial Engineering, Information Systems, Mean Square Error (MSE), Mean Absolute Percentage Error (MAPE).

1. Introduction
PT. Goodyear Indonesia.Tbk is a manufacturing company that manufactures tires, and one of the largest tire distributors in Indonesia that are not merely dealing with the domestic market, but export their products overseas. The research will focus on the supply chain in company that has the task to manage the supply, production planning, and product distribution.

Several prior studies have been conducted and represented by major journals that are authored by Segerstedt (2006), Sallehuddin (2007), Gustavsson (2008) and Xie (2004). Those journals are further elaborated by discussion in other related journals, in term of Forecasting, Time Series Method, MRP, MPS and Information Systems.
Furthermore, several related books and articles are discussed as well to support the discussion in both theoretical aspects and managerial implication in its case in PT. Goodyear Indonesia, Tbk. PT. Goodyear Indonesia, Tbk, uses its own methods for its forecasting method, and this company does not specify a particular name for this method. However, it is unknown whether the company forecasting methods have been effective or not. Therefore this company conducted its own forecasting calculations to find it out by using the method of time series. This paper is further elaborated the discussion surrounding this issue of effectiveness through the mentioned time series method and information systems that are used.

First, in term of Forecasting and Time Series Method, the related journals have conducted prior researches that support the discussion in this paper, in particular Segerstedt (2006), Sallehuddin (2007), Gustavsson (2008) and Xie (2004). In term of Forecasting and Time Series Method, the related books have elaborated both aspects. Precisely, Baroto (2002, p.30) in quantitative forecasting method using time as a basis for forecasting. This method is done by creating a pattern of demand, which then analyzed for the search pattern that will make it easier to determine what forecasting methods should be used based on the pattern. How to determine the most convenient form of the pattern is to use the eye or visual. (Yulianto, 2006, p.22). After selecting and performing calculations obtained by the method of forecasting accuracy of the calculations or forecasting error will perform. In this study, the accuracy of the calculation used is the Mean Square Error (MSE) and Mean Absolute Percentage Error (MAPE). The latter method, is used to select the best forecasting method based on the level of accuracy. Prior to choose the methods, then the next step comprises the comparison with the MSE and MAPE method companies to see which method is better.

Second, subsequently, in term of Master Production Schedule (MPS) and Material Requirement Planning (MRP), the related journals have conducted prior researches that support the discussion in this paper. Precisely, the journals that are authored by (Zaidi, 2012, p. 1457) discussed the MPS as relate to MRP, with the surrounding discussion on Inventory Management and Forecasting as two topics that are indispensable in this paper. The research of (Mula, 2006, p. 275) has elaborated this paper from view of MRP that is expanded into Supply Chain, as this paper pertaining PT. Goodyear Indonesia Tbk is facing. The first Mula’s view on MRP is supported by prior researches of Hegseth (1984), New and Mapes (1984), Murthy and Ma(1991), Donselaar (1992), Donselaar et al. (2000), and Hatchuel et al. (1997). The second Mula’s view on Supply Chain is supported by prior researches of Bertrand and Rutten (1999), Caridi and Cigolini (200), Das and Abdel-Malek (2003).

Third, furthermore, in term of Information System, the related journals have conducted prior researches that support the discussion in this paper. Several factors within the scope of supply chain are deemed important to be considered, to ensure the fulfilment of demand from customers. Those factors are: a. The company is unable to meet the demand that outsource or ask factory outside Indonesia to send it. b. Companies outside Indonesia factory produce more than the demand so they distributed it to another subsidiary. c. Companies do not have the machinery to produce the requested product. So that the necessary and correct quality information to assist in production planning. (Gustavsson&Wanstrom, 2008, p.334).

In term of Information System, the related books have elaborated it. Precisely, Marchewka (2010) on Information Technology Project Management, Satzinger (2005) on Object-Oriented Analysis and Design, and Whitten (2004) on Systems Analysis and Design Methods, and not to mention other books that are elaborated in this paper.

2. Methods

2.1. Data Collection
This session provide information on how to gather the data through data collection. The Data are collected randomly, as depicted in the following processes. Prior to start the research, observation and interviews will conducted to the company. This is done in order to get a clear view of business processes and policies that are owned by the company.
Furthermore, the data collection is conducted, in term of the product, the actual production, product inventory, supply, labor day, the engine, the actual production, forecasting the company's methods, and demand. Posterior to data capture of product data, the overall demand of the two categories of products, the consumer and commercial bias are then categorized for domestic and export markets. Of each product category is also taken two products, namely 165/80 R13 83T TL DURAPLUS, 175/65R14 82H DURAPLUS, HM G2020 10.00-20 16 TT, and HM XTRA GRIP 7.00-15 TT 10. Data on overall demand and product categories are divided between domestic and export markets, will take the data from the years 2009-2011 the data for forecasting and demand. As for the products of the category of consumer and commercial bias the data request will be taken in 2009-2012. For the actual production will take overall demand data in 2011.

