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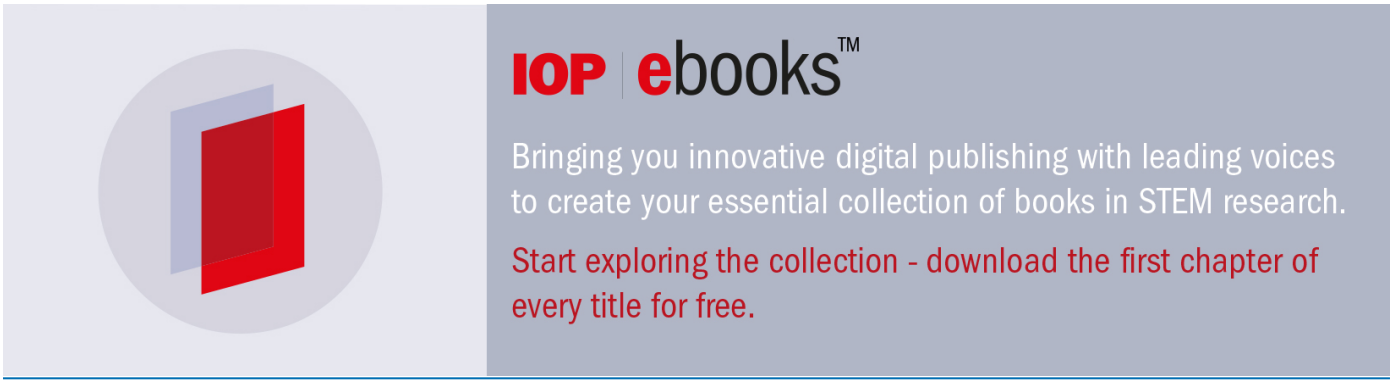

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Measurement and Proposed Improved Supply Chain Performance approach With PDCA frame work

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Abstract Supply Chain Management covers all the activities since material came from the supplier, then the material was processed into semi-finished products or finished products until the product is distributed to consumers. To know the performance of the company's Supply Chain, measurement is needed. From these measurements will be obtained result, so good or not good performance of the company's Supply Chain can be seen and can find the weaknesses of existing systems to be repaired. Given a good supply chain performance, the performance the company will increasingly focus and provide benefits, whether for the company, suppliers, and consumers. The company in this research is a company engaged in manufacturing Crude Palm Oil. The delayed raw material of fresh fruit bunches from suppliers resulted in fluctuating production numbers which need to be identified Supply Chain in the manufacturing process to maximize CPO production. By the result of supply chain performance measurement by using Supply Chain Operation Reference (SCOR) method there are 55 KPI that is 10 KPI for perspective plan, 5 KPI for perspective source, 15 KPI for perspective, deliver, 15 KPI for perspective make, and 10 KPI for perspective return. The result of scoring by using OMAX (Objective Matrix) method obtained by total index value equal to 6,1. Based on the traffic light system, the index is in the yellow category indicating that the performance of company supply chain as a whole has not achieved the expected performance even though the result is close to the target set. From KPI performance measurement result with OMAX calculation and traffic light system, it can be seen that KPI included in green category is 24 KPI, yellow category as many as 25 KPI, and red category as many as 6 KPI.

1. Introduction

The palm oil industry plays an important role in the development of the national economy in general and in particular the Province of North Sumatra. Despite the obvious economic benefits from the development of palm oil-based industries, on the other hand, the industry also contributes significantly to environmental degradation, both on inputs and on the outputs of industrial activities. Palm Oil Factory (POF) processes raw materials in the form of fresh fruit bunches (FFB) and produces crude palm oil (CPO) and palm kernel oil (PKO)[1].

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At this time began to emerge many new companies in similar industries. Companies must be able to meet market demands by considering the quality and efficiency of production. In the fulfillment of these market demands, the company should apply the concept of Supply Chain Management.

1.1. Consept of Supply Chain management

A supply chain is alignment of firms that bring products or services to market. A supply chain is a network of facilities and distribution options that performs the functions of procurements of materials, transformation of these materials into intermediate and finished products, and the distribution of the finished products to customers[3]. Supply chain is usually an integrated process in which there are raw materials processed into finished goods, then deliver it to consumers (through distributors, retail, or both) [2].

The term Supply Chain Management (SCM) was first put forward by Oliver & Weber in 1982[4]. If the supply chain is the physical network, the companies involved in supplying the raw materials, producing the goods, or sending it to the end user, SCM is the method, tool, or management approach. However, it should be emphasized that SCM requires an integrated approach or method with enthusiasm collaboration.

A good SCM can improve competitiveness for the supply chain as a whole but not cause one party to sacrifice in the long run[5]. SCM is a set of approaches used to efficiently integrate suppliers, manufacturers, warehouses and retailers so that products can be produced and distributed in the right quantities at the right location and at the right time to reduce costs and meet customer satisfaction [4].

1.2. Measurement of Supply Chain Performance

There are a number of different performance measurement types used for characterize system, especially production system, distribution, and inventory. The number of measurement systems, then to make the selection of which measurement system is most appropriate to the measurement of supply chain performance is very difficult. With the changes occurring in the corporate world, a growing performance measure that focuses on nonfinancial measurements. To develop a balanced performance measurement system, firms must consider both financial and non-financial aspects. Although financial performance measurement is important for strategic decision making and external reporting, control of manufacturing and distribution operations is better handled with nonfinancial measurements[6].

Along with the development of industry in the 21st century, Supply Chain Management has managed to become the main focus of any organization. Even some recent research states that Supply Chain Management is a practical management to improve world class company performance.

Measurement of supply chain performance has an important role in knowing the condition of the company, whether decreased or improvement and improvement what must be done to improve their performance. According to Rakhman[7] performance measurement is important because of the following reasons:

1. Performance measurement can control the performance either directly or indirectly.
2. Performance measurement will keep the company on track to achieve the purpose of increasing supply chain.
3. Performance measurement can be used to improve supply chain performance
4. The wrong measurement method can cause supply chain performance to decrease
5. Supply chain can be directed after performance measurement is done.

