The Analysis of Green Supply Chain to Improve Performance Solid Product Using SCOR Analysis at Pharmaceutical Company, Jakarta

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ABSTRACT

In improving the performance of pharmaceutical companies, it is necessary to implement a green supply chain using the Supply Chain Operation References (SCOR) method. Several pharmaceutical KPI deviations during 2016-2018 such as Supplier Irregularities, Documentation Errors, CO₂ Energy complaints, Water-H₂O complaints, and Waste. Therefore, green manufacturing is a production process that uses inputs with relatively low environmental impact, is efficient, and produces little waste or pollution. This study aims to analyze the performance of the Green Supply Chain in pharmaceutical companies in Jakarta by using SCOR. This study uses quantitative methods and qualitative methods with a focus on measuring the performance of green manufacturing. The population and samples in this study were all sales and operating planning divisions, supply chain divisions, logistic divisions, commercial divisions, production divisions, procurement divisions, engineering and health divisions and environmental safety divisions. The results of research using green SCOR show that the performance value of green pharmaceutical manufacturing is 96.506 (very good) and is a new way of monitoring the performance of pharmaceutical companies.

Keywords: Supply Chain, Green Supply Chain, Supply Chain Operation References

JEL Classification: L2, J2

1. INTRODUCTION

Awareness of health among Indonesians is also a driving force for increased consumption of medicines, this has led to an increase in the variety of products produced by the pharmaceutical industry. The supply chain movement of the pharmaceutical industry in Indonesia tends to show an increase. Based on statistical data, the growth of the pharmaceutical market in 2008-2016 continued to increase, which was valued at USD 2.76 billion in 2008 to reach USD 8.14 billion in 2016 (Figure 1). Supply chain movements in the pharmaceutical industry reached 7.49% in the 4th quarter of 2016 and 4.92% when compared to 2015.

Pharmaceutical companies in Jakarta have performance constraints such as Supplier Irregularities, Documentation Errors, Complaints, energy use, water-H₂O use, and waste, so that the company’s performance has not been achieved since 2016-2018. Therefore it is necessary to measure supply chain performance using the Supply Chain Operation References (SCOR) model (Irfan et al., 2008; Wayyun et al., 2010; Jamehshooran et al., 2015).

The impact of the industrial sector on the environment occurs throughout the life cycle of a product, starting from the material procurement process, the production process, the distribution process to the reuse of the product and finally to the manufacturing stage (Zhu et al., 2010).

To deal with pollution, waste and other hazards to the environment due to the impact of activities in the Supply Chain, Green Supply Chain Management is now being promoted. Model Analysis of Supply Chain Operation Reference (SCOR) aims...
to determine supply chain performance towards management (Sutawijaya, 2016).

The application of the SCOR model can identify supply chain performance indicators by showing the company’s supply chain process, so that it can be used as an evaluation material in improving performance (Kurien and Qureshi, 2012; Ambe, 2014; Susanty, 2017).

Public awareness of health and government support in creating a healthy society has an impact on increasing supply chains in the pharmaceutical industry.

2. LITERATURE REVIEW

2.1. Supply Chain
According to Finch (2008) supply chain is all activities related to the flow and transportation of goods from raw materials (inbound logistics) to finished products into the hands of consumers (outbound logistics) and also the flow of information.

Supply chain is a network of facilities and distribution channels which includes the procurement of raw materials, production, assembly and delivery of products or services to customers (Borade and Bansod, 2007).

Dedicate the supply chain according to Pujawan and Mahendrawathi (2010), is a network consisting of many companies jointly working to produce and send products to the hands of consumers. The network of many companies are suppliers, manufacturers, distributors, retailers, and supporting companies such as logistics (third pastry logistics) services.

2.2. Green Supply Chain
Green Supply Chain Management as a process of using environmentally friendly inputs and turning those inputs into outputs that can be reused at the end of its life cycle thereby creating a sustainable Supply Chain (Penfield, 2007).

Green supply chain management is also defined as the integration of environmental thinking into Supply Chain Management, including product design, material purchasing and supplier selection, manufacturing processes, delivery of final products to consumers (Srivastava, 2007).

2.3. Supply Chain Operations Reference (SCOR)
SCOR divides into five processes including Plan (planning process), Source (Procurement process), Make (production process), Deliver (delivery process), and Return (return process) (Pujawan, 2017).

The SCOR framework provides a variety of performance measures for evaluating supply chains arranged in several levels of metric measurements associated with one of the performance attributes: Reliability, Responsiveness, Flexibility, Cost, and Asset (Natalia and Astuario, 2015).