2.2. Times Series Method

Time series method is a forecast method of quantitative using time as the base of the forecast. In general, demand for the future will be influenced by time. To make a forecast, a data demand from the past is needed. This data will be analysis-using time as the parameter and the base. There are four pattern, trend, seasonal, cylical and random (Baroto, 2002, p.30). The identification of the data pattern can be used with visual. (Yulianto, 2006, p.22). Furthermore the discussion of Time Series Method are referring to three aspects of 1. Moving Average, 2. Weight Moving Average, and 3. Winter. Respectively, the description and formulas are discussed by 1. Nasution (2003, p.35) and Gaspersz (2008, p. 87), 2. Gaspersz (2001, p. 92), 3. Nasution (2003, p.41). Eventually those aspects are represented by the following equations, as the third one is segregated in Trend, Seasonal, or Forecast.

Moving Average n-Period= \[ \frac{\sum \text{(Demand in previous n-period)}}{n} \]  

(1)

WMA(n) = \[ \frac{\sum \text{(Weight for n Period) (Actual Demand in n Period)}}{\sum \text{(Weight)}} \]  

(2)

\[ F_t = \alpha \text{Dt} + (1- \alpha)(F_{t-1} + T_{t-1}), \quad T_t=\beta(F_t+F_{t-1})+(1-\beta)T_{t-1}, \quad I_t=\gamma \text{Dt} + (1-\beta)I_{t-m}, \quad F_{t+1}=(F_t-T_t) \text{I}_{t+1-m} \]  

(3)

Where, \( F_t \)=Value smoothing, \( \alpha \)= Smoothing constant (0< \( \alpha \) <1), \( \text{Dt} \)= Actual Demand, \( I_t \)=Estimation of seasonal, \( T_t \)=Estimation of trend, \( \beta \)=The constant trend smoothing (0< \( \beta \) <1), \( F_{t+m} \)= Forecast, \( \gamma \)=The constant seasonal smoothing (0< \( \gamma \) <1).

2.3. The Size of Forecasting Accuracy

Based on Nasution (2003, p.35), the size of the forecasting results which is a measure of forecasting error is a measure of the degree of difference between the results of forecasting and actual demand happening.

2.3.1. Mean Square Error (MSE)

MSE is calculated by summing the squares of all errors of forecasting at each period and dividing by the number of the forecast period. Mathematically, the MSE is defined as follows:

\[ \text{MSE} = \frac{\sum \text{(At-Ft)}^2}{n} \]  

(4)
2.3.2. \textit{Mean Absolute Percentage Error (MAPE)}

MAPE is a measure of the relative error. MAPE is usually more significant than MAD because MAPE stated percentage forecast error of the actual demand over a given period that will provide the error percentage is too high or low. Systematically, MAPE is expressed as follows:

\[
\text{MAPE} = \left( \frac{100}{n} \right) \sum \left| \frac{A_t - F_t}{A_t} \right |
\]  

(5)

2.4. \textit{Master Production Schedule (MPS)}

This paper elaborated the reason why MPS Model in Table 1 of Segerstedt is chosen and the discussion on comparison with similar model. Precisely, First, for the reason, (Segerstedt, 2006, p.3595) indicated that MPS can also evaluate alternative schedules in capacity requirements, providing input to the MRP system and helps the production manager to generate priorities for production scheduling.

