Optimize Softex 1097-A Material Inventory Planning with Master Production Schedule Method
(Case Study at BASF Company)

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Abstract
This study aims to implement the Master Production Schedule (MPS) method for the production process at BASF Company, especially for Softex 1097-A products. The author conducted an online interview with one of the employees at BASF Company regarding information about Production Planning and Inventory Control at BASF Company, which includes inventory records, Bill of Materials (BOM), forecast, customer orders, production plans, and capacity. From the information obtained, the Softex 1097-A production process was optimized at BASF Company by making a Master Production Schedule (MPS). Apart from interviews, the authors also collect literature from books, journals, and research related to Production Planning and Inventory Control. The results of the discussion show that Master Production Schedule (MPS) can help to adjust fluctuations in demand, reduce waste, minimize waste, prevent shortages and scheduling errors, increase efficiency at the site of production resources, provide more effective cost control and more accurate estimates of material requirements and delivery dates, reducing waiting times during processing.

Keywords
MPS, Production Plan, Softex 1097-A, BASF Company

1. Introduction
For a company that produces or manufactures goods, the most important element about customer service is product availability (Coyle, Bardi, and Langley, 1992). Product availability means that a company must prepare an amount of product before they release it to the market and sell it to the customer. To fulfill the availability of their product, a company needs to make a plan or strategy to control their production activity. That plan or strategy will help the company to assemble, manufacture, and buy a product with an objective to fulfill the amount that their customer wants based on the order. Not only the production activity that is important for this plan or strategy, the inventory planning also has a big contribution to support and improve it. Both production and inventory planning are important to make sure that the objective is to fulfill what the customer needs or make sure the product availability in the market has been achieved.

To dive deeper and understand the importance of preparing the plan or strategy for production and inventory planning, we will conduct research based on real data and the company. In this research, we will take a business case using real data from BASF company. BASF is the largest chemical company in the world from Germany, headquartered in Ludwigshafen. BASF itself was originally an acronym for Badische Anilin- und Soda-Fabrik (Soda and Anilina Baden Factory). The company is listed on the Frankfurt Stock Exchange, the London Stock Exchange, the New York Stock Exchange and the Zurich Stock Exchange. The company has operations in Europe, Africa, Asia, North America and South America. Founded in 1865 and employing 113,000 workers in 2012, with 52,800 workers in Germany.

In Indonesia, BASF company has a main factory in West Jakarta. In that factory, they usually produce a lot of chemical substances. For this research, we will use a real data base on the production and inventory planning of one of their products, Softex 1097-A. Softex 1097-A is a product that is in liquid form with 50% of calcium stearate dispersion content. This product is produced using some material resources that BASF has and we will show the Bill of Material (BOM) of it below. This product is very effective as anti-tack preparation in the rubber industry, mold release agent
and anti-crack compound for stored slabs, sheets, and extruded articles. Softex 1097-A also reduces cracking in the dry coating, improving printability, and preventing dusting at the super calendars, slitting, and printing operations. Because of the use of Softex 1097-A in industry, the demand of this product is really high for each month in 2021 that we will show below.

Based on the data that we have collected for the production and inventory planning of Softex 1097-A. BASF company does not use any method to prepare the needs of the customer besides a forecast calculation based on the data of customer order last year. The company only uses the forecasting method to estimate the current customer order. Logically, the demand between two periods of time will be different depending on what customers need against the product. Based on the data from BASF company, customer demands for a product are constantly rising over a period of time, which means that the demand of the current year is higher than the last year. That will cause a miscalculation if we just use the data from the last year to forecast the demand of the customer without taking another look into another opportunity that the demand will rise. Due to that reason, we suggest an improvement for the BASF production and inventory planning using Master Production Scheduling (MPS).

Master production scheduling (MPS) is the process of developing plans for identifying which quantities of products should be manufactured during certain periods. MPS therefore drives operations in terms of what is assembled, manufactured, and bought (Vieira and Favaretto, 2006). During some period of production activity, MPS will make sure that the company makes the best decision about what kind of product that they have to assemble, manufacture, and buy to accomplish the objective of customer demand. For the production case of Softex 1097-A from BASF company, we will use the MPS to calculate the right amount of product we have to produce based on the customer order in 2021 and the inventory level the company has.

