

Factors influencing the choice of performance measures for the oil and gas supply chain – exploratory study

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Abstract. The current value of the oil price per barrel has severely impacted the oil and gas industry around the world. This has worsened the situation due to the fact that it has long been the backbone of the country through the energy supply, employability and also its role as the major economic contributor. Due to multiple external factors that affect this industry such as crude oil availability, oil price fluctuation, high transportation cost, as well as exposure to high uncertainties, it is sensible for the supply chain practitioner to shift their focus in managing their resources and capabilities. To maximise the potential of supply chain activities in improving overall company performance, it is important to pay extra attention on their performance management. This includes the design of meaningful performance measurement framework to assess organisational performance. This study will explore the influencing factors in choosing performance measures for the oil and gas supply chain. Five in-depth interviews were conducted with supply chain experts within the industry. Eight influencing factors have been identified through the interviews.

1. Introduction

The drop of oil price per barrel to below USD 35 [1] has severely impacted the oil and gas industry around the world. To make things worse, this industry has been the backbone of the oil and gas operators country through its role as the major economic contributor [2,3]. Even though it receives positive responses from the end user [oil and gas consumer], but the affect that it has on the oil and gas producer and the economic condition of the country are not to be undermined [4].

There are multiple external factors that affect this industry such as crude oil availability, oil price fluctuation, high transportation cost, as well as exposure to high uncertainties [5–9]. Therefore, it is sensible for the supply chain practitioners of the industry to shift their focus into managing their resources and capabilities. This can be conducted through supply chain management. As with other industries, the reliance on outsourcing activities has mushroomed in the oil and gas industry. Research suggested that 30 - 40% of oil and gas activities will be outsourced to accomplish the project [6,10]. Oil and gas organisations normally outsource part of their function to subsectors in order to minimise their operation cost, to overcome their limited manpower and expertise as well as to pass some of the supply chain risk to another party [11]. To maximise the potential of supply chain activities in improving overall company performance [12], it is important to pay extra attention on supply chain



performance management. Anatan [13] suggested that supply chain management practices have a significant influence on the achievement of competitive advantage. This study will explore the factors that influencing the choice of performance measures for the oil and gas industry. In-depth interview is conducted with five supply chain experts to explore these factors.

2. Supply chain performance management

Performance management is a highly relevant topic for business organisation and has gained scholars attention since the 1970s [14]. However, the earliest works on performance management of supply chain are primarily focused on the context of manufacturing industry [15,16]. Nowadays, with the increase on reliance of outsourcing activities, companies are more concern on improving their supply chain performance to compete in today's market [17–19]. In line with this trend, research on supply chain performance management that focuses on various contexts of supply chain management have gained so much attention by both researchers and supply chain practitioners.

The industrial characteristics influence supply chain strategy and structure, where different industry requires different strategy [20]. For instance, due to the competitive market in the garment industry [21], the performance framework should also focus on the agility measures, which were driven by innovative product and unstable demand [22]. On the contrary, the automobile industry's performance rely upon the forecasting accuracy [as a make-to-stock system] and this requires measuring the accuracy of forecasting [23]. The given examples suggest that different supply chain context will provide different views in managing their supply chain, which were important on the knowledge expansion on this subject. This in line with Gunasekaran et al. [24] that emphasised the importance of concentrating on the most critical success factors in developing performance measures. They added, most of the companies are still lacking in designing meaningful measures to assess organisational performance.

Chima and Hill [25] stated that the main challenges face by the oil and gas industry is not the oil and gas resources availability but instead on the production and delivery of refined product to the end consumers at the lowest cost. Similar to this, Varma et al. [26] highlight the industry imposed by high transportations cost in comparison to the other industries. The authors proposed other distinguishing characteristics of the industry including process industry, in-flammability, contamination, bulk volumes, long supply chain and fluctuation of raw materials. Despite presenting performance measures for the downstream oil and gas industry, Varma et al. [26] did not investigate some other important elements of the industry, which are safety and environmental factors.

