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An empirical study of oil and gas value chain agility in the UAE

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Abstract

Purpose

The aim of this research paper is to investigate the agility of oil and gas value chains in the United Arab Emirates and to understand the impact of implementing supply disruption strategies, outsourcing strategies and management strategies on oil and gas value chain agility. The results can support oil and gas industry across the UAE to build resilience in the value chain.

Design/methodology/approach

The research design consists of a comprehensive literature review, followed by questionnaire based survey responses of 106 participants and comprehensive statistical analysis, thus validate the developed theoretical framework and contributes to both practical and methodological approach.

Findings

The findings indicate that oil and gas value chain in the UAE have a good combination of supply disruption and outsourcing strategies in place that are synchronized with the overall management strategies. The implementation of these strategies have a positive and significant effect on the agility of the value chain and therefore the company's competitive position.

Research limitations/implications

The research provides guidance for oil and gas supply chain managers to better understand the critical factors that impact and determine value chain agility. The paper also describes relevant strategies that should be taken into consideration by these managers in order to build agile value chains. The research contributes to social dimensions of supply chain sustainability of how resilient are the oil and gas value chain during uncertain conditions so that it can respond to uncertain changes in order to contribute to corporate social responsibility. Some of the limitations of this research include the geographic coverage of the study region and other methodological limitation.

Originality/value

This research is the first of its kind in the UAE region to assess the link between dimensions of agile value chain, outsourcing strategies, supply disruption strategies and management strategies primarily from the Emirates of Abu Dhabi and Dubai.

Keywords

Supply Chain Agility, Oil and Gas supply chain, Empirical research.

Paper type

Research paper

1 Introduction

In the last few years, Global Value Chains (GVCs) have increasingly become the center around which production and world trade are structured. A value chain classifies the complete series of activities and processes that firms perform to convey a service or a product from its foundation stage to its finishing stage to be used by end consumers (Gereffi & Fernandez-Stark, 2011). This range of activities include product conception, design, sourcing for intermediate inputs and raw materials, prototyping, production, marketing, distribution and support. In other words, global value chains today are complex networks of sourcing, pre-manufacturing, manufacturing, marketing, and consumption. Nowadays, this chain of activities is no longer confined in one place. As the cost of communication and transportation falls and the technological growth advances, the opportunities of international trade with intermediate and final services and goods have enhanced (Andersen, Nellemann & Thomsen, 2015). Moreover, factors like cost, access to raw materials and other resources, access to new markets, and commerce policy improvements have enabled the geographical destruction of the value chain activities throughout the globe. This global fragmentation of manufacturing processes is a significant source of competitive advantage and improved efficiency. Today, it is reported that intermediate services constitute 70% of the world's service imports and more that 50% of world manufactured imports are in the form of semi-finished products, parts and components (Backer & Miroudot, 2013).

There are two kinds of global value chains. The first kind initiates with a natural resource like mining, farming or any other kind of resource extraction. The start point of this kind of value chains is specific and pre-determined. The second kind is unattached to nature, this type of global value chains is free to search for the best location, influenced greatly by cost reductions. In addition, by looking into the literature, we can see that there are many indicators that give a better understanding of the global value chain sensation. First is the global value chain participation index, which indicates in absolute and relative terms the level to which a specific country is participating in a steeply fragmented value chain. It differentiates between the forward participation which is the use of local resources in the production of exports, and backward participation which using non-local resources and intermediates in exports. The second indicator is the index of the number of manufacturing stages, which shows the international and global parts of the VC and gives an indication of how long the global value chain is. Third, the distance to end market. This indicator shows the "upstreamness" of the country and define its location in the global value chain (Backer & Miroudot, 2013).

One of the significant signs of the global value chain phenomena is that we should take a better look pass the industries to realize production and trade patterns. The global value chain literature asserts on business functions, such as design, R&D, purchasing, operations, distribution, advertising, customer services and all other activities along the value chain. While, on the other hand, countries incline to specialize in a particular business function that involves specific tasks instead of specializing in specific industries. Moreover, some countries tend to specialize in upstream activities like R&D, production of inputs and components, design and innovation while other countries prefer to specialize in downstream activities such as logistics, marketing, final assembly of products and branding.

In the field of global value chain applications in specific industries, it is clear that the chemical manufacturing industry is one of the top industries to be characterized by the existence of a large number of different global value chains. Probably, because it involves a large number of manufacturing and production

processes along with many final and intermediate products. Looking into the value chain and the complete structure of the chemical manufacturing industry, we can see that it starts with oil and gas as inputs that are then converted in the subsequent production stages to different products such as active ingredients, petrochemicals, specialties, basis chemicals and polymers (Kannegieser, 2008). The chemical manufacturing industry produces inputs and raw materials that can be used in different other industries. The chemical global value chain has mainly two types of products. First are commodity products that are sold at low prices in mass quantities and are produced in large volumes at the early stages. The second type of products are normally produced at later stages and are called specialty products, because they integrate a higher degree of complexity and require larger investments when it comes to marketing and research and development such as the raw materials used in the pharmaceutical industry. Global market growths vary through the different phases in the chemical value chain. Evidence in the petrochemical industry, particularly "propylene polymers" which are affected by the expensive and unstable prices of crude oil around the world. On the other hand, the latest studies on shale rock as an important source of natural gas offers an increasing supply of raw materials used in the production of ethylene based products. The geography of the chemical industry is changing as a result of these different progressions. In the specialty products, new competitors are trying to increase their market share in this high money-making market. As a result, an obvious trend in the direction of commoditization is detected.

The chemical manufacturing industry sources its inputs internally from chemical sub-industries in addition to the inputs sourced from other industries. Moreover, there is a significant part of these inputs that is being obtained locally, mirrored in the fairly high average local size of the chemical global value chain among countries. There is no surprise that smaller countries illustrate relatively more global stages; on the other hand, the chemical manufacturing industries in large countries like China purchase more than 90% of its inputs locally (Backer & Miroudot, 2013). Which means that the chemical manufacturing industry in China is highly grouped with other supplying industries geographically. Nowadays, the opportunities and the challenges in the global market force chemical manufacturing organization to concentrate their efforts and source of added value on the manufacturing of high quality products and implementation of effective, flexible and strong global value chains (Caiazza, Volpe & Stanton, 2016). Furthermore, Yusuf et al. (2014) indicated that the agility of different service providers along the oil and gas value chain and the influence of their performance on the value chain are of significant importance in realizing associated value chain competitiveness. In fact, the early supporters of agility describe it as an overall system that has extraordinary capabilities to deal with the fast changing requirements of the market with flexibility and speed. Which make agility an important trade that every oil and gas value chain needs to have in all areas of the world including the UAE. All value chain agility definitions have a few themes in common, these themes are known as the four dimensions of agility which include improving the customer experience, empowering the influence of information and people, facing change and uniting to compete (Yusuf et al., 2014).

The survey used in this research paper sought to investigate the agility of oil and gas value chains in the UAE. In addition, it strived to understand and evaluate the critical factors that impact and determine UAE's oil and gas value chain agility including supply disruption strategies, outsourcing strategies and management strategies. The results can support oil and gas companies across the UAE build resilience in the value chain. The remainder of this paper is divided into five parts: after this introduction the first part explains the problem and its background. The second part is the literature review that defines global value chains, oil and gas value chains, value chain agility and UAE oil and gas value chain. It also includes the research tree and identification of research gap. The third part is research methodology including research approach, measurements, questionnaire design, sample profile, sample size and data collection process. The forth part is the analysis of data using IBM SPSS statistical package, the fifth and final part is discussions and conclusions.

