Escalation proposal of supply chain management performance of oil and gas upstream industry in PT. XYZ by using SCOR model approach

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Abstract. Oil and gas industry in Indonesia is one of the industries with the largest contribution for country's foreign exchange. As recorded in 2014, 12% of country's budget was sourced from oil and gas industry and able to provide a significant increase in national economic growth. But in the other hand, supply chain performance in this industry shows inconsistencies in each year, especially in PT. XYZ. As one of the largest oil and gas companies in East Kalimantan, Indonesia. As the result, company's targets are missed offentimes and have not been able to achieve competitive advantage. Therefore, the purpose of this study is to propose performance improvements in the supply chain of PT. XYZ. This study uses the model of Supply Chain Operations Reference (SCOR) 11.0 which focuses on the attributes of reliability, Analytical Hierarchy Process (AHP), and fishbone in collecting and processing research data. The result shows that the supply chain performance of PT. XYZ which focused on the reliability attribute is categorized as good, starting from 2012 to 2017. There is 1 indicator that need to be improved and get further control, that is the indicator of percentage of supplier meeting environmental metrics/criteria and fill rate. One means to overcome the problem is by using big data analysis approach, because the approach can analyze big number of data in the Company, whether it's structured, semi-structured, or unstructured.

1. Introduction
In Indonesia, oil and gas industry is one of the industries with the largest contribution for country's foreign exchange. As recorded in 2014, 12% of country's budget was sourced from oil and gas industry and able to provide a significant increase in national economic growth [1]. With rapid changes and the increasing of complexity in business processes, the industry needs to be guided in order to quickly and accurately provide the final product according to customer needs. The supply chain of this industry is relatively long and involves a lot of other companies from upstream to downstream. As a result, inconsistencies in the performance of this industry continue to take place and has not been able to show significant changes until now. Therefore, to overcome these problems requires a strategic supply chain approach from upstream to downstream involving all stakeholders as a whole [2]. According to Basta and Liyanage [3], a sustainable approach is very much needed in improving the supply chain performance of an industry. The approaches are by assessing and measuring supply chain performance. It has become important in the management process, that is when supply chain performance needs to be improved then performance assessment process is carried out [4].
Supply chain management (SCM) is a series of business activities from upstream to downstream, raw materials procurement, manufacturing processes, distribution activities, consumer service, as well as recycling the final products [5]. Moreover, SCM is an integrated process with the objectives and risks are mutually borne in creating long-term cooperative relationship between suppliers, intermediaries, manufacturing companies, and customers [6]. There have been many contributions from academics and practitioners related to assessment and strategy in improving supply chain performance in recent years [5]; [7]. In the other words, to achieve competitive advantage in improving supply chain performance, the company needs a strategic and effective approach or method to overcome inconsistencies problem in the performance of company's supply chain.

Supply chain performance appraisal is a process that involves some or all of the companies engaged without exception [8]. To obtain maximum results from the process, a systematic approach is needed through proven concepts and performance standards which then being compared to company's business processes and internal organization [7]. For this reason, this research uses Supply Chain Operations Reference (SCOR) model in the process of assessing and proposing for performance improvement of upstream oil and gas industry supply chain in PT. XYZ. In the concept of SCOR Model, there are six main attributes of business process in assessing and improving, i.e: plan, source, make, deliver, return and enable. These attributes have covered a series of company activities and been recognized in most industries [9]; [10]; [11]. In this study, the proposed improvement in supply chain performance is focused on the reliability attributes of the SCOR model used. Due to the restricted time and access to the company, the scope of the research is being limited. With this research, it is expected to be able to give alternative solutions to fix the performance of company's supply chain as well as the failure in the process of drilling and production during 2012 to 2017 which happened four times and resulted in huge losses of company profits. Thus, it can help that the failures will not occur in the coming years.

2. Research Method
This research was conducted in PT. XYZ, as one of upstream oil and gas industries. The company is located in East Kalimantan, Indonesia. It has Oil and Gas Regulatory Authority (BPMIGAS) license for oil and gas drilling in East Kalimantan. Moreover, the focus of this study is how to improve the performance of company's supply chain through assessment process and proposed improvements by using Supply Chain Operations Reference (SCOR) 11.0 model. SCOR 11.0 is the result of Supply Chain Councils development in performance assessment of company's supply chain. In this study, reliability attributes became the focus or research indicator. It measured things related to supply chain performance in obtaining the right product, location, time, conditions, packaging, quantity, documentation, as well as the right customer. Supply chain performance reliability is company's ability in performing the work according to expectations [9]. In addition, the process of weighting the value of performance indicators was done using Analytical Hierarchy Process (AHP) method [12]; [13]. AHP was started by defining the problem, preceded by identifying the objectives to be achieved, then comparing the components by pairwise method, in regard to the criteria and final structure in the hierarchy arranged by logical and organized grouping in representing the problem [13]. In the process of identifying the cause of errors occurred, fishbone diagram was used.

3. Result and Discussion
3.1. Supply chain management reliability performance of PT. XYZ.
After indicators mapping were conducted, it was validated by company's expert using SCOR 11.0 model. As the result, 17 indicators were obtained. Traffic light system was used to identify each performance indicator where Red meant that the indicator value was below 60 percent (<60%), Yellow meant that the value was between 60 to 80 percent (60% -80%), and Green meant above 80 percent (> 80%). These values are the standards given by the object company. Overall supply chain management performance of PT. XYZ. showed good results. There was only 1 indicator that showed the percentage value below 80% (<80).
The following is the results of a complete calculation of supply chain performance using SCOR model as in table 1 as follows.

