Performance analysis of Supply Chain Management with Supply Chain Operation reference model

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Abstract. This research was conducted at PT. Shamrock Manufacturing Corpora, the company is required to think creatively to implement competition strategy by producing goods/services that are more qualified, cheaper. Therefore, it is necessary to measure the performance of Supply Chain Management in order to improve the competitiveness. Therefore, the company is required to optimize its production output to meet the export quality standard. This research begins with the creation of initial dimensions based on Supply Chain Management process, ie Plan, Source, Make, Delivery, and Return with hierarchy based on Supply Chain Reference Operation that is Reliability, Responsiveness, Agility, Cost, and Asset. Key Performance Indicator identification becomes a benchmark in performance measurement whereas Snorm De Boer normalization serves to equalize Key Performance Indicator value. Analytical Hierarchy Process is done to assist in determining priority criteria. Measurement of Supply Chain Management performance at PT. Shamrock Manufacturing Corpora produces SC. Responsiveness (0.649) has higher weight (priority) than other alternatives. The result of performance analysis using Supply Chain Reference Operation model of Supply Chain Management performance at PT. Shamrock Manufacturing Corpora looks good because its monitoring system between 50-100 is good.

1. Introduction

Higher consumer needs, and more intelligent in choosing their needs. Starting from the middle to upper class always demand the best quality and economical price. The Company will make every effort to improve productivity, efficiency, prompt service, and continue to create new innovations to stay ahead and survive in the marketplace. In addition to productivity and efficiency that need to be improved, the company must also understand and know what is needed by consumers. That the importance of the role of all parties ranging from suppliers, manufacturers, distributors, retailers, and customers in creating a cheap, quality, and fast products is what then gave birth to a new concept of Supply Chain Management (SCM).
Supply chain is a network of companies that work together to create and deliver a product into the hands of end users. These companies usually include suppliers, manufacturers, distributors, or retailers, as well as support companies such as logistics services companies. Measurement of supply chain performance is a performance measurement system that aims to help monitor the running of SCM application to run well. Therefore, the performance indicators used are more specific and relatively different from the organizational performance measurement system. This system is more integrative with the work area that includes suppliers, factories, and distributors that aims to achieve successful supply chain implementation. PT. Shamrock Manufacturing Corpora (PT SMC), continuously strives to optimize glove production to meet export quality standards. One of the efforts that can be done is to conduct performance measurement analysis of SCM.

2. Theoretical basis

2.1. Understanding Supply Chain and SCM
Supply chain is a network of companies that work together to create and deliver a product into the hands of the end user. These companies usually include suppliers, manufacturers, distributors, stores, or retailers, as well as support companies such as logistics services. Supply chain is the physical network, the companies involved in supplying raw materials, producing goods, or sending to end users, SCM is a method, tool, or management approach.
Supply chain performance measurement is a performance measurement system that aims to help monitor the running of SCM applications to run properly. Therefore, the performance indicators used are more specific and relatively different from the organizational performance measurement system. This system is more integrative with the work area that includes suppliers, factories, and distributors that aims to achieve successful supply chain implementation.

2.2. Supply Chain Operation Reference (SCOR)
One way to measure supply chain performance is to use the SCOR method. This method was introduced by the Supply Chain Council (SCC) as a model of supply chain performance measurement across industries. The SCOR model is a process reference model for supply chain operations developed by SCC, Pittsburgh, PA. SCOR splits supply chain processes into five processes including Plan (planning process), Source (procurement process), Make (production process), Deliver (delivery process), and Return (return process).

2.3. Normalization Process
There are various ways of measuring the performance ever performed by the company. That the performance fulfillment rate is defined by the normalization of the performance indicator. Each indicator has different weights with different size scales. Therefore, it is necessary to process the equation of parameters that is by way of normalization. Here normalization plays a significant role in achieving the final value of performance measurement. The normalization process is done by Snorm De Boer normalization formula, namely:
Where :

\[ S_{\text{norm}} = \frac{(S_i - S_{\text{min}})}{(S_{\text{max}} - S_{\text{min}})} \times 100 \quad \text{or} \quad \frac{(S_i - S_{\text{min}})}{(S_{\text{max}} - S_{\text{min}})} = \frac{\text{skor} - 0}{100 - 0} \] (1)

In this measurement, each indicator weight is converted to a certain value interval of 0-100. Zero (0) is interpreted at its worst and one hundred (100) is best interpreted. Thus the parameters of each indicator are the same, after that obtained a result that can be analyzed. The table shows the monitoring system of performance indicators.

