FACTORS THAT LEAD TO THE EFFICIENT MANAGEMENT OF THE MATERIAL SUPPLY CHAINS OF OIL AND GAS INDUSTRIES IN INDONESIA

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ABSTRACT

The supply chains management in oil and gas industries is currently facing problems regarding its flows of materials. The basic theory of supply materials has not been well practiced to support its operational processes. Inefficiency of supply chains and logistics practices will reduce the performance of oil and gas industries. Therefore, this study aims to investigate the relationship between external factors of material supply and logistics performance (dependent variable) and three (3) factors related to independent variables. The three (3) factors (independent variables) representing to the external of materials supply which includes the infrastructure technology, transport policy & regulation and transport availability. A survey was conducted among the practitioners of oil and gas industries and the total of 108 respondents were accepted and analyzed. The Statistical Package for Social Sciences (SPSS) (version 18) and the related statistical techniques were also used. The findings of this study indicated that there were significant relationships for better ways in dealing with material supply and logistics towards the efficiencies for oil and gas industries in Indonesia. The findings are also suggested to be used in future guidelines for the related industries.

Keywords: External Factors, Supply Chain Efficiency; Logistics Performance, Oil and Gas Industries, Indonesia

INTRODUCTION

Nowadays, the economic climate has highly influenced in many industries, particularly in the oil and gas sectors. It is realized that globalization contributes to the high impact of competition among the industry players. However, this condition has influenced the awareness of oil and gas companies on the developments that are related to oil and gas as well as the pipeline industries. According to BP Statistical Review of World Energy (2014), the consumption of oil and gas in the world is around 890,000 barrels per day. In 2014, The President of PT. PERTAMINA Indonesia realized the total consumption of oil and gas is about 56 Million Kiloliters per year. This exceeds the country's production capacity of only 40 Million Kiloliters per year. In order to attend to the emerging demand-supply deficiency in the oil and gas companies, those with operating plants in

Indonesia are encouraged to explore and develop new facilities in order to increasing their productions. An example of such plant is the oil and gas pipelines through integrated systems. Particularly, the construction project must be conducted and focusing on cost and quality. There must be an adequate management in utilizing on technology and deployment of other profitable strategies that able to support the competitive environment. The improvement of supply chain and the performance of the logistics activities, competitors' efficiency and productions will be further maximized by taking into consideration on the issue of green environment. This will also able to minimize the barriers and costs of the oil and gas projects in future.

In the construction of oil and gas industries, supply chain and logistics are integrated in shaping and controlling the processes of physical flow of goods. Information centered is reaching to the most favorable relations between quality, level of services, provision and costs structure (Barcik & Jakubiec, 2013). Physical flow represents the goods production, storing, shipping, including raw materials, work in progress and finished goods. As a result, logistics and supply chains process are important elements in the most of companies that deals with oil and gas projects. Efficient supply and logistics activities do have impact in competitive advantage among the players of the oil and gas sectors. It would also lead to efficient supply of material as needed to develop the operational of oil and gas activities in that particular industry. However, the unique role of supply and logistics is to guide the company to become a leader in their sector through reduction on costs and improving value chains of their projects. Hence, oil and gas companies are to ensure the consistent and efficient of supply chain and logistics management in day to day's activities. This is considered one the core business values and will be the competitive advantage for its industry, co-players towards the satisfactory results in future. Therefore, supply chains and logistics integrated systems are significant aspects for companies during the time of competition, especially those are planning to execute the oil and gas projects in future.

LITERATURE REVIEW

Oil and gas are recognized as the safest and the most economical ways in distributing huge quantities of oil and gas from production fields, refineries and finally to the consumers. The pipeline systems and components are huge and sometimes larger than the standard size (Trench, C. J. 2003). As recorded, such bigger sizes do affect both the construction of the pipeline system, oil transportation, thus influence the supply chains and logistics performances. Logistics performance is related to management factors and its elements. It is also found that most of practitioners and researchers agreed that logistics is part of the supply chain combination (Brian S. Fugate, J. T. 2010). In overall, the concept of supply chain management covers more of the logistics activities and this aligns with the Council of Supply Chain Management Professionals' Statement. Logistics management is the subsidiary science of supply chain management and influencing the organizational performance (Sutherland, 2008). If the organizational performance is achieved the targeted for the demand and supply will be met and costs