The goal is to create an analysis that will later provide an overview of the relationship of supply chain functions with environmental aspects in order to create improved management performance between the two (Taylor, 2003).

Figure 2 Green SCOR model adds several considerations related to the environment in it. In this way, this model is used as a tool for managing the environmental impact of a supply chain.

3. RESEARCH METHODS
This research uses a qualitative and quantitative methods with using a descriptive exploratory approach with the object of research is pharmaceutical company in Jakarta, DKI Jakarta, Indonesia. Data collection methods used in this study include:

1. Primary Data. The following are primary data conducted by researchers:
   a. Interview, conducted by Focus Group Discussion (FGD) which is interview with Commercial Managers, Logistic Managers, Planner Managers, Material Management Managers, Warehouse Managers, Quality Control Managers, Quality Assurance Managers, Head of Operations Managers, Procurement Manager, Engineering Manager, Environment Health and Safety Manager and Site Director.
   b. Direct observation. This data collection method is done through careful observation at the research location at pharmacy company at Jakarta.

2. Secondary Data. The data obtained through literature related to green supply chain and other previous research related to research.

4. RESULT AND DISCUSSION
4.1. Overview of Pharmacy Company at Jakarta
The pharmacy company was first established in 1973 at Bogor with an area of 36,500 m² and the second in 1994 at Pulubuaran Raya Street, Jatinegara, Distric Cakung, City of East Jakarta with an area of 19,050 m².

Below Figure 3 is the process supply chain in the pharmaceutical company Jakarta.
**Figure 2:** Structure of the SCOR model

Source: (Supply Chain Council, 2006)

**Figure 3:** End-to-end Supply chain

**Figure 4:** Supply chain market

Source: The Supply Chain Pharmacy Jakarta
### Table 1: SCOR model key performance indicator (KPI)

| Component | Attribute | No KPI | Key Performance Indicator | KPI section |
|-----------|-----------|--------|---------------------------|-------------|
| Reability | PR-1 | Sales and Operation Planning - commercial demand forecast information | Commercial |
| | PR-2 | Supply Review Meeting - Ensure that the forecast received is in accordance with SNOP - Sales and Operation Planning | Logistic |
| | PR-3 | Master Production Schedule - Creating a schedule based on production capacity | Planner |
| | PR-4 | MPS - Preparation of a schedule for checking raw material and packaging material | QC |
| Plan | PR-5 | MPS - Schedule release of raw material and packaging material | QA |
| | PR-6 | Material Requirement Planning - Making a material procurement schedule, and material allocation for production needs | Management |
| | PR-7 | Material Requirement Planning - Making a material purchasing schedule | Procurement |
| | PR-8 | Making maintenance schedule | ENG |
| | | Making a schedule for disposal of Non Hazardous waste | EHS |

| Component | Attribute | No KPI | Key Performance Indicator | KPI section |
|-----------|-----------|--------|---------------------------|-------------|
| Plan | P.Re - 1 | The period of time for making a production schedule | Planner |
| | P.Re - 2 | Timeframe to revise the production schedule | Planner |
| | P.Re - 3 | RM/PM admission period | Warehouse |
| | P.Re - 4 | RM/PM examination period | QC |
| | P.Re - 5 | RM/PM release period | QA |
| Responsiveness | P.Re - 6 | Production period | Production |
| | P.Re - 7 | FG Solid release period | QA |
| | P.Re - 1 | The period of time for making a production schedule | Planner |
| | P.Re - 2 | Timeframe to revise the production schedule | Planner |