Table 1. Monitoring system of work indicators.

| Monitoring System | Work Indicators |
|-------------------|-----------------|
| < 40              | Poor            |
| 40 – 50           | Marginal        |
| 50 – 70           | Average         |
| 70 – 90           | Good            |
| > 90              | Excellent       |

2.4. Analytical Hierarchy Process (AHP)
Analytical Hierarchy Process, hereinafter called AHP, is a decision support model developed by Thomas L. Saaty. This decision support model will describe complex multi-factor or multi-criteria problems into a hierarchy. AHP has an advantage because it can combine objective and subjective elements of a problem.

Below is an example of pairwise matrix matrix using A1, A2, A3, ...... An.

\[
\begin{array}{ccccccc}
C & A1 & A2 & A3 & \cdots & An \\
A1 & a_{11} & a_{12} & a_{13} & \cdots & An \\
A2 & a_{21} & a_{22} & a_{23} & \cdots & An \\
A3 & a_{31} & a_{32} & a_{33} & \cdots & An \\
\vdots & \vdots & \vdots & \vdots & \ddots & \vdots \\
An & an_{1} & an_{2} & an_{3} & \cdots & Ann \\
\end{array}
\]

Figure 1. Matched comparison matrices.

To begin this pairwise comparison process, start at the top of the hierarchy to select the C criteria, or properties, to be used for the first comparison. Then from the level just below it, take the elements to be compared: A1, A2, A3, and so on. In this matrix, compare the elements A1 in the column to the left with elements A1, A2, A3, and so on in the upper row with respect to the C property in the upper left corner. Then repeat with column element A2 and so on. The goal is to get a single value that represents a respondent. The average geometry formula is as follows:
\[ G = \sqrt[n]{X_1 \cdot X_2 \cdot X_3 \ldots X_n} \]  

(2)

Where:
\[ G \] = Geometry average  
\[ X_n \] = Assessment to 1,2,3 ... n  
\[ n \] = Number of ratings

The notion of consistency is a type of measurement that can not just happen or have certain conditions. The formula of consistency index (CI / Consistency Index) is:

\[ CI = \frac{(\lambda \text{ maks} - n)}{(n-1)} \]  

(3)

Where:
\[ CI \] = Consistency Index  
\[ \lambda \] = Eigenvalue  
\[ n \] = The size of the matrix.

The maximum eigenvalue of a matrix will not be less than n so that there can be no negative CI value. The formula of consistency ratio (CR/Consistency Ratio) is written as follows:

\[ CR = \frac{CI}{RI} \]  

(4)

Where:
\[ CR \] = Consistency Ratio  
\[ CI \] = Consistency Index  
\[ RI \] = Random Index

If CR is greater than 0.10 it means that there is a 10% chance that each element is not worth comparatively. In this case, the decision maker should review the comparative process that has been done.

| N  | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  |
|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| RI | 0.0 | 0.52| 0.89| 1.11| 1.25| 1.35| 1.4 | 1.45| 1.49|

### 3. Research Methodology

Research methodology is a problem-solving process used to solve emerging problems, based on the background and objectives to be achieved by using supporting theories in problem solving, and collecting data either through literature or through field studies, processing data until conclusion studied. In the application of the preferred AHP method is the quality of the respondent's data, and does not depend on the quantity. Therefore, AHP assessment requires experts as respondents in decision making in alternative selection. The experts here are competent people who really master, influence the decision-making or
really know the information needed. For the number of respondents in the AHP method does not have a certain formulation, but there is only a minimum limit of 2 respondents.

The SCOR method is a supply chain language, which can be used in a variety of contexts to design, describe, and reconfigure various types of commercial/business activities. Normalization plays a significant role in achieving the final value of performance measurement. The normalization process is done by the normalization formula of Snorm De Boer.