Industrial developments involving various business activities and operations have had an impact on environmental change. The resulting environmental impacts occur throughout the life cycle of a product, starting from raw material procurement, production process, and product reuse and last until the disposal stage. The industrial sector as the main actors causing environmental problems are expected to realize the importance of using environmentally friendly technologies in their production process in

order to minimize waste or waste and reduce negative impacts to the surrounding environment. These environmental impacts can occur along an industrial supply chain.

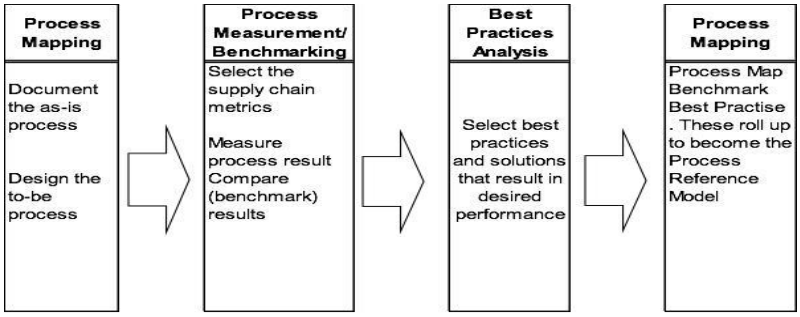
2. Theoritical review

2.1 SCOR Model Concept

Supply Chain Operation Reference (SCOR) Model is a conceptual model developed by the Supply Chain Council (SCC), an independent non-profit organization, as a cross-industry standard. The purpose of SCC standardization is to facilitate the understanding of the supply chain as a first step in order to obtain an effective supply chain management and efficient in sustaining the company's strategy[8] .

The organization formed in 1996 by Pittligio, Rabin, Todd, and Mc. Grath (PRTM) and AMR research institute in America, consisting of 69 volunteers consisting of industrial practitioners and researchers. The SCOR model has a framework that combines supply chain business processes, best practice based performance measurements into an integrated structure so that communication processes between supply chain actors and supply chain management activities can work optimally [8]

Excess SCOR Model as Process Reference Model is its ability to integrate Business Process Reengineering, Benchmarking, and Best Practices Analysis into the supply chain framework, as shown in Figure 1 Integration of several Business Process Concepts into the following SCOR Process Process Model:



Source :*Supply Chain Council* (2006)

Figure 1. Integration of some Business Process Concepts into SCOR Process Reference Model

2.2 Analytical Hierarchy Process (AHP)

This method can be used in solving complex and unstructured problems, where the existing data is qualitative. As for some of the advantages of AHP, among others [9]

1. Unity (unity), AHP makes the problem wide and unstructured into a model that is flexible and easy to understand.
2. Process repetition (AHP) is able to get people to filter the definition of a problem and develop their assessment and understanding through the process of repetition.
3. udgment and consencus, AHP does not require a consensus, but incorporates different assessment results.
4. Tradeoffs, AHP considers the relative priority of factors in the system so that people are able to choose the best alternative based on their goals.
5. Synthesis (AHP) leads to an overall estimate of how desired each alternative.
6. Complexity, AHP solves complex problems through system and approach deductive integration.
7. Interdependence, AHP can be used on the elements of the system that are independent and does not require linear relationship.
8. Hierarchy structuring (Hierarchy structure), AHP represents natural thinking which tends to group system elements to different levels of each level containing similar elements.

9. Measurement (measurement), AHP provides a scale for measuring intangible and methods for prioritization.
10. Consistency, the AHP considers the logical consistency in the judgments used to determine priorities.In weighting, value the weight is said to be consistent or acceptable if it meets the maximum limit of the ratio value inconsistency (CR) allowed is ≤ 0.1 [10]

2.3 Objetive Matrix (OMAX)

OMAX combines productivity criteria into an integrated and connected form. This model involves a whole range of companies, from subordinates to superiors. Goodness of OMAX model in measuring company productivity among others[11].

1. Relatively simple and easy to understand.
2. Easy to implement and no special skills required.
3. The data is easy to obtain.
4. More flexible, depending on the problem at hand
5. Ability to normalize the units of different measurement specifications.
6. It output orientation is compared on a simple with measurement activities. Calculation of this performance achievement score is generated by comparing the results achievement of the target. The scoring scheme based on the OMAX model can be shown in Figure 2.



Figure 2. Scheme based on the model OMAX

Based on Figure 2, there are three parts to the scoring scheme with the OMAX model namely Defining, Quantifying, and Monitoring.

1. Section A, is part of Defining or determine the factors that affect the performance of the company. The second line, Performance, is the result of the company's performance.
2. Part B, is a Quantifying section. At this stage of measurement is determined the division of levels of performance achievement.
3. Section C, is part of Monitoring as an analysis of level, weight, and value for each performance indicator. The level or score row is filled according to the position of the level of achievement specified in section B. Row weight is filled according to the weight of each indicator. While the value line is the result of the assessment or multiplication between the line level with the weight line.

Index is the sum of all value values of each criterion that states indicators of achievement of company performance. Performance improvement can be determined by the increase in the indicator of achievement when compared with the previous period measurement. In the OMAX scoring scheme,

2.4 Traffic Light System

There is a Traffic Light System that serves as a sign of whether performance indicators require an improvement or not. Traffic Light System is represented in three colors, namely:

1. Green color, with a threshold of 8 to 10 which means the achievement of a performance indicator has been achieved
2. Yellow color, with a threshold of 3 to 7 which means the achievement of a performance indicator has not been achieved even though the value is close to the target
3. Red color, with more threshold small or equal to 2 which means the achievement of a performance indicator is really below the target set and requires immediate improvement

3. Case Study

The company in this research is one of the companies engaged in manufacturing Crude Palm Oil (CPO) producers. Products manufactured by the company are the production of Crude Palm Oil. As for the scope of its business field is processing of fresh fruit bunches (FFB) as raw material into Crude Palm Oil (CPO), Kernel (Palm core) with capasity 25 ton/hours while its by-products are shells Crude and fibers that can be utilized as turbine drives to generate electricity used by factories. FFB as the raw material of the company comes from 3 sources that is from the company's own garden from the garden of third party company and from the result of the surrounding community garden the marketing area from the output of company that is to some buyer company at outside the company area.

Palm Oil production in the range of October 2016 to October 2017 in line is seen fluctuating and unstable. With the increasing number of companies that require Crude Palm Oil to support industrial activities. Problems can come from the input, process and output that can be seen in Figure 3.