| Component | Attribute | No KPI | Key Performance Indicator | KPI section |
|-----------|-----------|--------|---------------------------|-------------|
| Source | SR-1 | RM/PM documentation in accordance with compliance requirements | QA |
| | SR-2 | RM/PM packaging is in accordance with the RM/PM requirements specifications | QA |
| | SR-3 | The amount of RM/PM received is in accordance with the PO | Warehouse |
| | SR-4 | RM according to specifications | QC |
| | SR-5 | PM according to specifications | QC |
| Responsiveness | S.Re-1 | RM testing lead time 10 days | QC |
| | S.Re-2 | PM testing lead time 8 days | QC |
| | S.Re-3 | RM testing lead time release 3 days | QA |
| | S.Re-4 | Lead time release PM testing 3 days | QA |
| | S.Re-5 | Production lead time 10 days | QC |
| | S.Re-6 | The FG testing lead time is 5 days | QC |
| | S.Re-7 | The lead time for FG release is 7 days | QA |
| | S.Re-1 | RM testing lead time 10 days | QC |
| Flaxibility | SF-1 | Campaign testing material process | QC |
| | SF-2 | Campaign production process | Production |
| Cost | SC-1 | RM/PM packaging | Procurement |
| Aset | SA-1 | 5 pieces of RM stock | Material |
| | SA-2 | 2 batches of PM stock | Management |
| Make | MR-1 | Adjustment production schedule | Planner |
| | MR-2 | Granulasi process | Production |
| | MR-3 | Compressing process | Production |
| | MR-4 | Primary packaging process | Production |
| | MR-5 | Secondary packaging process | Production |
| | MR-6 | The number of defective primary packaging material | Production |
| | MR-7 | The number of defective secondary packaging material | Production |
| Responsiveness | M.Re-1 | FG product manufacturing time | Production |
| | M.Re-2 | Production responsiveness with a variety of products | Production |
| | M.Re-3 | Production responsiveness to changes in production schedule | Production |
| Flexibility | MF-1 | Campaign production process | Production |
| | MF-2 | Campaign testing FG | QC |
| Cost | MC | Product cost | Production |
| Aset | MA | The average length of life of the production machines | ENG |
| Deliver | DR-1 | RM/PM readiness | Planner |
| | DR-2 | FG readiness | Planner |
| Responsiveness | D.Re | Loadtime FG | Production |
| Return | RR | Customer complain | QA |
| Responsiveness | R.Re | OOS product replacement time | QA |

Source: Analysis Results (2020)
Figure 3 shows the end-to-end supply chain which is divided into 3 business areas pharmacy external, which is a supplier that supplies all of the packaging material needs, both primary packaging material and secondary packaging material, and pharmacy internal...
### Table 3: (A) Weighting using the AHP method

| Component/Process | Attributes/Dimensions | No KPI | KPI attributes | KPI weights |
|-------------------|-----------------------|--------|----------------|-------------|
| Plan              | Reliability           | PR-1   | Sales and Operation Planning - commercial demand forecast information | 0.296486    |
|                   |                       | PR-2   | Supply Review Meeting - Ensure that the forecast received is in accordance with SNOP - Sales and Operation Planning | 0.998829    |
|                   |                       | PR-3   | Master Production Schedule - Creating a schedule based on production capacity | 0.998829    |
|                   |                       | PR-4   | MPS - Preparation of a schedule for checking raw material and packaging material | 0.08858     |
|                   |                       | PR-5   | MPS - Schedule release of raw material and packaging material | 0.998829    |

### Table 3: (Continued)

| Component/Process | Attributes/Dimensions | No KPI | KPI attributes | KPI weights |
|-------------------|-----------------------|--------|----------------|-------------|
| Plan              | Reliability           | PR-6   | Material Requirement Planning - Making a material procurement schedule, and material allocation for production needs | 0.998829    |
|                   |                       | PR-7   | Material Requirement Planning - Making a material purchasing schedule | 0.998829    |
|                   |                       | PR-8   | Making maintenance schedule Making a schedule for disposal of Non Hazardous waste | 0.120791    |

### Table 3: (B) Weighting using the AHP method (advances)

| Component/Process | Attributes/Dimensions | No KPI | KPI attributes | KPI weights |
|-------------------|-----------------------|--------|----------------|-------------|
| Plan              | Reliability           | PR-1   | Responsiveness P.Re-1 The period of time for making a production schedule | 0.09109     |
|                   |                       | PR-2   | Timeframe to revise the production schedule | 0.26179     |
|                   |                       | PR-3   | RM/PM admission period | 0.248415    |
|                   |                       | PR-4   | RM/PM examination period | 0.019135    |
|                   |                       | PR-5   | RM/PM release period | 0.093391    |
|                   |                       | PR-6   | Production period | 0.157953    |
|                   |                       | PR-7   | FG Solid release period | 0.128225    |
| Source            | Reliability           | SR-1   | RM/PM documentation in accordance with compliance requirements | 0.129288    |
|                   |                       | SR-2   | RM/PM packaging is in accordance with the RM/PM requirements specifications | 0.277045    |
|                   |                       | SR-3   | The amount of RM/PM received is in accordance with the PO | 0.593668    |
|                   |                       | SR-4   | RM according to specifications | 0.5        |
|                   |                       | SR-5   | PM according to specifications | 0.5        |
|                   |                       | SR-6   | Material Requirement Planning 10 days | 0.142857    |
|                   |                       | SR-7   | Material Requirement Planning 8 days | 0.142857    |
|                   |                       | SR-8   | Material Requirement Planning 3 days | 0.142857    |
|                   |                       | SR-9   | Lead time release PM 10 days | 0.142857    |
|                   |                       | SR-10  | Production lead time 10 days | 0.142857    |
|                   |                       | SR-11  | The FG testing lead time is 5 days | 0.142857    |
|                   |                       | SR-12  | The lead time for FG release is 7 days | 0.142857    |
|                   |                       | SR-13  | Campaign testing material process | 0.75        |

