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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, CO_2 Energy complaints, Water-H_2O 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

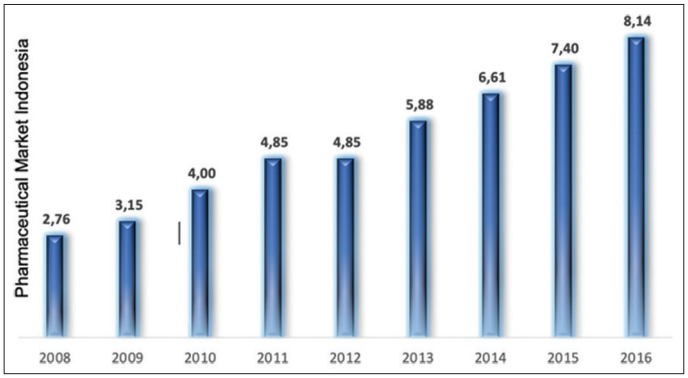
Awareness of health among Indonesians is also a driving force for increased consumption of medicines, this has led to an increase in the variety of products produced by the pharmaceutical industry. The supply chain movement of the pharmaceutical industry in Indonesia tends to show an increase. Based 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-H_2O 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

Figure 1: Indonesian Pharmaceutical Market, 2008 - 2016



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).

Green Supply Chain Management concept is a supply chain management that deals with environmental aspects (Lamming and Hampson, 1996).

2.3. Supply Chain Operations Reference (SCOR)

SCOR divides into five processes including Plan (planning process), Source (Procurement process), Make (production process), Deliver (deliveryprocess), 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 m^2 and the second in 1994 at Pulobuaran Raya Street, Jatinegara, Distric Cakung, City of East Jakarta with an area of 19,050 m^2.

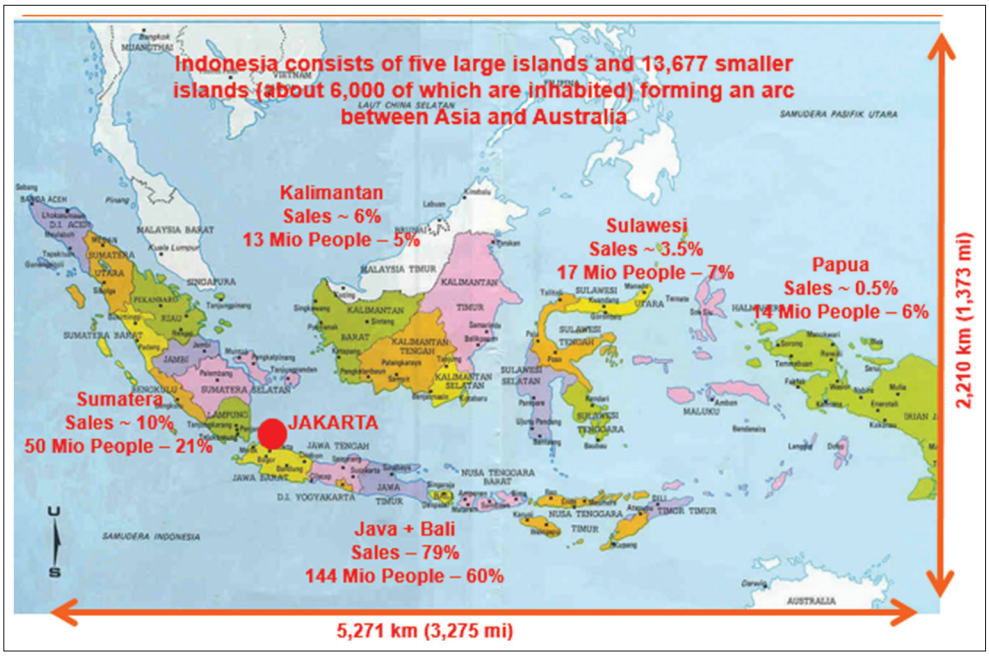
Below Figure 3 is the process supply chain in the pharmaceutical company Jakarta.