Specifically, (Segerstedt, 2006, p. 3594 and 3595) refers to similar situation in PT. Goodyear Indonesia Tbk, pertaining the mechanism of manually introducing a customer order in the MPS through the form of spreadsheet software. On the other hand, this company also have the its own computer system for materials and production control, or the ERP, in this case SAP/R3. Thus, it is one of the reason that tMPS Model of Segerstedt is chosen, in addition to the feature of Availability to Promise. The mentioned reason by Segerstedt, is supported by Nasution (2003, p. 95), in which production plan stating the size of the aggregate and manufacturing output of a company. Implementation of production planning requires an aggregate product planning disaggregation into the planning for each individual product. MPS is the final statement about the "how" a lot of end items to be produced and "when" should be produced. Second, for the similar model, this paper highlight the MPS as indicated by (Xie, 2004, p. 205 and 206) that has similar model, but emphasize more on the total cost, schedule instability (SI) and service level (SL) of a production inventory system. The MPS drives the material requirements planning (MRP) system and provides the important link between forecasting, order entry and production planning activities on the one hand, and the detailed planning and scheduling of components and raw materials on the other. The similar model, has been elaborated as well by (Mula, 2006, p. 278), with the further consideration of customer satisfaction that is ambiguous in term its maximization. Therefore, Mula’s research is supported with prior research by ( Lehtimaki, 1987) that studies MPS in a MRP environment that maximizes the fuzzy customer satisfaction level from the perspective of a multi-objective decision problem. The objective of maximizing customer satisfaction is ambiguous and can be modelled using fuzzy set theory.

Table 1  MPS Example

| Item No | Description |
|---------|-------------|
| Lead Time | Safety Stock |
| On Hand | Demand Time Fences |
| Lot Size | Planning Time Fences |

| Forecast | Customer Order | Available Balance | Project Available Balance | Available to Promise | Master Schedule |
|-----------|----------------|-------------------|---------------------------|---------------------|----------------|
| Past Dux | Time Period (Month) | 1 | 2 | 3 | 4 | 5 | 6 |

3. Data Processing

In the data processing techniques to the industry will start from the manufacture of patterns for each product category and the total demand by the method of time series. This is done to look at the data pattern of each product category and the total demand. Data pattern determination is conducted by visual means. Based on the four patterns in the methods of time series forecasting methods will be taken based on the patterns that emerge.
Two steps in calculation methods are: First, MSE and MAPE is intended to determine the best method and also to see whether the different methods are needed for each product category. Second, the iteration of MSE and MAPE, but based on the company forecasting method data to be compared with first forecasting methods. Both results are then decided on which one is better.

Based on the pattern of demand data to the PT. Goodyear to its products can be seen to have a repeating pattern every year. In addition, the same pattern can be seen on the demand for domestic and export markets, as well as to the product type consumer and commercial bias. Then based on the analysis and identification of data patterns visually, it can be concluded that the PT. Goodyear has a seasonal pattern data. There are three types of prediction that can be used, namely, Moving Average, Moving Average Weight, and Winter as discussed in session 2.2.

Both the Mean Square Error (MSE) and Mean Absolute Percentage Error (MAPE) conduct a comparison between each product and period used to find the smallest MSE and MAPE. In Table 2 indicated that Winter has the smallest MSE and MAPE than the moving average and the weight moving average. Therefore, the chosen method is a winter method of forecasting by a period of 2 due to having the smallest value of MSE and MAPE than other periods.

Then, Table 3 indicated that the ratio for the smallest MSE and MAPE. Winter methods of forecasting have the smallest MSE and MAPE in comparison to the company. So it can be concluded that the method of forecasting winter N = 2 is the best forecasting method for the company. Then based on the method of winter N = 2 will do the calculations for product forecasting.

Furthermore, in Table 4 Based on calculations shown in the table 4 about the efficiency and utilization for each month of the company. Can be seen that the efficiency and capacity utilization per month for the company was good. Moreover, it can be seen that the average of the efficiency and utilization was 90.3% and 89.8% which is a figure which is fairly good. This is because the resulting product is a tire company that not too many differences between each type of tire product.

Table 2 The results of MSE and MAPE Moving Average, Moving Average and the Winter Weight