Master Production Scheduling (MPS) that we implement in BASF production and inventory planning will improve many aspects. Based on the definition of MPS, BASF company will use the resource more efficiently against production activity in a certain period of time. The utilization of the resource to make a product that becomes more efficient will affect the profit of the company. If we apply MPS to their production and inventory planning, the cost that is spent for the resource that is not well utilized can be pressed, so the profit will rise. Beside the rising in profit, the availability of the product in the market will gain the satisfaction and the loyalty of the customer for the product. So in the future, they will consider reordering the product from the BASF company.

2. Literature Review

2.1 Production Planning and Control

Production planning is a part of production planning and control, involving basic concepts such as what to produce, when to produce, and how much to produce. It involves long-term observation of the overall production plan. Therefore, the goal of the production plan is to ensure that the correct quantity and quality of raw materials, equipment, etc. are available during production, and that the capacity utilization rate is always consistent with the forecast demand. Production control hopes to use different types of control technologies to achieve the best performance of the production system, so as to achieve the overall production plan goals. Therefore, the goal of production control is to standardize inventory management, organize production plans, and make the best use of resources and production processes (Prachi, 2015).

A manufacturing company that carries out the production process is a very important part, so every company must be able to produce well. To carry out production functions properly, a series of activities is needed that will form a production system. For this reason, plans are made to monitor actual production results against production plans and make adjustments. With planning, production activities to be carried out will be more focused and the company can achieve its goals well (Kiran, 2019).

The planning process starts with demand planning to determine the Master Production Schedule (MPS). For the type of mass production that involves only one type of product, production planning does not need to go through the disaggregation stage, and production planning has become MPS. The function of the production plan are to determine the output based on the sales forecast, decide whether to manufacture or purchase according to cost economics, determine the operating sequence according to product specifications, determine the number of runs and the number of settings based on the target Minimize the total amount of work-in-process inventory, determine each product: the type of material used, the machine to be operated, and tools used, determine the right place and right time when these functions are required, and undertake steps to fulfill
the production target established by master schedule and budgets. The production scheduling model provides the optimal production scheduling solutions in the beverages factory production (Rahmat, Amar, and Tommy, 2016).

Figure 1 illustrates the phases of production planning and control

![Figure 1. The Phases of Production Planning and Control](image)

### 2.2 Master Production Schedule

According to Gaspersz (2004), basically the master production schedule is a statement about the final product (including replacement parts and spare parts) of a manufacturing industrial company that plans to produce output in terms of quantity and time period (Gaspersz, 2004). The Master Production Schedule (MPS) transforms the business plan into a comprehensive product manufacturing plan that covers what to assemble or manufacture, when and when to purchase materials, and the cash required. MPS is a key component of material requirements planning (Kiran, 2019). It provides the basic foundation for planning for the material and capacity requirements, making good use of manufacturing resources, making customer delivery promises, resolving tradeoffs between sales and manufacturing, and attaining strategic objectives in the sales and operations plan.

The information needed to develop a MPS are production plan data, forecasts, actual customer orders, inventory, and capacity constraints. Master Production Scheduling (MPS) activities are basically related to how to compile and update the master production schedule, process transactions from the MPS, and provide evaluation reports in regular time periods for feedback and review purposes (Gaspersz, 2004). These aggregate production plans are prepared as detailed aggregate planning. Next, the plans are disaggregated for scheduling each and every item and to ensure that no small detail is omitted. Then, MPSs are then prepared as explained in detail in subsequent paragraphs (Gaspersz, 2004). These stages are illustrated in figure 2.
The general form or format of the MPS is shown in figure 3. The following will provide a brief explanation regarding the information contained in the MPS as shown in figure 3. Lead Time is the time (number of periods) required to produce or buy an item. On Hand is the initial inventory position that is physically available in stock, that is the quantity of an item in stock. Lot Size is the quantity of an item that is usually ordered from a factory or supplier. Often referred to as the order quantity or batch size. Time Periods for Display is the number of time periods displayed in MPS format. Sales Plan (Sales Forecast) is a sales plan or sales forecast for the scheduled item. Actual Orders are orders that are accepted and certain (certain). Projected Available Balances (PAB) is a projection of on-hand inventory over time during the MPS planning horizon, which shows the projected inventory status at the end of each time period within the MPS planning horizon. Available-To-Promise (ATP) is very useful information for marketing departments to be able to provide accurate answers to customer questions about: "When can you ship the ordered item?". The ATP score provides information about how many items or specific products scheduled in that time period are available for customer orders.

