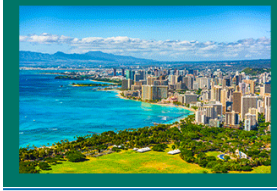
# Assessing of supply chain performance by adopting Supply Chain Operation Reference (SCOR) model





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# Assessing of supply chain performance by adopting Supply Chain Operation Reference (SCOR) model

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**Abstract**. This paper aims at an assessing of a supply chain performance by adopting the Supply Chain Operation Reference (SCOR) Model. The supply chain activities are divided into five core processes, i.e. plan, source, make, delivery and return. Each level of the SCOR model is weighted using Fuzzy Analytical Hierarchy Process (FAHP). The mapping of SCOR Model consists of 5 core processes at 1st level, 21 performance matrices at 2nd level, and 28 Key Performance Indicator (KPI) at 3th level. The result shows that the supply chain performance is 68,231. Referring to the performance indicators, the performance achieved by the supply chain at this time is in the average category. Proposed improvement strategies are designed based on lean supply chain principles, through the implementation of Gemba Kaizen which consists of 17 proposed strategies.

## 1. Introduction

Procurement activity is an upstream activity in the supply chain that systematically and strategically involves manufacturers and suppliers [1]. The purpose of the material procurement activity is to obtain required materials, start from designing relationships with suppliers to evaluating supplier performance. The material procurement activities should have efficiency through the integration of all acquisition of material and material storage in the company [2].

In practical conditions, constraints often occur between manufacturer and suppliers. These constraints include difficulties to select suppliers who able to meet the required quality and/or quantity material, and to meet due dates. These problems will affect the production activities such as defective products due to inappropriate material quality, uncertain production costs, unfulfilled customer demand, and/or delays to deliver finished products to the customers. To anticipate these problems, manufacturers often order material more than is needed so that a buildup of material in the warehouse occurs. This shows the inefficiency of procurement, and it will detrimental to the company both in terms of time and cost. Therefore, it is necessary to measure the performance of the Procurement Department and make improvements.

Supply chain performance measurement can be done with the Supply Chain Operation Reference (SCOR) Model proposed by the Supply Chain Council. Performance measurement with SCOR Model is done by identifying supply chain performance indicators through the company's supply chain process so that it can be used to evaluate and improve the performance [3]. The SCOR model provides a systemic approach to improve strategy, define structure (including human capital), manage processes, and measure performance [4].

Measurement of supply chain performance with the SCOR Model has been carried out by several researchers, including [5,6] combine SCOR and FAHP; [7] combines SCOR Model and fuzzy-TOPSIS; [8] align SCOR with business process and information technology in the ERP system; [9] develops a Financial Components Reference Model (FCOR) based on SCOR Model; [10] integrates AHP and SCOR (ASIM); [11] Apply SCOR Model in the footwear industry; and [12] measures the performance of construction logistics.

This study aims at measuring the performance of the Procurement Department by combining the SCOR Model and FAHP, referring to Arif [5] and Azmiyati [13]. After the performance is measured, the causes of the problems are identified and then improvements are recommended. This article is organized as follows: Section 2 describes research methodology, Section 3 shows the result and discusses the result, and Section 4 states the conclusion.

## 2. Research methodology

Supply Chain Operation Reference (SCOR) Model and Fuzzy Analytical Hierarchy Process (FAHP) are chosen to measure the Supply Chain (SC) performance. The SCOR model divides SC activities into 3 levels. Level 1 consists of five core processes, i.e. plan, source, make, delivery, and returns. At level 2 all core processes are configured into the SCOR performance matrix, i.e. reliability, responsiveness, agile, cost and assets. Furthermore, each SCOR level 2 performance matrix is broken down into key performance indicators (KPI) at level 3. The KPIs are then weighted using FAHP, where in the FAHP method, variables (l, m, u) are used to represent each criterion in the form of triangular fuzzy numbers arranged according to a set of linguistics [14].