reductions were also recorded. Cost minimization can also be achieved when the supply of material, handling, manufacturing, assembly, productions and distributions are done with minimum cost incurred (Brian S. Fugate, John T. Mentzer, Theodore P. Stank, 2010). This supports the purpose of this study which focuses on material supply efficiency of oil and gas and pipeline construction industries. These industries are typical examples in logistics-driven and thus necessary to the focus in this study. Supply chain and logistics performance are required to be measured in oil and gas construction projects (Wegelius-Lehtonen, 2001). The oil and gas companies are always having several related projects that run simultaneously. Therefore, the pipelines contractors should be conscious on the possibility of emerging of the external factors and therefore they should be focusing on the material supply efficiency. That is why the understanding on supply and logistics performance is considered the interest to logistics researchers which has been conceptually and empirically investigated.

On the other hand, the research was discussed on the matters which were parallel with the objectives of the study and supported by the literature reviews with four (4) related journals. Table 2.1, consists of articles that show different concepts in defining and measuring performance within the oil and gas industries. Considering the cost and lead time as the concepts, the cost means measuring the used cost for the execution of the project. The lead time involves performance assessment among pipelines construction of material supply efficiency. The authors believed that managers should have the highest authority in managing and determining the performance in line with other operational elements. These literatures are divided into two (2) subsidiaries that contributing to supply and logistics performances which include the following;

1. Conceptual frameworks that were discussed especially on the techniques in achieving the supply chains and logistics performances.

2. Empirical studies that developed performance of supply chain and logistics definition and discussions are based and focused on its performances on the related works.

Table 2.1 : The different measurement concepts

Journal/Article/Book	Summary
Wegelius-Lehtonen (2001)	It focuses on costs and lead time in examining performance within the oil and gas industries.
Douglas M. Lambert, Sebastian J. Garcia-Dastugue, & Keely L. Croxton (2008)	It reviews the managers' contributions in involvement to the eight cross-functional processes: Customer Relationship, Supplier relationship, customer service, demand management, order fulfillment, manufacturing flow management, product development and commercialization, and returns management.
Brian S. Fugate, John T. Mentzer, Theodore P. Stank (2010)	It focuses on the differentiation other than just traditional measurement of effectiveness and efficiency as performance measure of the supply and logistics performance.
Susana Perez- Lopez (2011)	It defines technology competency and knowledge management processes and some of its implications for the market performance.

METHODOLOGY

In order to conclude the research objectives, the researchers used the questionnaire and survey as a method of the data collection instruments. The respondents of the study are practitioners, expertise, contractors and workers in the logistics department of oil and gas companies. The overview of the research study, framework and hypotheses development, measurements and instrument designs, data collection method, population, sampling and data analysis techniques were presented.

Measurement

The dependent and independent variables are based on the proposed research framework. The research questionnaire is designed using the operational measurements of the related variables. All items in this study were adopted from previous related works like Coombs (2009), Heneman and Schwab (1985), Rogg et al. (2001), Eisenberger et al. (2002), Landau and Hammer (1986), and Paré, Tremblay & Lalonde (2001). The responses to these items designed questions were measured based on the Likert five-point scale (1=very low extent, 2=low extent, 3=moderate extent, 4= high extent, 5=very high agree) as shown in Table 3.1. The objectives of the study were transformed in to the research hypotheses as follows;

H1: There is a significant relationship policy and regulation of materials supply and logistics performance in oil and gas industries

H2: There is a significant relationship between fleet availability and material supply performance in oil and gas industries

H3: There is a significant relationship between infrastructure technology and material supply performance in oil and gas industries.

The Research Model

The research frameworks of the study is measured using specific variables as discussed in the literature reviews and met with the objectives of the study. The variables as suggested include the Material supply Chain performances as the Dependent Variable and Three (3), Independent Variables such as Policy and Regulation, Transport availability and infrastructures. Figure 3.1 refers to the Research Model of the study.