### Flaxibility

| Component/Process | Attributes/Dimensions | No KPI | KPI attributes | KPI weights |
|-------------------|-----------------------|--------|----------------|-------------|
| Plan              | Reliability           | PR-1   | Responsiveness S.Re-1 | 0.142857    |
|                   |                       | PR-2   | S.Re-2 | 0.142857    |
|                   |                       | PR-3   | S.Re-3 | 0.142857    |
|                   |                       | PR-4   | S.Re-4 | 0.142857    |
|                   |                       | PR-5   | S.Re-5 | 0.142857    |
|                   |                       | PR-6   | S.Re-6 | 0.142857    |
|                   |                       | PR-7   | S.Re-7 | 0.142857    |

(Contd...)
manufacturing which is all production processes, starting from dispensing or preparation raw material and packaging material, mixing raw materials between active substances and fillers with coloring agents and flavorings, granulation or the process of forming drug particles according to predetermined sizes, compressing or molding the particle shape into tablet or caplet form, filling or the process of packaging the primary packaging in which the tablet or caplet is inserted into the packaging blister, packing or packaging process secondary packaging where each blister included in the carton and then inserted into the carton shipper or box and commercial the ordering of products and distribute the finished product (Figure 4).

The supplier sends packaging materials, primary packaging and secondary packaging materials to help pharmacy company make products which are then distributed by pharmacy company commercial products to customers.

### 4.2. Research Result

Measurement of Green Supply Chain performance indicators at pharmacy using the SCOR model at level 1. Level 1 SCOR models include 5 main activities namely plan, source, make, deliver, and return.

At level 1 there are 5 attributes namely reliability, responsiveness, agility, cost and assets. Level 2 key performance indicators (KPI) are used to measure the level of achievement of objectives. KPI identified from the metric of green SCOR green based on objective expected by each stakeholder.

### 4.3. Determination of KPIs

An interview and question and answer discussion process was held with senior managers (department heads), and managers namely the Head of Commercial, Head of Procurement, Head of Logistics, Manager Planner, Material Management Manager, Warehouse Manager, Quality Control Manager, Quality Assurance Manager, Head of Operation, Value Stream Solid-Semi Solid Manager, Head of Engineering, Head of Environment Health and Safety as well as direct observation through observation or direct observation in the logistics department. Results of Focus Group Discussion in which there are interviews and question and answer discussions obtained the communication process manufacturing flow and Key Performance Indicator (KPI) which is the basis for the calculation to determine the value of Green SCOR (Table 1).

### 4.4. Determination of Normalization

The next step is to normalize each KPI. This is done because each KPI has different weights with different size scales. For this reason, the parameter equalization process is needed, namely by means of the normalization. The normalization process is carried out with the Snorm De Boer normalization formula (Table 2).

### 4.5. AHP Calculation

The next step is weighting with the AHP (Analytical Hierarchy Process) method. Determining the scale of 1-9 is the best scale in expressing opinions. At this stage pairwise comparisons are discussed with the Head of Commercial, Head of Procurement,
### Table 4: Calculation of the final value of KPI