2.3 Bill of Material
The bill of materials (BOM) for a particular product specifies how to build that product (parent product) from its intermediate components. These components may have their own bill of materials, and so on. BOM is a network of products, and relationships can be established. The network can be understood as an acyclic directed graph (H.M.H. Hegge and J C. Wortmann, 1991). For forecasting and planning purposes, the planning approach is used by BOM. In
schematic form, apart from being known as a product structure, a structured Bill of Materials is also known as a product tree (I Gusti, 2020). In the Bill of Materials, there are levels on which the logic is based, including:

- **Level 0**: A finished product that is not used as a constituent component of another product.
- **Level 1**: Component example bill of material which forms the direct form of a product with level 0. At the same time, however, this component can also be a finished product. As an overview, car tires can also be sold separately as a ready-to-use finished product. So, if it is used as a direct form component in the manufacture of a car or vehicle, it will be classified as a level 1 item.
- **Level 2**: A direct forming component of a level 1 product. As with level 1, a component at this level can also be used as a direct forming component at level 0 or a finished product.
- **Level 3**: Furthermore, this level can be defined with the same meaning.

### 3. Methods

#### 3.1 Data Type

- **Quantitative and Qualitative Data Type**
  The data used is a combination of quantitative and qualitative data. The quantitative data used show numerical variables in the form of quantity units from the production process of one of the products at BASF Company. Meanwhile, the qualitative data used are in the form of production codes and customer codes from the production process at BASF Company.

  Quantitative research does have hypotheses or predictions about what will happen in the study (Creswell, 2009). Quantitative research presented with quantitative data usually begins with the words "what" and "why" so that it can be investigated whether there is a relationship or difference between the variables used in the study. Quantitative data can be represented by a number of various statistical charts, such as bar charts, scatter plots, distribution charts, etc. Examples of quantitative data are test scores, body weight, height, shoe size, dress size, and room temperature.

  According to (Cresswell, 2009), the purpose of qualitative research is to explore the meaning of the people’s experiences, the meaning of people’s culture, and how the people view a particular issue or case. The purpose of the quantitative research is to examine the relationship between variables, such as the dependent, independent variables, and extraneous. Qualitative data represent exploration of findings, so there is no hypothesis. Examples of qualitative data are hair color, shape of nose, etc.

- **Nominal and Ordinal Data Type**
  Nominal data are simply names or properties having two or more categories, and there is no intrinsic ordering to the categories, i.e., data have no natural ranking or ordering. For example, gender (male and female) and marital status (married/unmarried) have two categories, but these categories have no natural order or ranking (Misha, Pandey, Singh, & Gupta, 2018).

  Nominal data aims to differentiate qualitative data in a group. Usually, nominal data only has names or attributes. In this study, nominal data is used to distinguish Customer Name and Customer Group.

  An ordinal variable is similar to a nominal variable. The difference between the two is that there is a clear ordering in the data, i.e., ordinal data, unlike nominal data, have some order. For example, ordinal scales are seen in questions that call for ratings of quality (very good, good, fair, poor, very poor), agreement (strongly agree, agree, disagree, strongly disagree), economic status (low, medium, and high), etc. All the ranking data including Likert scales, Bristol stool scale, and all the other scales which are ranked between 0 and 10 are also called ordinal data (Misha, Pandey, Singh, & Gupta, 2018).

  In ordinal data there is a classification of data based on its level. In this study, ordinal data were used to show inventory levels, production plans, customer orders, and forecasts for the Softex 1097 A 1000 KG at BASF Company.

- **Continuous Data Type**
  In this research, the data used are continuous data, where the measurement of the weight of the components in the product can be presented in a precise size. Data is measured in values and can be quantified and
presented in decimals. Age, height, weight, body mass index, serum creatinine, heart rate, systolic blood pressure, and diastolic blood pressure are some examples (Misha, Pandey, Singh, & Gupta, 2018).

3.2 Data Collecting Method
Data collecting method that we used is primarily data based. According to (Kabir, 2016), "Data that has been collected from first-hand-experience is known as primary data. Primary data has not been published yet and is more reliable, authentic and objective. Primary data has not been changed or altered by human beings; therefore its validity is greater than secondary data".