| Produk | Periode (Bulan) | Moving Average | Weight Moving Average | Winter |
|--------|----------------|----------------|-----------------------|--------|
| | | MSE | MAPE | MSE | MAPE | MSE | MAPE |
| Permintaan Total | 2 | 222,243 | 5,422 | 7032236,306 | 1112,846 | 2,042 | 0,515 |
| | 6 | 405,881 | 8,409 | 1022521,911 | 425,318 | 1533,382 | 11,509 |
| | 12 | 261,071 | 6,495 | 290,677 | 6,890 | 609,066 | 9,340 |
| Domestik | 2 | 11,179 | 8,532 | 151679,191 | 1113,542 | 1,247 | 1,821 |
| | 6 | 10,553 | 9,136 | 21907,494 | 425,001 | 10,779 | 8,207 |
| | 12 | 7,184 | 7,363 | 7,811 | 7,692 | 19,057 | 11,371 |
| Consumer Domestik | 2 | 2,900 | 8,343 | 42380,170 | 1117,029 | 0,071 | 1,182 |
| | 6 | 2,854 | 9,365 | 6206,916 | 428,382 | 2,155 | 7,216 |
| | 12 | 2,309 | 8,430 | 2,462 | 8,708 | 3,309 | 8,759 |
| Commercial Bias Domestik | 2 | 3,708 | 10,597 | 39054,077 | 1117,295 | 0,720 | 2,369 |
| | 6 | 3,122 | 10,633 | 4682,983 | 423,640 | 3,937 | 11,347 |
| | 12 | 2,084 | 8,238 | 2,240 | 8,591 | 6,877 | 13,847 |
| Export | 2 | 188,487 | 5,763 | 5120834,805 | 1114,034 | 3,694 | 0,791 |
| | 6 | 322,126 | 8,362 | 747539,754 | 425,810 | 222,049 | 5,867 |
| | 12 | 218,387 | 6,775 | 241,911 | 7,055 | 440,428 | 8,544 |
| Consumer Export | 2 | 114,603 | 7,308 | 202216,087 | 1116,270 | 2,199 | 0,331 |
| | 6 | 171,949 | 9,439 | 321513,226 | 426,792 | 150,649 | 7,792 |
| | 12 | 105,747 | 7,537 | 118,276 | 7,794 | 226,163 | 9,917 |
| Commercial Bias Export | 2 | 10,295 | 4,875 | 485192,688 | 1102,040 | 1,698 | 1,336 |
| | 6 | 9,252 | 4,750 | 69023,002 | 414,409 | 13,334 | 5,587 |
| | 12 | 8,422 | 4,586 | 8,519 | 4,605 | 26,369 | 7,466 |
Table 3 Comparison of MSE and MAPE method of Winter and Company

| Produk               | Peramalan Perusahaan | Winter 2 bulan |
|----------------------|----------------------|-----------------|
|                      | MSE      | MAPE   | MSE      | MAPE    |
| Permintaan Total     | 786,089  | 9,597  | 2,042    | 0,515   |
| Domestik             | 22,556   | 11,195 | 1,247    | 1,821   |
| Consumer Domestik    | 3,910    | 11,422 | 0,071    | 1,182   |
| Commercial Bias Domestik | 3,360   | 10,517 | 0,720    | 2,369   |
| Export               | 549,726  | 10,701 | 3,694    | 0,791   |
| Consumer Export      | 81,485   | 6,602  | 2,199    | 0,331   |
| Commercial Bias Export | 7,058   | 4,031  | 1,698    | 1,336   |

Table 4 Calculation results of efficiency and utilization

| Bulan | Produksi Aktual | Effeciency (%) | Utilization (%) |
|-------|-----------------|----------------|-----------------|
| Jan   | 204,456         | 91,2           | 90,7            |
| Feb   | 212,041         | 98,1           | 97,6            |
| Mar   | 218,841         | 94,3           | 93,8            |
| Apr   | 219,547         | 97,9           | 97,4            |
| May   | 214,923         | 95,9           | 95,4            |
| Jun   | 187,393         | 83,6           | 83,2            |
| Jul   | 212,327         | 88,4           | 88,0            |
| Aug   | 196,481         | 98,2           | 97,7            |
| Sep   | 197,687         | 85,1           | 84,7            |
| Oct   | 191,285         | 82,4           | 82,1            |
| Nov   | 181,071         | 80,8           | 80,4            |
| Dec   | 196,569         | 87,7           | 87,2            |
| Total Rata-Rata     | 190,3       | 89,8           |                 |

Table 5 Examples of MPS Total Demand

| Item No | Description | Permintaan Total |
|---------|-------------|------------------|
|         |             | Safety Stock     |
| On Hand | 10,609      | Demand Time Fences |
| Banyak   | 100         | Planning Time Fences |

Forecast: 203,077, 215,813, 206,973, 211,486, 201,618, 209,703, 210,679, 197,325, 184,241, 177,232, 179,248, 209,629.

Customer Order: 203,006, 253,296, 206,625, 203,858, 212,078, 210,335, 197,487, 185,334, 178,54, 198,192, 209,576.

Supply: 3,545, 5,704, 4,115, 4,580, 4,087, 3,903, 3,454, 6,208, 4,022, 3,981, 3,247, 3,671.

Customer Order II: 199,554, 209,394, 202,511, 206,315, 207,901, 205,531, 206,881, 191,229, 181,312, 174,559, 194,946, 205,905.