2 Literature review

2.1 Global Value Chains

Looking into the role played by global value chains in specific industries will give a better understanding to the idea that the competition is no longer between companies but entire value chains. In their paper Giovannetti & Marvasi (2016) offer a company level perspective of the participation of global value chains in the food industry specifically in Italy. The paper analyzed the link between the global value chain participation and the probability to export, showing that the later will increase significantly as a result of participating in a global value chain. Moreover, the possibility of selling finished goods through large sales points will contribute significantly to internationalization. Moreover, there is no doubt that value chain management assisted organizations to optimize manufacturing and distribution costs, meet their customers demand and manage their production volumes. Specifically, in the chemical manufacturing industry where companies that have very high complexity in distribution networks and production processes used value chain management to effectively run their operations. Moreover, challenged by globalization and the fluctuation of raw material prices, it is not enough to optimize the costs in order to guarantee the overall profitability (Kannegiesser, 2008).

2.2 Oil and Gas Value Chains

The value chain of the oil and gas industry is very complex compared to the value chains of other industries. This value chain has two very different, yet very much related, major sections. First is the upstream value chain which involves getting hold of crude oil. This segment of the value chain contains many processes starting with crude oil exploration and drilling, forecasting production needs, production process and finally managing the logistics of moving the explored crude oil from remote locations to refineries. The upstream value chain processes is the responsibility of oil companies, while the processes of the second segment which is the downstream value chain are the responsibility of petrochemical companies and refineries. In the downstream processes the crude oil is converted to consumable derivatives at the refineries. Other downstream activities include forecasting of manufacturing quantities, manufacturing process, and logistics management of transferring the manufacturing outputs from the refineries to the end customers around the world. (Hussain, Assavapokee & Khumawala 2006). Figure (1) represents the total value chain for the oil and gas industry.

[Figure 1: Value Chain of the Oil and Gas Industry]

Hussain, Assavapokee & Khumawala (2006) state that the value chain management in the oil and gas industry has many challenges, more than any other industries, especially in the logistics management area. One of the major challenges is supply disruption. It is important to understand what external security threats may cause a disruption to the flow of oil and gas and how oil and gas companies are facing these threats through value chain strategies. Urciuoli et al. (2014) used multiple case studies to identify security threats to the oil and gas flow to Europe and the strategies companies used to face them. The results showed that a decent combination of strategies is being applied in the European oil and gas value chains such as safety stocks, portfolio diversification, transport capacity and flexible contracts. The study also identified the biggest security threats to the value chain including terrorism, vessel hijacking and war. There is no doubt that economies that depend on energy need to use their energy security strategies to manage the supply disruptions to the oil and gas flow. According to Gülpinar et al. (2014) the disruption to the oil and gas flow has a substantial financial effect on economies that are oil-dependent and many companies in these economies have faced cash- flow and revenue catastrophes because of such disruptions. Moreover, in their paper Modarress, Al Ansari & Thies (2016) examined the concept of outsourcing and looked into the challenges, the positive outcomes and the risks behind this strategy. It was clear that oil and gas exporters have a positive position toward outsourcing because it can provide significant savings along the oil and gas

value chain, on the other hand, it creates a disturbing resistance as a result of the fear from the unknown and compromising value chain privacy.

2.3 Oil and Gas Value Chain Agility

The oil and gas value chain includes a variety of service providers in the form of small and medium sized companies that have a supporting role in the operations of oil and gas companies. It is of substantial importance to the efficiency and effectiveness of the oil and gas value chain to make sure that these providers are well managed as a significant part of this chain. Moreover, Yusuf et al. (2014) reported that the agility of these enterprises along the oil and gas value chain and the influence of their performance on the value chain are of significant importance in realizing associated value chain competitiveness. In fact the early supporters of agility describe it as an overall system that has extraordinary capabilities to deal with the fast changing requirements of the market with flexibility and speed. These capabilities include highly motivated experienced management members, state of the art information technology, and capable human resources (Youssef, 1994). Agility of a value chains can also be defined as the ability of the organization to master market instability (van Hoek, 2000, 2001; van Hoek et al., 2001). Moreover, Gligor and Holcomb (2012) argued that an agile value chain has the ability of quickly engage in strategic alliances to serve it is own benefit, can speedily satisfy customer orders and can always announce new products in an consistence and timely manner. All value chain agility definitions have a few themes in common, these themes are known as the four dimensions of value chain agility which include improving the customer experience, empowering the influence of information and people, facing change and uniting to compete (Yusuf et al., 2014). In another paper Yusuf et al. (2014) look at how agility is distributed in the oil and gas industry and examine the influences of physically belonging to an industrial cluster on the agility of an organization. The findings of the paper described the important role of belonging to a cluster as an effective strategy for profitable exploitation and utilization of oil and gas natural resources. There is no doubt that oil and gas companies have a high level of uncertainties circulating its value chain and therefore these companies need dynamic value chain capabilities. Saad, Udin & Hasnan (2013) state that dynamic value chains requires constant reevaluation of organizational structures, technologies and partners. The more agile the value chain is, the more likely for the organization to invest, explore and create dynamic competences and therefore a better performance level with time.

2.4 UAE Oil and Gas Value Chain

In the continuously changing world of oil and gas, United Arab Emirates is considered an important partner and an accountable producer in the global energy market having the world's 7th largest crude oil reserves. Nowadays, Oil and gas exports makeup for 25% of the country's total domestic product (uae-embassy.org). At this time the United Arab Emirates does not perform refining processes because this kind of activities needs advances and progressive expertise. Only basic refining is being performed by Abu Dhabi Oil Refining Company (TAKREER) while developing other facilities to support the overall value chain responsiveness. Other aspects of the oil and gas value chain include inventory management, supplier selection, new fields researches and transportation. In terms of supplier selection, the strategy now is based on safety, speed, quality and flexibility. The oil and gas value chain strategy asserts on always having a buffer inventory while conducting advanced researches to locate new crude oil wells. Transportation across the value chain is extremely responsive, and is steered through ADNATCO (Binlootah & Sundarakani, 2012). Nevertheless, the UAE oil and gas value chain have to keep working on improving its agility to face the increasingly unstable energy market.

2.5 Research Tree

A comprehensive research tree representing the core articles reviewed across the themes of the various oil and gas value chain elements are presented in Figure 2. The identified key research gaps are discussed in the proceeding section.

[Figure 2: Research Tree]

2.6 Identification of Research Gap

Based on the previous in depth review of the existing literature, it is obvious that the need for agile value chains with increased responsiveness in the field of oil and gas industry has been recognized. Nevertheless, unlike in the other process industries where there is a plenty of data on the role of agility in organizational success (Azevedo et al., 2012; Gunasekaran and Ngai, 2012; Sarkis et al., 2011; Khan and Pillania, 2008; Abdulmalek, and Rajgopal, 2007; Lin et al., 2006; Yusuf et al., 2004) this issue remains untapped in the area of oil and gas industry especially in the United Arab Emirates oil and gas value chains. The following table summarizes three core journals and shows how the findings were used to identify research objectives and research gap.

[Table 1: Identification of Research Gap]

3 Research Framework and Hypotheses

The purpose of this research is to assess the link between dimensions of agile value chain, outsourcing strategies, supply disruption and management strategies in the context of the UAE oil and gas industry. The continuously growing and vibrant nature of the oil and gas value chain presents many challenges for effective structure coordination. Members of the value chain stakeholders cannot compete independently any more due to the nature of the today's competition unless they innovate and sustainably differentiate their service or product offerings. The final product delivered to the end customer moves across a chain of entities that add to the value of the product. Moreover, recent aspects like outsourcing, globalization and cost savings along the value chain increased uncertainty and risk exposure.