Table 1. Calculation results of actual value of performance

| Operation Process | Code   | Indicators                                      | Performance 2012 | Performance 2013 | Performance 2014 | Performance 2015 | Performance 2016 | Performance 2017 |
|-------------------|--------|------------------------------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Plan              | RL.3.37| Forecast Accuracy                                | 100%              | 100%              | 100%              | 100%              | 100%              | 100%              |
|                   | RL.3.18| % Orders/ Lines Processed Complete              | 95%               | 97%               | 94%               | 96%               | 96%               | 97%               |
|                   | RL.3.19| % Orders/ Lines Received Defect Free            | 98%               | 99%               | 95%               | 98%               | 97%               | 99%               |
| Source            | RL.3.20| % Orders/ Lines Received On-Time To Demand Requirement | 94%             | 92%               | 95%               | 92%               | 90%               | 97%               |
|                   | RL.3.23| % Orders/ Lines Received with Correct Shipping Documents | 99%               | 100%              | 100%              | 98%               | 100%              | 100%              |
|                   | RL.3.27| % Schedules Changed With Supplier's Lead Time   | 90%               | 87%               | 91%               | 85%               | 88%               | 92%               |
|                   | RL.3.31| Compliance Documentation Accuracy               | 100%              | 100%              | 100%              | 100%              | 100%              | 100%              |
| Make              | RL.3.36| Fill Rate                                       | 101%              | 93%               | 101%              | 105%              | 102%              | 102%              |
|                   | RL.3.49| Schedule Achievement                             | 100%              | 100%              | 100%              | 100%              | 100%              | 100%              |
|                   | RL.2.3 | Documentation Accuracy                          | 97%               | 98%               | 95%               | 94%               | 98%               | 98%               |
|                   | RL.3.11| % of Faultless Invoices                         | 100%              | 100%              | 100%              | 100%              | 100%              | 100%              |
|                   | RL.3.16| % of suppliers meeting environmental metrics/criteria | 60%               | 75%               | 57%               | 67%               | 53%               | 69%               |
| Deliver           | RL.3.31| Compliance Documentation Accuracy               | 100%              | 100%              | 100%              | 100%              | 100%              | 100%              |
|                   | RL.3.35| Delivery Quantity Accuracy                      | 100%              | 100%              | 100%              | 100%              | 100%              | 100%              |
|                   | RL.3.36| Fill Rate                                       | 100%              | 100%              | 100%              | 100%              | 100%              | 100%              |
|                   | RL.3.50| Shipping Documentation Accuracy                 | 100%              | 100%              | 100%              | 100%              | 100%              | 100%              |
| Enable            | RL.3.37| Forecast Accuracy                                | 100%              | 100%              | 99%               | 100%              | 99%               | 98%               |

3.2. Weighting of performance indicators
The weighting of performance indicators was done to determine the level of importance of each performance indicator, because each performance indicator had a different level of importance. Weighting was done by using the analytical hierarchy process (AHP) method. Based on the results as presented in table 2, the most important indicator from Make variable was Fill Rate indicator.

Table 2. Weighting result of performance indicator

| Operation Process | AHP (Weight) | Code | Indicator                                      | AHP (Weight) |
|-------------------|-------------|------|-----------------------------------------------|-------------|
| Plan              | 0.161       | RL. 3.37 | Forecast Accuracy                             | 1.00        |
| Source            | 0.089       | RL. 3.18 | % Orders/ Lines Processed Complete            | 0.09        |
|                   |             | RL. 3.19 | % Orders/ Lines Received Defect Free          | 0.46        |
|                   |             | RL. 3.20 | % Orders/ Lines Received On-Time To Demand Requirement | 0.24       |
|                   |             | RL. 3.23 | % Orders/ Lines Received with Correct Shipping Documents | 0.07       |
|                   |             | RL. 3.27 | % Schedules Changed With Supplier's Lead Time | 0.14       |
### 3.3. Fishbone diagram

According to Table 1, there was only one indicator that needed to be improved in order to escalate supply chain reliability performance. However, because **Fill Rate** was the most important indicators according to experts, therefore needed to control and maintain the performance. Fishbone diagram was used to find the cause of errors and get the best way to improve the performance. It is shown on figure 1 & 2 below:

**Figure 1. Fishbone Diagram of Fill Rate**

**Figure 2. Fishbone diagram of supplier meeting environmental matrices/criteria percentage**
4. Conclusions
Based on the results of processing and analysis that had been done could be concluded that the performance of company’s supply chain in PT. XYZ, which focused on reliability attributes with the SCOR method was categorized as good, started from 2012 to 2017. There were two indicators which needed to be fixed and improved; suppliers that meet the environmental metrics / criteria, and fill rates. In addition by using fishbone diagram, the obtained proposal for improved indicators was to maintain relationships with suppliers that had been established and always supported the business, especially because in the market, such suppliers could be considered as rare and hard to find. For Fill Rate indicators in particular, a way to overcome the problem was by using Big Data analysis because it could analyze a big number of data, whether they were well structured, semi-structured, and unstructured data. Moreover, Big Data was able identify the root of the problems so that it could provide good planning and forecasting [14]. Furthermore, alternative pricing scenarios could be done instantly, thus reduced inventory and increased profit margins.

The researchers suggest that companies and similar industries should pay more attention to the elements in the company’s overall supply chain, so that common goals and common targets as well as the balance in achieving competitive advantage can be effectively achieved. In addition, for further researchers are expected to include all attributes exist in the SCOR model for assessments and proposed improvement supply chain performance in that companies or other similar companies.

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