Among other research conducted in the oil and gas context are the local content issues [27–29] project management of upstream oil and gas in the United Kingdom [30] and the link between agility supply chain and business performance [31]. Asrilhant et al. [30] proposed that the key driver for performance success is through internal business elements but it receives inadequate attention by the management. In particular, some of the key elements such as flexibility, interdependency, and learning and innovative are often neglected. Similarly, Yusuf et al. [31] finds that there is strong positive correlation between supply chain and competitive factors like quality, proactive, delivery, speed and innovation. These findings support similar elements, which are known as key driver to success in Asrilhant et al. [30] work. Despite considerable evidence presented performance management research in the supply chain context, there are still many areas remain unexplored [23,32]. Amongst the areas that are worth further investigation are the understanding of characteristics of various supply chain measures in different approaches and environment, the critical success factor in supply chain integration and partnership, benchmarking in performance measures and also the role of socio–environmental measures in supply chain. In particular, a study on supply chain performance within oil and gas environment is still under researched. As such, this research will explore the factors influence the choice of performance measures in the oil and gas industry.

3. Methodology

An exploratory approach was adopted for this study consisting of in-depth interview with five supply chain practitioners from the oil and gas industry. The same method has been widely used for exploring an area when there is scarce publication on the topic [30,33,34]. Five phone interviews with supply chain managers based in the United Kingdom, United States, Indonesia, and Malaysia were undertaken. The reasons these five participants were chosen are based on accessibility and contact that the researcher had with them when she was working in the oil and gas industry. Voss et al. [35] proposed that the ideal contact to gain access for case study is by approaching the person that could open the door. The participants involved have 15 – 30 years experiences in the supply chain and oil and gas industry. These consisted of those involved in the operator side and also contractor side. Table 1 depicted a brief description about the participants for this study. All the participants except participant A have experiences working directly with oil and gas operators. Nevertheless, as a consultant himself Participant A have various experiences dealing with major oil and gas operators around UK, which positioned him as suitable participant for this study. The phone interviews were recorded, transcribed, and analysed. The analysis processes involved coding and constructing themes by categorizing the similarities in the interviews data [36,37]. This process, which is known as thematic analysis [38] was conducted using Microsoft Excel.

Table 1. Participants demographic.

Participant	Year of experience	Role in company	Country	Educational background	Previous companies	Current company
A	20	President	UK	Engineering	Services advisory – oil and gas operator	Services advisory
B	25	Project procurement manager	USA	Business administration	Oil and gas operator and contractor	Services advisory
C	15	Senior supply chain manager	Indonesia	Engineering	Oil and gas operator and contractor	Oil and gas operator
D	30	Head of supply chain	Malaysia	Quantity surveying	Oil and gas operator and contractor	Oil and gas contractor
E	15	Leader, supply chain	Malaysia	Engineering	Oil and gas operator and contractor	Oil and gas contractor

4. Result and analysis

4.1 Factors that influence the choice of performance measures

There are various factors suggested by participants which are local content, the need for balance priority across measures, the role in supply chain which either operator or joint investor, company's reputations, desire for safety, profitability potential, oil price per barrels, and finally company's objective.

4.1.1 Local content

The local contents, which aim to leverage business wealth into country wealth are seen as part of the factors that influence the choice of performance measures. All the rules and regulation set by the country in operation such as localize supply chain should be incorporated into the supply chain performance management. Increasingly, the local agency whose provide license to the operator has inquired them to engage certain amount of services or equipment from the local companies instead of international companies.