Each performance indicator has a different weight so that the parameters should be normalized. The normalization process uses the Snorm De Boer Equation as follows:

Larger is Better*:* $Snorm = \frac{(Si - Smin)}{(Smax - Smin)} \times 100$ (1)

Lower is Better: $Snorm = \frac{(Smax - Si)}{(Smax - Smin)} \times 100$ (2)

Si : The value of actual achievement indicator
Smin : The worst achievement value of performance indicator
Smax : The best achievement value of performance indicator

Each weight of a performance indicator is converted into intervals of 0 to 100, where 0 means the worst and 100 means the best performance indicator. Monitoring system of performance indicators can be seen at Table 1.

**Table 1.** Monitoring system of performance indicators [15].

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

## 3. Result and discussion

To provide an overview of supply chain performance measurements by the SCOR Model and FAHP, a plastic company is taken as a case study. This company has a problem about delayed delivery of their products to costumer. Based on observation, it is found that suppliers often do not meet the agreements stated in the MoU between suppliers and manufacturers. This shows that there are inefficiencies in the

Procurement Department. The assessing result of Procurement Department using SCOR Model and discussion the results can be described as follows.

### *3.1. Result*

Supply chain flow of the case study company can be seen in Figure 1.

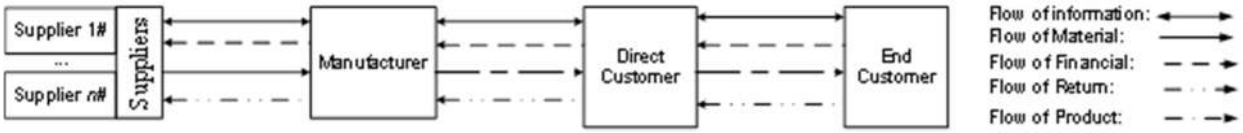


**Figure 1.** Supply chain flow of the case study company.

*3.1.1. Validated performance indicator determination.* The first step to measure performance with the SCOR Model is to identify the Procurement Department's performance indicators, followed by the validation step of the performance indicators. The plant managers are chosen to validate the indicators by facing validation techniques. The validated performance indicators are shown in Table 2.

**Table 2.** Validated procurement performance indicator.

| Code | Performance Indicator | Unit | Code | Performance Indicator | Unit |
|---|---|---|---|---|---|
| PR1 | Suppliers selection | Supplier | MR1 | Product defects due to material quality | (%) |
| PR2 | Preparing purchase order (PO) | PO | | | |
| PR3 | Documentation of procurement activities | Document | MRe1 | Suitability of production output | (%) |
| | | | MRe2 | Product lead time | (day) |
| PRe1 | Submission purchase order (PO) | PO | MF1 | Machine setup time | (Minute) |
| PF1 | Material quantity planning | (Kg) | MC1 | Flexibility of Production volume | (%) |
| PF2 | Fulfilment of supplier selection criteria | (%) | MA1 | Production cost | (Rp) |
| PC1 | Maximize order cost | (Rp) | MA2 | Number of “injek” Machine | (Unit) |
| PA1 | Finished goods inventory management | (%) | DR1 | Number of crushing Machine | (Unit) |
| SR1 | Management of materials in the warehouse | (%) | DRe1 | Material quantity received | (%) |
| SRe1 | Material procurement of suppliers | (%) | DC1 | Delivery time | (%) |
| SF1 | Allocation of material inventory | (%) | DA1 | Material payment | (Rp) |
| SC1 | Labour cost | (Rp) | RR1 | Material delivery transportation | (%) |
| SA1 | Utilization of company resources | (%) | RRe1 | material Quality control | (%) |
| SA2 | Change assets into money | (%) | | Material return | (%) |

*3.1.2. The SCOR hierarchy.* The validated procurement performance indicators are then mapped as the SCOR hierarchy starting from level 1 to level 3. The result shows that level 1 of the SCOR hierarchy consists of five SCOR core processes, i.e. plan, source, make, delivery and return. Level 2 of the SCOR hierarchy consists of 21 elements that show SCOR's performance matrix, i.e. Reliability, Responsiveness, Agility, Costs and Assets. Level 3 of the SCOR hierarchy consists of 28 validated KPIs. The SCOR hierarchy of level 1, level 2 and level 3 can be seen in Figure 2.