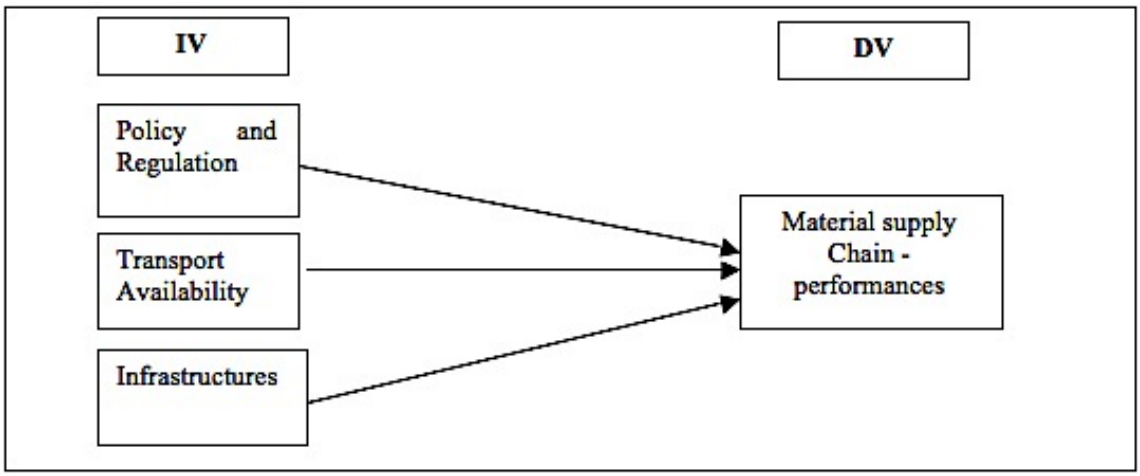

Figure 3.1: Research Model

Response Rate

A survey was conducted through the selected target groups as suggested. The overall of the target group responded and met with the objectives of the study. The questionnaires were administered using a specific reference as formatted (Hair et al., 1994). It is described as an important indicator on the quality of the research. A higher response rate is considered to likely provide higher accuracy for the result of the research. In this study, the researcher had distributed to 125 questionnaires, from which 113 were responded and returned. Screening had been made only 108 of answered questionnaires were accepted. Therefore, the response rate is 86.4%. According to Richardson (2005), 80%-85 is good in the face-to-face survey. Therefore, a response rate of 86.4%, as recorded by this study is acceptable. Table 3.1, refers to the distribution of the questionnaires and patterns suggested by the related sources to obtain the information. Most of the survey used the face to face survey to ensure the quality of the data.

Table 3.1: Response Rate (Source: Richardson, 2005)

Mail	50% adequate, 60% good, 70% very good
Phone	80% good
Email	40% average, 50% good, 60% very good
Online	30% average
Face-to-face	80-85% good

DATA ANALYSIS AND RESULTS

The data collection was completed in two batches. It was collected, after obtaining permission, from the logistics department of companies with experience in oil and gas industry. The target groups selected in this survey were normally dealing the day to day activities in oil and gas companies and considering on their efficiency and experts in supply materials of the projects. After the permission was granted to the respective companies, questionnaires were distributed through the human resource department and related operational managers for oil and gas pipeline projects in the selected companies. After checking and screening were being made to all the answered questionnaires, only 108 accepted. The data were analyzed using a software package used for statistical analysis SPSS version 18.

Background and Respondents

The background of respondents in the data collection shown in Table 4.1, 4.2, 4.3 and 4.4, started with genders, marital status, ages, and education level, working duration, experiences and current positions. The overall respondents were 108 employees from oil and gas companies. It consists of 88 males and 20 females. The analysis showed there are 81.48% of sample respondents are male and 18.52% of sample respondents are female.

Table 4.1: The Gender Percentage (%)

	Frequency	**Percent**	**Valid Percent**	**Cumulative (%)**
Female	20	18.52	18.52	18.52
Male	88	81.48	81.48	100
Total	108	100	100	

Table 4.2 : The Marital Status Percentage (%)

	Frequency	**Percent**	**Valid(%)**	**Cumulative (%)**
Single	39	36.11	36.11	36.11
Married	69	63.89	63.89	100
Total	108	100	100	

Table 4.2 shows the overall respondents of 108 employees consist of 39 single and 69 married which is 36.11% are single 63.89 married. Therefore, male employees are of high percentage than the females.

Table 4.3 : The Age Average

	Frequency	**%**	**Valid (%)**	**Cumulative (%)**
17-24	11	10.19	10.19	10.19
25-30	40	37.04	30.04	47.22
31-36	25	23.15	23.15	70.37
37-42	15	13.89	13.89	84.36
43-48	10	9.26	9.26	93.52
> 48	7	6.48	6.48	100
Total	108	100	100	

Table 4.3 shows the age averages in six (6) different groups. It showed that the age of highest frequency is 25 – 30 years, with 37.04% of the sampled respondents. This also indicated that the industry is populated by the younger generation Next is 31-36 years old, recorded to 23.15%, followed by 37-42 years of 13.89% of sample respondents. Senior and experts workers ranged from 43 years old and above recorded 17 staff with 15.74% out of total staff.