The data collecting method used is by conducting an interview with BASF Company. The tool used to obtain this data is a list of questions, which contains questions about inputs from the Master Production Schedule (MPS), namely production plans, forecasts for individual end items, actual customer orders, inventory, and capacity. The obtained raw datasets are presented in complex tables and sheets in Excel file format. From this dataset, simplified data will be presented using simpler tables. There is also a descriptive sentence that will explain the calculation of these statistics.

3.3 Flowchart
Quality is a slippery concept thus definition of quality is affected by individual perspective (Rahmat, Lukito, and Dendi, 2016). To manage quality, we can use 7 basic quality tools. Flowchart is one of the 7 basic quality tools according to Dr. Kaoru Ishikawa. According to ISO, flowchart is a graphical representation of a process or the step-by-step solution of a problem, using suitably annotated geometric figures connected by flowlines for the purpose of designing or documenting a process or program (Ilham, 2017).

The flowchart in this study was used to determine strategic and systematic steps from the initial drafting of the paper to the finalization of this paper. Figure 4 shows the flowchart for this paper.

![Flowchart for MPS Making](image)

4. Data Collection
Based on the product structure by containing the specified information on the number and type of components, the number of components needed on it. To produce Softex 1097-A need emulan, fatty acids, tall oil fatty acid, oleic acid, calcium hydroxide, urea, potassium hydroxide, nonylphenol, disponil, fatty acid, and C-IBC. The list of materials can also be arranged in table 1 and figure 5.
According to interviews with BASF company, table 2 shows inventory records for 2020. In October until December 2020, BASF Company did not have stock for softex 1097-A. This means BASF Company has poor inventory management. This can be detrimental to the company which results in the company failing to meet consumer demand, inefficiency because the company does not have accurate real time information about the amount of inventory you have. Of course, the risk of errors in rearranging supplies from suppliers or selling those supplies will also increase.

Table 2. Inventory Records of Softex 1097-A on 2020

<table>
<thead>
<tr>
<th>2020</th>
<th>INVENTORY</th>
</tr>
</thead>
<tbody>
<tr>
<td>JAN</td>
<td>2790947,8</td>
</tr>
<tr>
<td>FEB</td>
<td>2923273,5</td>
</tr>
<tr>
<td>MAR</td>
<td>2834830,3</td>
</tr>
<tr>
<td>APR</td>
<td>2596491,5</td>
</tr>
<tr>
<td>MAY</td>
<td>1709136</td>
</tr>
<tr>
<td>JUN</td>
<td>2779843</td>
</tr>
<tr>
<td>JUL</td>
<td>2673174</td>
</tr>
<tr>
<td>AUG</td>
<td>2213900,5</td>
</tr>
<tr>
<td>SEP</td>
<td>2142870,5</td>
</tr>
<tr>
<td>OCT</td>
<td>0</td>
</tr>
<tr>
<td>NOV</td>
<td>0</td>
</tr>
<tr>
<td>DEC</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 3. Forecast Order or Demand for Softex 1097-A

<table>
<thead>
<tr>
<th>2021</th>
<th>FORECAST</th>
</tr>
</thead>
<tbody>
<tr>
<td>JAN</td>
<td>414.000</td>
</tr>
<tr>
<td>FEB</td>
<td>252.000</td>
</tr>
<tr>
<td>MAR</td>
<td>509.000</td>
</tr>
<tr>
<td>APR</td>
<td>459.000</td>
</tr>
<tr>
<td>MAY</td>
<td>414.000</td>
</tr>
<tr>
<td>JUN</td>
<td>180.000</td>
</tr>
<tr>
<td>JUL</td>
<td>313.000</td>
</tr>
<tr>
<td>AUG</td>
<td>289.000</td>
</tr>
<tr>
<td>SEP</td>
<td>451.000</td>
</tr>
<tr>
<td>OCT</td>
<td>325.000</td>
</tr>
<tr>
<td>NOV</td>
<td>343.000</td>
</tr>
<tr>
<td>DEC</td>
<td>366.000</td>
</tr>
</tbody>
</table>

Table 3 shows the forecast order or demand for Softex 1097-A in 2021. The highest forecast occurs in March and the lowest forecast occurs in October.
occurs in June. Table 4 shows the customer order for Softex 1097-A in 2021. The highest customer order occurs in March and the lowest order occurs in February. In June, there was a high gap between forecast and customer order. This resulted in the BASF company failing to meet consumer demand.