| Component | Attribute | No KPI | KPI | Snorm | KPI weights | Performance value |
|-----------|-----------|--------|-----|-------|-------------|-------------------|
| Plan      | Reability | PR-1   | Sales and Operation Planning - commercial demand forecast information | 50.00 | 0.271324 | 13.566176 |
|           |           | PR-2   | Supply Review Meeting - Ensuring a good forecast | 25.00 | 0.121324 | 3.033088 |
|           |           | PR-3   | Master Production Schedule - Creating a schedule based on production capacity | 100.00 | 0.099265 | 9.926471 |
|           |           | PR-4   | MPS - Preparation of raw material inspection schedule and packaging material | 100.00 | 0.088971 | 8.897059 |
|           |           | PR-5   | MPS - Schedule release of raw material and packaging material | 100.00 | 0.099265 | 9.926471 |
|           |           | PR-6   | Material Requirement Planning - Making a material procurement schedule, and material allocation for needs production | 100.00 | 0.099265 | 9.926471 |
|           |           | PR-7   | Material Requirement Planning - Making a schedule purchase of material | 100.00 | 0.099265 | 9.926471 |
|           |           | PR-8   | Making a schedule for disposal of Non Hazardous waste | 100.00 | 0.121324 | 12.132353 |
| Responsiveness | Reability | PRe - 1 | The period of time for making a production schedule | 50.00 | 0.091090 | 4.554525 |
| Responsiveness | Reability | PRe - 2 | Timeframe to revise the production schedule | 50.00 | 0.261790 | 13.089481 |
| Responsiveness | Reability | PRe - 3 | RM/PM admission period | 50.00 | 0.248415 | 12.420761 |
| Responsiveness | Reability | PRe - 4 | RM/PM examination period | 100.00 | 0.019135 | 1.913548 |
| Responsiveness | Reability | PRe - 5 | RM/PM release period | 66.67 | 0.093391 | 6.226059 |
| Responsiveness | Reability | PRe - 6 | Production period | 100.00 | 0.157953 | 15.795293 |
| Responsiveness | Reability | PRe - 7 | FG Solid release period | 100.00 | 0.128225 | 12.822537 |
| Source     | Reability | SR-1   | RM/PM documentation in accordance with compliance requirements | 62.50 | 0.129288 | 8.080475 |
| Source     | Reability | SR-2   | RM/PM packaging is in accordance with the specifications requirements | 62.50 | 0.277045 | 17.315303 |
| Source     | Reability | SR-3   | The amount of RM/PM received is in accordance with the PO | 100.00 | 0.593668 | 59.366755 |
| Source     | Reability | SR-4   | RM according to specifications | 100.00 | 0.500000 | 50.000000 |
| Source     | Reability | SR-5   | PM according to specifications | 100.00 | 0.500000 | 50.000000 |
| Responsiveness | Reability | S.Re-1 | RM testing lead time 10 days | 90.00 | 0.142857 | 12.857143 |
| Responsiveness | Reability | S.Re-2 | PM testing lead time 8 days | 100.00 | 0.142857 | 14.285714 |
| Responsiveness | Reability | S.Re-3 | RM testing lead time release 3 days | 100.00 | 0.142857 | 14.285714 |
| Responsiveness | Reability | S.Re-4 | Lead time release PM testing 3 days | 100.00 | 0.142857 | 14.285714 |
| Responsiveness | Reability | S.Re-5 | Production lead time 10 days | 100.00 | 0.142857 | 14.285714 |
| Responsiveness | Reability | S.Re-6 | The FG testing lead time is 5 days | 100.00 | 0.142857 | 14.285714 |
| Responsiveness | Reability | S.Re-7 | The lead time for FG release is 7 days | 85.71 | 0.142857 | 12.244898 |
| Flexibility | Reability | SF-1   | Campaign testing material process | 50.00 | 0.750000 | 37.500000 |
| Flexibility | Reability | SF-2   | Campaign production process | 50.00 | 0.250000 | 12.500000 |
| Cost       |          | SC-1   | Kemasan RM/PM | 90.00 | 1.000000 | 90.000000 |
| Aset       |          | SA-1   | 5 bacth RM stock | 100.00 | 0.500000 | 50.000000 |
| Make       | Reability | MR-1   | Adjustment production schedule | 100.00 | 0.140155 | 14.015549 |
| Make       | Reability | MR-2   | Granulasi process | 100.00 | 0.071233 | 7.123345 |
| Make       | Reability | MR-3   | Compressing process | 100.00 | 0.071233 | 7.123345 |
| Make       | Reability | MR-4   | Primary packaging process | 100.00 | 0.061568 | 6.156756 |
| Make       | Reability | MR-5   | Secondary packaging process | 100.00 | 0.102322 | 10.233242 |
| Make       | Reability | MR-6   | Jumlah primary packaging material yang cacat | 0.95 | 0.233873 | 0.222736 |
| Make       | Reability | MR-7   | Jumlahsecondary packaging material yang cacat | 0.95 | 0.316050 | 0.304386 |
| Responsiveness | Reability | M.Re-1 | FG product manufacturing time | 82.61 | 0.277045 | 22.886314 |
| Flexibility | Reability | M.Re-2 | Production responsiveness with a variety of products | 66.67 | 0.593668 | 39.577836 |
| Flexibility | Reability | M.Re-3 | Production response with schedule changes | 100.00 | 0.129288 | 12.928760 |
| Cost       |          | MC     | Product cost | 25.00 | 1.000000 | 25.000000 |
| Aset       |          | MA     | The average length of life of the production machines | 100.00 | 1.000000 | 100.000000 |
| Deliver    | Reability | DR-1   | RM/PM readiness | 100.00 | 0.250000 | 25.000000 |
| Deliver    | Reability | DR-2   | FG readiness | 100.00 | 0.750000 | 75.000000 |
| Responsiveness | Reability | D.Re   | Laadtime FG | 100.00 | 1.000000 | 100.000000 |
| Return     | Reability | RR     | Customer complain | 100.00 | 1.000000 | 100.000000 |
| Responsiveness | Reability | R.Re   | OOS product replacement time | 100.00 | 1.000000 | 100.000000 |