*3.1.3. Total performance calculation.* The total performance of the SCOR model can be calculated through the weighting stage using the FAHP method, i.e. determine the level of importance of each performance indicator. The next process is multiplying the weighted value of the SCOR model with the normalization result of the actual achievement of each performance indicator. The results of the performance value can be seen in Table 3.

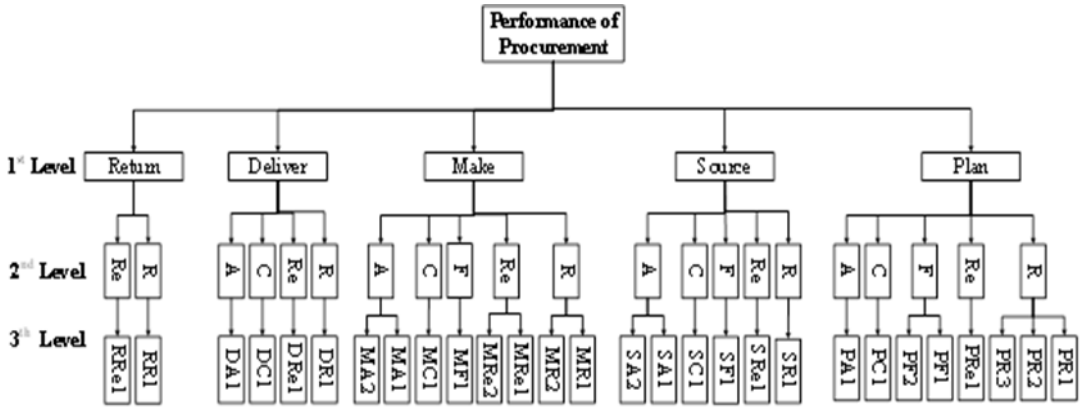


**Figure 2**. SCOR hierarchy of procurement department.

**Table 3**. Total performance calculation.

| Key Performance Indicator | Metric Weights | Score | Performance index |
|---|---|---|---|
| Suppliers selection | 0,0069 | 50,00 | 0,345 |
| Preparing purchase order (PO) | 0,0212 | 50,00 | 1,058 |
| Documentation of procurement activities | 0,0179 | 25,00 | 0,449 |
| Submission purchase order (PO) | 0,0483 | 50,00 | 2,415 |
| Material quantity planning | 0,0193 | 100,00 | 1,932 |
| Fulfilment of supplier selection criteria | 0,0290 | 80,00 | 2,318 |
| Maximize order cost | 0,0506 | 68,25 | 3,453 |
| Finished goods inventory management | 0,0368 | 0,01 | 0,00037 |
| Management of materials in the warehouse | 0,0552 | 0,00 | 0,00 |
| Material procurement of suppliers | 0,0504 | 100,00 | 5,040 |
| Allocation of material inventory | 0,0456 | 30,43 | 1,388 |
| Labour cost | 0,0552 | 60,00 | 3,312 |
| Utilization of company resources | 0,0133 | 90,00 | 1,199 |
| Change assets into money | 0,0227 | 75,73 | 1,718 |
| Product defects due to material quality | 0,0324 | 91,53 | 2,966 |
| Suitability of production output | 0,0396 | 91,42 | 3,620 |
| Product lead time | 0,0240 | 100,00 | 2,400 |
| Machine setup time | 0,0360 | 60,00 | 2,160 |
| Flexibility of Production volume | 0,0570 | 100,00 | 5,700 |
| Production cost | 0,0660 | 38,25 | 2,525 |
| “injek” Machine | 0,0248 | 100,00 | 2,475 |
| crushing Machine | 0,0203 | 100,00 | 2,025 |
| Material quantity received | 0,0580 | 100,00 | 5,800 |
| Delivery time | 0,0540 | 100,00 | 5,400 |
| Material payment | 0,0560 | 66,67 | 3,734 |
| Material delivery transportation | 0,0320 | 50,00 | 1,600 |
| material Quality control | 0,0180 | 80,00 | 1,440 |
| Material return | 0,0220 | 80,00 | 1,760 |
| Total Performance | | | 68,231 |