“The percentage of your total bought in of your goods and services is being set for local country provision. And sometimes it might be in absolute amount of spend in pound. But, usually it is in percentage.” [Participant A]

Even though other participants did not state the local content as the influencing factor in choosing the performance measures, most of them have suggested that it has affect the way they manage their supply chain performance as qualitative extracts;

“So, if you are working in a remote area, your company might have a desire to hire a certain amount of local people or local companies to work on those jobs. I think that becomes very important.” [Participant B]

“The local content required us to deal with the local supplier “[Participant C]

“And another thing on procurement is, if we go to the market, we need to look at whether the market being regulated by the government. Here in Malaysia, the government objective is to maximise local participation.” [Participant D]

Qualitative extract from Participant C is one of the classic examples on how they have to consider local content requirement in managing their performance;

“...where most of them are the middle person and do not have sufficient knowledge on product or services they provided.” [Participant C]

In order to comply with local content requirement while at the same time ensuring services delivery, company have to go one step further in developing local companies and thoroughly measure their performance in the caveat of the level of competencies of the local providers. In addition to that, as pointed by participant E, there is a need to trade time and cost in order to meet the stringent process set by the country in question. For this reason, other measures like process compliance have to be introduced and implemented to tackle this issue.

“They might need more transparent and more stringent process involves in our supply chain activities which in the same time come with cost and time.” [Participant E]

4.1.2 Role of company in supply chain

Participants A and E apprehend that it is important to consider the role that a company have in supply chain which are either operator or joint investor. A company role in supply chain will influence the information required and evaluate in managing supply chain performance.

“So, for example in procurement, if you are a joint venture operator, you would want to make sure, while you are not responsible of the delivery of the procurement, you want to make sure that the operator who is responsible is following a good and fair process and is compliance to the standards and procedures that has been set in place.” [Participant A]

“If we look into client perspectives which involve national oil and gas companies, there are other indicators that out weight cost and timeliness which is integrity and transparency because they are representing public entities or Governments Corporation.” [Participant E]

The previous interview responses suggest that the role a company have in supply chain will determine the performance measures that are meaningful in assessing their performance.

4.1.3 Reputations of company

One of the participants suggested that the reputation of the company particularly on environmental concerns and corporate social responsibilities are also influence the choice of performance measures. This factor will determine how company managing their operations and what are the measures that important to the company to ensure that company’s reputations are maintained.

“The primary effect that I’ve seen driving measurement one is the reputation of your company. I think companies in the oil and gas business are really concern about the reputations. They want to make sure that they are doing things responsibly, protecting people, and protecting environment.” [Participant B]

4.1.4 Desire for safety

Desire for safety in the oil and gas industries is also one of the determinant factors in choosing performance measures. Pertaining to this, the priority of safety measures over other measures is believed to drive the performance measurement of oil and gas companies. Moreover, participants B, C, and E emphasised that safety aspects have higher priority over any other measures including financial measures.

“In a safety critical industry, safety has to be a very important measure. And health and safety supply chain is critically important to the operators.” [Participant A]

“I think the next factor is sort of the desire for safety, going to operate safely. And basically not to perform work that is going to harm anyone. So, I think that companies in the oil and gas business place safety and facilities integrity as more important than lowering costs.” [Participant B]

“Oil & Gas Industry is high risk industry where safety and quality are considered have priority over price and cost.” [Participant C].

“Safety always considered as the first priority for the oil and gas companies. That is why we have to ensure our supply chain always kept safety in mind.” [Participant E]

4.1.5 Profitability potentials

Apart from that, most of the participants have commented that profitability potential is considered as one of the important drivers in determining choices of performance measures to be used in managing their supply chain.

“And another determinant factor is profitability potential.” [Participant B]

“Whatever performance measures that we choose must be able to contribute to the profit and loss. For example, cost saving would be directly influence the bottom line, and then timely delivery that wouldn't cause any standby would also directly improve the bottom line. That is why I said, all the measures selection should reflect on how to improve the bottom line.” [Participant D]

“Since most of the oil and gas companies are running by the profit driven organisation, most of the indicators chosen are influence by cost and delivery reliability aspects.” [Participant E]

4.1.6 Risk mitigations

The next factor highlighted by participants A, B, and C is to consider risk mitigation aspect in choosing performance measures. Participant A mentioned about locality issues like crime rate as part of consideration in determining performance measures. While, Participant B elaborates the need for joint venture activities for cost and risk sharing in the oil and gas exploration activities. Thus, the latter suggest the requirement in managing performance of the partnership activities.