Available to Promise: 10,609, 101,287, 101,287, 101,287, 101,287, 101,287, 101,287, 101,287, 101,287, 101,287, 101,287, 101,287.

Difference: -64,984, 7,669, 30,763, 18,916, 17,316, 19,716, 33,510, 9,875, 51,963, 58,763, 30,316, 19,316.

Model MPS was made under the existing standards MPS, but have differences with the supply, customer order II, capacity and difference. Customer order II obtained from the reduction of customer orders with supply and difference obtained from the reduction of capacity by the master schedule. If there is a lack of production in scheduling due to differences in demand and production capacity it will be left. Therefore, it would need the approval of upper management in determining the action to be taken. Nevertheless, based on interviews known that the lack of production can be anticipated with the supply of plant PT. Goodyear outside Indonesia or other policies owned by the company.
### Table 6 Examples of MPS per product

| Item No | Description          | Lead Time | Safety Stock | Order Lead | Forward Time Fence | Multiple lot | Planning Time Fence |
|---------|----------------------|-----------|--------------|------------|-------------------|-------------|---------------------|
|         |                      |           |              | 0.50       | 18                | 100         | 19                  |

| Inventory | | | | | | | |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Date      | 1         | 2         | 3         | 4         | 5         | 6         | 7         | 8         | 9         | 10        | 11        | 12        |
| Forecast  | 2,308     | 2,172     | 2,066     | 2,228     | 2,242     | 3,069     | 2,936     | 3,089     | 3,000     | 2,766     | 2,600     | 2,382     |
| Customer Order | 2,253 | 2,229 | 2,064 | 2,312 | 2,306 | 3,082 | 2,822 | 3,009 | 3,031 | 2,710 | 2,601 | 2,377 |
| Inventory | 0.300     | 0.134     | 0.107     | 0.111     | 0.094     | 0.088     | 0.225     | 0.140     | 0.110     | 0.075     | 0.035     | 0.013     |
| Customer Order | 2,253 | 2,206 | 2,206 | 2,206 | 2,206 | 2,900 | 2,764 | 2,758 | 2,757 | 2,942 | 2,428 | 2,254     |

### Table 7 Examples of MPS Results Per Product

| Master Schedule | Time Period (Month) |
|-----------------|---------------------|
|                 | 1       | 2       | 3       | 4       | 5       | 6       | 7       | 8       | 9       | 10      | 11      | 12      |
| C-165 80 R1 DURAPLUS KIT TL | 2,700   | 2,100   | 2,100   | 2,300   | 2,200   | 3,000   | 2,800   | 2,800   | 2,800   | 2,800   | 1,900   | 2,400   |
| C-175 65R14 D2H DURAPLUS | 2,300   | 2,100   | 1,900   | 1,900   | 1,800   | 1,900   | 2,100   | 2,100   | 2,100   | 1,800   | 2,000   | 2,700   |
| CB-10.00-20 HM G2020 16 TT | 6,500   | 5,800   | 4,200   | 4,600   | 4,000   | 4,000   | 4,000   | 4,000   | 4,000   | 4,000   | 5,300   | 5,300   |
| CB-700-35 HM XTRA GRIP 10 TT | 1,700   | 1,200   | 1,300   | 1,300   | 1,400   | 1,400   | 1,300   | 1,300   | 1,300   | 1,400   | 1,400   | 1,400   |
| Total | 12,100 | 11,100 | 8,000 | 10,100 | 9,200 | 10,000 | 9,100 | 12,100 | 10,200 | 9,000 | 10,200 | 10,000 |

### Discussion and Information Systems

Information Systems is an organized combination of people, software, hardware, communication networks and data resources that collect, transform, and disseminate information within an organization (McLeod, 2001, p.4). The Information Systems in this paper performed the analysis and design of the new information system will be made. Figure 1 indicates the Deployment Diagram in PT. Goodyear Indonesia Tbk, through the programming language of VB.net with MYSQL database, with the purpose of establishing user friendly features with the characteristics of error reduction and ability to adapt to the system. Other than user features, each department involved in PT. Goodyear Indonesia Tbk, is connected through Local Area Network (LAN).