[Figure 3: Research Framework]

Nowadays, both researchers and practitioners are highly interested in managing supply disruptions however not much emphasize are paid to design agile value chain. It has been frequently noticed over the years that oil and gas value chains in general do not operate smoothly as planned because supply disruptions usually arise in different areas. For example, natural disasters, extreme weather conditions, workers strike, products theft, machinery break down, oil spill-off and explosions at sea ports and so on. As a result, many researches has asserts on the necessity of implementing adequate strategies to handle supply disruptions (Deane et al., 2009; Krishnan and Ulrich, 2001). A good combination of supply disruption strategies include building safety stocks and transport capacity planning (Urciuoli et al., 2014), are expected to enhance the overall agility of the value chain and therefore increase the responsiveness to unplanned events. Henceforth the research designs the first hypothesis as follows;

> H1. There is a positive relationship between implementing supply disruption strategies and oil and gas value chain agility

Alternatively, to mitigate supply disruptions, Urciuoli et al. (2014) confirmed the importance of diverse management strategies. Top management should work on implementing the concept of information sharing to build a ground base of data to face supply disruptions and manage outsourcing activities. Moreover, value chain risk management tools must to be implemented to enable supply chain managers to continuously monitor external threats and re-evaluate their strategies and respond to their clients accordingly. This kind of management strategies are expected to have a positive effect on value chain agility. Based on these natures the second hypothesis has been designed as;

H2. There is a positive relationship between implementing management strategies and oil and gas value chain agility

Another issue facing the oil and gas value chain management is to sustain a good economic growth line in geopolitical zones as required by investors, especially with the unprecedented low oil and gas prices in the past few years. Therefore, outsourcing has become a significant part of the oil and gas value chain strategy for cost-saving across all segments of the value chain. Nevertheless, the likelihood that outsourcing strategy can contribute to the profitability of the oil and gas value chain has unexplored areas. For example, hidden or unexpected costs, quality of product or service and knowledge partnership and its effect on companies security (Modarress, Ansari & Thies, 2016). It is expected that the outsourcing have a negative effect on value chain agility. Therefore the research designs the third hypothesis as follows;

H3. Outsourcing has a negative effect on oil and gas value chain agility

4 Research methodology

This research is a study with an inductive nature that proposes a model with a causal relationship between value chain agility and implementing supply disruption strategies, outsourcing strategies and management strategies. This proposed relationship requires validation using empirical data. A quantitative approach is adapted in this research using information gathered through a survey based questionnaire to obtain categorical data needed for the statistical testing. The statistical analysis of the data gathered through the questionnaires was performed using IBM SPSS Statistics (v.23)

4.1 Research Approach

Questionnaires are considered one of the best methods for data collection because non like other methods, for example observations and interviews, the sample population is spread over a large area which allows a countrywide or even global coverage. In addition, questionnaires used to contact people that would not be reachable by other methods like interviews. Moreover, questionnaires considered very economical for both the researcher and the respondent in terms of cost, time and effort. There is no need to travel or to hire a team to conduct interviews, which can also be time consuming. In the case of researches that need repetitive information, questionnaires are considered more useful and less expensive in comparison with other methods like observation or interviews. Also, while observations and interviews requires specific times and prior arrangements, respondents can reply to questionnaires at their own leisure. Moreover, because questionnaires ensure the anonymity of its respondents, they feel free to express their own point of views without having to worry about being identified or questioned for giving their honest feedback. Questionnaire is also considered an easy method. It does not require much knowledge or technical skill to plan, design and manage. Moreover, questionnaires do not allow much of data variation because it is distributed in a written form which will help the respondents to focus on the significant aspects and will standardize the process to record responses and therefore ensure uniformity. Another important advantage of using questionnaires for data collection that it can be used as an initial tool for performing a more in-depth research by any other method afterward. In addition, questionnaires have a unique advantage in regards to the validity of its information. In the questionnaire respondents provide their written responses using their own language which does not allow for any miss interpretation by the researcher while with other methods like observations and interviews the validity and reliability of the information depends on how the researcher interpret them which may be influenced by their own opinions and prejudice (Choudhury, 2015).

4.2 Measurements:

Measurements are defined as a concept for linking the research model to the real world by using observations that are expressed in terms of steps to measure (Vogt, 2007). Given the amount of papers published in the area of this research, current measures were adopted to operationalize the variables. For Example the dependent variable value chain agility was measured using four dimensions of agility adopted from Yusuf et al. (2014), supply disruption was measured using two items adopted from Urciuoli et al. (2014), Outsourcing was measured using three items adopted from Modarress, Ansari & Thies (2016), and the last independent

variable which is implementing management strategies was measured using two items adopted from Urciuoli et al. (2014). Table (2) below includes all measurements adopted for each variable and their references.

[Table 1: Measurement Items]

4.3 Questionnaire Design

The questionnaire in this research thesis was designed to provide the input needed to answer the research question. The above measurement items were included and then analyzed to fulfil the research objectives. Moreover, formal procedures of questionnaire design, distribution, administration and analysis was applied to improve the validity of the data and reduce error.

The questionnaire used a "5-Point Likert Scale" to scale the answers of the survey research respondents. From a statistical point of view, the results of the questionnaire should have a normal distribution around a good percentage of points at the middle. Using a five point scale will allow the respondents to answer at either side of the middle point (3) and will result in the desired distribution.

The questionnaire started with a short introduction to brief the respondents on the researcher, research aims and the purpose of the study. Also to ensure participants that their participation is voluntary and all personal details will be kept confidential and anonymous. In addition, brief definitions of Value Chain and Agility was stated at the beginning to acquaint respondents with the study.

The questionnaire had six sections, the first section (A) aimed to gather some information about the company, including type of company, company legal structure, number of employees in company, type of workflow process and the average procurement / contracted expenditure per annum. The second section (B) intended to collect market / industry information including respondents' opinion on size of their main competitor and which companies control the oil and gas industry. Other questions aimed to specify the main aspects on which the companies compete or consider for oil and gas projects and oil & gas company's competitive priorities.

The third, fourth and fifth sections were designed so that answers are used to proof the proposed hypothesis. The third section (C) started with a brief definition of supply disruption, then a question on supply disruption strategies was incorporated with the below scale:

1: Not Used
2: Very Limited
3: Limited
4: Extensive
5: Very Extensive

The forth section (D) started with a brief definition of outsourcing, then a question on outsourcing strategies and their effect on company's profitability was included. Both negative and positive values scale was used to determine if implementing such strategies have a positive or negative effect or no effect at all (Zero). This scale was later converted to (1 to 5) scale for the purpose of data analysis.

2: Highly Positive
1: Positive
0: No effect
-1: Negative
-2: Highly negative

The fifth section (E) was designed to determine the degree to which company's use management strategies within the value chain, the below scale was adopted:

1: Not Used
2: Very Limited
3: Limited
4: Extensive
5: Very Extensive

As for the dependent variable, Value Chain Agility, a question linking the four dimensions of agility with each of supply disruption, outsourcing and management strategies was included in all three sections (C, D & E) with the following scale:

1: Very Low
2: Low
3: Moderate
4: High
5: Very High

The last section (F) was added to gather personal information on the participants including department, job role, name, contact number and email address. This part was pushed to the end to raise confidence level of the respondents.

4.4 Sample Profile

The population targeted by this questionnaire was initially those in the designation of supply chain manager, supply chain director, purchasing manager, purchasing officer, director, managing director (MD) and chief executive officer. After starting the data collection the researcher found the response rate to be very low therefore the target audience was expanded to include more departments such as logistics, engineering, services and finance. The questionnaire was sent to respondents working in large, medium and small enterprises in the field of oil and gas explorations and production, logistics services, engineering services and offshore construction. This is supported by the view that oil and gas value chains are served by companies from different industrial sectors and different sizes (Cumbers *et al.*, 2003). Moreover, the questionnaires was sent out to respondents in companies that the researcher have no investment in nor direct relationship with (van der Vaart and van Donk, 2008).