“If you are in the midstream distribution in the Nigerian delta where theft is a problem, people tapping into the pipeline and selling out black market refineries then, I imagined crude loss would be a very important measure.” [Participant A]

“And the next one I have is risk mitigation. So, you know the oil and gas business requires really large sum of money for projects and at the same time have really large potential profitability. But, there is really large factor of risk of loss and then they have to reserve that in their project. So, you see in the oil and gas business upstream where companies will take on partners and joint ventures caused the potential risk in a one company might be too great if they go in solely by themselves.” [Participant B]

“If we were to pass all the risk to our vendor, then obviously they will factor in somewhere in their cost. A lot of people love to have risk pre-contract, but a lot of time we fail to realise whether the premium that we have to pay is worth it or not. Maybe in some cases, we could get better price by managing the risk instead of pass all the risk to the subcontractor.”

[Participant C]

4.1.7 Oil prices per barrel

Other than that, the world's oil price per barrel is considered as one of the factors in devising performance measures for supply chain management in the industry. For instance, companies have to relook into their strategy in order to sustain in this industry in a low-price oil environment and revisit their priorities to reflect the situation. Qualitative extracts from the participants explain the situation;

“Again, we get back to the 100\$/per barrel prices of oil, if we are in supply chain and all we want to measure is cost, the business might be saying that the most important now is the speed of completion. Because if we can get stuff on-board faster, the higher profitability from more quickly obtaining oil & gas sales is greater than focusing on reducing project costs.” [Participant B]

“Since the world's oil price is very low, we are trying very hard. There are a lot of areas that we have to squeeze. One thing for example a lot of time we never care less about the brand that we purchase, if we normally use certain brand, we just go for that. Nowadays, the oil and gas price have dropped a lot, we started looking for other options.”

[Participant D]

“Take for example, in the current dropped of oil price per barrel, we got to really manage our cost and to get more jobs for the company to sustain. In this case we have to change our sourcing strategy, choose different vendors or equipment in order to get better price.” [Participant E]

4.1.8 Company's objectives

Finally, company's objectives are also considered as the influencing factor. Qualitative extracts of Participant D explain how the measures chose have to be aligned with company objective, which in this case he spell out about company's profit target. Other participants mentioned about company's objectives with regards to desire for safety, profitability potential, company's reputation as the drivers in choosing performance measures. These have been presented in the previous sections.

“For example, first of all we want to have 300mil which is the enabler. So, from our revenue stream we found that we can only gain 280mil, we short of 20mil, where can we get this 20 mil? One of the options is through staff reduction, and another 10 mil maybe through procurement saving, so that we go to bid. That is how we normally do it. Performance measures must always starts from objective, whatever PMs you designed, must be able to support you to achieve your objective. It must be aligned with the company objective.” [Participant D].

Table 2 summarises the factors influencing the choice of performance measures according to participants.

Table 2. Factors that influence the choice of performance measures.

Influencing factors	Participant A	Participant B	Participant C	Participant D	Participant E
Profitability potential		√		√	√
Company’s reputation		√			
Desire for safety	√	√	√		√
Risk mitigation	√	√		√	
Oil prices per barrels		√		√	√
The role in supply chain	√				√
Local content	√	√	√	√	√
Company’s objectives	√	√		√	

5. Discussion

Several significant findings can be drawn from this study. First, we have seen that local content has been presented by all participants as an influencing factor in managing supply chain performance. It is interesting to come across similar opinion raised by participants operating in developing countries and also developed countries on their concern with regard to local content. This lead to the next question whether the local content requirements are applied both for the work performed in these two continents. Our follow up question clarified this matter where Participant B explains that they have to comply with local content requirement in USA which concern more on safety, environmental issues and social responsibilities and not particularly concentrated on engaging local services provider. There are a lot of literatures discussing on Local content requirement which has started since 1990s where they focus on the booming industry on that time, manufacturing and automobile industry [16,27,29,39]. Recent article from [28] presents how the international oil and gas companies have to respond to local content requirement to international oil and gas companies, which includes to renegotiate local content requirement with local government proved that it is part of vital components in supply chain performance management.