Source: Analysis Results (2020)
Table 5: Calculation of the final value of attributes

| Component/Process | Attributes/Dimensions | No KPI | KPI | Snorm | KPI weights | Performance value | Total for each attribute |
|-------------------|-----------------------|--------|-----|-------|-------------|-------------------|------------------------|
| Plan              | Reability             | PR-1   | Sales and Operation Planning - commercial demand forecast information | 50    | 0.296486   | 14.824305        | 77.763543              |
|                   |                       | PR-2   | Supply Review Meeting - Ensure that the forecast received is in accordance with SNOP - Sales and Operation Planning | 25    | 0.098829   | 2.470717         |                        |
|                   |                       | PR-3   | Master Production Schedule - Creating a schedule based on production capacity | 100   | 0.098829   | 9.88287          |                        |
|                   |                       | PR-4   | MPS - Preparation of a schedule for checking raw material and packaging material | 100   | 0.08858    | 8.85798          |                        |
|                   |                       | PR-5   | MPS - Pembuatan schedule release raw material and packaging material | 100   | 0.098829   | 9.88287          |                        |
|                   |                       | PR-6   | Material Requirement Planning - Making a material procurement schedule, and material allocation for production needs | 100   | 0.098829   | 9.88287          |                        |
|                   |                       | PR-7   | Material Requirement Planning - Making a material purchasing schedule | 100   | 0.098829   | 9.88287          |                        |
|                   |                       | PR-8   | Making maintenance schedule | 100   | 0.120791   | 12.079063        |                        |
|                   |                       |        | Making a schedule for disposal of Non Hazardous waste |        |            |                  |                        |
|                   | Responsiveness        | P.Re - 1 | The period of time for making a production schedule | 50    | 0.09109    | 4.554525         | 66.822204              |
|                   |                       | P.Re - 2 | Timeframe to revise the production schedule | 50    | 0.26179    | 13.08948         |                        |
|                   |                       | P.Re - 3 | RM/PM admission period | 50    | 0.248415   | 12.420761        |                        |
|                   |                       | P.Re - 4 | RM/PM examination period | 100   | 0.019135   | 1.913548         |                        |
|                   |                       | P.Re - 5 | RM/PM release period | 66.67 | 0.093391   | 6.226059         |                        |
|                   |                       | P.Re - 6 | Production period | 100   | 0.07953    | 9.88287          |                        |
|                   |                       | P.Re - 7 | FG Solid release period | 100   | 0.128225   | 12.822537        |                        |
|                   | Source                | SR-1   | RM/PM documentation in accordance with compliance requirements | 62.5  | 0.129288   | 8.080475         | 184.762533             |
|                   |                       | SR-2   | RM/PM packaging is in accordance with the specification requirements | 62.5  | 0.277045   | 17.315303        |                        |
|                   |                       | SR-3   | The amount of RM/PM received is in accordance with the PO | 100   | 0.593668   | 59.366755        |                        |
|                   |                       | SR-4   | RM according to specifications | 100   | 0.5        | 50               |                        |
|                   |                       | SR-5   | PM according to specifications | 100   | 0.5        | 50               |                        |
|                   |                      |        | The lead time for FG testing is 5 days | 85.71 | 0.124857   | 12.244898        |                        |
|                   | Responsiveness        | S.Re-1 | RM testing lead time 10 days | 90    | 0.142857   | 12.857143        | 96.530612              |
|                   |                       | S.Re-2 | PM testing lead time 8 days | 100   | 0.142857   | 14.285714        |                        |
|                   |                       | S.Re-3 | RM testing lead time release 3 days | 100   | 0.142857   | 14.285714        |                        |
|                   |                       | S.Re-4 | Lead time release PM testing 3 days | 100   | 0.142857   | 14.285714        |                        |
|                   |                       | S.Re-5 | Production lead time 10 days | 100   | 0.142857   | 14.285714        |                        |
|                   |                       | S.Re-6 | The FG testing lead time is 5 days | 100   | 0.142857   | 14.285714        |                        |
|                   |                       | S.Re-7 | The lead time for FG release is 7 days | 85.71 | 0.142857   | 12.244898        |                        |
|                   | Flexibility           | SF-1   | Campaign testing material process | 50    | 0.75       | 37.5             | 50                     |
|                   |                       | SF-2   | Campaign production process | 50    | 0.25       | 12.5             |                        |
|                   | Cost                  | SC-1   | Kemasan RM/PM | 90    | 1          | 90               | 90                     |
|                   | Aset                  | SA-1   | 5 batch RM stock | 100   | 0.5        | 50               | 100                    |
|                   |                       | SA-2   | 2 batch PM stock | 100   | 0.5        | 50               |                        |
|                   | Make                  | MR-1   | Adjustment production schedule | 100   | 0.140155   | 14.015549        |                        |
|                   |                       | MR-2   | Granulasi process | 100   | 0.071233   | 7.123345         |                        |
|                   |                       | MR-3   | Compressing process | 100   | 0.071233   | 7.123345         |                        |
|                   |                       | MR-4   | Primary packaging process | 100   | 0.061568   | 6.156756         | 45.179359             |
|                   |                       | MR-5   | Secondary packaging process | 100   | 0.102332   | 10.233242        |                        |
|                   |                       | MR-6   | The number of defective primary packaging material | 0.95  | 0.233873   | 0.227236         |                        |
|                   |                       | MR-7   | The number of defective secondary packaging material | 0.95  | 0.319605   | 0.304386         |                        |
|                   | Responsiveness        | M.Re-1 | FG product manufacturing time | 82.61 | 0.277045   | 22.886314        |                        |
|                   |                       | M.Re-2 | Production responsiveness with a variety of products | 66.67 | 0.593668   | 39.577836        |                        |