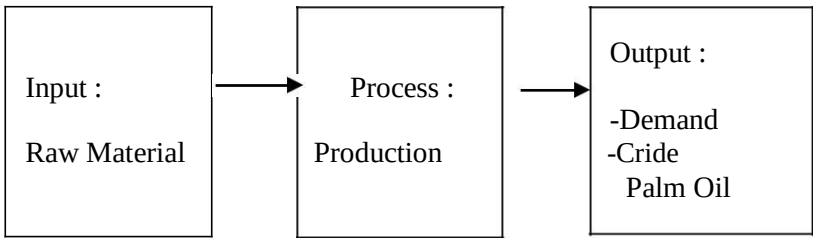


Figure 3. Input and Output

The occurrence of the number of production processes that fluctuate due to mismatch between input, process and output. In this case due to unstable raw materials. Because the amount of raw materials produced one of them depends on weather conditions, kind of the plant, and seasonible. All of the parameter conditions resulted in the supply of raw materials for the production process inhibited.

In order to optimize the amount of incoming raw materials to produce the same output in the months that have a high supply of raw materials one way to solve it is to see and assess from the supply chain management (SCM) of the company to align input, process, and output. So that in the end the physical flow, the flow of information and the flow of money in the company can be aligned.

4. Literature review

There are only a few studies retalted to measurement performance of company with supply chain management (SCM) till now. Some of the reasherches have tried to examine the concept. these are :

Ritajeng[12]. The results showed level 1 with 5 criteria and Level 2 with 24 sub criteria. The results of the dissemination of 7 questionnaires that have been spread and processed by ANP method using

Super Decision software. The result of ANP processing has sub criteria of weight with highest ranking OFC1 (percent of purchasing speed from start to order coming) equal to 0.08421 point. Then processed by OMAX method with result of lowest criterion value EN6 (high water consumption) & EN8 (high emission to water). EN6 is mainly due to engine leakage factor and on EN8 by method factor on IPAL process system. Proposed repairs with engine maintenance and reset the IPAL system in Downstream Steel Industry Company. I

Ihwan [13]. From the results of performance measurement, there are seven KPIs that are very low value and need to be repaired immediately. The seven KPIs are: accuracy of product delivery, raw material price level, product delivery cost, lead time of delivery of orders, delivery timeliness, supplier certification and level of damage to facilities and production equipment. The performance of the apple coke supply chain overall is worth 7.4 or enough level. Improvement recommendations are focused on low value KPIs and are expected to improve the performance of apple cider supply chains

Nurus [14] obtained value of achievement of company's supply chain performance as a whole is equal to 7,48. By doing AHP weighting and scoring system calculation using OMAX, 2 supply chain performance indicators that need immediate corrective action, that indicator is in the red category, that is the percentage of actual demand deviation rate by the number of production planning with value 3,34 and time effectiveness of checking machine periodically with value 3,38. By making improvements to these indicators is expected to help improve supply chain performance on the company.

Masoumik [15], The results proposed a procedure for obtaining relative intensity for problem solving, proposed a conceptual model for developing green supply chain strategy. the proposed conceptual model as a procedure for strategic priority of supply chain initiatives. Model decision-making using the combined application of ANP and SEM.

5. Research Methodology

Method of this research using systematic with PDCA framework that is Plan, Do Check, and Action

6. Result and Discussion

6.1. Plan

Planning is to put the objectives and processes needed to deliver results in accordance with the specification on the selection of supply chain indicators The classification of supply chain activity is based on the Supply Chain Operation Reference (SCOR) model.

The determination of key performance indicators is done by interview with the company and based on references from the literature study. Key performance indicators are classified based on supply chain activity on SCOR model with 5 perspectives. those are perspective plan, source, make, deliver, and return. In each perspective there are 3 main sizes to be considered namely reliability, responsiveness, and flexibility

From the result of supply chain performance measurement by using Supply Chain Operation Reference (SCOR) method there are 55 KPI that is 10 KPI for perspective plan, 5 KPI for perspective source, 15 KPI for perspective, deliver, 15 KPI for perspective make, and 10 KPI for perspective return

6.2. Do

Data processing is done by following the steps on Analytical Hierarchy Process (AHP) and OMAX (Objective Matrix) method.

Determination Hierarchy structure aims to determine the level and criteria of supply chain performance measurement to be used. The criteria obtained are based on the SCOR model approach that has been compiled into hierarchical forms such as Fig. 4.

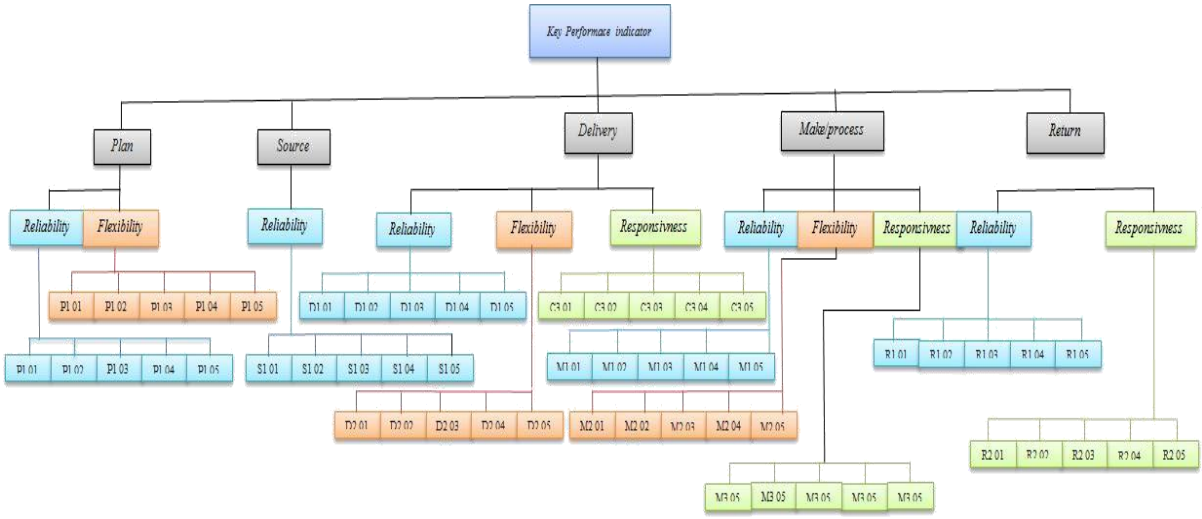


Figure 4. Performance Measurement Hierarchy Supply Chain in PT. XYZ

6.2.1 Calculation of weighting

Supply Chain Performance With Analitycal Hierarchy Process (AHP). Weights from each perspective (Level 1), dimension(Level 2) and KPI (Level 3) are obtained by spreading questionnaires to managers, production assistants, aortation assistants, technician assistant firms who are considered to know the state of the company.