Other than that, the three influencing factors in choosing performance measures namely role of company in supply chain, profitability potential, and company’s objective are recognised amongst the factors that received the same amount of attention in the supply chain of other industry. In the literature review of performance measures and metrics in logistic and supply chain management from 1995 – 2004 by Gunasekaran & Kobu [23], it is highlighted that most of the widely used performance measures are financial measures which consists of 38% of total measures. Not only that, Taticchi et al. [40] have also mentioned about the need to meet conflicting objectives of maximising profitability and at the same time reducing operating cost and a lot other literatures have addressed the same measures [14,32,41]. In this sense, this particular factor (Company’s objectives) makes no different between the oil and gas industry and other industries. In the same vein, existing literatures claimed that company’s objective is one of the fundamental factors in designing performance measurement framework [14,32,42]. From this analysis it is appealing to investigate further the most common company’s priority in this industry. While for role in supply chain on either the operator side or joint investor, it relates back to the information required by the customer. If there is the need for traceability and detail information for the bidding exercise, it has to be part of the performance measures.

As specified by the participants, the reputation areas that they focus on are social responsibilities and also safety issues. Nowadays, the company’s reputation and their concern on safety have gained

immense attention from the public, non-government organisation, environmentalist, and human right organisation. Not only that, any environmental incident issues resulted from oil and gas activities will attract so much publicities and eventually tarnished their reputation in the industry. This is due to the impact that it has to the people and environments [34,42,43]. Hence, it is essential to consider company's reputation in deciding on performance measures.

In addition, the participants also proposed risk mitigation as part of the influencing factors. In the case of the oil and gas industry, it is important to note that it is impossible to dictate the oil and gas reservoirs for exploration activities. On top of that, there is the risk of low oil and gas content within it after they have incurred so much cost and effort on it. Therefore, risk mitigation is something that requires company consideration in structuring their strategy and performance framework. Apart from risk mitigation, oil price per barrel has the huge impact on their business strategy as it will determine company's profitability potential. Based on the response from one of the participant, company will shift their focus on different performance measures in different oil price environment. For example, he mentioned that at the highest price, they will focus on delivery speed. Whilst, on the lower price they have to focus more on the cost saving to ensure they could manage their margin. In this case, a company has to be flexible to response to the external environment by managing their internal resources and capabilities. The same applies in supply network of other industry. "When business was booming, executives concentrated on maximising speed, and when the economy head south, firms desperately tried to minimise supply costs" [44]. This might infer, for the oil and gas industry, the world oil prices per barrel are one of the driving factors in priorities their performance measures.

6. Conclusion and research limitation

This exploration study has present significant findings on the influencing factors in the choice of performance measures. There are eight influencing factors have been identified for the oil and gas industry. More specifically, with the aid of existing literature, we managed to determine the factors, which are also relevant to other industry and the distinguishing characteristics in those factors. Local contents requirement has found to be the only factor proposed by all participants. Hence, it is very important to manage local content issue in achieving supply chain performance improvements. This finding is in line with previous literature and works report provided by the oil and gas advisory companies. One of the limitation of this study is the exploratory interview was conducted on a small number of respondents. The study on larger number of experts will bring more added values to this exploratory study. Moreover, the study was conducted among respondents that largely involve on the upstream sector and the result could not represent an accurate perspective on the downstream parts of the industry. However, with the aid of existing literature on the downstream part, further research can be performed to validate this result with large number of respondents in order to construct generalisation on the influencing factors in choosing performance measures for the industry.

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