(Contd...)
Table 5: (Continued)

| Component | Attribute | No KPI | KPI | Snorm | Bobot KPI | Nilai Kinerja | Total tiap Atribut |
|-----------|-----------|--------|-----|--------|-----------|---------------|-------------------|
| M.Re-3    | Production response with schedule changes production | 100 | 0.129288 | 12.92876 | 75.39291 |
| Flexibility MF-1 | Campaign production process | 100 | 0.833333 | 83.33333 | 100 |
| MF-2 | Campaign testing FG | 100 | 0.166667 | 16.66667 |
| Cost | Product cost | 25 | 1 | 25 | 25 |
| Asset | The average length of life of the production machines | 100 | 1 | 100 | 100 |
| Deliver Reability DR-1 | RM/PM readiness | 100 | 0.25 | 25 | 100 |
| DR-2 | FG readiness | 100 | 0.75 | 75 |
| Responsiveness | DR-2 | FG readiness | 100 | 1 | 100 | 100 |
| Reability RR | Customer complain | 100 | 1 | 100 | 100 |
| Responsiveness | R.Re | OOS product replacement time | 100 | 1 | 100 | 100 |

Source: Analysis Results (2020)

Head of Logistics, Manager Planner, Material Management Manager, Warehouse Manager, Quality Control Manager, Quality Assurance Manager, Head of Operation, Value Stream Solid-Semi Solid Manager, Head of Engineering, Head of Environment Health and Safety by assessing the importance of one element to other elements (Table 3).

Normalization results are shown in the “Eigen 1” column. Logical consistency needs to be taken into account to see whether the comparison matrix is consistent or not.

The method is as follows:
1) Multiply the matrix with Eigen 1, where the results are shown in the WSV column.
2) Add up the product by line.
3) The sum of each row is divided by priority and the results are summed.
4) Results c divided by the number of elements, will be obtained λ max.
5) Calculate the Consistency Index (CI).
6) Calculate Consistency Ratio.

This is done to determine the level of importance of each level and KPI with the aim of calculating the total value of the performance of Green SCOR. This weighting is carried out for each KPI and its components and attributes by: Pairwise Comparison Matrix Measurement.

4.6. KPI Calculation

The next calculation is to calculate the final value of the performance of Green SCOR. This calculation is done by multiplying each normalization score that has been obtained from the Snorm De Boer normalization formula with the weights of each key performance indicator, attribute, and component. Here are the results of the calculation: Examples of calculating performance value on KPIs “Adding supplier using milkrum delivery are follows in Table 4

4.7. Attribute Calculation

The next calculation is to calculate the final attribute value from Green SCOR. This calculation is done by adding up all the performance values of each attribute. Here are the results of the calculation presented in Table 5.

4.8. Calculation of the Value of Green Manufacturing Work

The next calculation is to calculate the Green Manufacturing performance value from Green SCOR.

This calculation is done by adding up all the total values of component performance.

Here are the results of the calculation:

In Table 6 the Green Manufacturing performance value is calculated where the performance value of the component plan,
source, make, deliver and return is obtained by multiplying “Total Each Component” multiplied by “Weight of Components,” then the results of the overall performance value of the components are added up. The result of the sum is the performance value of green SCOR. Green SCOR performance value for Green Manufacturing obtained is 96.5067 which according to the monitoring system work indicator included in the category of “Excellent.” These results indicate that pharmacy Indonesia is already good in carrying out green manufacturing activities and this performance should continue to be improved. To facilitate the evaluation of strategies from the calculation results of the performance value of the green supply chain the researchers made 2 performance boards namely the daily performance board and the weekly performance board to monitor the achievement of KPIs in 2019 (Table 7).