![Deployment Diagram of PT. Goodyear Indonesia Tbk.](image-url)
Furthermore, Figure 2, indicated the Information Systems in term of Class Diagram of PT. Goodyear Indonesia, Tbk, pertaining Product Master (including its SAP Code), is surrounded by Inventory, Supply and Demand, in addition to the TBM, Production Capacity and Plan, and also Product Business Unit (PBU) and its detail of PBU The necessity of the analysis on the company's business processes and then on the supply chain are the focus in which the information system is designed. Which will produce a rich picture, activity diagrams, use case, use case description table event, object, class diagrams and sequence diagrams. Thus the analysis phase has to be completed and continued to the design phase of designing the user interface, sequence diagram for each use case, class diagram design, architecture, and database design, that are indispensable for PT. Goodyear Indonesia.

![Class Diagram and Information System in PT. Goodyear Indonesia, Tbk.](image)

Based on observations in mind that the supply chain are the focus of research known that the supply chain requires a system that can help improve work processes and reduce the level of error that may occur. This saves processing time through the supply chain in making production scheduling and minimize errors is occurring. Where to support this system, programming language will be used VB.net to get the user interface is user friendly and to be using MySQL database.

Unified Model Language is a standard model of the form and notation developed for developing object-oriented. In general, the depiction of the diagram, the notation used for the show, describing the model is defined by using UML. Using UML analysts and users are able to understand a variety of diagrams that are used for system development project. (Satzinger et al., 2005, p.48)
According to Marchewka (2010, p.364) in a final stage of implementation or the implementation of the project is the result of a system that has been created. Where to implement the new system needed an implementation plan. In the implementation plan there are three approaches that can be done. Direct cutover, an implementation plan that is done by replacing the old with the new system directly. Process of the supply chain itself, beginning at the time of the supply chain receives the data order / demand from the sales. Later sections will examine the supply chain of products that are still available at the warehouse. After ascertaining the amount of products available in the warehouse, then the supply chain publish an order confirmation is sent to the finance section. Parts supply chain will also examine the capacity of the manufacturing production, in order to know the limits of production that can be done. Furthermore the supply chain will directly create production scheduling based on the company's policy, and wait for release from the sales order. After the release order is received by the supply chain will immediately issue orders to the manufacturing production. Parts manufacturing to produce the finished product will send a confirmation that product has been completed. Parts supply chain will then be issued a delivery order for a product that has been made to the warehouse which will then be sent to the customer.

5. Conclusion
The Production and Supply Optimization in PT. Goodyear Indonesia Tbk and its study in this paper provide the purposes to create a model of the Master Production Schedule (MPS). The mentioned MPS complies with company policy, production capacity and supply received. Precisely, in several aspects the conclusion comprises: First, Forecasting winter methods with N = 2 due to get the smallest error rate is better than other methods. And after a comparison with the company forecasting methods, methods of winter N = 2 still has the smallest error. Second, The company does not require different forecasting method because based on the indigo error for each category of products, methods of winter N = 2 memiliki lowest error value compare other methods that do the same with winter N = 2. Third, Based on the calculation of efficiency and utilization where the results obtained 90.3% and 89.8% made the production capacity at its optimal. Fourth, MPS models suggested by the form shown in tables 5 and 6 to demand total and per product. Ultimately as the conclusion for future research, in this paper there are prior research that are indispensable in as the stepping stone for further elaboration of the research in the area of Forecasting, Time Series Method, MRP, MPS and Information Systems, in particular by prior researches of Segerstedt (2006), Sallehuddin (2007), Gustavsson (2008) and Xie (2004).

6. Recommendation
Subsequent to the conclusion and its elaborated aspects in the above paragraph; the recommendation is deployed, not only from the Industrial Engineering Perspective but also from the Information Systems Perspective. Furthermore, the elaboration are the following: From view point of Industrial Engineering, there are needs for forecasting method effectiveness toward the company production capacity. Furthermore, from view point of Information Systems, there are needs to provide the MPS as compare to prior systems that was done manually resulting in the frequent error at the time of making MPS deductible. Several Methods are used and considered, such as: The method of time series, Mean Square Error (MSE), Mean Absolute Percentage Error (MAPE), the calculation of production capacity, MPS, and designing information systems. By having the combination of views from Industrial Engineering and Information Systems perspective the improvement can be conducted from both theoretical development and its managerial implications. First, Company should update the methods used in the company to become more optimal considering all theoretical and managerial implication. Second, Manufacturing companies should replace the code with the code SAP, as already standardized in the ERP, in this case SAP/R3 for PT. Goodyear Indonesia.
Third, Companies should make a backup data regularly to avoid the undesirable possibility. Fourth, for further research is suggested taking into account data that is not counted in this study, not to mention similar Multinational Companies operating in several countries worldwide, and other aspect of limitation, constraints of this paper that is merely within PT. Goodyear Indonesia Tbk.

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