4.5 Oil & gas companies in the UAE

Oil and gas companies in the UAE spread through the seven emirates. However, most of the companies are located in Abu Dhabi, the emirate with the biggest deposits of oil. Followed by Dubai, the next largest oil producer in the UAE. Its important status is reinforced by the presence of JAFZA where most of the oil and gas supporting companies exists. In fact, there are hundreds of companies under the oil and gas industry classification in both Abu Dhabi and Dubai chambers' commercial directory. And since it is difficult to send a survey to the whole population, the non-probability sampling method was followed and the questionnaire was sent to the people that are most conveniently available. Some of the companies that were contacted include: GE Oil & Gas, ABB, Siemens, Silvertech Middle East, Delta Controls FZCO, Abu Dhabi Marine Operating Company (ADMA-OPCO), Abu Dhabi National Oil Company (ADNOC), Abu Dhabi Oil Refining Company (TAKREER), Abu Dhabi Gas Industries Company (GASCO), Zakum Development Company (ZADCO), Abu Dhabi Company for Onshore Oil Operations (ADCO), Emirates National Oil Company (ENOC), and Dubai Petroleum Company (DPC).

4.6 Sample size

In this research, there are three independent variables (3IVs) and one dependent variable (1DV) that constitutes a total of 4 variables. As per Hair *et al.* (2010) standard response of quantitative research must be equal to or greater than 10 times the number of variables. Therefore a total of 40 responses or more will be sufficient enough to proceed with the statistical testing. For the survey participants, totally 400 participants were invited with a target to get a minimum of 40 responses to meet Hair *et al.* (2010) recommendation of 10 times or more observations per variable.

4.7 Data Collection

Once the questionnaire was designed and validated the researcher started the date collection process. The participants were required to complete an online questionnaire using an online questionnaire tool named "Survey Monkey". An online survey tool is employed because it is more convenient, cost effective and the responses can be easily exported to the data analysis application for statistical testing. The survey was created on 26th of October and closed 42 days later on the 6th of December, 2016. A total of 108 responses were received representing 27% response rate, nevertheless, two of them were incomplete. Therefore, 106 responses were used as input for IBM SPSS Statistics software package to conduct data analysis.

5 Results

The statistical analysis of the data gathered through the questionnaires was performed using IBM SPSS Statistics (v.23).

5.1 Respondents and Responding firms characteristics

Table (3) below represents the characteristics of the respondents and their firms; first are the demographic and personal characteristics of the respondents to the questionnaire which include: participants' position / job role in the organization and participants department. Second are companies' information which include type of the company, company legal structure, size of the company, type of workflow process and value of procurement / contracted expenditure per annum. Finally are industry information that include size of the competition, control over the oil and gas Industry, main aspects for project consideration and the frequency of obtaining new contracts.

[Table 3: Characteristics of Respondents and Responding Firms]

5.2 Validity and reliability

Content validity is a tool used to make sure that the questions in the questionnaire have some relationship with the variables and they are quantifying the concepts that are planned to be tested (Sekaran, 2003). For this purpose the survey was sent for a consultant agency by the name "Rapid Action Management Consultancy" in to order to make sure that the questionnaire was designed so that it is capable of providing information that can be analysed to achieve the aim of the research. Second, the survey was shared with an industry expert to get his feedback on the questions and revise accordingly in case of any issues arising. Finally, a pilot test of the survey was also conducted by sharing the questionnaire with a number of individuals for the purpose of testing the understanding of the questions and then making relevant modifications.

Reliability test is conducted on each individual variable to confirm if the results obtained for that particular variable is reliable. Cronbach's alpha was used to measure internal consistency and the results in table (4) below confirmed that all variables are accepted as all Cronbach's alpha values are 0.7 and above. (Cronbach, 1951)

[Table 4: Variables Cronbach's alpha]

In addition, Cronbach's alpha was measured for the overall questionnaire (table (5)) and found to be 0.675. Although alpha values preferably range between (0.7 and 0.9), Nunnally & Bernstein (1994) stated that figures as low as 0.6 maybe acceptable. Therefore, the alpha value obtained for the overall questionnaire also ensures the internal consistency and validity of the variables used.

[Table 5: Questionnaire Cronbach's alpha]

5.3 Descriptive Statistics

Table (6) below shows the descriptive statistics of each variable including minimum, maximum, mean and standard deviation. All missing entries in the data were replaced with the corresponding mean and since a 5-Point Likert Scale was adopted, no outliers were detected.

[Table 6: Descriptive Statistics]

With respect to the independent variables, it is clear that on average, the supply disruption strategies is the strongest variable (Mean = 4.08, SD = 0.83) followed by outsourcing strategies (Mean = 4.06, SD = 0.84). The weakest variable is management strategies (Mean = 3.05, SD = 1.19). Therefore, the suggestion is that, oil and gas companies would pay extra attention to implementing supply disruption strategies to insure continuous supply. Next is the management strategies that work side by side with supply disruption strategies to enhance the overall agility of the value chain and therefore increase the responsiveness to unplanned events.

5.4 Factor analysis

Factor analysis is defined as a reliant method and technique that is used to explain the underlying structure between the variables used in the analysis (Hair *et al.*, 2010). In addition to adequate sample size which means that number of observations must be equal or more than 10 times the number of variables, three main items were checked and confirmed before proceeding with factor analysis: first, strong foundational rationale supporting the existence of a structure; second, an existence of sufficient correlation among the variables supported by Barlett's test of sphericity with sigma value less than 0.05; and finally, Measure of Sampling Adequacy (MSA) with values for each variable exceeding 0.5. After carrying out the factor analysis, total variance explained was examined as well as factor loadings and commonalities which all were within the acceptable range as per (Nunnally and Vernstein, 1994). Table 7 below displays the output of the factor analysis conducted.

[Table 7: Factor Analysis Output]

Bartlett's Test of Sphericity was performed to indorse the statistical significance of the correlation between the items of the variable. As seen in table (7) above, the probability related to Bartlett's test for all constructs is < 0.001 which fulfills the requirement and confirms that factor analysis is appropriate for the selected data. Moreover, the KMO value for all variables is 0.5 or above which also fulfills the requirement of a minimum value of 0.5 (Kaiser, 1974).

The indicators for the "Supply Disruption Strategies" construct explain (90.9%) of the total variance in the data. The values for the other constructs are as follows: Outsourcing Strategies (70.99%), Management Strategies (92.7%) and Value Chain Agility is (67.4%). Moreover, Factor loadings for all measurement items are above 0.7 as shown in the table.

5.5 Multiple Linear Regression Analysis (MRA)

In order for the researcher to validate the proposed model, statistical techniques has to be employed to explain and predict the impact of the independent variables on the dependent variable and also to compare the combined effect of all individual variables on the independent variable. Multiple regression analysis is used to test the relationship between dependent and independent variables because this approach examines the relationship between single dependent variable (Value Chain Agility) and several independent variables (Supply disruption strategies, Outsourcing Strategies and Management Strategies). The significance value can also be determined through this.

5.5.1 Model Summary

Table (8) for model summary shows as sig F change value is 0.000 which is less than the limit value of 0.05 therefore the addition of the three independent variables is statistically significant in predicting the dependent variable . In addition the table shows an R square value of 0.293 which indicates that 29.3% of the variability in the dependent variable VCA is explained by the independent variables (SD, OS and MS).