4. Data Processing

4.1. Weighting with AHP

![Figure 2. Weighting with AHP](image)

| Supplier | Production | Distributor |
|----------|------------|-------------|
| 0,333    | 0,333      | 0,333       |

Table 3. CR value (Consistency Ratio)

| Criteria   | CR  | Information |
|------------|-----|-------------|
| Supplier   | 0,07| Consistency |
| Production | 0,08| Consistency |
| Distributor| 0,08| Consistency |
4.2. Performance Analysis based on SCOR

Table 4. Normalization Value.

| Process Core Level 1 | Dimension Level 2 | Key Performance Indicator Level 3 | Si | Smax | Score | Monitoring |
|----------------------|-------------------|----------------------------------|----|------|-------|------------|
| Plan                 | Reability         | Meeting with suppliers           | 1  | 2    | 50    | Average    |
|                      | Responsiveness    | Percentage of raw material needs | 15 | 30   | 50    | Average    |
|                      |                   | with production target           |    |      |       |            |
|                      | Asset             | Cash to cash cycle time          | 3  | 3    | 100   | Excellent  |
| Source               | Reability         | Fulfillment of raw materials     | 98860,7 Kg | 100.000 Kg | 98,86 | Excellent  |
|                      | Responsiveness    | Lead time of raw materials       | 4  | 4    | 100   | Excellent  |
|                      | Agility           | Supplier availability            | 9  | 9    | 100   | Excellent  |
| Make                 | Reability         | Achieving production targets     | 1,848,000 pieces | 2,520,000 pieces | 73,3 | Good       |
|                      | Responsiveness    | Time of manufacture of products to achieve production targets | 24 hours | 24 hours | 100 | Excellent  |
|                      | Asset             | Type of mold                     | 5  | 5    | 100   | Excellent  |
| Delivery             | Reability         | Level of fulfillment of finished product | 4,800,000 pieces | 9,000,000 pieces | 53,3 | Average    |
|                      | Responsiveness    | Timely delivery of products      | 1  | 1    | 100   | Excellent  |
| Return               | Reability         | The level of customer complaints | -  | -    | -     | -          |

From the table can be seen that the performance of supply chain management in PT. Shamrock Manufacturing Corpora looks good because of the monitoring system is between 50 – 100 which means good.

5. Analysis and Evaluation

5.1 Analysis
The results of the performance measurement by weighting the AHP can be concluded SC Responsiveness (0.649) has higher weight (priority) than other alternatives. This can be seen in Figure 3, the result of the AHP weighting. The results of questionnaires filled by respondents prioritize the speed of the supply chain in providing products for consumers (SC Responsiveness).
5.2. Evaluation

Identify the products produced per day to see the ability of the company in transforming raw materials into products, production target PT. Shamrock Manufacturing Corpora is 2,000,000 pieces but on three times the production target did not reach 2,000,000 pieces that can be seen in table 5.

| Date         | Total Production (Pieces) | Target (Pieces) |
|--------------|----------------------------|-----------------|
| 18-Juli-2017 | 1,936,000                  | 2,000,000       |
| 24-Juli-2017 | 1,848,000                  | 2,000,000       |
| 29-Juli-2017 | 1,980,000                  | 2,000,000       |

The company's ability to achieve production target is still not 100% because on 18, 24 and 29 have not reached production target, based on table 5 above. Equalization of the value scale with the normalization process of Snorm De Boer, shows that the value of the received score is at the lowest value of 50. Which is the ability of the company is in the medium value (regular).

6. Conclusions

1) Weighting with AHP shows CR value of criteria and subcriterion below or <0.1 means consistent CR value, ie criteria with CR 0 value, supplier with CR value 0.07, production with CR value 0.08, distributor with value CR 0.08.

2) The results of the performance measurement by weighting the AHP can be concluded SC. Responsiveness (0.649) has higher weight (priority) than other alternatives.

3) The result of performance analysis using SCOR model of SCM performance in PT. SMC looks good because of the monitoring system is between 50-100 which means good.
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