The result of the calculation of weighting value for the measurement of the company's supply chain performance can be seen in Table 1

Table 1 The Result Of The Calculation Of Weighting Each Level

Perspective	Dimension	KPI	Weight of Perspektive	Weight of Dimension	Weight of KPI	Total Weight
Plan	Reliability	P1 01	0,2474	0,9010	0,1944	0,0433
		P1 02			0,1763	0,0393
		P1 03			0,2692	0,0600
		P1 04			0,1485	0,0331
		P1 05			0,2116	0,0472
	Responsiveness	P2 01		0,0990	0,2217	0,0054
		P2 02			0,2217	0,0054
		P2 03			0,2289	0,0056
		P2 04			0,1539	0,0038
		P2 05			0,1739	0,0043
Source	Reliability	S1 01	0,1615	1,0000	0,1851	0,0299
		S1 02			0,191	0,0308

Perspective	Dimension	KPI	Weight of Perspektive	Weight of Dimension	Weight of KPI	Total Weight
		S1 03			0,2686	0,0434
		S1 04			0,1614	0,0261
		S1 05			0,1938	0,0313
		D1 01			0,204	0,0469
		D1 02			0,1915	0,0440
	Reliability	D1 03		0,7898	0,214	0,0492
		D1 04			0,1917	0,0441
		D1 05			0,1989	0,0457
		D2 01			0,221	0,0052
		D2 02			0,1974	0,0047
Make	Flexibility	D2 03	0,2910	0,0812	0,2378	0,0056
		D2 04			0,1892	0,0045
		D2 05			0,1546	0,0037
		D3 01			0,1453	0,0055
	Responsivness	D3 02			0,1850	0,0069
		D3 03		0,1290	0,1192	0,0045
		D3 04			0,4238	0,0159
		D3 05			0,1267	0,0048
		M1 01			0,1526	0,0119
		M1 02			0,2485	0,0194
		M1 03		0,5530	0,1443	0,0113
		M1 04			0,2747	0,0214
	flexibility	M1 05			0,1798	0,0140
		M2 01			0,2408	0,0042
Deliver		M2 02	0,1411		0,2445	0,0043
		M2 03		0,1248	0,2263	0,0040
		M2 04			0,128	0,0023
		M2 05			0,1605	0,0028
	Responsiveness	M3 01		0,3222	0,1919	0,0087
		M3 02			0,172	0,0078

Perspective	Dimension	KPI	Weight of Perspektive	Weight of Dimension	Weight of KPI	Total Weight
		M3 03			0,2843	0,0129
		M3 04			0,1596	0,0073
		M3 05			0,1921	0,0087
Return	Reliability	R1 01	0,1590	0,7795	0,1382	0,0171
		R1 02			0,1367	0,0169
		R1 03			0,2333	0,0289
		R1 04			0,1617	0,0200
		R1 05			0,3300	0,0409
	Responsiveness	R2 01		0,2205	0,2139	0,0075
		R2 02			0,1609	0,0056
		R2 03			0,1772	0,0062
		R2 04			0,2193	0,0077
		R2 05			0,2286	0,0080
	Total					1,0000

6.2.2 Measurement Of Supply Chain Performance With OMAX Scoring System

After all Key Performance Indicators are selected clearly, data collection is then performed, Each target data and realization of Key Performance Indicator that has been quantified by the company. The data taken is data from January-December 2016 – 2017

The company's supply chain performance measurement scheme that has been obtained based on the calculation of OMAX and Traffic Light System can be seen in table 2 to table 8

Table 2 Performance Measurement Scheme of Supply Chain Perspective Plan With OMAX Method

KPI	**P1 01**	**P1 02**	**P1 03**	**P1 04**	**P1 05**	**P2 01**	**P2 02**	**P2 03**	**P2 04**	**P2 05**
Unit	%	%	kali	%	%	hari	hari	hari	Hari	%
Performance	11,45	13,50	3	6	6,28	1	2	2	1	90
10	9	13	4	3	5	1	1	1	1	97,25
9	9,64	13,64	4,64	3,64	5,64	1,64	1,64	1,64	1,64	97,89
8	10,28	13,58	4,35	4,31	5,97	1,78	1,78	1,78	1,78	98,03
7	10,92	13,53	4,07	4,98	6,31	1,92	1,92	1,92	1,92	98,17
6	11,57	13,47	3,78	5,65	6,64	2,07	2,07	2,07	2,07	98,32
5	12,21	13,42	3,50	6,32	6,98	2,21	2,21	2,21	2,21	98,46
4	12,85	13,36	3,21	7,00	7,31	2,35	2,35	2,35	2,35	98,60
3	13,50	12,61	2	7,70	7,34	2	3	2	2	85
2	15,00	14,07	1,66	8,46	8,22	2,33	3,33	2,33	2,33	85,33
1	16,50	15,53	1,33	9,23	9,11	2,66	3,66	2,66	2,66	85,66
0	18	17	1	10	10	3	3	3	3	84
Level (score)	6,18	6,5	3,82	9,91	2,52	10	6,46	6,46	10	3,36
(weight)	0,19	0,17	0,26	0,14	0,21	0,221	0,22	0,22	0,15	0,17
Value	1,20	1,14	1,02	1,47	0,53	2,217	1,43	1,47	1,53	0,58

Table 3 Performance Measurement Scheme Supply Chain Perspective Source With OMAX Method