[Table 8: The model summary]

5.5.2 Coefficients table

To measure the contribution of each independent variable to the model we examine the above coefficients table (9). Based on β values, the value chain agility with respect to supply disruption strategies, outsourcing strategies and management strategies can be presented as:

$$\hat{Y}\ (VCA) = 3.588 - 0.141\ SD_{avg} + 0.099\ OS_{avg} + 0.327\ MS_{avg} + \textit{Error}$$

[Table 9: VCA Coefficients]

5.5.3 ANOVA

ANOVA table (10) shows that as P value = 0.000, the regression model is significantly better at predicting the relationship between the dependent and independent variables than some random method.

[Table 10: ANOVA results]

5.6 Hypothesis Testing

The hypothesis testing is performed to confirm the hypothesis that was proposed. In this research the researcher is interested in quantifying the strength and the direction of an assumed relationship between numbers of variables. Therefore, correlation is used to determine the nature and features of this relationship. And since the survey results have a normal distribution and there are no outliners as the Likert scale is adopted, Pearson's Product-Moment Correlation Coefficient is better suited than others. (Prion & Haerling, 2014)

Pearson's Product-Moment Correlation Coefficient, which is commonly known as "Pearson's *r*", usually generates an *r* value between the values of -1 and 1. The value -1 indicates a strong negative relationship, the value 1 indicates a strong positive relationship and "Zero" indicates no relationship at all (Prion & Haerling,

2014). The ‘‘rule of thumb’’ for interpreting Pearson’s *r* results are as follows for absolute values: (0 to 0.20) is negligible, (0.21 to 0.35) is weak, (0.36 to 0.67) is moderate, (0.68 to 0.90) is strong, and (0.91 to 1.00) is considered very strong and also very rare in social science research. (Taylor, 1990; Shavelson, 1996).

Puth, Neuhauser & Ruxton (2014) stated that having a positive correlation indicates that both the dependent and independent variables move in same direction. In other words if the value independent variable goes up then the value of the dependent variable will go up as well. Moreover, having a negative correlation indicates that the dependent and independent variables moves in opposite directions. If one variable goes up the second one will go down.

Another outcome that can be determined from the Pearson’s *r* value is the coefficient of determination (r^2). For example, if the value of r^2= 0.7 then 70% of the variation in the dependent variable (Y) can be explained by the variation in the dependent variable (X). And similarly, 70% of the variation among sampled respondents in their values in the independent variable (X) can be explained by the variation in their values in the dependent variable (Y). (Puth, Neuhauser & Ruxton (2014)). Table 11 below shows the output for Pearson Correlation test.

[Table (11): Output for Pearson Correlation test]

The table shows that there is a positive and significant relationship between implementing supply disruption strategies, outsourcing strategies, management strategies and value chain agility as all Pearson’s *r* have a positive value in the range (0.68 to 0.90) which indicates a “moderate positive correlation”. The table also shows sig. values of .000 which indicates that the correlation is significant. Moreover, 18.7% of the variation in the dependent variable (VCA) can be explained by the variation in the dependent variable (SD), 15% of the variation in the dependent variable (VCA) can be explained by the variation in the dependent variable (OS) and 20.9% of the variation in the dependent variable (VCA) can be explained by the variation in the dependent variable (MS).

6 Discussions and Conclusions

The analysis of the data confirmed that oil and gas value chains in the UAE have in place a good combination of supply disruption strategies including transport capacity planning and building safety stocks. This is in line with previous research stating that it is essential to plan and implement in advance effective strategies to handle supply disruption (Deane et al., 2009; Krishnan and Ulrich, 2001; Urciuoli et al., 2014). Value chain managers build safety stocks to ensure uninterrupted supply in case of disruption by calibrating inventories to guarantee availability of products (Tomlin, 2006; Sheffi, 2006; Torhaug, 2008; Tang, 2006). Moreover, companies usually seek to set up access to various modes of transportation by dealing with multiple carriers and therefore multiple channels and distribution routes (Tang, 2006; Tomlin, 2006). Some of the other strategies that was mentioned by the respondents to mitigate supply disruption include pre-arranging critical stocks in advance, reduce dependence on key suppliers, better contingency planning, contracts management and supplier engagement. In addition, respondents confirmed that the implementation of such strategies improved the agility of the value chain through a positive impact on various dimensions of agility. Previous researches suggested that such strategies enhanced the resilience competences of the companies by enabling rapid responses to unexpected situations and hence improve competitive advantage which was also confirmed by the questionnaire respondents. (Khan et al., 2012, Urciuoli et al., 2014)

Moreover, the analysis of the data confirmed the importance of diverse management strategies including information sharing and the effective use of risk management tools. Similarly to what is proposed in the current literature (Tomlin, 2006; Blos et al., 2009; Li et al., 2006; Skipper & Hanna, 2009; Christopher et al., 2011). Respondents confirmed that top management should work on implementing the concept of

information sharing to build a ground base of data to face supply disruptions and manage outsourcing activities. Moreover, value chain risk management tools should be implemented to enable supply chain managers to continuously monitor external threats and re-evaluate their strategies and respond to their clients accordingly. The output of the data gathered through the questionnaire also confirmed that implementing such strategies have a positive effect on diverse dimensions of agility and therefore increase the overall value chain responsiveness.

Another issue facing the oil and gas value chain management is to sustain a good economic growth line in geopolitical zones as required by investors, especially with the unprecedented low oil and gas prices in the past few years. Therefore, outsourcing has become a significant part of the oil and gas value chain strategy for cost-saving across all segments of the value chain. Respondents to the questionnaire confirmed that outsourcing has a positive effect on their companies' profitability in terms of cost savings, which is in line with previous research stating that reducing cost is one of the major benefits of outsourcing (Modarress, Ansari & Thies, 2016). Respondents also confirmed that outsourcing has a positive impact on the quality of product or service as contracting some functions to third parties for cost reduction results in added value to in-house efficiency. This is also consistent with current literature (Doh et al. 2005; Modarress et al. 2010). On the other hand, Respondent's to the questionnaire had split views on the effect of outsourcing on knowledge partnership, some considered that outsourcing has a positive effect on knowledge partnership. This is supported in the literature by viewing outsourcing as a strategic knowledge partnership with highly skilled vendors that can bring experience and knowledge to the organization (Roza et al., 2011). Other respondents considered that outsourcing has no effect on the companies' information security. This view is also supported in the literature by the fact that knowledge partnership with outsourcing providers is controlled by laws of intellectual property protection. Oil and gas companies have legal rights to patents its trademarks and products (Modarress, Ansari & Thies, 2016). Taking into consideration the effect of outsourcing on companies' profitability the results of the questionnaire confirmed that outsourcing has a positive effect on different dimensions of agility resulting in a highly responsive and more resilience value chains. This is consistent with view that the benefits of outsourcing outweigh the potential risks of hidden or unexpected costs, lack of confidentiality, poor service and late delivery. (Schiederjans & Zukweiler, 2004; Modarress &Ansari, 2007; Modarress, Ansari & Thies, 2016)

From a scientific perspective, this research paper contributes to the ongoing research on the role of agility in organizational success and the factors that impact and determine this agility in the context of UAE oil and gas industry. The literature review included in this paper reveals that unlike in the other process industries where there is a plenty of data on the role of agility in organizational success (Azevedo et al., 2012; Gunasekaran and Ngai, 2012; Sarkis et al., 2011; Khan and Pillania, 2008; Abdulmalek, and Rajgopal, 2007; Lin et al., 2006; Yusuf et al., 2004) this issue remains untapped in the area of oil and gas industry especially in the United Arab Emirates oil and gas value chains. Hence, this research contributes with an overview of the effect of implementing supply disruption, outsourcing and management strategies on the overall value chain agility. From a practical perspective, this paper describes relevant strategies that should be taken into consideration by value chain managers of oil and gas companies in order to improve their companies value chain's agility. Figure (4) below shows the final theoretical framework with the results of hypothesis testing using Pearson Product-Moment Correlation Coefficient.