This improvement also has an impact on the costs incurred by the company PT. XYZ are:

Figures 5-7 points to a reduction in costs for Waste, which was previously 4.3 billion to 1.2 billion due to the implementation of cost reduction in several programs including:

### 5. CONCLUSION AND RECOMMENDATION

#### 5.1. Conclusion

After measuring and analyzing the calculation of the green manufacturing performance value, the conclusions that can be drawn from this study are as follows:

1. The results of performance measurements with PT XYZ’s Supply Chain Operation Reference (SCOR) show that the processes that exist in the company include Plan, Source, Make, Deliver, and Return. Based on the indicator determination questionnaire, all of the existing Key Performance Indicators (KPI) totaled 51 KPIs. Also based on the results of interviews and discussions obtained a new communication channel. In Table shows that the green manufacturing performance value is 96.506 shows the monitoring system and performance indicators are Excellent.

2. As for improvements that should be done to improve the performance value of the Green Model Supply Chain Operation Reference is by proposing a more focused strategy that is decision making at the management level and for the long term.

#### 5.2. Recommendation

It is recommended that the implementation of Green Supply Chain Management be communicated not only at the Managerial level but for all employees who are directly and indirectly involved in Green Manufacturing activities. Life Cycle Assessment - LCA needs to be carried out to identify and analyze the environmental impacts caused by products or activities throughout the life cycle starting from taking raw materials, followed by production and use processes, and ending with waste or waste management. Which is caused by the activities of green manufacturing in other chemical companies.

### REFERENCES

Ambe, I.M. (2014). Key indicators for optimising SC performance: The case of light vehicle manufacturers in South Africa. The Journal of Applied Business Research, 30(1), 277-290.

Borade, A., Bansod, S.V. (2007), Domain of supply chain management-a state of art. Journal of Technology Management and Innovation, 2(4), 109-121.

Finch, B.J. (2008), Operation Now: Supply Chain Profitability and Performance. 3rd ed. Singapore: McGraw-Hill Book Co.

Irfan, D., Xiaofei, X., Chun, D.S. (2008), A SCOR reference model of the SC: Management system in an enterprise. The International Arab Journal of Information Technology, 5(3), 288-295.

Jamehshooran, B.G., Awaluddin, M.S., Habibah, N.H. (2015), Assessing SC performance through applying the SCOR model. International Journal Supply Chain Management, 4(1), 1-11.

Kurien, G.P., Qureshi, M.N. (2012), Performance measurement systems for green supply chains using modified balanced score card and analytical hierarchical process. Academic Journals, 36, 149-161.

Lamming, R., Hampson, J. (1996), The environment as supply chain issue. British Journal of Management, 7, 45-42.

Natalia, C., Astuario, R. (2015), Penerapan model green SCOR Untuk Pengukuran Kinerja green supply chain. Jurnal Metris, 16, 97-106.
Penfield, P. (2007), Sustainability can be competitive advantage. Jurnal Manajemen Akademik Whitman, 3, 11-15
Pujawan, I.N. (2017), Supply Chain Management. 3rd ed. Surabaya: Guna Widya.
Pujawan, I.N., Mahendrawathi, E.R. (2010), Supply Chain Management. 2nd ed. Surabaya: Guna Widya.
Srivastava, P. (2007), Sustainability Can be Competitive Advantage. New York: Whitman School of Management.
Susanty, A., Santosa, H., Tania, F. (2017), Penilaian implementasi green supply chain management di UKM batik Pekalongan dengan pendekatan GreenSCOR. Jurnal Ilmiah Teknik Industri, 16(1), 55-63.
Sutawijaya, E.M. (2016), Penerapan menggunakan reference (SCOR) di PT INDOTURBINE. Jurnal Ilmiah Manajemen, 6(1), 1-10.
Taylor, W. (2003), GreenSCOR: Developing a Green Supply Chain Analytical Tool. Washington DC: Defense Technical Information Center.
Wayyum, R., Ahmad, S., Usman, M. (2010), Effects of SCOR on Management of SC. International Journal of Management and Organizational Studies, 2(1), 85-91.
Zhu, Q., Geng, Y., Fujita, T., Hashimoto, S. (2010), Green supply chain management in leading manufacturers: Case studies in Japanese large companies. Management Research Review, 33(4), 380-392.