KPI	**S1 01**	**S1 02**	**S1 03**	**S1 04**	**S1 05**
Unit	%	%	%	%	%
Performance	94,55	96,78	11,05	99,80	60
10	95	99	10	100	60
9	94,73	98,01	10,42	99,94	60,00
8	94,46	97,02	10,85	99,88	60,00
7	94,19	96,03	11,27	99,82	60,00
6	93,92	95,04	11,70	99,77	60,00
5	93,65	94,05	12,12	99,71	60,00
4	93,38	93,06	12,55	99,65	60,00
3	93,12	92,08	12,98	99,60	60.00
2	89,76	91,38	16,98	98,06	56,66
1	86,40	90,69	20,99	96,53	53,33
0	83,05	90	25	95	50
Level (score)	8,33	7,75	7,52	6,6	10
(weight)	0,18	0,19	0,26	0,16	0,19
Value	1,541	1,48	2,01	1,06	1,93

Tabel 4 Performance Measurement Scheme Supply Chain Perspective Delivery With OMAX Method

KPI	**D1 01**	**D1 02**	**D1 03**	**D1 04**	**D1 05**	**D2 01**	**D2 02**	**D2 03**	**D2 04**	**D2 05**
Unit	Hari	Hari	Hari	Hari	%	Hari	Hari	Hari	%	%
Performance	6,0	3	2,0	4,0	99,00	3,00	3,00	1,0	90,00	85,00
10	2,0	2	1,0	2,0	99,00	2	2	1,0	100	98
9	2,71	2	1,42	2,28	98,99	2,42	2,42	1,0	98,57	95,42
8	3,42	2	1,85	2,57	98,98	2,85	2,85	1,0	97,14	92,85
7	4,14	2	2,28	2,85	98,98	3,28	3,28	1,0	95,71	90,28
6	4,85	2	2,71	3,14	98,97	3,71	3,71	1,0	94,28	87,71
5	5,57	2	3,14	3,42	98,97	4,14	4,14	1,0	92,85	85,14
4	6,28	2	3,57	3,71	98,96	4,57	4,57	1,0	91,42	82,57
3	7	2	4	4	98,96	5	5,0	1,0	90	80
2	8,0	3,3	3,7	4,3	95,97	5	5,0	2,3	88,33	83,33
1	9,0	4,7	3,3	4,7	92,98	5	5,0	3,7	86,67	86,67
0	10	6	3	5	90,00	5	5,0	5,0	85,00	90,00
Level (score)	4,39	2,23	8,59	3	10	7,65	7,65	10	3	4,95
(weight)	0,20	0,19	0,21	0,19	0,19	0,22	0,19	0,23	0,18	0,15
Value	0,89	0,42	1,83	0,57	1,98	1,69	1,51	2,37	0,56	0,76

Tabel 4 Performance Measurement Scheme Supply Chain Perspective Delivery With OMAX Method (Continue)

KPI	**D3 01**	**D3 02**	**D3 03**	**D3 04**	**D3 05**
Unit	100	100	100	%	%
Performance	97,56	90,00	97,56	96,00	96,00
10	99	99	98,00	99,00	99,00
9	98,65	98,51	97,80	98,85	98,42
8	98,31	8,02	97,60	98,71	97,85
7	97,97	97,54	97,40	98,57	97,28
6	97,62	97,05	97,20	98,42	96,71
5	97,28	96,57	97,00	98,28	96,14
4	96,94	96,08	96,80	98,14	95,57
3	96,6	95,6	96,6	98,00	95
2	95,07	93,36	94,40	95,33	93,33
1	93,53	91,11	92,20	92,67	91,67
0	92	88,87	90	90	90,00
Level (score)	5,82	0,50	7,80	2,25	4,72
(weight)	0,14	0,185	0,11	0,42	0,12
Value	0,84	0,09	0,92	0,95	0,59

Tabel 5 Performance Measurement Scheme of Supply Chain Perspective Make With OMAX Method

KPI	**M1 01**	**M1 02**	**M1 03**	**M1 04**	**M1 05**	**M2 01**	**M2 02**	**M2 03**	**M2 04**	**M2 05**
Unit	%	%	%	%	%	%	%	%	%	%
Performance	96	96	96,77	96	15	93	22	4,20	18	25
10	99	99,00	100	99	10,	98,85	25	5,00	15	35
9	98,42	98,28	99,50	98,57	11,42	97,58	23,57	4,78	16,42	33,57
8	97,85	97,57	99,00	98,14	12,85	96,32	22,14	4,57	17,85	32,14
7	97,28	96,85	98,50	97,71	14,28	95,05	20,71	4,35	19,28	30,71
6	96,71	96,14	98,00	97,28	15,71	93,79	19,28	4,14	20,71	29,28
5	96,14	95,42	97,50	96,85	17,14	92,52	17,85	3,92	22,14	27,85
4	95,57	94,71	97,00	96,42	18,57	91,26	16,42	3,71	23,57	26,42
3	95	94	97	96	20	90	15,0	3,5	25	25
2	91,7	91	96,0	90,77	21,6	90	13,3	3,5	30	20
1	88,3	88,00	95,5	85,37	23,33	90	11,7	5,7	35,	15
0	85	85	95	80	25	90	10	10	40	10
Level (score)	4,75	5,81	2,77	3,00	5,49	5,37	7,90	6,33	7,89	3
Unit *(weight)*	0,15	0,24	0,14	0,27	0,17	0,24	0,24	0,22	0,12	0,16
Value	0,72	1,44	0,39	0,82	0,98	1,29	1,93	1,43	1,00	0,48

KPI	**M3 01**	**M3 02**	**M3 03**	**M3 04**	**M3 05**
Unit	%	%	%	%	%
Performance	15,00	0,00	15,00	30,00	98,00
10	15	0	5	10	98,75
9	14,28	2,14	6,42	14,28	97,50
8	13,57	4,28	7,85	18,57	96,25

Tabel 7 Performance Measurement Scheme Supply Chain Perspective Return With OMAX Method

KPI	**M3 01**	**M3 02**	**M3 03**	**M3 04**	**M3 05**
Unit	%	%	%	%	%
7	12,85	6,42	9,28	22,85	95,00
6	12,14	8,57	10,71	27,14	93,75
5	11,42	10,71	12,14	31,42	92,50
4	10,71	12,85	13,57	35,71	91,25
3	10	15	15	40	90
2	15,00	11,67	13,33	44,29	88,33
1	20,00	8,33	11,67	40,95	86,67
0	25	5	10	30	85
Level (score)	10,00	10,00	3,00	5,33	9,36
(weight)	0,19	0,17	0,28	0,15	0,19
Value	1,91	1,72	0,85	0,85	1,79