[Figure 4: Theoretical Framework with Hypothesis Testing Results]

The main limitation of this study is the limitation in geographic accessibility issues since many oil and gas companies are based in Abu Dhabi and Dubai in the UAE. The researcher recommendation for future research is to adopt a qualitative approach by conducting interviews with industry experts form different oil and gas companies across the United Arab Emirates to gain deeper understanding on some outcomes of the study. Moreover, case studies can be used to understand how oil and gas companies, from a value chain perspective, are working to increase their overall responsiveness to gain competitive advantage.

In conclusion, the oil and gas value chains today are complex networks of sourcing, pre-manufacturing, manufacturing, marketing, and consumption. Supply chain managers of these companies are more often being asked to take decisions in complex environments where both technical and social capabilities make the difference in terms of building agile value chains. The findings indicates that oil and gas value chain mangers in the United Arab Emirates have in place a good combination of supply disruption and outsourcing strategies that are synchronized with management strategies. The implementation of these strategies have a positive and significant effect on the agility of the value chain and therefore the company's competitive position.

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Figure 1: Value Chain of the Oil and Gas Industry
(Source: cliq energy n.d.)

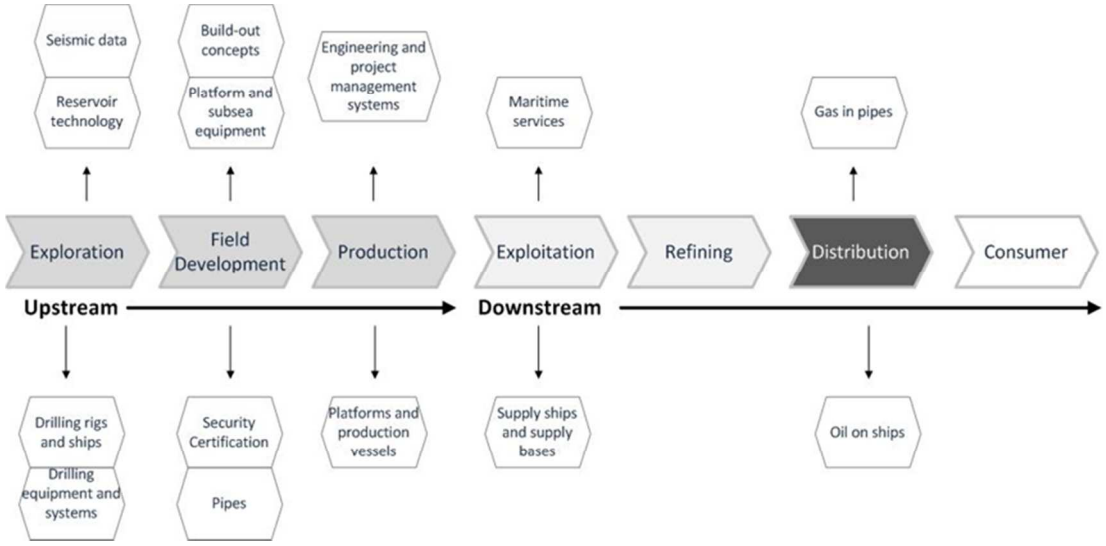

Figure 2: Research Tree

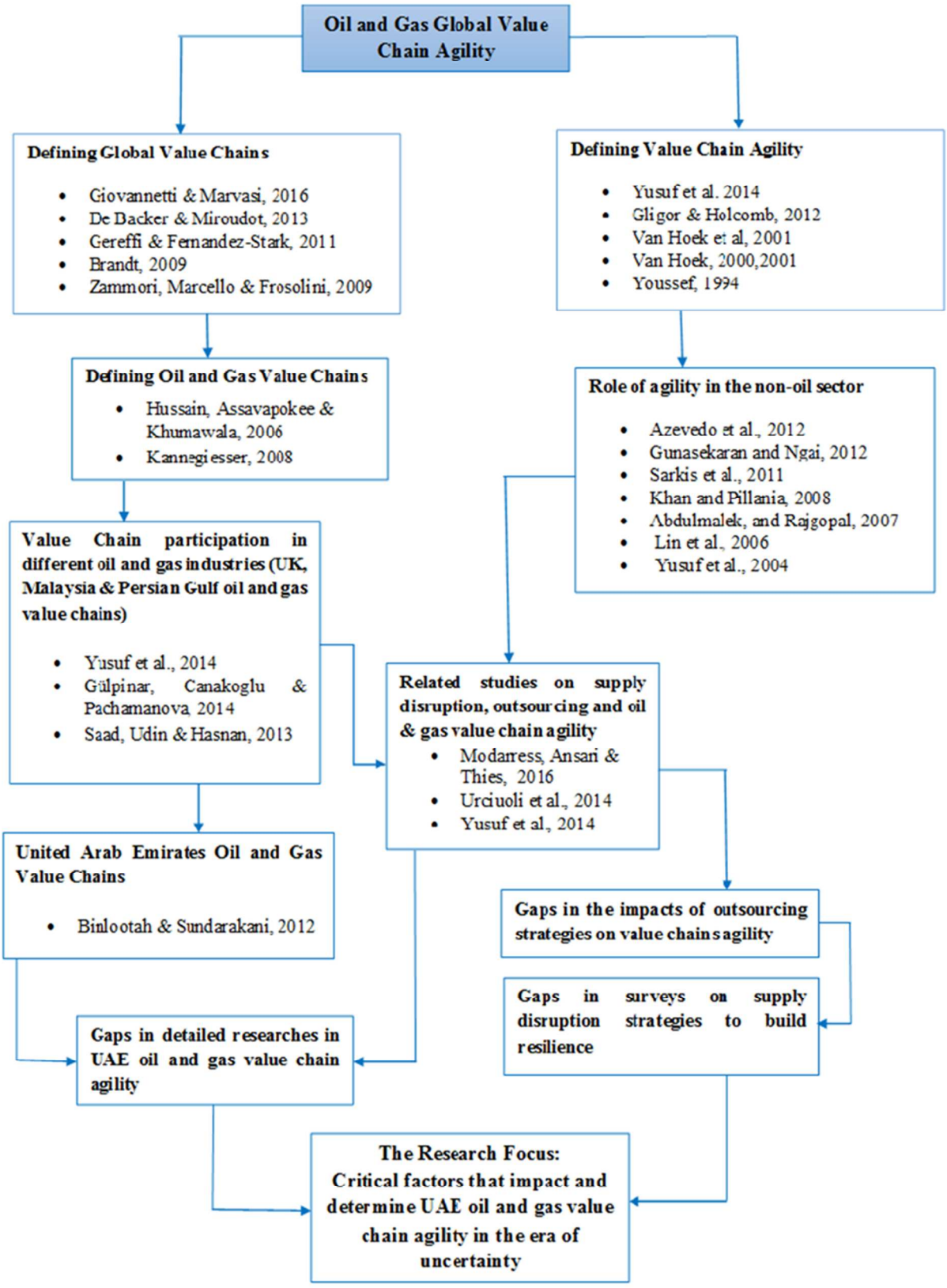

Figure 3: Research Framework

(Framework developed by Author)