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
		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
	Reability	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	Material 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**
		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
Plan	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
Source	Reability	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 Management
		SA-2	2 batches of PM stock	Material Management
Make	Reability	MR-1	Adjustment production schedule	Planner
		MR-2	Granulasi process	Production
		MR-3	Compressing prosess	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
	Flaxibility	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	Reability	DR-1	RM/PM readiness	Planner
		DR-2	FG readiness	Planner
	Responsiveness	D.Re	Laadtime FG	Production
Return	Reability	RR	Customer complain	QA
	Responsiveness	R.Re	OOS product replacement time	QA

Source: Analysis Results (2020)

Table 2: (A) Normalization of Snorm De Boer

Component	Attribute	No KPI	Key Performance Indicator	Snorm	Category
Plan	Reability	PR-1	Sales and Operation Planning - commercial demand forecast information	50	Average
		PR-2	Supply Review Meeting - Ensure that the forecast received is in accordance with SNOP - Sales and Operation Planning	25	Poor
		PR-3	Master Production Schedule - Creating a schedule based on production capacity	100	Axcellent
		PR-4	MPS - Preparation of raw material inspection schedule and packaging material	100	Axcellent
		PR-5	MPS - Preparation of raw material release schedule and packaging material	100	Axcellent
		PR-6	Material Requirement Planning - Making a material procurement schedule, and material allocation for production needs	100	Axcellent
		PR-7	Material Requirement Planning - Making a schedule purchase of material	100	Axcellent
		PR-8	Making maintenance schedule	100	Axcellent
	Responsiveness	P.Re - 1	The period of time for making a production schedule	50	Average
		P.Re - 2	Timeframe to revise the production schedule	50	Average
		P.Re - 3	RM/PM admission period	50	Average
		P.Re - 4	RM/PM examination period	100	Axcellent
		P.Re - 5	RM/PM release period	66.67	Average
		P.Re - 6	Production period	100	Axcellent
		P.Re - 7	FG Solid release period	100	Axcellent
Source	Reability	SR-1	RM/PM documentation in accordance with compliance requirements	62.5	Average
		SR-2	RM/PM packaging is in accordance with the RM/PM requirements specifications	62.5	Average
		SR-3	The amount of RM/PM received is in accordance with the PO	100	Axcellent
		SR-4	RM according to specifications	100	Axcellent
		SR-5	PM according to specifications	100	Axcellent
	Responsiveness	S.Re-1	RM testing lead time 10 days	90	Good
		S.Re-2	PM testing lead time 8 days	100	Axcellent
		S.Re-3	RM testing lead time release 3 days	100	Axcellent
		S.Re-4	Lead time release PM testing 3 days	100	Axcellent
		S.Re-5	Production lead time 10 days	100	Axcellent
		S.Re-6	The FG testing lead time is 5 days	100	Axcellent
		S.Re-7	The lead time for FG release is 7 days	85.71	Good
	Flaxibility	SF-1	Campaign testing material process	50	Average
		SF-2	Campaign production process	50	Average
	Cost	SC-1	RM/PM packaging	90	Good
	Aset	SA-1	5 pieces of RM stock	100	Axcellent
		SA-2	2 batches of PM stock	100	Axcellent
(B) Normalization of Snorm De Boer (Advances)					
Component	**Attribute**	**No KPI**	**Key performance indicator**	**Snorm**	**Katagori**
Make	Reability	MR-1	Adjustment production schedule	100	Axcellent
		MR-2	Granulation process	100	Axcellent
		MR-3	Compressing process	100	Axcellent
		MR-4	Primary packaging process	100	Axcellent
		MR-5	Secondary packaging process	100	Axcellent
		MR-6	The number of defective primary packaging material	0.95	Poor
		MR-7	The number of defective secondary packaging material	0.95	Poor
	Responsiveness	M.Re-1	FG product manufacturing time	82.61	Good
		M.Re-2	Production responsiveness with a variety of products	66.67	Average
		M.Re-3	Production response with schedule changes	100	Axcellent
	Flaxibility	MF-1	Campaign production process	100	Axcellent
		MF-2	FG campaign testing	100	Axcellent
	Cost	MC	Product cost	25	Poor
	Aset	MA	The average length of life of the production machines	100	Axcellent
Deliver	Reability	DR-1	RM/PM readiness	100	Axcellent
		DR-2	FG readiness	100	Axcellent
	Responsiveness	D.Re	Laadtime FG	100	Axcellent
Return	Reability	RR	Customer complain	100	Axcellent
	Responsiveness	R.Re	OOS product replacement time	100	Axcellent