6.3 Check (Evaluation)

Monitor and evaluate processes and outcomes against objectives, specifications and report results. From each indicator, the researcher will evaluate the performance indicators entering the red category based on the company's supply chain performance measurement scheme in each perspective. Indicators - indicators are for researchers considered necessary to be improved in order to raise the company's performance. The root cause of the problem in this study uses a Cause-and-effect diagram

The Key Performance Indicator (KPI) entering the red category in the Performance Measurement Scheme can be seen in table 7

Tabel 8. Key Performance Indicator (KPI) entering the red category

No	KPI Code	Indicator
1	P1 05	Percentage of conformity of raw material planning with amount of raw material received
2	D1 02	Dexterity in serving raw material orders
3	D3 02	Delivery of products to consumers on time
4	D3 04	Quality of raw materials and products when shipping
5	M1 03	Changes in shipping costs of raw materials and products
6	R2 05	Number of complaints the company overcame

Analysis on the evaluation discussion, the researchers process the data of the cause based on interviews and direct visits of researchers to the production floor of the company. Diagram of Cause - Due to the evaluation of each indicator entering the red category can be seen in the picture from figure 5 – 10.

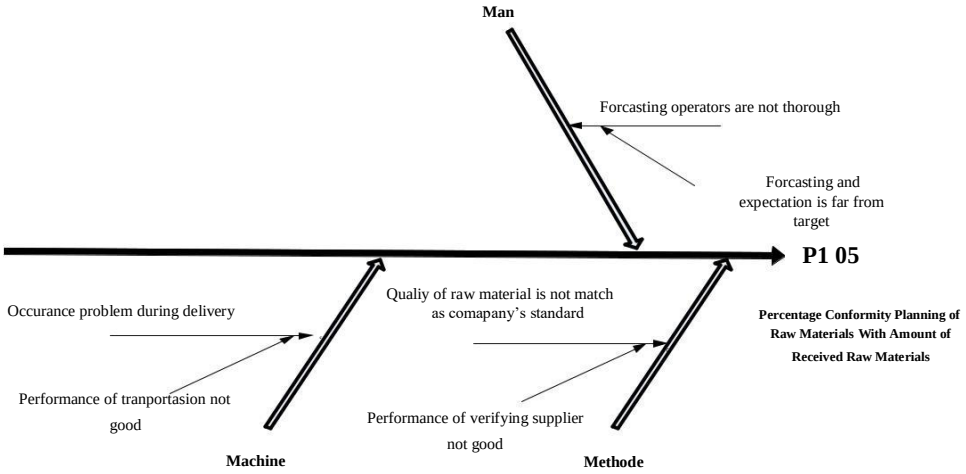


Figure 5. Cause – Effect Diagram to indicator Percentage Conformity Planning of Raw Materials With Amount of Received Raw Materials

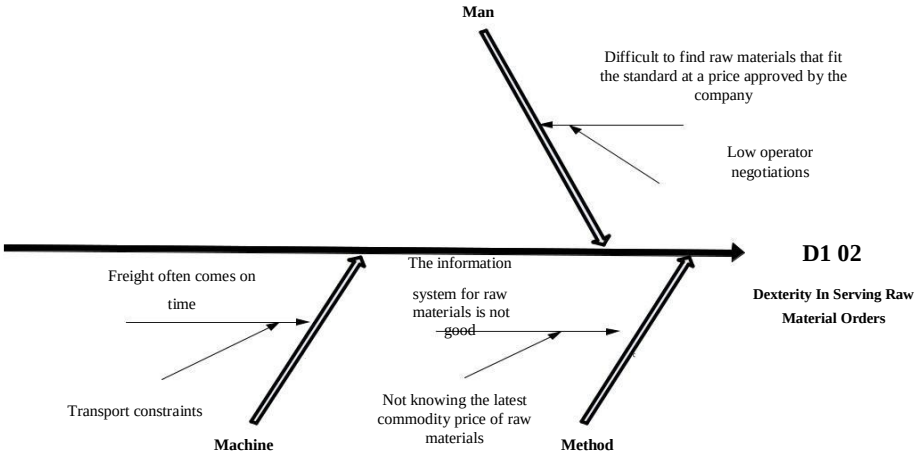


Figure 6. Cause – Effect Diagram indicator to Dexterity In Serving Raw Material Orders