Table 5 shows the production plan for Softex 1097-A in 2021. The highest production plan occurs in August and October, and the lowest production plan occurs in May. Table 6 shows capacity for Softex 1097-A in 2021. The highest capacity occurs in March and the lowest capacity occurs in February.

5. Results and Discussion
5.1 Numerical Results
From the datas, we calculate the MPS for Softex 1097-A to schedule finished goods items. Table 7 shows the Master Production Schedule for Softex 1097-A in 2021.
Table 7. Master Production Schedule for Softex 1097-A

<table>
<thead>
<tr>
<th></th>
<th>JAN</th>
<th>FEB</th>
<th>MAR</th>
<th>APR</th>
<th>MAY</th>
<th>JUN</th>
<th>JUL</th>
<th>AUG</th>
<th>SEP</th>
<th>OCT</th>
<th>NOV</th>
<th>DEC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forecast</td>
<td>41400</td>
<td>25200</td>
<td>50900</td>
<td>45900</td>
<td>41400</td>
<td>18000</td>
<td>31300</td>
<td>28900</td>
<td>45100</td>
<td>32500</td>
<td>34300</td>
<td>36600</td>
</tr>
<tr>
<td>Customer Order</td>
<td>41576</td>
<td>25200</td>
<td>50900</td>
<td>460540</td>
<td>37800</td>
<td>45200</td>
<td>46800</td>
<td>28800</td>
<td>45000</td>
<td>32400</td>
<td>34200</td>
<td>36600</td>
</tr>
<tr>
<td>Projected Available Balance</td>
<td>0</td>
<td>4240</td>
<td>7240</td>
<td>8240</td>
<td>12700</td>
<td>24700</td>
<td>7700</td>
<td>4700</td>
<td>1700</td>
<td>1700</td>
<td>7700</td>
<td>10700</td>
</tr>
<tr>
<td>Available to Promise (ATP)</td>
<td>4240</td>
<td>3000</td>
<td>1000</td>
<td>4460</td>
<td>12000</td>
<td>17000</td>
<td>3000</td>
<td>3000</td>
<td>0</td>
<td>6000</td>
<td>3000</td>
<td>6000</td>
</tr>
<tr>
<td>MPS</td>
<td>420000</td>
<td>255000</td>
<td>510000</td>
<td>465000</td>
<td>390000</td>
<td>435000</td>
<td>465000</td>
<td>285000</td>
<td>450000</td>
<td>330000</td>
<td>345000</td>
<td>360000</td>
</tr>
</tbody>
</table>

With a lot size of 15000, BASF Company should schedule the production planning of Softex 1097-A every month. In September, the ATP is zero means that it matches the MPS proposed by the customer order or forecast so there is no excess and no shortage. From the calculation we know that there’s no stockout on the production process. By using MPS, BASF Company has successfully made adjustments to demand fluctuations while minimizing waste, preventing shortages and scheduling errors, increasing efficiency at the site of production resources, providing more effective cost control and more accurate estimates of material requirements and delivery dates, reducing waiting times during processing. take place. year, and provide effective communication channels with the sales team for planning purposes.

5.2 Graphical Results

Figure 6 shows the data comparison between customer order and forecast order for the Softex 1097-A product. The data for customer order is obtained from the real order amount that the company gets from the customer in 2021. Then the data for forecast order is generated from the customer order last year and any variable that can help calculate the forecast amount. Based on the data that we have collected from BASF company, the forecast order that states in the report of the production plan does not have the same number or almost equal with the customer order amount for every month in 2021. That situation occurs in the forecast order for January, April, June, and July. In January, April, June, and July, the forecast order that has been calculated shows an amount that is less than the customer order, the difference between the two of them is quite big. That difference can make a stockout problem if the inventory cannot recover the deficiency with the customer order. In this case, the BASF company does not have any product in their inventory at the start of the year.