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	KPI weights
Plan	Reability	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	0.098829
		PR-3	Master Production Schedule - Creating a schedule based on production capacity	0.098829
		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	0.098829
(B) Weighting using the AHP method (advances)				
Component/ Process	**Attributes/ Dimensions**	**No KPI**	**KPI**	**KPI weights**
Plan	Reability	PR-6	Material Requirement Planning - Making a material procurement schedule, and material allocation for production needs	0.098829
		PR-7	Material Requirement Planning - Making a material purchasing schedule	0.098829
		PR-8	Making maintenance schedule	0.120791
			Making a schedule for disposal of Non Hazardous waste	

(*Contd...*)

Table 3: (*Continued*)

(B) Weighting using the AHP method (advances)				
Component/ Process	**Attributes/ Dimensions**	**No KPI**	**KPI**	**KPI weights**
	Responsiveness	P.Re - 1	The period of time for making a production schedule	0.09109
		P.Re - 2	Timeframe to revise the production schedule	0.26179
		P.Re - 3	RM/PM admission period	0.248415
		P.Re - 4	RM/PM examination period	0.019135
		P.Re - 5	RM/PM release period	0.093391
		P.Re - 6	Production period	0.157953
		P.Re - 7	FG Solid release period	0.128225
Source	Reability	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
	Responsiveness	S.Re-1	RM testing lead time 10 days	0.142857
		S.Re-2	PM testing lead time 8 days	0.142857
		S.Re-3	RM testing lead time release 3 days	0.142857
		S.Re-4	Lead time release PM testing 3 days	0.142857
		S.Re-5	Production lead time 10 days	0.142857
		S.Re-6	The FG testing lead time is 5 days	0.142857
		S.Re-7	The lead time for FG release is 7 days	0.142857
	Flaxibility	SF-1	Campaign testing material process	0.75

(*Contd...*)

Table 3: (*Continued*)

(B) Weighting using the AHP method (advances)				
Component/ Process	**Attributes/ Dimensions**	**No KPI**	**KPI**	**KPI weights**
		SF-2	Campaign production process	0.25
	Cost	SC-1	RM/PM packaging	1
	Aset	SA-1	5 pieces of RM stock	0.5
		SA-2	2 batches of PM stock	0.5
Make	Reability	MR-1	Adjustment production schedule	0.140155
		MR-2	Granulation process	0.071233
		MR-3	Compressing process	0.071233
		MR-4	Primary packaging process	0.061568
		MR-5	Secondary packaging process	0.102332
		MR-6	The number of defective primary packaging material	0.233873
		MR-7	The number of defective secondary packaging material	0.319605
	Responsiveness	M.Re-1	FG product manufacturing time	0.277045
		M.Re-2	Production responsiveness with a variety of products	0.593668
		M.Re-3	Production responsiveness to changes in production schedule	0.129288
	Flaxibility	MF-1	Campaign production process	0.833333
		MF-2	FG campaign testing	0.166667
	Cost	MC	Product cost	1
	Aset	MA	The average length of life of the production machines	1
Deliver	Reability	DR-1	RM/PM readiness	0.25
		DR-2	FG readiness	0.75
	Responsiveness	D.Re	Laadtime FG	1
Return	Reability	RR	Customer complain	1
	Responsiveness	R.Re	OOS product replacement time	1