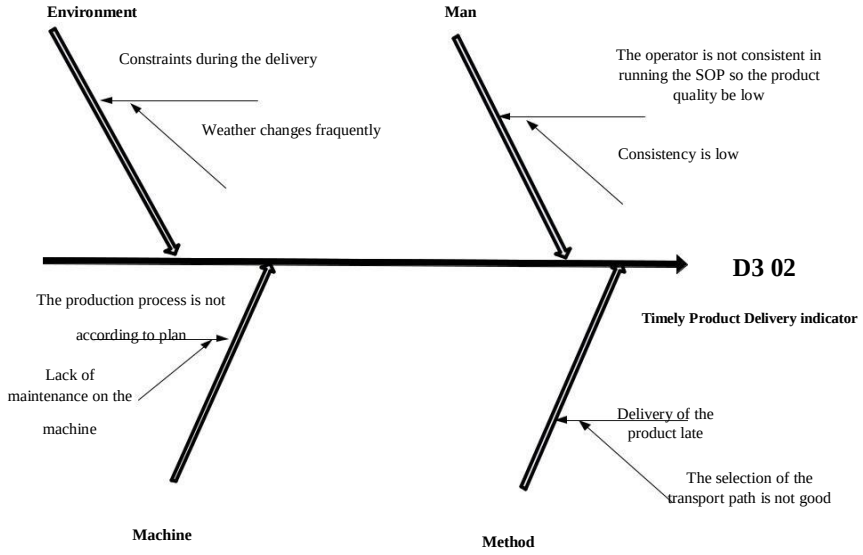


Figure 7. Cause – Effect Diagram indicator to Timely Product Delivery indicator

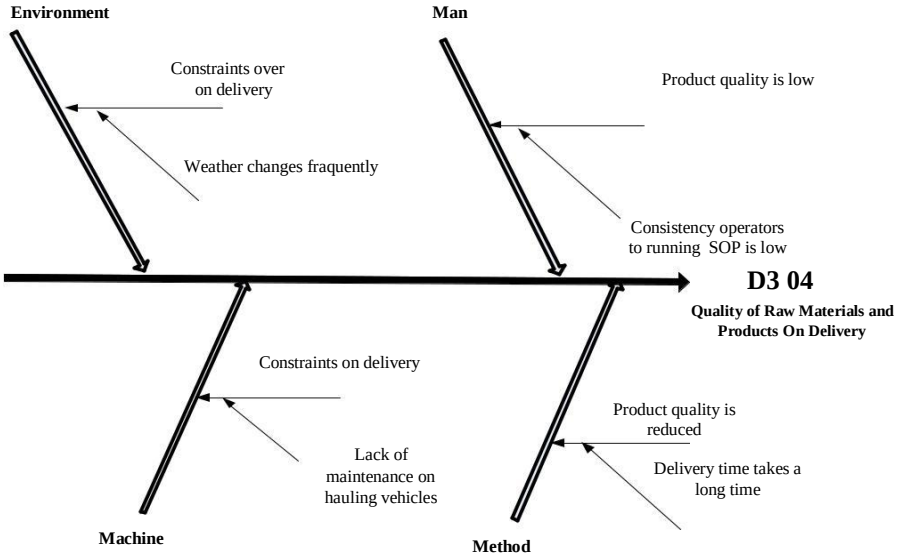


Figure 8 Cause – Effect Diagram indicators to Quality of Raw Materials and Products On Delivery

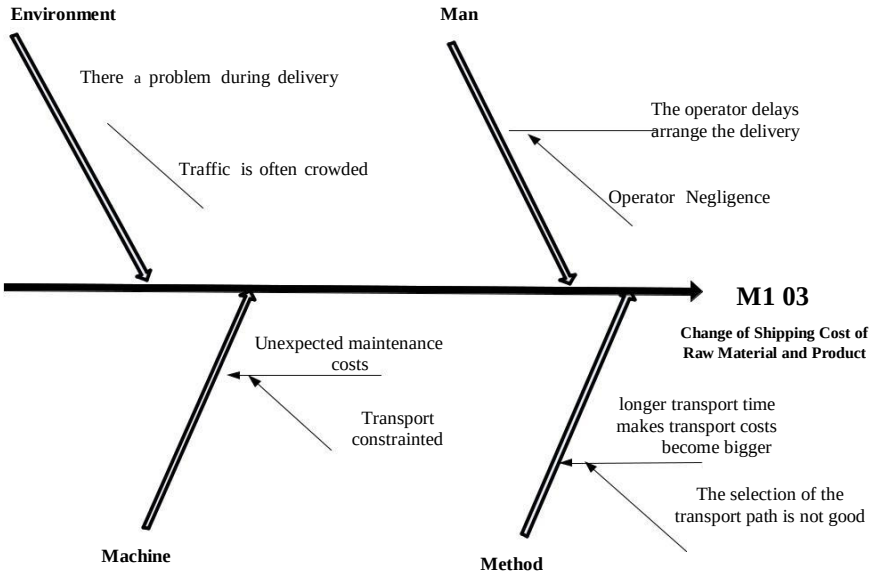


Figure 9 Cause – Effect Diagram indicator to Change of Shipping Cost of Raw Material and Product

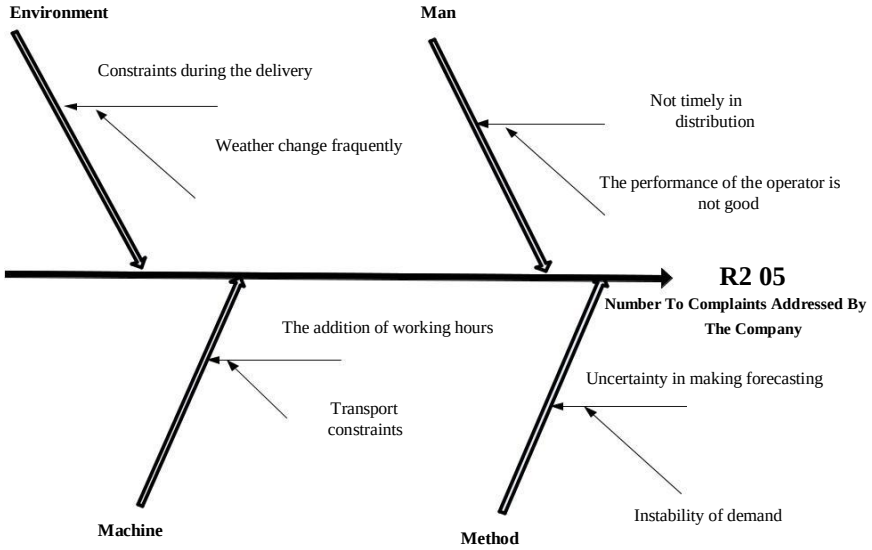


Figure 10 Cause – Effect Diagram Indicator Number To Complaints Addressed By The Company

6.4 Action

Follow up the results to make the necessary improvements. This also means reviewing all steps and modifying the process to fix it before implementation. The proposed improvement for the Key Performance Indicator (KPI) which entered the red category on the scheme of measuring the performance of the company's supply chain using the 5W + 1H method can be seen in table 8 to table 13

Tabel 9 Conformity Indicators of Raw Material Planning With Amount of Received Raw Materials

Faktor	What	Where	Why	Who	When	How
Method	Verify supplier	Office	in order to standardize raw materials quality	Production Assistant	First period	seeing from previous supplier track record
Man	Increase operator performance	Delivery	In order for the amount of raw materials and products delivered in accordance with the planning	Shipping and marketing	During the period	Provide training
Machine	Reduce the constraints on the way	Delivery	To reduce delivery time on the go	Shipping and marketing	During the period	Doing preventif maintenance

Tabel 10 Proposed Improvement with Method 5W + 1H Indicators of Dexterity In Serving Raw Material Orders

Faktor	What	Where	Why	Who	When	How
Method	Raw material information system is improved	Office	To check out the latest material prices	marketing	During the period	Seeking a variety of sources of raw and current price information for raw materials
Man	Negotiate according to market price	marketing	In order for the supplier not to move to a competitor company	marketing	During the period	Keep up with the latest raw material prices
Machine	Shipment of raw materials arrived on time	marketing	To reduce delivery time on the go	Shipping and marketing	During the period	Conducting preventive maintenance on transport