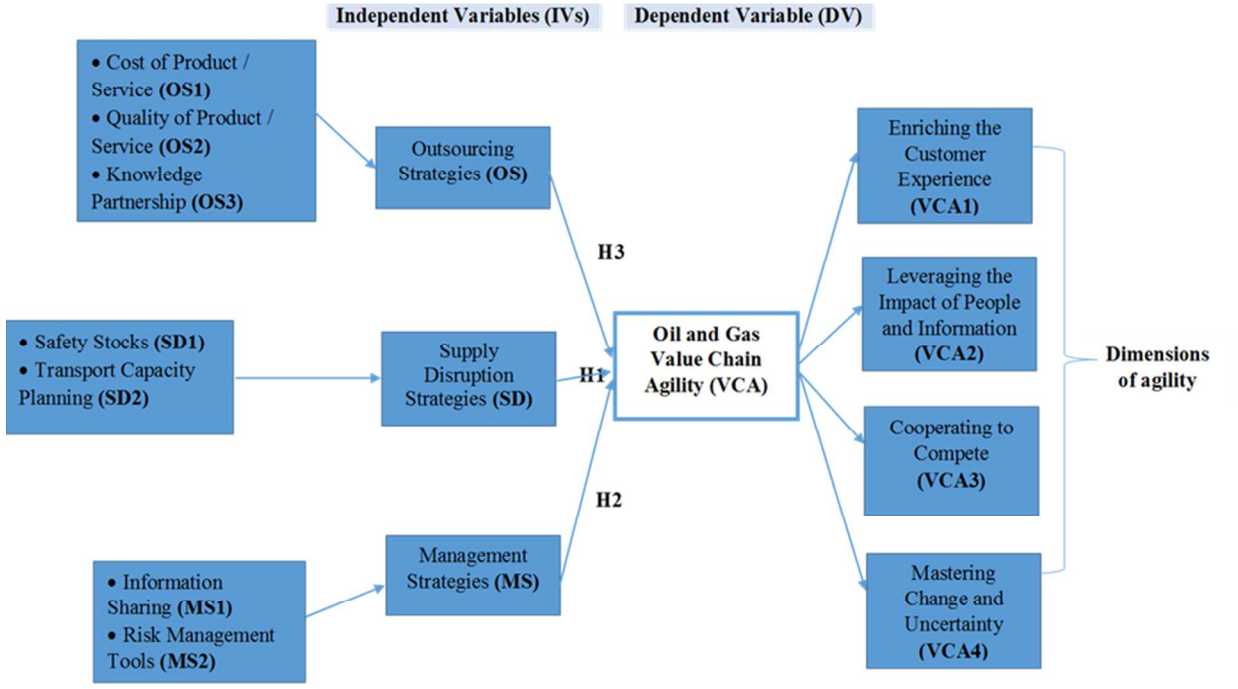

Figure 4: Theoretical Framework with Hypothesis Testing Results

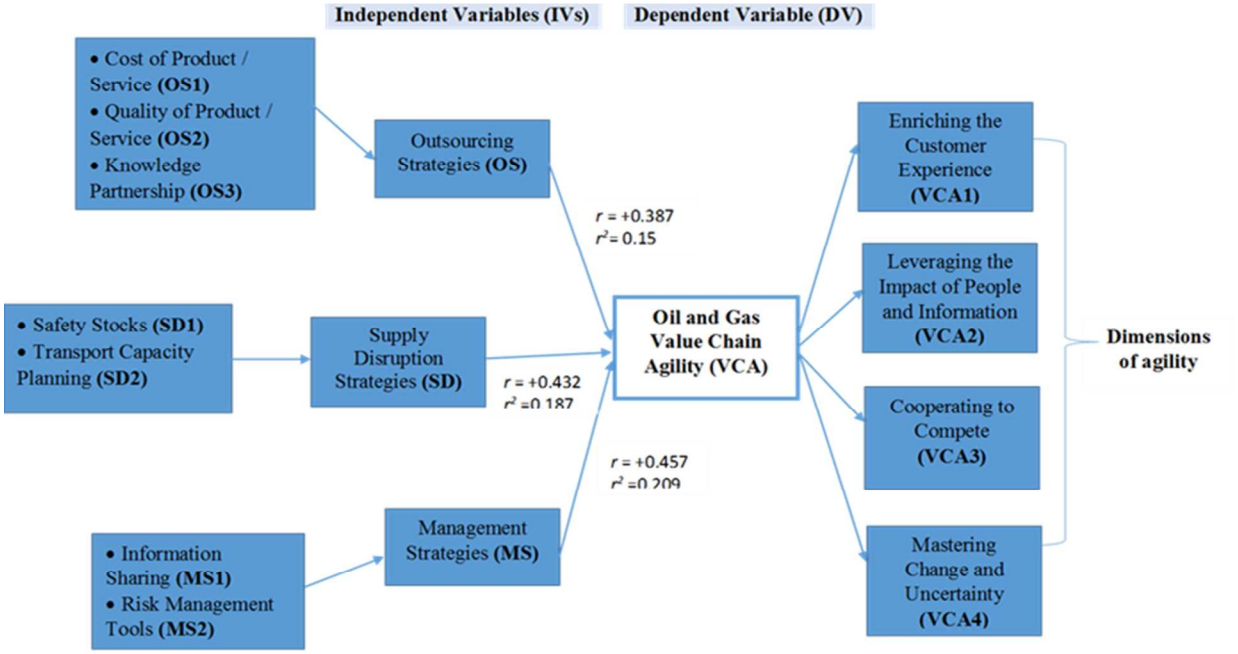

Table 1: Identification of Research Gap

Auther	Title	Research Method	Major research findings	Identefied (potiontial) research gaps	Research objectives
Modarress, Ansari & Thies 2016	**Outsourcing in the Persian Gulf petroleum supply chain**	Quantitative + Qualitative	**1.** Challenges, benefits and risks in outsourcing	undisclosed	Investigate the implementation of outsourcing strategy
			2. The oil and gas exporters have mixed but broad positive view of outsourcing strategy		
			3. While outsourcing could provide savings across the entire supply chain, it also generates a distracting resistance due to the fear of unknown in a complex range of culture		
			4. The results reveal the compromise between the potential benefits in cost reduction and the security of petroleum supply		
Urciuoli et. al. 2014	**The resilience of energy supply chains: a multiple case study approach on oil and gas supply chains to Europe**	Case study	**1.** Disruption strategies that companies are using include: portfolio diversification, flexible contracts, transport capacity planning and safety stocks	**1.** New supply chain risk management tools need to be developed to enable supply chain managers to continuously monitor and assess policies and foreign political conflicts and then align their strategies accordingly	Supply disruption & management strategies to build resilience
			2. Security threats companies fear, include hijacking of vessels (sea piracy), terrorism, and wars	**2.** Surveys could be used to collect data from a wider sample of companies and also to demonstrate and validate causal relationships among the structures identified	
			3. European Union has built a comprehensive portfolio of strategies to deal with scarcity of oil and gas resources		
Yusuf et. al. 2014	**A relational study of supply chain agility, competitiveness and business performance in the oil and gas industry**	questionnaire based survey	**1.** The paper identifies the most important dimensions and attributes of supply chain agility and provides a deeper insight into those characteristics of agility that are most relevant within the oil and gas industry	There is a need to look in-depth at each of the streams of the industry (i.e.,operators, contractors and suppliers) to determine the critical factors that impact and determine the agility of their respective supply sub-chains	How agile are the oil and gas supply chains in the oil and gas industry?
			2. Agility has a significant influence on competitive objectives and business performance		
			3. Where supply chains are considered as long-term partnerships, they lead to enhanced customer loyalty		
			4. Prosperity in a dynamic business environment can be attainted only through innovation and risk taking		
			5. Statistical evidence was found to support the impact of capturing demand information on both financial and non-financial business performance measures		