After figure 6 shows the comparison between customer order and forecast order for the Softex 1097-A product, figure 7 will show the simulation if we use Master Production Scheduling (MPS) for the production and inventory planning. The amount of Master Production Scheduling (MPS) was generated by paying attention to the customer order and the lot size from production activity. In figure 7, the model of the production activity and inventory arrangement of MPS make a big difference in the way the company prepares the product to fulfill the customer demand. The example of the success case by applying the MPS is like in June. In June the MPS is less than the customer order, but in April and May, the situation is opposite of it, the MPS is bigger than the customer order. So to recover the deficiency of customer order in June, we can use the excess product that has been stored in inventory from the production activity in April and May. The same solution was also brought to us for August and December case.
The last, figure 8 will show the comparison between MPS and forecast order. Based on the previous figure, the use of Master Production Scheduling (MPS) is a lot better than only using the forecast order. The forecast order does not use the actual data, so they only can calculate a value that is not too different from the customer order data last year. But if we use MPS calculation, there will be another variable that can make the data that the company uses be more accurate in objective to fulfill customer demand. As we can see on the graph, the amount of Master Production Scheduling calculation is dominantly bigger than the forecast order and also more likely the same with customer order. That fact will make the implementation of MPS into the production activity of Softex 1097-A become the best solution that BASF can do.

5.3 Proposed Improvements
After implementing the MPS, we proposed improvements for BASF Company to use sophisticated MPS method. Choosing a sophisticated MPS method is critical to plan feasibility, though it is less clear whether it has a generally important impact on plant performance. More detailed, context-related studies are thus needed to further analyse this relationship. The present study contributes to MPS in practice by clarifying how MPS performance can be improved. Sophisticated methods in particular increase plan feasibility, though the use of overly simple methods can also negatively impact delivery service, no matter the context.

6. Conclusion
From this discussion, it can be concluded that implementing the Master Production Schedule (MPS) in the BASF Company can make better use of the resource and easier to fulfill the demand from the customer to minimize the stored product and maximize the profit for the BASF company. This is because:
1. There is effectiveness in the inventory allocation system, where the inventory in the previous month can be used as additional inventory in the following month.
2. After the MPS is made, it is seen that there may be no stockout when the production process is carried out.

References


**Biographies**

**Arriq Daffanadi Putra** is an industrial engineering student at Universitas Indonesia batch 2019. Born in Semarang 19 January 2001. Currently a head of research and development division at BK MWA UI UM 2021. Before joining BK MWA UI UM 2020, he had an experience becoming the head of IKHTIAR IMTI 2020. Outside the organization activity, he is also active in the student association from his hometown that also studies in Universitas Indonesia. He especially has an interest in human study based on ergonomics and production systems for manufacturing. He is also a person that has a good ability to adapt with a new environment and is highly motivated in studying new things.

**Ivonny Aqili Filza Adinda** is an industrial engineering student at Universitas Indonesia batch 2019. Currently a head of entrepreneurship IMTI FTUI 2021 and a laboratory assistant of MISDS Laboratory IE UI. She was a project officer of Aksioma FTUI 2020 and other organizations. She likes to work in a team. She is a highly motivated, initiative person, and quickly adapts to the new environment with rapid learning ability. She specializes in entrepreneurship skills, business development, and management information systems. She is able to solve the problems with industrial engineering principles.

**Rhania Devi Amaradhanny** is a second-year student and serves as a laboratory assistant at Product Development and Innovation Laboratory in Industrial Engineering at University of Indonesia. She has taught courses in communication, management, UI/UX design, entrepreneurship, and innovation for engineers. Although in daily life she has been living as an engineering student, Rhania Devi also served as staff of Student Affairs in Industrial Engineering Student Association and also staff of Department of Arts and Culture in Student Executive Board at University of Indonesia. Right now, she serves as a staff of UI Fashion Club to elaborate between her passion for fashion and her knowledge in the engineering field.
Rahmat Nurcahyo is currently active as academic staff in Industrial Engineering Department, Universitas Indonesia. Mr. Rahmat was born in Jakarta, June 2nd 1969. He started his higher education in Mechanical Engineering, Universitas Indonesia and graduated in 1993. Then, he continued his study in University of New South Wales and earned his master degree (M.Eng.Sc.) in 1995 and doctoral degree in Faculty of Economics, Universitas Indonesia. Mr. Rahmat has taught several courses in Industrial Engineering UI, including Industrial Psychology, Industrial Economy, and Total Quality Management. Mr. Rahmat is International Register of Certificated QMS Auditors.