### *3.2. Discussion*

Table 3 shows that the measured Procurement Department's performance score of 68.231. Referring to the monitoring system shown in Table 1, the measured Procurement Department performance is in the average category because it is in the range of 50-70. Based on the results of these performance measurements, it is necessary to improve strategies based on five core processes, namely plan, source, make, delivery and return. The proposed improvement strategy is designed based on the Gemba Kaizen principle through the adoption of 5S and the application of the PDCA cycle to the Procurement Department to create continuous improvement. The proposed improvement is formulated as 17 strategies that are related one to another. Therefore, the strategies should be done in parallel starting from the plan to the return process. Table 4 shows the proposed improvements.

**Table 4**. Proposed strategies.

| Proposed Strategy | Code | Key Performance Indicator |
|---|---|---|
| SP-1 Improvement of coordination and collaboration between manufacturer, customers and suppliers. | PR1 | Suppliers selection |
| | PR2 | Preparing purchase order (PO) |
| | PRe1 | Documentation of procurement activities |
| SP-2 Keep bookkeeping for each procurement activity | PR3 | Submission purchase order (PO) |
| | PF1 | Material quantity planning |
| SP-3 Increase supplier loyalty | PF2 | Fulfilment of supplier selection criteria |
| | PC1 | Maximize order cost |
| SP-4 Increase storage of finished products | PA1 | Finished goods inventory management |
| SS-1 Apply 5S method | SR1 | Management of materials in the warehouse |
| | SF1 | Material procurement of suppliers |
| | SRe1 | Allocation of material inventory |
| SS-2 Understand the market situation | SA1 | Labour cost |
| | SA2 | Utilization of company resources |
| SS-3 Increase employee loyalty | SC1 | Change assets into money |
| SM-1 Increase product quality | MR1 | Product defects due to material quality |
| SM-2 Improving delivery accuracy according to customer requests | MR2 | Suitability of production output |
| | MF1 | Product lead time |
| SM-3 Shorten product lead time | MRe1 | Machine setup time |
| SM-4 Decrease *setup time* | MRe2 | Flexibility of Production volume |
| SM-5 Increase profit | MC1 | Production cost |
| SM-6 Increase production capacity | MA1 | “injek” Machine |
| | MA2 | crushing Machine |
| SD-1 Increase material quality | DR1 | Material quantity received |
| SD-2 Improve the timeliness of material delivery | DRe1 | Delivery time |
| SD-3 Improve the timeliness of payment | DC1 | Material payment |
| | DA1 | Material delivery transportation |
| SR-1 Apply Kaizen | RR1 | material Quality control |
| | RRe1 | Material return |

## 4. Conclusion

In the case study, it was found that the SCOR Model mapped the Procurement Department activities into 3 SCOR levels. Level 1 consists of five core processes (plan, source, make, delivery, and return), Level 2 configures SCOR's main matrix, i.e. customer-facing (Reliability, Responsiveness, and Agility) and internal-facing (Cost and Assets) into 21 performance matrices. All SCOR level 2 performance

matrices are broken down into 28 Key Performance Indicators (KPI) at level 3. The measurement of the Procurement Department's performance of 68.231 which is in the average category.

There are 17 proposed strategies designed with reference to the application of the Gemba Kaizen principle through the application of 5S and the application of the PDCA cycle. The detailed design of each strategy becomes an opportunity for further research.

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