Table 4.4: The Level of Education (%)

Education levels	Frequency	Percent	Valid Percent	Cumulative (%)
Senior High School	10	9.26	9.26	10.19
Bachelor Degree / S1	83	76.85	76.85	86.11
Master Degree / S2	14	12.96	12.96	99.07
PHD / S3	1	0.93	0.93	100.00
Others	0	0	0	100.00
Total	108	6.48	6.48	

The educational levels of the respondents is shown in table 4.4, Respondents with senior high school are 9.26%, bachelor degrees are 76.85%, Master degree holders are 12.96%, Doctorate degree holders is 0.93%. This result illustrates a good level of education of pipeline construction experts, in Indonesia. It shows that more than 50% of the oil and gas pipelines construction experts are educated. They are also experienced enough to be able to answer the questions posed to them.

Table 4.5: Working Experience (%)

	Frequency	Percent	Valid Percent	Cumulative percent
<5 years	41	37.96	37.96	37.96
5-10 years	19	17.59	17.59	55.56
11-20 years	44	40.74	40.74	96.30
>20 years	4	3.70	3.70	100
Total	108	100.00	100.00	

Working experience of the respondents is illustrated in Table 4.5. It shows that those with less than 5 years working duration are 37.96% while 11 to 20 years are of 40.74%, among the company experts, 19% have worked for 5 -10 years, and 3.7% are those with more than 20 years working duration. The experience of respondents with the pipeline construction project in Indonesia is presented in table. All the respondents, making 100%, are experienced in oil and gas pipelines construction. This shows that all the respondents are valid for this study. It therefore increases the confidence level of the findings of this study. This shows that Indonesia has a good number of experts that can improve the project efficiency of pipeline construction in the country.

Table 4.6: Current Position (%)

	Frequency	**Percent**	**Valid Percent**	**Cumulative percent**
Manager	14	12.96	12.96	12.96
Supervisor	28	25.93	25.93	38.89
Chief Off	19	17.59	17.59	56.48
Others	47	43.52	43.52	100
Total	100	100	100	

Table 4.6 shows the positions held by the respondents in their respective companies is shown in, Manager, supervisor, chief officer and others are found to be 12.96%, 25.93%, 17.59%, 43.52% respectively. With the highest record from “others” level, it showed that the majority of the respondents are low-ranking staff or labor with no administrative portfolio and based on multi- functional jobs.

Analysis of the Model Correlation Analysis

The purpose of correlation analysis is to measure the strength of the linear association between two variables. In this study, the correlations of three independent variables with the dependent variable were tested. The results were determined the strengths and direction of the relationships as suggested in the ranges from "-1 to +1" (Guilford, 1956). However, there is a possibility of having zero (0) as the Pearson value. This implies that there is no relationship between the two variables. Meanwhile, if the Pearson value is "-1" means there is a strong negative relationship between two variables. Also, if the Pearson value is "+1" means the two variables tested is having a strong positive relationship.

Evaluation of the Hypothesis Testing

Table 4.7 presents the result of the correlation analysis conducted by this study. There are three (3) independent variables resulted a positive relationships with logistics performance. The result shows that IT has the strongest correlation to LP, because of its highest Pearson correlation's r=0.629 (p<0.01). The second highest Pearson correlation is FA with r=0.518 (p<0.01).

Table 4.7: Correlation between Variables

		TP	FA	IT	LP
TP	Pearson Correlation	1	.471**	.418**	**.500****
	Sig. (2-tailed)		.000	.000	.000
	N	108	108	108	108
FA	Pearson Correlation	.471**	1	.458**	**.518****
	Sig. (2-tailed)	.000		.000	.000
	N	108	108	108	108
IT	Pearson Correlation	.418**	.458**	1	**.629****
	Sig. (2-tailed)	.000	.000		.000
	N	108	108	108	108
LP	Pearson Correlation	.500**	.518**	.629**	**1**
	Sig. (2-tailed)	.000	.000	.000	
	N	108	108	108	108

Remarks:
TP has the lowest Pearson Correlation of r=0.500 (p<0.01).
There are Three (3) hypotheses had been formulated and tested in this study. The results of the hypotheses testing are shown in the following sub-sections.