Table 1: Measurement Items

Variable		Measurements Items		Source
Dependent	Value Chain Agility (VCA)	VCA1	Enriching the customer Experience	Yusuf et al., 2014
		VCA2	Leveraging the impact of people and information	
		VCA3	Cooperating to compete	
		VCA4	Mastering Change and Uncertainty	
Independent	Supply Disruption Strategies (SD)	SD1	Transport capacity planning	Urciuoli et al., 2014
		SD2	Safety stocks	
	Outsourcing Strategies (OS)	OS1	Cost of product or service	Modarress, Ansari & Thies, 2016
		OS2	Quality of product or service	
		OS3	Knowledge partnership	
	Management Strategies (MS)	MS1	Information sharing	Urciuoli et al., 2014
		MS2	Risk management tools	

Table 3: Characteristics of Respondents and Responding Firms

		Count	Percentage
1	**Participants Position / Job Role in the Organization**		
	Senior Management	11	10.38%
	Middle Management	38	35.85%
	Junior Management	35	33.02%
	Others	22	20.75%
	Total	106	100.00%
2	**Participants Department**		
	Procurement	45	42.45%
	Logistics	10	9.43%
	Engineering	24	22.64%
	Finance	3	2.83%
	Senior Management	11	10.38%
	Others	13	12.26%
	Total	106	100.00%
3	**Type of the Company**		
	Refineries	14	13.21%
	Distributors	5	4.72%
	Retailers	2	1.89%
	Contractors	6	5.66%
	OEM (Original Equipment Manufacturer)	32	30.19%
	PMC (Project Management Consultant)	7	6.60%
	EPC (Engineering, Procurement & Construction)	21	19.81%
	Others	19	17.92%
	Total	106	100.00%
4	**Company Legal Structure**		
	Sole Proprietorship	1	0.94%
	Partnership	11	10.38%
	Public Limited Company (PLC)	40	37.74%
	Private Limited Company (Ltd)	42	39.62%
	Others	12	11.32%
	Total	106	100.00%
5	**Size of the Company**		
	Micro Enterprises (<10)	2	1.89%
	Small Enterprises (10-49)	9	8.49%
	Medium Enterprises (50-249)	26	24.53%
	Large Enterprises (>250)	69	65.09%
	Total	106	100.00%
6	**Type of Workflow process**		
	Project Based Production	45	42.45%
	Continuous Production	22	20.75%
	Batch Production	8	7.55%
	Mass Production	13	12.26%
	Jobbing / Customized Production	18	16.98%
	Total	106	100.00%
7	**Value of procurement / contracted expenditure per annum**		
	Less than AED 10 Million	7	6.60%
	AED 10 to AED 20 Million	11	10.38%
	AED 20 to AED 30 Million	8	7.55%
	AED 30 to AED 40 Million	6	5.66%
	AED 40 to AED 50 Million	6	5.66%
	More than AED 50 Million	68	64.15%
	Total	106	100.00%
8	**Size of the Competition**		
	Micro Enterprises (<10)	0	0.00%
	Small Enterprises (10-49)	1	0.94%
	Medium Enterprises (50-249)	26	24.53%
	Large Enterprises (>250)	79	74.53%
	Total	106	100.00%
9	**Control Over the Oil and Gas Industry**		
	Micro Enterprises (<10)	0	0.00%
	Small Enterprises (10-49)	0	0.00%
	Medium Enterprises (50-249)	6	5.66%
	Large Enterprises (>250)	100	94.34%
	Total	106	100.00%
10	**Main aspects for project consideration**		
	Price	93	87.74%
	Quality	80	75.47%
	Lead – Time	45	42.45%
	Project Value	40	37.74%
	Scope of Work	28	26.42%
	Others	3	2.83%
11	**Frequency of Obtaining New Contracts**		
	Always	17	16.04%
	Very Often	75	70.75%
	Sometimes	14	13.21%
	Rarely	0	0.00%
	Never	0	0.00%
	Total	106	100.00%

Table 4: Variables Cronbach's alpha

Variable	Number of Items	Cronbach's alpha
Supply Disruption Strategies (SD)	2	0.886
Outsourcing Strategies (OS)	3	0.781
Management Strategies (MS)	2	0.91
Value Chain Agility (VCA)	4	0.838

Table 5: Questionnaire Cronbach's alpha

Cronbach's alpha	Number of Items
0.675	11

Table 6: Descriptive Statistics

Descriptive Statistics						
Variable		Measurment Items	Minimum	Maximum	Mean	Std. Deviation
Independent	Supply Disruption Strategies (SD)	2	1	5	4.08	0.83
	Outsourcing Strategies (OS)	3	1	5	3.05	1.19
	Management Strategies (MS)	2	1	5	4.06	0.84
Dependent	Value Chain Agility (VCA)	4	1	5	4.64	0.41

Table 7: Factor Analysis Output

Variable		Code	Measurements Items	KMO	Bartlett's Sig.	Factor Loadings	Variance Explained
Independent	Supply Disruption Strategies	SD1	Safety Stocks	0.500	0.000	0.953	90.879
		SD2	Transport Capacity Planning			0.953	
	Outsourcing Strategies	OS1	Cost of Product / Service	0.691	0.000	0.794	70.985
		OS2	Quality of Product / Service			0.866	
		OS3	Knowledge Partnership			0.865	
	Management Strategies	MS1	Information Sharing	0.500	0.000	0.963	92.696
		MS2	Risk Management Tools			0.963	
Dependent	Value Chain Agility	VCA1	Enriching the Customer Experience	0.750	0.000	0.864	67.353
		VCA2	Leveraging the Impact of People and Information			0.793	
		VCA3	Cooperating to Compete			0.774	
		VCA4	Mastering Change and Uncertainty			0.848	

Table 8: VCA Model Summary

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.541[a]	**.293**	.272	.35209	.293	14.069	3	102	**.000**	1.962

a. Predictors: (Constant), MS_Average, OS_Average, SD_Average

b. Dependent Variable: VCA_Average

Table 9: VCA Coefficients

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Correlations			Collinearity Statistics	
		β	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	**3.588**	.180		19.919	**.000**	3.231	3.946					
	SD_Average	**-.141**	.219	-.284	-.644	**.521**	-.576	.293	.432	-.064	-.054	.036	28.096
	OS_Average	**.099**	.030	.286	3.295	**.001**	.039	.159	.387	.310	.274	.923	1.083
	MS_Average	**.327**	.218	.666	1.499	**.137**	-.106	.760	.457	.147	.125	.035	28.495

a. Dependent Variable: VCA_Average

Table 10: ANOVA

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.232	3	1.744	14.069	**.000[b]**
	Residual	12.645	102	.124		
	Total	17.877	105			

a. Dependent Variable: VCA_Average

b. Predictors: (Constant), MS_Average, OS_Average, SD_Average

Table (11): Output for Pearson Correlation test

Correlations					
		SD_{avg}	OS_{avg}	MS_{avg}	VCA_{avg}
SD_{avg}	Pearson Correlation	1			
	Sig. (2-tailed)				
	N	106			
OS_{avg}	Pearson Correlation	.216*	1		
	Sig. (2-tailed)	.026			
	N	106	106		
MS_{avg}	Pearson Correlation	.982**	.245*	1	
	Sig. (2-tailed)	.000	.011		
	N	106	106	106	
VCA_{avg}	Pearson Correlation	**.432****	**.387****	**.457****	1
	Sig. (2-tailed)	**.000**	**.000**	**.000**	
	N	**106**	**106**	**106**	106

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).