Source: Analysis Results (2020)

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 secodary 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. Tresults 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 maintenance schedule Making a schedule for disposal of Non Hazardous waste	100.00	0.121324	12.132353
	Responsiveness	P.Re - 1	The period of time for making a production schedule	50.00	0.091090	4.554525
		P.Re - 2	Timeframe to revise the production schedule	50.00	0.261790	13.089481
		P.Re - 3	RM/PM admission period	50.00	0.248415	12.420761
		P.Re - 4	RM/PM examination period	100.00	0.019135	1.913548
		P.Re - 5	RM/PM release period	66.67	0.093391	6.226059
		P.Re - 6	Production period	100.00	0.157953	15.795293
		P.Re - 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
		SR-2	RM/PM packaging is in accordance with the specification requirements	62.50	0.277045	17.315303
		SR-3	The amount of RM/PM received is in accordance with the PO	100.00	0.593668	59.366755
		SR-4	RM according to specifications	100.00	0.500000	50.000000
		SR-5	PM according to specifications	100.00	0.500000	50.000000
	Responsiveness	S.Re-1	RM testing lead time 10 days	90.00	0.142857	12.857143
		S.Re-2	PM testing lead time 8 days	100.00	0.142857	14.285714
		S.Re-3	RM testing lead time release 3 days	100.00	0.142857	14.285714
		S.Re-4	Lead time release PM testing 3 days	100.00	0.142857	14.285714
		S.Re-5	Production lead time 10 days	100.00	0.142857	14.285714
		S.Re-6	The FG testing lead time is 5 days	100.00	0.142857	14.285714
		S.Re-7	The lead time for FG release is 7 days	85.71	0.142857	12.244898
	Flaxibility	SF-1	Campaign testing material process	50.00	0.750000	37.500000
		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
		SA-2	2 bacth PM stock	100.00	0.500000	50.000000
Make	Reability	MR-1	Adjustment production schedule	100.00	0.140155	14.015549
		MR-2	Granulasi process	100.00	0.071233	7.123345
		MR-3	Compressing prosess	100.00	0.071233	7.123345
		MR-4	Primary packaging process	100.00	0.061568	6.156756
		MR-5	Secondary packaging process	100.00	0.102332	10.233242
		MR-6	Jumlah primary packaging material yang cacat	0.95	0.233873	0.222736
		MR-7	Jumlahsecondary packaging material yang cacat	0.95	0.319605	0.304386
	Responsiveness	M.Re-1	FG product manufacturing time	82.61	0.277045	22.886314
	Flaxibility	M.Re-2	Production responsiveness with a variety of products	66.67	0.593668	39.577836
		M.Re-3	Production response with schedule changes production	100.00	0.129288	12.928760
		MF-1	Campaign production process	100.00	0.833333	83.333333
		MF-2	FG campaign testing	100.00	0.166667	16.666667
	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
		DR-2	FG readiness	100.00	0.750000	75.000000
	Responsiveness	D.Re	Laadtime FG	100.00	1.000000	100.000000
Return	Reability	RR	Customer complain	100.00	1.000000	100.000000
	Responsiveness	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 Making a schedule for disposal of Non Hazardous waste	100	0.120791	12.079063	
	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	13.089481	
		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	0.157953	15.795293	
		P.Re - 7	FG Solid release period	100	0.128225	12.822537	
Source	Reability	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	
	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	
	Flaxibility	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 bacth RM stock	100	0.5	50	100
		SA-2	2 bacth PM stock	100	0.5	50	
Component	**Attribute**	**No KPI**	**KPI**	**Snorm**	**Bobot KPI**	**Nilai Kinerja**	**Total tiap Atribut**
Make	Reability	MR-1	Adjustment production schedule	100	0.140155	14.015549	
		MR-2	Granulasi process	100	0.071233	7.123345	
		MR-3	Compressing prosess	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	0.222736	
		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
	Flaxibility	MF-1	Campaign production process	100	0.833333	83.333333	100
		MF-2	Campaign testing FG	100	0.166667	16.666667	
	Cost	MC	Product cost	25	1	25	25
	Aset	MA	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	D.Re	Laadtime FG	100	1	100	100
Return	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. Atribute 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.