Hypotheses 1: There is a significant relationship policy and regulation of materials supply and logistics performance in oil and gas industries

The result of correlation analysis and multiple regression analysis indicated a positive and significant relationship between transport policy and regulation and material supply performance because the Pearson's correlation value is 0.500 and β=0.214. The relationship is statistically significant (p=0.000 < 0.05). According to correlation and data values, transport policy and regulation are influencing the supply performance. Hence, the hypothesis is accepted.

Hypotheses 2: There is a significant relationship between fleet availability and material supply performance in oil and gas industries

The result of correlation analysis and multiple regression analysis indicated a positive and significant relationship between fleet availability and supply performance because the Pearson's correlation value is 0.518 and β=0.215. The relationship is statistically significant (p=0.011 < 0.05). According to correlation value and data value, fleet availabilities are influencing the supply performance. Hence, the hypothesis is accepted.

Hypotheses 3: There is a significant relationship between infrastructure technology and material supply performance in oil and gas industries.

The result of correlation analysis and multiple regression analysis indicated a positive and significant relationship between infrastructure technology and supply performance because the Pearson's correlation value is 0.629 and β=0.441. The relationship is statistically significant (p=0.00 < 0.05). According to correlation value and data value, infrastructure technology is influencing the supply performance. Hence, the hypothesis is accepted. Table 4.8 shows the overall results of hypotheses testing conducted in the study.

Table 4.8 : Hypothesis Results

Hypotheses	Results
Hypothesis 1: There is a significant relationship policy and regulation of materials supply and logistics performance in oil and gas industry	Accepted
Hypotheses 2: There is a significant relationship between fleet availability and material supply performance in oil and gas industry	Accepted
Hypotheses 3: There is a significant relationship between infrastructure technology and material supply performance in oil and gas industry	Accepted

DISSCUSSION AND IMPLICATIONS

The external factors of transportation influence the logistics performance in oil and Gas Companies in Indonesia. This study assessed on the three (3) of the external factors. These are transport policy and regulation, infrastructure technology, and fleet availability in supply and logistics performance. The results of data analysis showed that all factors have positive relationship with supply chains and logistics performances. Among these dimensions, infrastructure technology is the most critical factor that influences logistics performance by having a Pearson's correlation value of 0.629 ($p<0.01$).The questionnaires were distributed to 125 respondents who work in logistics department of oil and gas pipeline construction projects in Indonesia. Out of the questionnaires distributed, 108 questionnaires were returned and analyzed. This gave an acceptable response rate of 86.4% as suggested by Richardson (2005).

The main objective of this study is to investigate the relationship between the external factors of transportation and logistics performance in oil and gas pipelines for the related companies in Indonesia. The researchers used random sampling method, questionnaire as the survey instruments and administered with 108 respondents. The data collected are analyzed by the software of SPSS version 18 . The results showed that all the independent variables have positive relationship with the dependent variable. Infrastructure technology is the most significant factor that influenced among the variables on the supply chains and logistics performances. Then, fleet availability is the second and followed by the transport policy and regulation. The researcher used Pearson's correlation method in testing the hypotheses of this study. The coefficient of the Pearson's correlation indicated a relationship between the independent variables and the dependent variable. The higher the Pearson's correlation coefficient is the stronger the relationship between the variables. Among Three (3) independent variables, infrastructure technology has the highest influence on logistics performance with 0.629 percent.

In overall, this study has suggested the need to improve knowledge about efficiency of supply chains and logistics performances, whether in Indonesia or other countries which dealing with oil and gas industries. In Indonesia, especially, there are islands and provinces with different local regulations affecting the logistics performance. This implies that future studies can further focus on these specific areas to deepen the investigation of supply chains and logistics performances towards the quality of the respective countries. There are also other several processes in the pipelines industry which should be focuses and the government is suggested to implement its findings in the future policy implementation. Finally, one of the major issues in pipelines industry is the needed considerable factors for its efficiency. Among the factors that could be regarded as the determinants towards the significant relationship on supply chains and logistics in oil and gas industries are related to transport policies and regulation, fleet availability and infrastructure technology. These would be able to reflect for the better effective and profitable oil and gas industry in future. Hence, this research establishes the key antecedents for modeling the efficient factors in managing of material supply

chains and logistics performance in the pipeline industries. These suggestions are proposed to be adopted for future development in oil and gas or pipelines industry and not only for local but also in other countries involved in the similar projects. The future research should be considering on a longitudinal approach other than the used cross sectional approach as a research design and investigating new research model as proposed in this study.

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