Tabel 11 Proposed Improvement with Method 5W + 1H Timely Product Delivery indicator

Faktor	What	Where	Why	Who	When	How
Method	Delivery of products on time	Marketing	To reduce shipping costs	Production Assistant	During the period	Timely delivery of products from contracted companies
Man	Increase operator performance	Marketing	In order for the supplier not to move to a competitor company	Marketing	During the period	Keep up with the latest raw material prices
Machine	Increase the ability of the machine to run production as planned	production	To reduce delivery time on the go	Shipping and marketing	During the period	Conducting preventive maintenance on transport

Tabel 12 Proposed Improvement with Method 5W + 1H Raw Material Quality Indicator And Product On Delivery

Faktor	What	Where	Why	Who	When	How
Method	Make timely delivery	Delivery	To reduce shipping costs	Delivery	During the period	Arrange Production Planning in accordance with the agreed contract
Man	Create SOP in each department	Each departement	As a guide material to run the duties and responsibilities	Each division	During the period	Evaluate each worker
Machine	Maintain the quality of the transport machine	workshop	In order to reduce the cost of shipping on the go	Technical assistant	As the maintenance schedule	Conducting preventive maintenance on transport

Tabel 13 Proposed Improvement with Method 5W + 1H indicator Change of Shipping Cost of Raw Material and Product

Faktor	What	Where	Why	Who	When	How
Method	Search for alternate delivery path	delivery	To reduce shipping costs	Operator	During delivery	Create a delivery path
Man	Increase operator performance	During delivery	To keep costs from changing	operator	During the period	Keep watch the latest raw material prices
Machine	Maintain the quality of the transport machine	workshop	In order to reduce the cost of shipping on the go	Technical assistant	As the maintenance schedule	Conducting preventive maintenance on transport

Tabel 14 Proposed Improvement with Method 5W + 1H indicator Number of Complaints Addressed Company

Faktor	What	Where	Why	Who	When	How
Method	Make a list of times of increasing demand	office	In order to stabilize the request	Production assistant	Begin of period	Notes the increase of demand time
Man	Increase operator performance	office	As a guide material to run the duties and responsibilities	Production assistant	During production	Evaluate and training each worker
Machine	Designing the number of transportation according to distribution needs	delivery	In order to reduce the cost of shipping on the go	Delivery	Each period	Establish operating hours of transportation according to distribution schedule

7. Conclusions

From result of supply chain performance measurement by using Supply Chain Operation Reference (SCOR) method there are 55 KPI that is

10 KPI for perspective plan, 5 KPI for perspective source, 15 KPI for perspective, deliver, 15 KPI for perspective make, and 10 KPI for perspective return.

From KPI performance measurement result with OMAX calculation and traffic light system, it can be seen that KPI included in green category is 24 KPI, yellow category as many as 25 KPI, and red category as many as 6 KPI.

Key Performance Indicator (KPI) entering the red category are :

a. material planning with amount of raw material received
b. Dexterity in serving raw material orders
c. Delivery of products to consumers on time
d. Quality of raw materials and products when shipping
e. Changes in shipping costs of raw materials and products
f. Number of complaints the company overcame

Improvements need to be done immediately as follows ::

a. Percentage of conformity of raw material planning with amount of raw material received
b. Dexterity in serving raw material orders
c. Delivery of products to consumers on time
d. Quality of raw materials and products when shipping
e. Changes in shipping costs of raw materials and products
f. Number of complaints the company overcame

Refrencess

[1] Matondang, Nazaruddin 2017. *Productivity Improvement With Green Approach To Palm Oil Factory Productivity*, IOP Conference Series: Materials Science and Engineering , Medan, Indonesia
[2] Hugos, Michael 2003 *Essential of Supply Chain Management*, John
[3] Beamon, B M. 1999, *Measuring Supply Chain Performance. International Journal Of Operation and Production Management*, Vol. 19 No. 3
[4] Crimi, T. A, and Ralph G. K.. 2002. *How To Achieve Cost Savings From Supply Chain Management* ; Techniques That Work
[5] Pujawan, I Nyoman. 2005. *Supply Chain Management*. Edisi Pertama. Surabaya: Guna Widya
[6] Shah, j and Nitin. 2001. *Decision Making With Depence And Feedback : The Analytic Network Process*, RWS Publication, Pittburgh, PA.
[7] Rakhman, M. 2006. Pengukuruan Kinerja *Supply Chain* Dengan Model SCOR (Studi Kasus : PT. Atak Otomotif Indonesia Waru, Jurusan TI – UPN, Surabaya
[8] Supply Chain Council. http://www.supply-chain.org. 2010. Supply Chain Operations Reference Model SCOR version 10.0. Washington DC.
[9] Saaty, T. Lorie (1993), Proses Hirarki Analitik untuk Pengambilan Keputusan dalam Situasi yang Kompleks: Pengambilan Keputusan bagi Para Pemimpin, PT. Pustaka Binaman Pressindo, Jakarta.
[10] Suryadi, K. & Ramdhani, M. Ali (1998), Sistem Pendukung Keputusan, PT. Remaja Rosdakarya, Bandung
[11] Riggs, James L. (1986), *Production System*: *Planning, Analysis, and Control*, John Wiley & Sons, Singapore.
[12] Ritajeng, Metta Mega. 2015. Perancangan Model Pengukuran Kinerja Green Supply Chain Management Berdasarkan Green SCOR Dengan Pendekatan PDCA Pada Perusahaan Baja Hilir. Jurusan Teknik Industri Universitas Sultan Ageng Tirtayasa
[13] Ihwan, dkk. 2017 Evaluasi Kinerja Rantai Pasok Sari Apel Untuk Meningkatkan Kinerja Perusahaan : Jurusan Teknik Industri Universitas Brawijaya, Malang
[14] Subuhi, Nurus. 2014 Performance Measurement *Supply Chain Based On Core Process Of Supply Chain Operation Reference (SCOR)* : Jurusan Teknik Industri Universitas Brawijaya, Malang
[15] Mousamik. 2015. *A Strategic Approach to Develop Green Supply Chains*. *department of Mechanical Engineering, Faculty of Engineering*, University of Malaya, Kuala Lumpur, Wilayah Persekutuan, Malaysia