Table 6: Calculation of green manufacturing performance value

Component	Total of each component	Component weights	Component performance value (total of each component×component weight)
Plan	0.14518419	72.29287337	10.49578219
Source	0.44241392	105.51378716	46.68076799
Make	0.04697602	59.33924508	2.78752147
Deliver	0.29086861	100.00000000	29.08686100
Return	0.07455726	100.00000000	7.45572645
Green Score			96.50665910

Source: Analysis Results (2020)

Table 7: KPI Actual (Author 2020)

Defect	2016 Actual	2017 Actual	2018 Actual	2019 Actual
Proses deviation	2.73%	3.40%	2.87%	2.14%
Supplier deviation	3.65%	5.94%	5.80%	3.15%
Document error	3.71%	5.25%	2.75%	2.70%
Complaints	70	33	212	14
Reject	1	0	1	1
Waste				
Energy CO_2	−8.50%	1.20%	13.90%	11.30%
Water H_2O	17.00%	−19.40%	−22.40%	−21.30%
Non-Hazardous Waste	5.20%	−28.10%	−38.00%	−40.00%
Landfill Waste	0.079	−0.12	−0.326	−0.3

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 table 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.

Figure 5: Waste cost graph

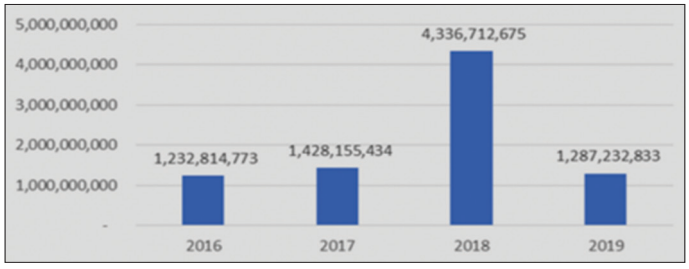


Figure 6: Graphical electrical cost

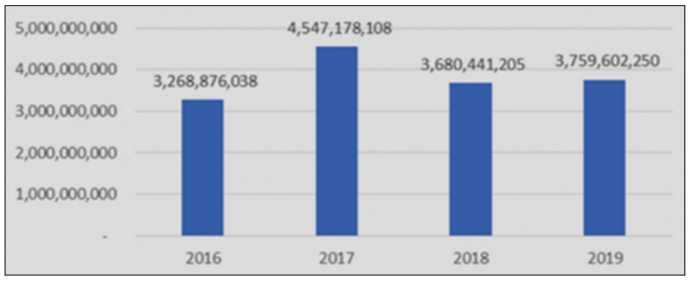
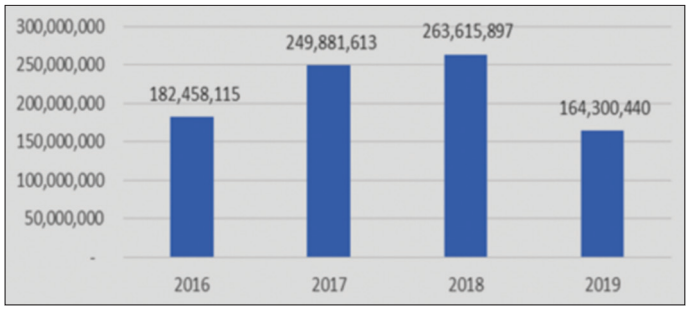


Figure 7: Water cost graph



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.

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